



Corrigendum: Climate change in sub-Saharan Africa: Nature restoration as an ethical issue

**Authors:**

Didier N. Buwani¹ 
R. Tseka H. Dolamo¹ 

Affiliations:

¹Department of Philosophy,
Practical and Systematic
Theology, College of Human
Sciences, University of South
Africa, Pretoria, South Africa

Corresponding author:

Didier Buwani,
buwanid@gmail.com

Dates:

Published: 21 Oct. 2020

How to cite this article:

Buwani, D.N. & Dolamo,
R.T.H., 2020, 'Corrigendum:
Climate change in sub-
Saharan Africa: Nature
restoration as an ethical
issue', *Theologia Viatorum*
44(1), a46. [https://doi.org/
10.4102/TV.v44i1.46](https://doi.org/10.4102/TV.v44i1.46)

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In the version of the article initially published, Buwani, D.N. & Dolamo, R.T.H., 2019, 'Climate change in sub-Saharan Africa: Nature restoration as an ethical issue', *Theologia Viatorum* 43(1), a4. <https://doi.org/10.4102/TV.v43i1.4>, on page 4, the acronym 'REDD' was incorrectly defined. The correct definition for the acronym 'REDD' should be 'reducing emission from deforestation and forest degradation' instead of 'deforestation and forest degradation'. The correct definition of the term is updated in the sentence as follows:

Therefore, mechanisms to conserve the forest, such as reducing emission from deforestation and forest degradation (REDD), could assist in the mitigation of climate change, reduce vulnerability and enable people to adapt (Peach Brown et al. 2014:759).



This correction does not alter the study's findings of significance or overall interpretation of the study's results. The authors apologise for any inconvenience caused.

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Note: DOI of original article: <https://doi.org/10.4102/TV.v43i1.4>

Climate change in sub-Saharan Africa: Nature restoration as an ethical issue

**Authors:**Didier N. Buwani¹ R. Tseka H. Dolamo¹ **Affiliations:**

¹Department of Philosophy, Practical and Systematic Theology, College of Human Sciences, University of South Africa, Pretoria, South Africa

Corresponding author:

Didier Buwani,
buwanid@gmail.com

Dates:

Received: 13 July 2018

Accepted: 29 May 2019

Published: 22 Nov. 2019

How to cite this article:

Buwani, D.N. & Dolamo, R.T.H., 2019, 'Climate change in sub-Saharan Africa: Nature restoration as an ethical issue', *Theologia Viatorum* 43(1), a4. <https://doi.org/10.4102/TV.v43i1.4>

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Sub-Saharan countries are among the vulnerable countries that encounter the impact of anthropogenic climate change. This article aimed to analyse the climate change threats that sub-Saharan countries are facing, such as the burning of fossil fuel, deforestation, desertification and floods. Therefore, the authors recommend conserving and restoring nature on an ethical basis for the preservation of future generation. Ethical virtues such as justice and equity will be considered in order to eradicate the problem. Thus the collaboration of all people is required.

Keywords: climate change; biodiversity; justice; equity; development; environment.

Introduction

Today, climate change in sub-Saharan Africa remains a big threat. Climate change is the result of human activities, the burning of fossil fuel and the clearing of forests (Arnold 2011:1). Therefore, mankind is facing consequences of climate change such as floods, sea level rise and extreme weather and deviations in rainfall (Levy & Sidel 2014:33).

In this article, the authors will analyse the consequences of climate change threats. Climate change will affect every continent and particularly the African continent will be the most affected as it depends on natural resources (Peach Brown 2011:164). Ethical virtues will play a key role by preserving future generations. To avoid the negative impact of climate change, the authors recommend mitigation and adaptation measures to reduce greenhouse gases in the atmosphere in order to protect our lives and biodiversity. Also, the implementation of renewable energy will be required to avoid pollution in sub-Saharan areas. To achieve a sustainable development, the contribution of all will be required, especially of politicians and economists.

Climate change

Climate change is the variability of the temperature, 'a permanent change in weather conditions' (Longman 2003:276). Many scientific reports suggest that humanity is causing environmental change at an unprecedented rate (Gardiner 2012:241). If current trends continue, massive devastation will be inflicted on non-human life, future humans and the current poor will be in danger (Gardiner 2012:241). Greenhouse gases from any part on the Earth's surface enter the atmosphere and affect the climate globally (Gardiner 2010:88).

Current climate change is driven by increasing atmospheric concentrations of greenhouse gases in the atmosphere, for instance, carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). The reason for the build-up of these gases is the burning of fossil fuels, the clearing of forests, and other activities of mankind (Union of Concerned Scientists 2003:7). A similar viewpoint is expressed by Arnold (2011) who states that:

It is well understood that the Earth's climate is changing as a result of human activity. More specifically, the climate is changing because of the inefficient consumption of fossil fuels and rapid deforestation. A changing climate will place present and future human populations in jeopardy and the poor will be most adversely impacted. (p. 1)

Some of the many consequences of climate change are global warming, deviations in rainfall, sea level rise, extreme weather events, droughts, and floods (International Panel on climate change [IPCC] 2001; Levy & Sidel 2014:33). Climate change threatens human health and well-being, for instance, infectious diseases, food insecurity and malnutrition and mental disorders (Levy & Sidel 2014:33). Collective violence because of climate change threatens basic human rights as it is written in the Universal Declaration of Human Rights (UDHR, art. 25). For example, it threatens the right to standard of living adequate for health and well-being, also rights to food, housing and

social services, as well as the right to security (Levy & Sidel 2014:33).

The Intergovernmental Panel on Climate Change suggests that greenhouse gas emissions are changing the global climate, and that (IPCC 2001, 2007, 2012):

Africa will experience increased water stress, decreased yields from rain-fed agriculture, increased food insecurity and malnutrition, sea level rise, and an increase in arid and semi-arid land as a result of this process. (n.p.)

The IPCC 2007 report highlights that 'extreme weather events, notably flood, drought and tropical storms are also expected to increase in frequency and intensity across the continent' (IPCC 2007:n.p.). Climate change will affect human populations across the world. However, not every continent will be affected in the same way. Many reports showed that it will be the global poor who will face the effects of global climate change. It will be the poorest regions of the world with the least amount of resources to mitigate those negative effects (Mastaler 2011:66-67). Peach Brown highlights that African populations are expected to be vulnerable to climate change because of three factors: 'a higher than the global average degree of change, high levels of dependence on natural resources and forest goods and services, and a low degree of adaptive capacity' (Peach Brown 2011:164).

From this point of view, critics and the Intergovernmental Panel on Climate Change have demonstrated that poor people will be more affected, as they do not have enough resources to address climate change threats. Based on the ethical principle of justice, policy makers have the responsibility to act on behalf of the poor and the voiceless, so that the developed countries could stop harming the poor and those who are vulnerable.

Researchers attributed changes in patterns of infectious diseases to recent climate change, such as malaria in the East African Highlands (Bannister-Tyrrell et al. 2015:448). Simultaneously, other critics observe that the rising temperatures increase diseases such as malaria. Mosquitoes reproduce rapidly with the increase in temperatures. This led to an increase of malaria in highland areas such as Nairobi, Kenya that have not experienced the disease. Today, malaria accounts for more than 80% of climate-related diseases in Africa (Anderko 2014:33).

Climate change will bring many consequences in the poorest regions of Africa. In his research, McMichael highlights that climate change will reduce food security, agricultural and fishery yields, especially in the sub-Saharan Africa region. The flooding and drying cycles will also increase the risks to agricultural productivity in sub-Saharan regions (McMichael, Barnett & McMichael 2012:647). This point is emphasised by other researchers who pointed out that these projections are consistent with recent climatic trends in southern Africa (Brown et al. 2012:1). The changes in climate are exacerbated by the high levels of sensitivity of the social and ecological systems in the region. There is also a limited capacity of civil society, private sector and government actors to respond to

these threats (Brown et al. 2012:1). This situation is visible in the Congo Basin region, where the rainforest is threatened and governments are unable to provide an accurate answer to the threat that the Basin is facing.

The Congo Basin is the second largest tropical rainforest in the world after the Amazonian forests, covering 228 million ha (FAO 2011) which, represents approximately 20% of the world's remaining tropical forest (Nkem et al. 2012:514). These forests cover about 60% of the total land area of six countries of the central African region: Cameroon, Central African Republic, Gabon, Equatorial Guinea, Republic of Congo and the Democratic Republic of Congo (DRC) (Nkem et al. 2012:514). The Congo Basin forest covers about 30 million forest dwelling indigenous people, representing over 150 ethnic groups that are concentrated around forest margins (CBFP 2006). The cultural isolation of the indigenous communities poses a challenge of national integration. They are excluded in decisions concerning national development and their communities are most vulnerable to the global challenges of climate change (Nkem et al. 2012:514).

The exclusion of local communities remains an error, for these communities are people of the forest. Their livelihoods depend on the forest, they should be involved in all decisions concerning their lives. Their lives are linked to the forest like the human body is linked to the soul. Ignoring this fact may result in the loss of lives.

Lack of information represents a huge gap regarding the climate change threat in sub-Saharan Africa. The IPCC states that by 2020, about 75 million Africans will experience water stress, also agricultural production of cropland could drop by as much as 50% (Mathews 2017). Another aspect that the African continent will face because of climate change is the migration phenomenon. Streamleau (2016) points out that:

If Trump forsakes support for the 2015 Paris climate Accord, endorsed by 193 members of the United Nations (UN), as well as Obama's bilateral climate agreement with China, the resultant rise of global warming and extreme weather events will wreak havoc throughout Africa. Global social media will amplify the human dramas and dangers of forced migrations, viral epidemics and related deadly conflicts as credible evidence of global warming's impact continue to accumulate. (n.p.)

American researchers demonstrate that Zimbabwe is beginning to experience the effects of climate change, especially rainfall variability and extreme events (Brown et al. 2012:ii). The effects of global warming are expected to render land marginal for agriculture, which poses a major threat to the economy and the livelihoods of the poor because of Zimbabwe's heavy dependence on rain-fed agriculture and climate sensitive resources (Brown et al. 2012:ii).

Climate change represents a huge danger to the environment. Therefore, if nothing is done to end the negative impact of climate change, the African continent will probably assist in the loss of its biodiversity. To secure lives and the future of this continent, the conservation of biodiversity should be implemented.

Biodiversity conservation

In Pearson's view, conservation is for people and nature. Throughout human history the conservation of nature is important because of the services provided for their benefit and because of intrinsic values of nature. For this reason, our immediate environment should be well managed. Consequently, the management of protected areas and biodiversity conservation are achieved through the protection of ecosystem processes (Hopkins et al. 2015:526). From this perspective, we can say that biodiversity conservation means the protection or preservation of nature. If nature is well managed, mankind will be in peace.

One of the most important goals of biodiversity exploration is to help conserve the vast diversity of languages, cultures, peoples and other organisms that inhabit this Earth (Moran, King & Carlson 2001:520–521). The management of nature requires some techniques. According to Sonwa et al. (2005) biotechnology can contribute to the management and conservation of forest resources in the Congo Basin, for example. It is therefore a complementary tool to the traditional management programme, not a substitute. There is a pressing need to support human and material capacity-building linked to the application of biotechnology for forestry resource management in the Basin (Sonwa et al. 2005:62).

According to Paterson (2006), the ethical challenge is to find a reason for why nature should be protected from human actions. It is the conservationist's responsibility to prove that such value exists. Mankind and nature are seen as being in profound conflict with each other, and if we wish to describe the mutual relations that exist between human beings and the environment in these terms we would say that the living self depends upon the environment for its existence (Paterson 2006:149). Therefore, mankind depends on the workings of the environment or natural ecological conditions for their growth and development. And, conversely, as indicated by the statement above, 'without life there is no environment', the environment must wait for the activities of human beings in order to take on a particular shape or undergo changes. Mankind thus plays a key role in the creation of a particular environment, and must bear the responsibility for such creation (Paterson 2006:149).

As mentioned above, the conservation of nature needs some techniques; one of the techniques is the implementation of solar energy by mankind. Solar energy using direct sunlight is potentially the most powerful renewable energy source for electricity and heat. Researchers claim that renewable energy sources will provide up to 35% of the global energy supply and nearly half of the electricity production by 2050 (Destouni & Frank 2010:19). To conserve nature or the environment, mankind has the responsibility to reduce, reuse and recycle items where possible. Palliser (2011) states that:

An effort to reduce, reuse, and recycle and considering your overall environmental footprint in your everyday actions will

reduce waste, prevent pollution, use less resources, save money, and work toward a cleaner, healthier Earth for the next generation. (p. 17)

The conservation of nature also implies the restoration of nature. This process has two aspects, which is mitigation and adaptation.

Nature restoration: Mitigation and adaptation

According to IPCC, 'mitigation is an anthropogenic intervention to reduce the anthropogenic forcing of the climate system: it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks' (Hopkins et al. 2015:502; IPCC 2007:878). This can be defined as a human intervention to reduce the sources of greenhouse gases (IPCC 2014). Protected areas can help mitigate climate change by storing carbon and capturing carbon by sequestering carbon dioxide from the atmosphere in natural ecosystems. Adaptation is the process of adjustment to actual climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities (IPCC 2014:1) (Hopkins et al. 2015:502).

The researchers have found that to limit the impacts of climate change on economies, countries should mitigate emissions or adapt to climate change consequences (Shalizi & Lecocq 2010:298). Mitigation consists of reducing emissions or removing greenhouse gas (GHG) from the atmosphere at the beginning of the chain to minimise climate change. By contrast, adaptation consists of responding to climate change impacts at the end of the chain. For example, shifting from coal- to gas-fired power plants, developing renewable energy, or reducing deforestation and associated emissions of carbon dioxide are mitigation actions. (Shalizi & Lecocq 2010:298–299).

Today, nature restoration has become a competing issue for the protection of nature. Restorationists claim that preserving nature won't save it; instead, we must restore nature if we need it. Among other factors, they point to damage to nature caused by global climate change as indicating the necessity of restoration for nature protection (Hettinger 2012:27). Restorationists reject the conception of humanity as separate from nature and argue that restoration is a virtuous way for humans to be part of nature. In their view, restoration is relevant for nature and for human development (Hettinger 2012:27–28).

The practice of ecological restoration provides an important arena within which we can work out what it means to have a moral relationship with nature today (Troop 2012:47). According to Troop, climate change complicates our attempts to develop a defensible moral relationship with nature, because it threatens to undermine both traditional views about how nature fits into a good human life and traditional views about how nature fits into a good human life and traditional aims of restoration (Troop 2012:47).

Africa is one of the regions that remains vulnerable to climate change. Global warming because of increased atmospheric concentrations of greenhouse gases is inevitable. Therefore, it is urgent that policy makers in regions such as sub-Saharan Africa begin to consider what measures they should take to adapt to the consequences of climate change (Smith & Lenhart 1996:193). For instance, Smith and Lenhart suggest that the planning and management along water shed and ecosystem lines reduce the institutional fragmentation in the management of natural areas and focus on protecting a variety of species and natural systems. The impacts of climate change are difficult to predict; the preservation of a variety of species in a healthy ecosystem may be the most effective way to protect those species that will be able to adapt to climate change (Smith & Lenhart 1996:198).

Climate change is intensifying problems and creating new risks, particularly in Africa, where there is poverty and dependence on the natural environment. There is a growing need for proactive adaptation to climate change risks (Ziervogel & Zermoglio 2009:133). Therefore, society needs researchers to find real solutions to the risk that communities are facing. However, research must be supported within institutions if they are going to keep their role in the development of knowledge (Bardsley 2015:45). A good example of the above statement is the case of South Africa. To address the issue of climate change (Odeku & Meyer 2010):

South Africa has establishing new focal points within government, developing partnerships with other governments or the private sector, or launching pilot projects, have contributed immensely to reducing GHG emissions in South Africa; the government is persistent in its quest to continue in this direction in the near future ... This is achieved by putting in place more stringent policies or by implementing new adaptation and mitigation measures. (p.183)

Another technique to protect the forest is in the Congo Basin in Central Africa. Tropical forests in these areas are vulnerable to climate change representing a risk for indigenous peoples and forest-dependent communities. Therefore, mechanisms to conserve the forest, such as deforestation and forest degradation (REDD), could assist in the mitigation of climate change, reduce vulnerability and enable people to adapt (Peach Brown et al. 2014:759). Although researchers pointed out that adaptive capacity is currently low, it could be enhanced with further development of institutional linkages and increased coordination of multilevel responses across all institutions and with local people. It is relevant to build networks with indigenous people at the local level who can contribute knowledge that will build adaptive capacity (Peach Brown et al. 2014:759).

In this regard, the researchers have a different point of view, truly REDD has found mechanisms to conserve the forest in the Congo Basin, the situation is critical even worse in the DR Congo because of political context. Greenpeace Africa is denouncing the fact that the Congolese government is giving

access to multinational companies to cut down the forest in the Basin. A petition was released in order to stop the Congolese government's decision (Greenpeace Africa 2017). To conserve the forest in the Congo Basin, political stability and strong institutions are required. However, the researcher noticed that in countries such as South Africa, where institutions are strong, the implementation of mitigation and adaptation measures can be successful.

The vulnerability to climate change in Africa is the result of increasing temperatures. Sub-Saharan countries depend on natural resources, but there is a low degree of adaptive capacity. The Congo Basin forest of Central Africa has also become a focus for REDD, because of its carbon reserves which are of global importance for regulating greenhouse gas emissions. To achieve progress, particularly in DRC and Central African Republic (CAR), increased efforts need to be made to establish a context of political stability, security and good governance (Peach Brown et al. 2014:767).

Today, the majority of nations in the world are united in the view that greenhouse-gas emissions should be reduced. Only the United States and Australia, of all the industrialised nations, have said that they are not prepared to commit themselves to a binding treaty that will achieve this goal (Singer 2010:197–198). The reduction of GHG remains the right thing to do and for the time being, it is the only way of solving the problem of climate change. Without mitigation and adaptation to climate change, the planet will not be tranquil for mankind's survival.

Jamieson states that mitigating climate change by reducing GHG emissions is important for many reasons. Firstly, slowing down the rate of change allows humans and the rest of the biosphere time to adapt, and reduces the treat of catastrophic surprises. Secondly, the right mitigation allows those who have done the most to produce climate change to be responsible for their actions (Jamieson 2010:271).

Ethical virtues: Justice and equity

The impact of climate change will be felt by future generations, thus a theory of global environmental justice must provide guidance on what duties to future generations those living at present have (Caney 2010:123). Moreover, climate change requires an analysis of moral relevance of decisions taken by previous generations. The important question is who should be responsible for dealing with the negative impact that comes from earlier generations. In this regard Caney suggests that a 'theory of justice that is to apply to global climate change must address the question of how the intergenerational dimensions of the issue make a morally relevant difference' (Caney 2010:124). In other words, the key problem is that 'the polluter should pay' or the one who produced the harm should pay. This principle is also affirmed in a number of international legal agreements. The Organisation for Economic Cooperation and Development (OECD), for example, recommended the adoption of the polluter pays' principle (PPP) in Council Recommendations

of 26 May 1972, and 14 November 1974 (Caney 2010:125). Therefore, we need to know, 'Who is the polluter?' and what kind of entities are the polluters? Are they individuals, state? Firstly, as we know, individuals use electricity for heating, cooking, lighting, televisions, computers and driving cars. This is to say that individuals are responsible for carbon dioxide emissions. Should we say that individuals should pay? If so, we should say that each individual should pay his or her share. Secondly, it might be argued that the causes of greenhouse gas emissions are economic corporations that consume vast amounts of fossil fuels and allow deforestation. Thirdly, many commentators argue that states should cut back on GHG emissions and they are the primary cause of global climate change (Caney 2010:126). One problem with applying the 'polluter pays' principle to climate change is that much of the damage to the climate was caused by the policies of earlier generations. It is, for example, widely recognised that there have been high levels of carbon dioxide emissions for the last 200 years, dating back to the industrial revolution in Western Europe. This is a difficult problem for the 'polluter pays' principle: who pays when the polluter is no longer alive? And the proposal made by some researchers that the industrial economies of the First World should pay seems unfair, for it does not make the actual polluter pay (Caney 2010:127).

In this regard, the researcher points out that, even carbon dioxide emissions were in the atmosphere since the industrial revolution, the actual polluters inherited some power stations from their ancestors in Western Europe and they are responsible for the global warming that is affecting the planet today. Moreover, we cannot say that those who caused the harm are no longer alive. The problem now is to slow GHG emissions in order to adapt to the climate change. Today, those who are harming the ... world are still ... alive and they are responsible for climate change. To protect the planet, we should slow down the greenhouse gas emissions. Unfortunately, some of the developed countries refused to ratify the resolutions of the Paris agreement (reduction of greenhouse gases to 2 °C).

Climate change is widely recognised as a global problem affecting the lives and well-being of millions of people, the stability of ecosystems and the existence of many natural species. Justice involves moral considerations regarding relationships between people or between people mediated by institutions and policies, and therefore this is the case with global justice as well. There are important moral questions regarding the effects of climate change on ecosystems, biodiversity, and species (Moellendorf 2012:131). Environmental justice recognises the integrity of local communities and their ability to subsist in the face of the consequences of climate change. Secondly, it offers normative legal frameworks for enabling a broader recognition of ecological values, as well as for linking these to functional ends. In these latter respects, environmental justice offers a means for encouraging wider engagement and participation within civil society (Stallworthy 2009:74).

By quoting Schlosberg, Fischer suggests that climate justice is used by different actors seeking to characterise their position as the equitable one. However, it is not only about the distribution of environmental goods between states but also about how such goods continue to be distributed at national and local levels under conditions of climatic change, as well as the importance of recognition and participation (Fisher 2015:73).

Climate justice work has focused on distributional aspects and the relationships between nations. Opening up scale as an object of enquiry allows climate justice to be considered as an ideal that has multiple sites both for injustices and for solutions towards more just livelihoods for the climate vulnerable poor. Marginalised communities experience a range of problems linked to development, environmental degradation and others. This requires an analysis and a policy approach that goes beyond a distributional focus (Fisher 2015:80).

Climate change sustainability

Sustainable development needs to become climate-sensitive. Efforts to reconcile economic development, equity and environmental protection need to be incorporated into climate change studies. In this sense, without an effort to integrate climate change into sustainable development, the effects of the former may paralyse the aspirations of the latter (Matthew & Hammill 2009:1127).

Researchers point out that education for sustainable development (ESD) has two objectives that were originally diametrically opposed: environmental education and education to cooperate with the Third World. The environment has always been a topic in geography instruction, yet the emphasis on preservation of nature did not really develop until the 1970s in response to public discussions of issues such as those triggered by the Limits of Growth and other influential works about environmental concerns. Today, global aspects of development are frequently covered by the term global learning. The focus of environmental education was primarily on the preservation of nature (Böhn & Petersen 2007:141). The challenge against climate change will be successful at all levels: politics, power, economics, behavioural psychology and ideology, but politicians should play a key role. We will make them a reality if we create a new politics of climate change that persuades politicians to act. The vision and determination of leaders from outside the established structures of power and wealth were the driving force behind other successes. The nature of public mobilisation is different today, but public pressure for action can be a force of change. It will require a vast investment of leadership, imagination and money to make this a reality. But there is no other pathway to success (Hale 2010:273).

Conclusion

The article highlighted the climate change threat that sub-Saharan countries are facing as a result of human activities. It

stated that the African continent is the continent that is most affected by the anthropogenic impact of climate change. However, to protect our own life and nature, the researcher recommends the following aspects: ethical norms such as justice and equity; mitigation and adaptation measures; and some mechanisms like the implementation of solar energy and renewable energy to prevent future generation against the impact of greenhouse gas effects. To achieve a sustainable development, the collaboration of everyone is relevant, especially of the politicians and economist.

Acknowledgements

This article is partially based on D.N. Buwani's thesis for the degree of Master of Theology in the subject Theological Ethics at the University of South Africa, South Africa, with supervisor Prof. Dr Ramathate Dolamo. Received June 2017, available here: https://uir.unisa.ac.za/bitstream/handle/10500/23677/dissertation_buwani_dn.pdf?isAllowed=y&sequence=1.

Competing interests

The authors have declared that no competing interests exist.

Authors' contributions

D.N.B. was responsible for the data collection and R.T.H.D. was responsible for theological and ethical formulations.

Ethical considerations

The authors declare that they have no financial or personal relationships which may have inappropriately influenced them in writing this article.

Funding information

This article was funded by the University of South Africa.

Data availability statement

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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