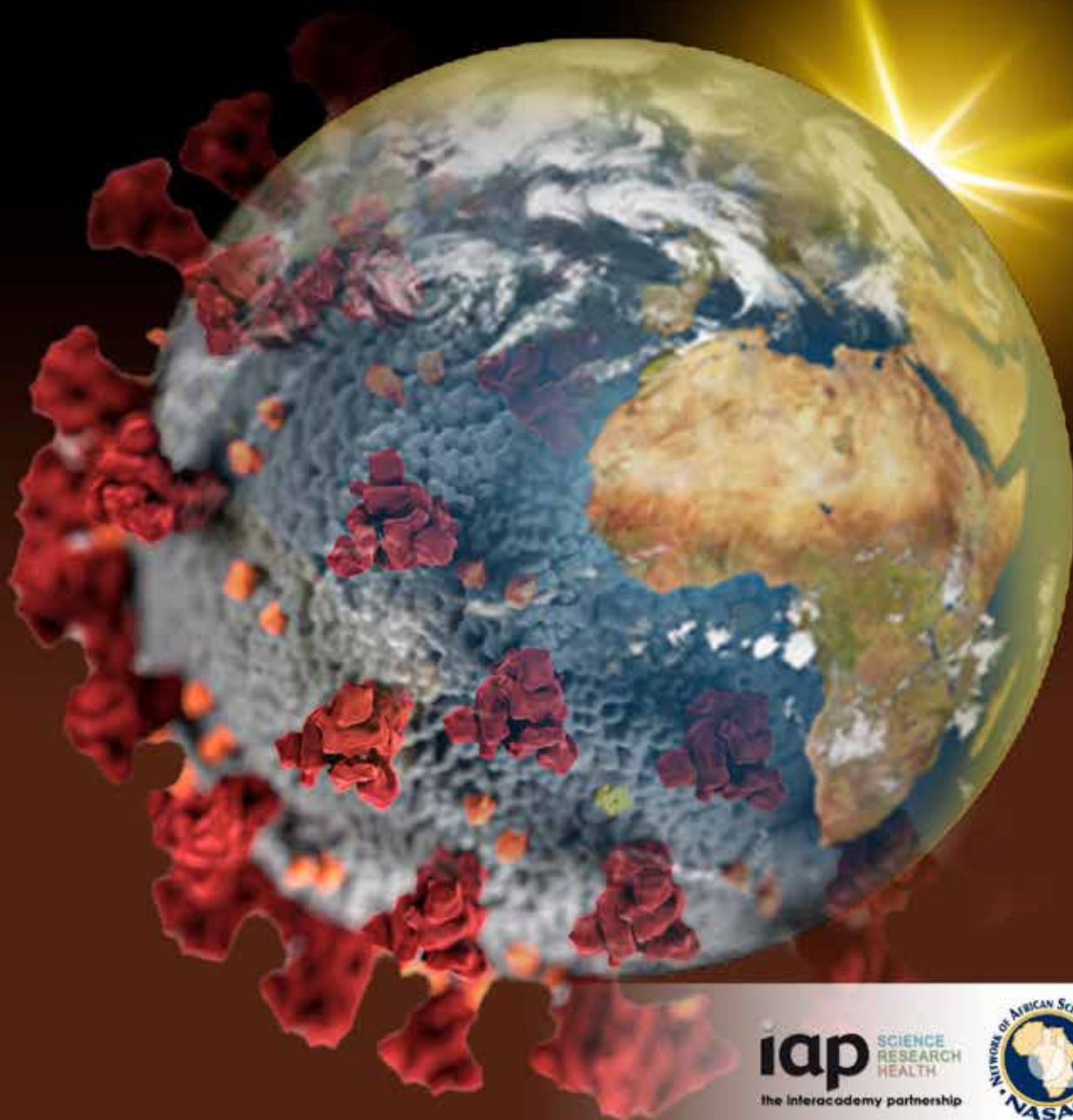


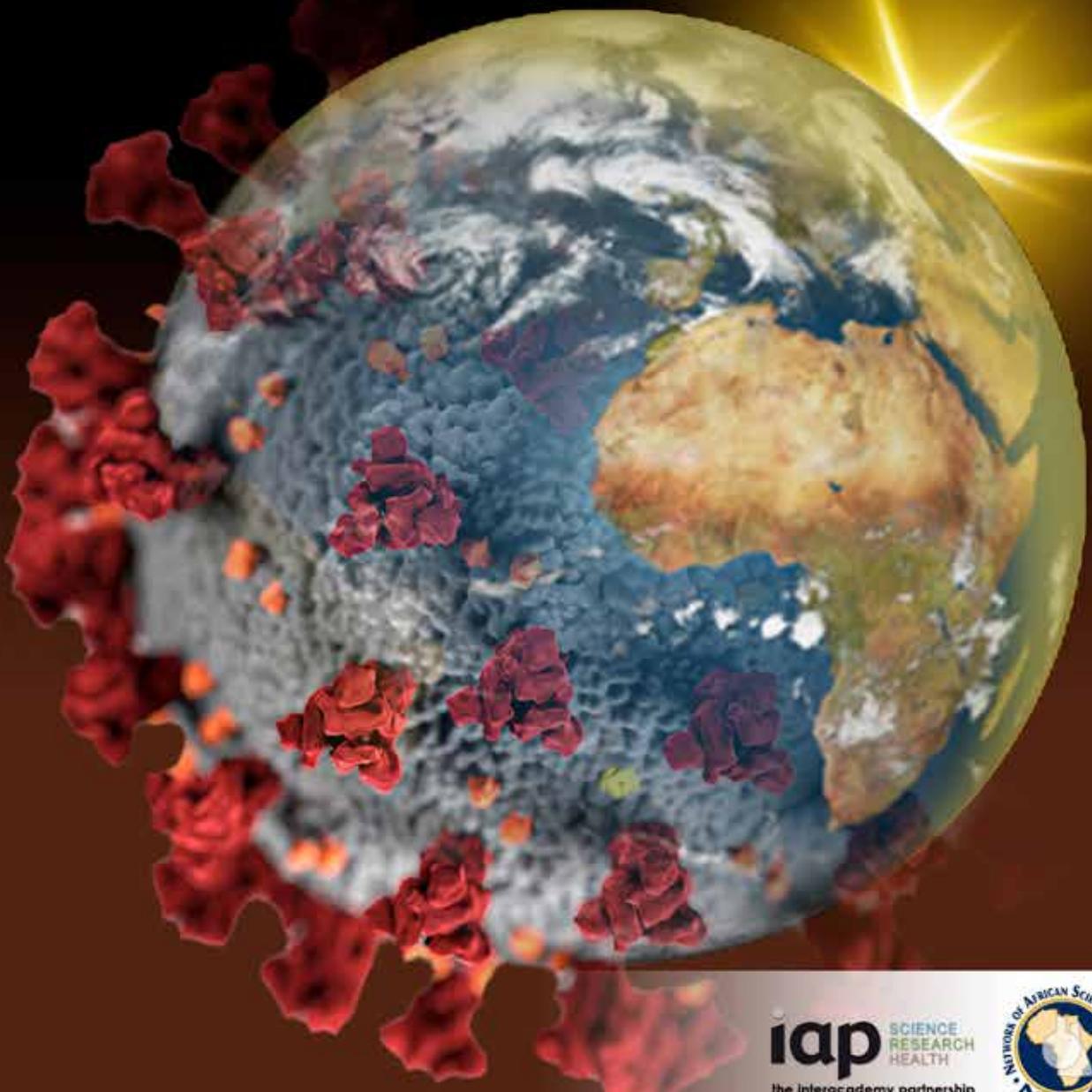
# THE RESPONSE OF AFRICAN SCIENCE ACADEMIES ON THE COVID-19 PANDEMIC

## WEBINAR REPORT

22 July 2020 at 3.00pm to 5.00pm EAT via Zoom



**THE RESPONSE OF AFRICAN SCIENCE ACADEMIES ON THE COVID-19 PANDEMIC**  
**WEBINAR REPORT | 22 July 2020 at 3.00pm to 5.00pm EAT via Zoom**



# TABLE OF CONTENTS

<b>Acronyms and Abbreviations</b> .....	iv
<b>1. Executive Summary</b> .....	1
<b>2. Opening Remarks</b> .....	2
<b>3. Response of IAP to COVID-19</b> .....	4
<b>4. Response of NASAC to COVID-19</b> .....	5
<b>5. Presentations by Member Academies</b> .....	7
5.1 Management of COVID-19: Immunology, Therapy and Vaccines .....	7
5.2 Securing Funding for COVID-19 research .....	9
5.3 COVID 19 Epidemic Model in Uganda — Projections — Community Transmission .....	10
5.4 Engaging with National Governments as a Response to COVID-19 .....	10
5.5 Using television to send messages on COVID-19 to communities .....	11
5.6 Global/Regional collaboration to combat COVID-19 .....	12
<b>6. Other Academies' Responses</b> .....	14
6.1 Algerian Academy of Sciences and Technologies (AAST) .....	14
6.2 Botswana Academy of Sciences (BAS) .....	14
6.3 Cameroon Academy of Sciences (CAS) .....	14
6.4 Ghana Academy of Arts and Sciences (GAAS) .....	15
6.5 Mauritius Academy of Science and Technology (MAST) .....	15
6.6 Académie Nationale des Sciences et Techniques du Sénégal .....	15
6.7 Sudan National Academy of Sciences .....	16
6.8 Rwanda Academy of Sciences (RAS) .....	16
6.9 South Africa Young Academy of Sciences .....	16
<b>7. Discussions</b> .....	18
<b>8. Recommendations</b> .....	18
<b>9. Closing Remarks</b> .....	19
<b>10. Annexes</b> .....	
10.1 Agenda of the Webinar .....	20
10.2 List of Participants .....	21

# ACRONYMS AND ABBREVIATIONS

<b>NASAC</b>	Network of African Science Academies
<b>IAP</b>	InterAcademy Partnership
<b>TWAS-SAREP</b>	TWAS Sub-Saharan Africa Regional Partner
<b>SAYAS</b>	South Africa Young Academy of Sciences
<b>NRF</b>	National Research Foundation (of South Africa)
<b>ISC ROA</b>	International Science Council Regional Office for Africa
<b>SADC</b>	Southern African Development Community

---

## The Response of African Science Academies on the COVID-19 Pandemic

© 2020 Network of African Science Academies (NASAC)

**Edited by:** Jacqueline Kado

**Design and layout:** Irene Ogendo

**Publishers:** Network of African Science Academies (NASAC)

## 1. EXECUTIVE SUMMARY

The Webinar on the Response of Science Academies to the COVID-19 pandemic was organised by NASAC in collaboration with the InterAcademy Partnership (IAP). Sixty (60) participants were in attendance, mainly from the academies' membership and secretariat staff. The inclusion and representation of national young academies was also noteworthy. In this report, this discussion on the efforts that academies have undertaken since March 2020, when COVID-19 was declared a pandemic, is highlighted.

The President of NASAC called on science academies to reflect and propose the most appropriate solutions for the African continent by turning the current difficulties into opportunities. Presentations made by academies already demonstrated the opportunities they exploited. The Ugandan National Academy of Science (UNAS) demonstrated innovation by developing a model for the management of COVID-19 while the Academy of Sciences of South Africa (ASSAf) had already established partnerships and initiatives that led to developing of joint papers, research and grant funding for COVID-19.

All participating members of academies were given an opportunity to highlight their efforts in responding to the pandemic during the webinar. Amongst the highlights shared, several academies were providing committee support to their national governments, fundraising to undertake COVID-19-related activities and leveraging partnerships for research, among other initiatives.

NASAC's response to the pandemic involved actions such as: (i) Conducting the COVID-19 survey among its membership, (ii) Drafting and circulating the Statement on COVID-19, and (iii) Hosting the Academies' COVID-19 response webinar. For Inter Academy Partnership (IAP), the response re-emphasised the need for an interdisciplinary approach in the management of COVID-19. That way, the physical, biological and behavioural sciences would collectively provide a meaningful and lasting path towards a post-COVID recovery. IAP had also established a multi-country COVID-19 Advisory Group that could be a source of technical advice for academies at the global level.

At the conclusion of the webinar, it was recommended that a multi-disciplinary and multi-stakeholder approach has to be adopted by academies in combating the pandemic.

## 2. OPENING REMARKS

**Prof. Norbert Hounkonnou, NASAC President**

The President of NASAC, Prof. Norbert Hounkonnou, welcomed participants to the meeting stating that this was the first meeting since the election of the new Board in November 2019 in Accra, Ghana. He acknowledged and congratulated both IAP and NASAC for organising the Webinar.

Life had drastically and fundamentally changed since the emergence of the global pandemic. Human activities in all sectors of the public life was now severely restricted in most countries in the World. Besides endangering basic human rights, COVID-19 also affected many aspects of modern civilisation with numerous preventive measures being instituted such as travel bans, social or physical distancing, contact tracing and isolation. He observed that the outbreak of the pandemic was a major shock to the hospitality industry affecting both international and domestic tourism. Seeing that it is difficult to estimate when the situation will return to normal, or at least to some optimal level in order for tourism to function without obstacles, an increasing number of people are losing their jobs. Small and medium-sized enterprises, which make up the majority of the tourism industry, are most affected. The return of trust among tourists to embark on adventure and whether attitudes of host countries to tourism will be positive appear as great challenges in the near future, he said.

The foregoing situation was similar in other socio-economic areas including schools and universities, which were closed and forced to move their activities online. He stated that there are various video-conferencing systems and teaching as a digital transfer of knowledge is certainly a new challenge. On a daily basis, information from the public about the number of COVID-19 infections, number of deaths and potential barrier measures is absorbed. In addition, information about medications that are used for treatment, and possible prevention, and the behaviour of populations is collected daily. For that reason, there is a growing fear by populations on the possibility of further infections.

Faced with this situation, the current scientific knowledge has almost reached its limits. The mode of production and distribution of agricultural products, transport, national and transnational trade have been affected. The social, economic and cultural way of life is vulnerable. Complexity has imposed itself denying science any supremacy. All sciences must therefore dialogue, collaborate and integrate into multi- and trans-disciplinary approaches for effective response to new developments and challenges in the field of health, education or economy. These fields cannot escape the system of balance and inclusion in the complexity of formal academic and non-academic knowledge and endogenous know-how which integrate the cultural, sociological and environmental ecosystem.

Science academies must reflect and propose the most appropriate solutions for the African continent, by turning the current difficulties into opportunities. Academies were challenged to develop contextualised unique responses to the pandemic because every country was facing different human, material, financial and organisational hardships. Health systems are different from one region to another, and even sometimes non-homogeneous within the same country. It is therefore important that all African

academies adapt their resources to their realities. It is important to avoid negative consequences encountered elsewhere and seek the simplest protocols that can be adapted to Africa. They should exploit the opportunity for African researchers to design protocols and facilities to locally overcome the pandemic.

In conclusion, he said the webinar is an opportunity for Science Academies in Africa to share experiences on how they are responding to the COVID-19 pandemic. It is also an opportunity to interactively explore lessons on coping mechanisms to successfully deal with and overcome global disruptions while identifying collective and individual responsibilities for the Network and Science Academies respectively to forge a post-COVID future.

### 3. RESPONSE OF IAP TO COVID-19

**Dr. Peggy Hamburg, Co-Chair, IAP Health**

In her speech, Dr. Peggy Hamburg observed that the COVID-19 pandemic had occasioned extraordinary times while stating that tools of science would help find a meaningful and lasting path forward. The tools of science must include physical, biological science and behavioral science because it is both how we act, how we work together and how we can identify the scientifically based strategies that will help us to combat the pandemic, she said. She commended the coming together of science academies through the webinar as it will help academies better prepare to deal with future pandemics and global threats that require science based solutions. Dr. Hamburg applauded NASAC and the activities that it is carrying out.

The InterAcademy Partnership (IAP) is a global network of 140 academies of science, medicine and engineering from around the world. IAP works together to provide a platform for academies to advise the governments and the public about science and pressing related science policy concerns. IAP works through four regional networks, in the Americas, Asia, Europe and Africa. NASAC is the regional network for the African region. IAP commended the efforts by NASAC to share experiences related to COVID-19 and noted that IAP embraces what NASAC does and will continue to provide full support.

In response to COVID-19, IAP has actively developed statements and communiqués on critical issues in a thoughtful science-driven manner emphasising the importance of global solidarity. IAP has also constituted a panel of experts, who were nominated from different countries to form an advisory group for COVID-19. This advisory group is a resource for all academies for purposes of identifying experts and providing answers to critical questions that academies are facing. The advisory group will also help connect academies with the best possible research on a topic or provide technical advice while providing a mechanism for sharing best practices. IAP is also engaging at a grassroots level to support global equity in response to COVID-19 as it recognises the challenges of coming together across disciplines, sectors and borders. The credibility, sense of dedication and commitment that science academies embody can serve a unique role for this purpose. More details on IAP's response to COVID-19 and its new COVID-19 Advisory Group can be found here: <https://interacademies.org/node/52980>.

In her capacity also as a member of the US National Academy of Medicine, Dr. Hamburg stated that because all countries have experienced challenges in responding appropriately to COVID-19, science academies must support each other. Academies were encouraged to step up and provide important leadership and information on the pandemic. For this reason, IAP was committed to continuous collaboration with NASAC and other regional networks.

## 4. RESPONSE OF NASAC TO COVID-19

Mrs. Jackie Kado, Executive Director, NASAC

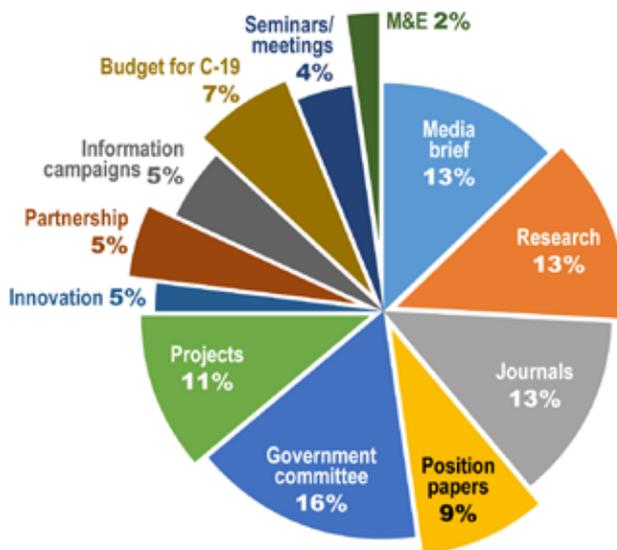
Mrs. Jackie Kado acknowledged and appreciated participants for attending the webinar which presented a new way of meeting. She thanked IAP for the continued support, indicating that NASAC spent the better part of the year re-strategizing when plans were thrown in disarray due to the pandemic.

The mandate of NASAC, which was founded in December 2001, is to provide authoritative science advice in Africa while facilitating an independent platform for credible science advice. NASAC facilitates the establishment of Science Academies while strengthening the existing ones.

In response to the pandemic, NASAC had undertaken three main activities as follows:

- I. Constituting a Committee to develop a Statement on COVID-19 in Africa: The Statement articulated 6 priorities for action to foster preparedness, control and mitigation of the COVID-19 health consequences in Africa as an impetus for change. It committed to offering scientific leadership and supporting regional initiatives and frameworks by supplying independent scientific evidence to appropriate policy options in Africa. The Committee further encouraged NASAC members to support concerted efforts towards implementation of a joint African preparedness and response plan for the pandemic. By the time of the webinar, NASAC had not established the impact of the Statement in spite of actively and widely disseminating it.

- II. Administering an online survey on Academies Response to COVID-19 pandemic in Africa: The response rate was unfortunately very low because only seven out of twenty-eight (26% response rate) academies responded. Possible reasons could be attributed to the restrictions caused by the pandemic including the general in-country lockdowns. The pie-chart below depicts the survey findings.



Survey results on Academy's response to COVID-19

- III. Hosting the Webinar on the response of science academies to the Pandemic: Through its convening power, NASAC organized the Webinar to enable its members and partners to share experiences on how African science academies are responding to the COVID-19 pandemic and to assess what had worked and what had not. The webinar provided a platform for the academies to interactively explore lessons on good coping mechanisms to successfully deal with and overcome global disruptions.

During this COVID-19 pandemic, NASAC had learnt lessons and implemented actions through virtual interactions and these included:

- Utilisation of NASAC's convening power had created platforms for dialogue on COVID-19 issues and concerns.
- Provision of virtual peer review support was possible through evidence-informed COVID-19 research to advice science, policy and society.
- Translation of COVID-19 science to recommendations and consensus for information enhance provision of science-advice.
- Enhancing the visibility of scientific breakthroughs and showcasing success stories on COVID-19 by African scientists and institutions was still possible using various online platforms. The breakthroughs provide homegrown solutions and the academies must inform the global scientific communities that local breakthroughs are happening.
- Fostering trans-disciplinary in all initiatives undertaken because all disciplines are required in the response and fight against the pandemic thereby emphasising the unity of science.

## 5. PRESENTATIONS BY MEMBER ACADEMIES

### 5.1 | Management of COVID-19: Immunology, Therapy and Vaccines

**Prof. Habiba B. Chaabouni**

*Academy of Arts, Sciences and Letters Beit al-Hikma, Tunisia*

The presentation highlighted recommendations made by the Tunisian Academy to the Government, via the COVID-19 Unit Watch. Many of these recommendations were adopted by the National Commission chaired by the government's presidency. Prof. Chaabouni gave a technical presentation on the Management of COVID-19: Immunology, Therapy and Vaccines. An overview of the exposure, incubation and manifestation of COVID-19 infection was presented.

Africa seems to be less affected by the COVID-19 pandemic when compared to other continents. In July the number of deaths was about 10,000 and 5% of clinical manifestations were critical. Clinical expression is variable and depends on several factors the main one being immune response.

#### **Immunology**

SARS Cov 2 infection has dual immune response: humoral and cellular. The cytokine storm in covid-19 causes high levels of inflammatory cytokines in blood and gives an immune cells flow and a local action on endothelium in diverse organs: liver, kidney, lung and heart.

Recent studies show that activation of lymphocytes T and B cells is not the same for all infected patients. Stable versus dynamic immunological signatures were identified and linked to trajectories of disease severity change. These analyses identified three "immunotypes" associated with poor clinical trajectories versus improving health: 1-CD4 T cell activation and proliferation, 2-CD8 T cell activation & plasmablasts, 3-Minimal B and T cell response. These immunotypes may have implications for therapeutics and vaccines.

#### **Therapy**

Many protocols of therapy were suggested for COVID-19 patients with clinical manifestation, out of emergency treatments in case of critical respiratory insufficiency. Antiviral drugs: remdesivir, lopinavir/ritonavir (the protease inhibitor disrupts viral replication), Remdesivir, Flavipiravir, Ribavirin (RNA-dependent RNA polymerase inhibitors), Hydroxychloroquine (viral entry inhibition & endocytosis) associated with Azithromycin (antibacterial) were used in different hospitals all over the world. Many other antiviral drugs are considered in ongoing trials.

Physicians considered alternative therapy to modulate the inflammatory response. Corticosteroid reduced risk of death for patients having symptoms over 7 days and they are indicated for patients who required mechanical ventilation. Monoclonal antibodies (against key inflammatory mediators) is not recommended owing to lack of data in COVID-19.

Targeted immunomodulatory therapies: -anticoagulants (subcutaneous low molecular weight heparin) for thromboembolic prophylaxis are recommended for all hospitalized patients with COVID-19, -antifibrotics (eg, tyrosine kinase inhibitors) and -plasmapheresis: convalescent plasma containing neutralising antibodies.

## Vaccine

Since the beginning of the COVID-19 pandemic, many physicians and researchers in different institutions started looking for a vaccine for SARS Cov-2, noting that there is no vaccine for the known coronaviruses family. Today there is a huge number of vaccine developers, 66% are in industry, 13% in academia and 21% as partnerships, working hard to produce the first Cov-2 vaccine. Based on deep knowledge, biotechnology and advanced manufacturing, they use different techniques and virus components (virus subunits, viral vector, live-attenuated and inactive virus, and for the first time nucleic acids: RNA and DNA). Few produced vaccines are on the way for clinical trials and recently Astra-Zeneca and Oxford university partners announced a successful vaccine (virus vector) currently tested.

Unfortunately, no registered specific therapies (including antiviral therapies, immunomodulating agents and vaccines) are currently available to treat coronavirus infections, highlighting an urgent need for therapeutics targeting SARS-CoV-2.

Specifically in response to the pandemic, the Tunisian Academy set up a scientific committee which has produced several papers and press releases with recommendations about testing, vaccinations, treatment, etc. These recommendations were adopted by the Tunisian government.

## 5.2 | Securing funding for COVID-19 research

**Dr. Abdesalam Hoummada**

*Hassan II Academy of Sciences and Technology - Morocco*

Hassan II Academy of Science and Technology in Morocco engaged in various measures in order to deal with the COVID-19 pandemic. In addition to its financial participation in the special COVID-19 Fund, the Academy issued a Press Release (No. 1) on April 14, 2020, in which it recommended, on a scientific level, some actions allowing better understanding of the nature, development and treatment of COVID-19. The Academy set up a Work Committee which on 1 May 2020, held a video conference meeting to concretely implement these proposals as part of an Action Plan (press release N°3 of 4 May, 2020) which can be accessed here: <http://www.academiesciences.ma>.

The Work Committee of the Hassan II Academy of Science and Technology adopted the following recommendations:

- I. It organised a webinar on 15 May 2020, bringing together Moroccan experts working in Morocco and abroad, to discuss all the actions taken or to be taken, in order to deal with the COVID-19 pandemic.
- II. It set aside a budget of 10 million DH and launched, from 1 June 2020, a Call for Research projects on the following three main themes:
- III. Medical aspect in pandemics (notably COVID-19): genomics and genetic variability of SARS-COV-2, physiopathology, chemical and molecular epidemiology of the COVID-19 pandemic (clinical axes, immunological and genetic axes).
- IV. Technology in the battle against coronavirus (manufacture and production of devices used in treatment such as artificial respirators, test kits, etc.).
- V. Mathematical modeling and artificial intelligence for COVID-19 fight. This Call for Proposals gave priority to multidisciplinary teams which in the medium term would hopefully constitute centers of expertise/excellence in the field of epidemiology in general.

- VI. The Academy constituted a Work Group responsible for carrying out a scientific assessment of the COVID-19 pandemic, by the end of May 2020. It organised a seminar on Scientific Research and Innovation for post-COVID-19 resilience and plans to organise a national seminar on a retrospective study of the Moroccan experience in the pandemic fight. It constituted a work group to carry out scientific assessments and Meta-analyse each of the selected research axes.
- VII. The Academy will organise the Third (3rd) Congress of the African Council for Scientific Research and Innovation (ASRIC), of the African Union, under the theme “Epidemics and Pandemics”. The congress will be held in Rabat, Morocco from 23–25 November 2020. The congress will have the participation of African Scientists and international experts.



The Academy is committed to promoting biomedical research by encouraging the creation of skill centers that gather several multidisciplinary research units, notably in the fields of virology, bacteriology, immunology, serology, and epidemiology as well as in modeling and technology. The Academy would give financial support to these structures.

The Hassan II Academy of Science and Technology renewed its proposal for the creation of a national structure bringing together researchers and units in biomedicine, by orienting their national priority actions, and financially supporting their research projects. In its declaration of 4 May 2020, the Academy gave recommendations that would be implemented at the end of the lockdown with a particular one on the need for an approach that would protect the country from any rebound effect. This recommendation integrated digital science and artificial intelligence.

### 5.3 | COVID 19 Epidemic Model in Uganda – Projections – Community Transmission

**Dr. Betty Kivumbi Nannyonga**  
*Uganda National Academy of Sciences*

Dr. Betty Kivumbi Nannyonga presented the mathematical model for management of COVID-19. Some assumptions of the model included a risk of infection that stood at 3.7% as per WHO projections. She expounded on some variables of the model detailing its applicability within context. For instance, the exposure to the virus at entry ports and for health workers handling COVID-19, public wearing of face masks and physical distancing as well as the rate of hand washing in Uganda were contextual and according to local statistics stood at 26%. The model estimated the transmission rate of COVID-19 in Uganda by multiplying the probability of infection by the number of contacts and prevalence.

## 5.4 | Engaging with National Governments as a response to COVID-19

**Dr. Oladoyin Odubanjo**  
*Nigerian Academy of Science*

The Nigerian Academy of Science's response encompassed intentional and strategic engagement with the national government of Nigeria. The Academy highlighted the issue as a policy problem and set goals, values and objectives for management of COVID-19. The normal policymaking process, which tends not to be followed in emergencies, involves:

- Enumerating all possible measures to address the problem
- Producing the consequences of each alternative
- Comparing the consequences with goals and objectives
- Selecting the strategy that most closely matched consequences with goals and objectives.

The engagement of NAS with the government involved the following:

- A National Advisory Panel set up by the Minister of Science and Technology to review claims of a cure for COVID-19 is chaired by the President of NAS, Prof Mosto Onuoha.
- The Ministry of Health set up a Ministerial Expert Advisory Committee chaired by the Immediate Past President of NAS, Prof. Oyewale Tomori, and with members including the President-elect (Prof. Braide) and three (3) other Fellows of the Academy.
- The Executive Secretary of NAS served in the Risk Communication Committee of the Nigerian Centre for Disease Control (NCDC).
- The Nigerian Academy advocated for dedicated research funding from the Tertiary Education Fund (Tetfund) which subsequently requested NAS to oversee implementation of Special Grants on COVID-19 in order to ensure impact and synergy amongst the research teams.

During crisis and disaster situations, decisions are made swiftly and under pressure. Due to the many 'unknowns' and questions being asked about the COVID-19 pandemic, the role of the Science Academy becomes crucial and it must intervene by giving rapid and independent credible science advice to government for rational evidence-informed decision-making.

Indirectly, NAS responded to the pandemic by launching two press releases. The first press release reassured the public not to panic while the second one advised the government on the need for a lockdown to give an opportunity to re-strategise.

NAS also wrote featured articles in local dailies and made media appearances as well as organised webinars that involved engaging policy makers and scientists in the country in order to address the pandemic. Additionally, NAS is working with other academies in West Africa to disseminate findings of surveys by Results To Save Lives (RTSL).

## 5.5 | Using television to send messages on COVID-19 to communities

**Prof. Fastone Goma**  
*Zambia Academy of Sciences*

Ridding on the Zambia Academy of Science's recent successful radio and television science and community interactive programme, Prof. Goma indicated that in April 2020, the Zambia Academy delivered a Policy Advisory Note on COVID-19 to the Vice President of the Republic of Zambia. The Advisory Note acknowledged the commendable work the Government was undertaking to contain the COVID-19 pandemic and also made the following observations:

- The need for multi-disciplinary collaboration
- Need for support of Government and other stakeholders
- Inadequate preparation of the national health sector and relatively weak health system encumbered by a double burden of communicable and non-communicable diseases
- Weak scientific and technological capacity
- Lack of a culture of planning for building scientific knowledge, skill and human resource capacity

The Vice President assured the Academy of the Zambian Government's high appreciation of the work of the Zambia Academy of Sciences and commended the Academy for the Policy Advisory which came at the right time. The Government, challenged the Academy to help with answers to many unknowns and especially provide local context to recommended scientific measures that were globally being implemented by Governments to manage COVID-19. The Government pledged support to the Academy to provide critical scientific advice beyond COVID-19 so as to ensure that the country invested more in science and technology. The speaker stated that the Zambian Government emphasized the need for scientists to take lead in informing the nation on COVID-19.

Following the meeting with Government, the Academy was invited by Loyola TV to a live televised discussion on COVID-19 and the state of science and technology in Zambia. The journalists as part of communities affected by COVID-19 asked questions such as whether COVID-19 was different from general forms of flu, or why Zambians and other Africans seemed not be as much affected as citizens of Western countries, what are risks of infection in high density areas and issues of lockdowns. The Scientists from the Academy, acknowledged that COVID-19, was a new evolving disease whose control measures depended on available evidence.

The Academy responded to queries from journalists in a non-technical scientific manner and attempted to calm the citizens to allay any panic due to the surge in the number of infections. This engagement showcased the contribution of the science community to the happenings in the country during such circumstances.

The local community sought to know the role that Zambian scientists would play, and these include epidemiological surveillance, disease diagnosis, and management, hospital capacity, risks of infections in different demographic settings. The Academy would encourage and support scientists and doctors to look for local solutions, including manufacture of relevant support equipment such as, the Decontaminator and Ventilator designed by the Copperbelt University and the University of Zambia respectively. The

Academy would advocate for herbal medications where found to be potent. Through the media appearance, the Academy appreciated community anxiety while affirming the need to provide authentic scientific answers to combat misinformation and disinformation in the country.

The Zambian Government emphasised the need for scientists to take lead in informing the nation on COVID-19. The Academy produced a policy brief which was presented to the President of the Nation who encouraged the Academy-as a science community-to engage the local community leading to the media engagement and television appearance. The local community sought to know the role that Zambian scientists would play, and these include epidemiological surveillance, disease diagnosis and management and speaking about hospital capacity. The scientists would encourage scientists and doctors to look for local solutions, speak about the CBU/UNZA –Decontaminator/Ventilator and would advocate for herbal medications where found to be potent. Through the media appearance, the Academy appreciated community anxiety while affirming the need to provide authentic scientific answers to combat misinformation and disinformation in the country.

## 5.6 | Global/Regional collaboration to combat COVID-19

**Prof. Himla Soodyall**  
*Academy of Science of South Africa*

Prof. Himla Soodyall started by saying: “It is evident that global collaboration inclusive of developing countries is of great essence if we are to combat the pandemic. Through strategic partnerships, we can use science and humanitarian considerations towards planning a way forward to alleviate the distress caused by the current situation.”

In response to the pandemic, ASSAf provided science advice, engaged in doing science, mobilised knowledge and partnerships. Specifically, ASSAf partnered with strategic international and regional stakeholders as follows:

- Four ASSAf Members were nominated to serve on the IAP’s ad hoc COVID-19 Advisory Committee
- ASSAf Members participated in four working groups (Future of Health, Circular Economy, Digital Revolution and Connecting the Dots) hosted by Saudi Arabia on the S20 response to the COVID-19 pandemic. ASSAf participated in completing a National Health Survey as part of this initiative.
- ASSAf with regional partners who included GenderInSITE Africa focal point; TWAS-SAREP, SAYA, NRF, ISC ROA, SADC and NASAC.
- ASSAf held webinars with Leopoldina, UK Academy of Medicine, Italian Embassy
- ASSAf administered a survey on National Academies of Science in the SADC Region: Responses to COVID-19

Following the survey on National Academies of Science in the SADC Region: Responses to COVID-19, it was decided that:

- ASSAf would in the near future like to support a coordinated effort using a multidisciplinary approach in driving a collective African agenda. One issue common to all Academies is Government interventions to limit the spread – lockdown measures. These interventions have also impacted the socio-economic “fitness” of communities. ASSAf was looking into coordinating the different country responses and evaluating the success and/or failures of these measures.

- The survey, beyond the response, would establish lessons-learned by the academies and assess the capacity of academies to continue operations virtually. This information would be useful in crafting new projects and directing interventions with respect to Academy development in the SADC region.
- There are different rates of transmission across Africa and ASSAf would aim to provide an analysis of the factors and the extent to which interventions contributed to success and failures.

## 6. OTHER ACADEMIES' RESPONSES

### 6.1 | Algerian Academy of Sciences and Technologies (AAST)

Dr. Harrat Zoubir

The response of the Algerian Academy of Sciences and Technologies (AAST) to COVID-19 focused on recommendations to policymakers on how to manage COVID-19 and providing practical actions based on epidemiological modeling analysis of the status of the disease at the national and departmental level. In addition, members of the Academy undertook public awareness against COVID-19. Public information was published in newspapers in Arabic and French. A member of the Academy designed, manufactured and patented an ozone disinfection device for hospitals, ambulances, and Intensive Care Units and an industrial scale manufacturing agreement was being finalized.

The Academy's recommendations and advice were taken into account by the authorities and the National Government. Some of the recommendations were implemented, encouraging the Academy to get more involved in reflection on actions to be taken afterwards to efficiently face any other health crisis.

The Academy requested NASAC's support in organising a virtual meeting with international experts to discuss the post-COVID 19 pandemic, the treatment, and vaccination against the disease.

### 6.2 | Botswana Academy of Sciences (BAS)

Prof. Ishmael Masesane

Prof. Masesane stated that the Academy was young and it therefore piggy-backed on activities of the university and other associations. The Academy was involved in the production of PPEs like shields for lecturers in collaboration with universities and other technical organisations in Botswana.

### 6.3 | Cameroon Academy of Sciences (CAS)

Dr. David Mbah

The Academy set up a COVID-19 Taskforce headed by the Dean of Biological Science who is a Professor of internal medicine. The Academy had also produced two (2) Statements. The first Statement emphasised on which scientific information needed to be generated by a Committee and on laboratories that had to be involved in testing. The greatest recommendation from the statement was decentralization to make sure that each of the 10 regions in Cameroon had a testing center for COVID-19.

The Academy felt that the Scientific Committee of the Ministry of Public Health was not strong enough thus they came up with a recommendation for the creation of a Scientific Committee with detailed Terms of Reference. CAS generated expert nominees from various disciplines who could complement and strengthen the Ministry's Committee. CAS emphasised that the Scientific Committee had to be independent.

## **6.4 | Ghana Academy of Arts and Sciences (GAAS)**

**Prof. Alfred Oteng-Yeboah**

GAAS is in the process of organising a symposium under the theme “This novel COVID-19 Pandemic” to take place from 17–20 November 2020. Four sub-themes including the Science, Epidemiology, Globalisation, Socio-economic implications and Innovations and Opportunities were being considered for presentation by experts.

Among the experts expected to participate in the symposium were medical scientists who had brought to the world’s attention to two crucial observations or discoveries on the use of certain drugs on COVID-19. One of them was priority exclusion of G6PD Deficiency patients in being exposed to Chloroquine/hydroxychloroquine or Intravenous Vitamin C and the other discovery was use of Hydrogen peroxide mouthwash and gargle to limit SARS-CoV-2 infection.

The Academy hoped the November Symposium would provide a fact-finding analysis for future positioning of the Academy as far as COVID-19 pandemic is concerned. It anticipated getting experts to provide information that would be availed to policymakers. The Academy also intends to produce policy briefs for quick dissemination.

The Academy expected NASAC to assist with a virtual capture of the daily events during the symposium for the benefit of distant and international partners.

## **6.5 | Mauritius Academy of Science and Technology (MAST)**

**Dr. Deoraj Caussy**

In response to the pandemic, the Mauritius Academy actively focused on the Agricultural sector on Food Security and developed a paper in this regard. Dr. Caussy also gave significant input to the NASAC statement on COVID-19 in Africa and provided a newsletter article for the electronic bulletin.

## **6.6 | Académie Nationale des Sciences et Techniques du Sénégal**

**Mame Bineta Gaye**

The Senegal National Academy produced statements in newspapers giving advice to policy makers. Members of the Academy served in scientific committees giving advice and heading laboratories that were involved with analysis of COVID-19.

The Academy also published papers and articles on COVID-19. Members of the Academy were interviewed in various panels and seminars and gave advice to the government. The Academy was working on a project that would provide scientific advice to government.

## 6.7 | Sudan National Academy of Sciences

**Prof. Mohamed Hassan**

The Academy was concerned with the long-term effect of COVID-19 on education in Sudan and in Africa. Universities worldwide are starting to develop online platforms to provide quality education for all. Sudan and Africa as a whole are faced with an opportunity and a challenge. An opportunity because online education platforms if utilised and managed well, can deliver high quality courses especially in higher education in African Universities. The opportunity entails inter-universities collaboration to develop a high-quality platform as quality of education in some of the universities is very low. This would be an opportunity to develop strong and quality courses that can be taught.

Many universities are faced with the challenge of providing technology to deliver online classes and provide reliable digital high-quality online courses to all. Most students do not have the technology, artificial intelligence, connectivity or even electricity and may therefore not be able to join the online classes. The Sudan National Academy of Sciences is convincing the government to invest in renewable energy and especially solar energy. SNAS is also advocating for COVID-19 recovery to be based on green technology that can provide education for all, especially the rural community.

## 6.8 | Rwanda Academy of Sciences (RAS)

**Prof. Mbonye Manaseh**

Prof. Mbonye indicated that the country had been fighting the pandemic by advocating for wearing of masks, hand washing and social distancing. The Academy worked with the Biomedical Centre which was in charge of national coordinating on issues of COVID-19.

Members of RAS also appeared on national TV creating awareness on the importance of wearing masks. They produced a paper on Testing Methods of Pulling (where many people could be tested in a short time) and this method was being used globally. Additionally, some members of the Academy who were abroad linked with members in Rwanda to work on a cure for the virus.

A group of members of the Academy were undertaking a research on COVID-19 under the title Rapid Optimal COVID-19 responses through science advice of multi-disciplinary multilateral demonstration network.

## 6.9 | South Africa Young Academy of Sciences

**Ms. Manjoia Marizvikuru**

SAYAS had made some strides in response to COVID-19 pandemic and these include the following initiatives:

- Communication of the precautionary measures to consider for preventing spread of COVID-19. Translations were made into local languages. The posters were disseminated in South Africa and beyond, through various social media platforms.
- Submission of a proposal in response to COVID-19 Africa Rapid Response Grant Call by the National Research Foundation (In conjunction with other

international Funders). This is in view of leveraging science advice for policy and leadership on COVID-19.

- Transmission of credible information to the science community through Webinars and collating articles written by SAYAS members for further dissemination.
- Support to a group of learners who did not have online access through running a campaign for donations to purchase learner study guides.
- SAYAS members published articles in local newspapers to reach out to the general public.

#### Other planned activities

- Book writing and publishing peer-reviewed articles.
- Reaching out to parents and learners through video series for support of home-schooling since most parents/guardians have resorted to informal and formal home schooling in fear of the pandemic.

***Expected impact of the response:*** Psycho-social support of researchers, learners and parents/guardians; increased societal knowledgebase on the pandemic using science as a trusted source; increased awareness of the pandemic and precaution thereof.

The Academy expected NASAC to assist in sourcing of research grants, with information dissemination continent-wide and with forging collaborations with Academies of Science in the continent in order to bring lessons learnt to bear, in a joint fashion.

## 7. DISCUSSIONS

During this session, participants were given the opportunity to discuss any pertinent issue based on the Webinar deliberations. Three main issues were recorded as highlighted below.

One of the COVID-19 interventions made by the Hassan II Academy of Science and Technology was to develop a concept note and other relevant documents in a bid to address the need for capacity building for the management of the pandemic in Morocco. In order to do this, the academy set up a COVID-19 Management Committee, whose outputs could benefit other African academies through collaboration with NASAC. The scope and mandate of such a committee would also inform lessons that other countries in Africa can emulate.

Clarification was sought on the creation of COVID-19 vaccines in Africa. It was noted that during the development of the vaccines, it is important to involve a diverse range of stakeholders including academia, the medical fraternity, policymakers and the local communities. In Africa, only Tunisia and Egypt were reported as working towards developing a COVID-19 vaccine even though the process was still at the very initial stages with slow-paced advancement. African scientists were encouraged to jointly engage across boundaries to contribute towards the development of a vaccine as well.

In the mathematical modeling presented for COVID-19 management, it was clarified that age was also a factor for consideration. This was a critical point because the model indicated that elderly people were most vulnerable for infection by the COVID-19 virus with a higher fatality rate. However, it was noteworthy that besides age, other issues like having an underlying medical condition also played a role in determining the appropriate course of management.

## 8. RECOMMENDATIONS

At the conclusion of the webinar, it was recommended that a multi-disciplinary and multi-stakeholder approach must be adopted by academies in responding and combating the pandemic.

Participants identified several areas for learning and implementation by academies as follows:

- Replication of best practices in collaboration, modeling and education from countries that have excelled in tackling the same.
- Linkage between the national responses to COVID-19 with the African Union regional framework.
- Importance of mathematical modeling in the management of COVID-19 to institute appropriate response at national levels.
- Consideration of the dire impact of COVID-19 pandemic on education, especially if the issue of national electrification was not fully implemented to allow for online learning.

## 9. CLOSING REMARKS

**Prof. Norbert Hounkonnou, NASAC President**

In his closing remarks, Prof. Hounkonnou thanked the speakers for their presentations, and congratulated participants for their active engagement in the webinar.

As a way forward, he encouraged NASAC members to increase awareness on the following facts:

- I. Academies should embrace the new normal of holding virtual meetings and other adaptability measures to continue to deliver on their mandate. Overcoming COVID-19 and its consequences is impossible without science and scientific work.
- II. Collaboration and partnership of all actors; scientists, experts of communication and mass media, journalists, decision-makers, civil society, NGOs etc. is important to combat the effects of the pandemic.
- III. At the scientific level and as part of the management of the pandemic, academies should acquire knowledge on COVID-19's immunology, therapy and vaccines, and modeling. This knowledge would form the basis for securing the much needed funding for in-country COVID-19 research, especially when working with national governments.
- IV. Making use of electronic media such as television and radio (together with social and print media) to communicate with local communities on the COVID-19 is crucial.
- V. Academies must develop an African homegrown response to the pandemic and implement it while taking into account national and regional specificities. NASAC would support academies at national and regional levels.

He concluded by thanking IAP for its support in organising the webinar, and the NASAC secretariat for its continuous commitment. He congratulated participants stating that he hoped that there would be greater participation from all member academies in future webinars.

## 10. ANNEXES

### 10.1 | Agenda of the Webinar

TIME (mins)	ITEM	SPEAKER
5	Opening Remarks	Prof. Norbert Hounkonnou   <i>President, NASAC</i>
7	IAP's Response on COVID-19	Prof. Peggy Hamburg   <i>IAP Representative</i>
7	NASAC's Response on COVID-19	Mrs. Jackie Kado   <i>Executive Director, NASAC</i>
Presentations by NASAC Member Academies		
10	Management of COVID-19: Immunology, Therapy and Vaccines	Prof. Habiba B. Chaabouni   <i>Academy of Arts, Sciences and Letters Beit al-Hikma – Tunisia</i>
10	Securing funding for COVID-19 research	Dr. Abdeslam Hoummada   <i>Hassan II Academy of Sciences and Technology – Morocco</i>
10	Application of a mathematical model for COVID-19 Management	Dr. Betty N. Kivumbi   <i>Uganda National Academy of Sciences</i>
10	Q&A Discussion	
10	Engaging with National Government as a response to COVID-19	Dr. Doyin Odubanjo   <i>Nigerian Academy of Science</i>
10	Using television to send messages on COVID-19 to communities	Prof. Fastone Goma   <i>Zambia Academy of Sciences</i>
10	Global/Regional collaboration to combat COVID-19	Prof. Himla Soodyall   <i>Academy of Science of South Africa</i>
10	Q&A Discussion	
General discussion on other academies responses and way forward (2 minutes each)		
30	<p>What is one response by your Academy to the COVID-19 pandemic?</p> <p>What is the expected impact of that response?</p> <p>How can NASAC support that response?</p> <p><b>Academies from:</b> Algeria, Benin, Botswana, Burundi, Cameroon, Egypt, Ghana, Mauritius, Senegal, Sudan and Zimbabwe</p> <p><b>Other institutions:</b> National Young Academies (Cameroon, Egypt, Nigeria and South Africa)</p> <p>International Science Council Regional Office for Africa (ISC-ROA)</p>	<p>Each Academy representative present</p> <p>(one speaker per institution)</p>
6	Closing Remarks	Prof. Norbert Hounkonnou   <i>President, NASAC</i>

#### Notes:

From the Ghana Academy of Arts and Sciences (GAAS), Prof. Felix Konotey-Ahulu suggests that the following articles may be of interest:

<https://www.bmj.com/content/369/bmj.m1432/rr-21> [From University of Cape Coast, Ghana by Professor F.I.D. Konotey-Ahulu] Re: COVID-19 Treatment with CHLOROQUINE or Intravenous VITAMIN C Requires Prior Exclusion of G6PD DEFICIENCY! (British Medical Journal, 20 April 2020).

<https://www.bmj.com/content/368/bmj.m1252/rr-27> [From University of Ghana by Professor Seth Andrews Ayertey & Colleagues, and University of Cape Coast Professor F.I.D. Konotey-Ahulu] Re: A Case for Hydrogen Peroxide Mouthwash and Gargle to Limit SARS-CoV-2 infection. (British Medical Journal, 2 July 2020).

Participants are further encouraged to share with the NASAC secretariat any other Africa-relevant scholarly articles on COVID-19 that we can compile and share with participants as part of the Webinar Report..

## 10.2 | List of Participants

### ALGERIA

**Prof. Abderrahmane Tadjeddine**

*Algerian Academy of Sciences and Technologies*

**Prof. Benouar Djillali**

*Algerian Academy of Sciences and Technologies*

**Prof. Allia Khedidja**

*University Of Science And Technology Houari*

*Boumediene (USTHB);*

*Algerian Academy of Sciences and Technologies*

**Dr. Zoubir Harrat**

*Institut Pasteur d'Algérie*

*Algerian Academy of Sciences and Technologies*

### BENIN

**Prof. Hippolyte Sènou Agboton**

*Academie Nationale Des Sciences Arts Et Lettres Du*

*Benin (ANSALB)*

**Prof. Hounkonnou Mahouton Norbert**

*President, NASAC;*

*Academie Nationale Des Sciences Arts Et Lettres Du*

*Benin (ANSALB)*

**Prof. Martin Chobli**

*Académie Nationale des Sciences, Arts et Lettres du*

*Benin (ANSALB)*

### BOTSWANA

**Prof. Ishmael Masesane**

*Botswana Academy of Science (BAS)*

### CAMEROON

**Prof. David Mbah**

*Cameroon Academy of Sciences*

**Prof. Rose Gana Fomban Leke**

*Treasurer, NASAC;*

*Cameroon Academy of Sciences*

*Biotechnology Center University of Yaoundé*

### EGYPT

**Prof. Hamzawy Mohamed**

*Faculty of Pharmacy, Fayoum University*

**Prof. Soror Sameh**

*Academy of Scientific Research and Technology*

*(ASRT);*

*European Academies' Science Advisory Council*

### GERMANY

**Dr. Nina Hobbhahn**

*German National Academy of Sciences Leopoldina*

**Ms. Johanna Mogwitz**

*European Academies' Science Advisory Council*

### GHANA

**Prof. Alfred Oteng-Yeboah**

*GAAS Ghana Academy of Arts and Sciences*

**Mr. Francis Prince Ankrah**

*Ghana Academy Of Arts And Sciences*

**Prof. David Kofi Essumang**

*University of Cape Coast;*

*Ghana Academy Of Arts And Sciences*

### ITALY

**Ms. Muthoni Kareithi**

*InterAcademy Partnership (IAP)*

**Dr. Peter McGrath**

*InterAcademy Partnership (IAP)*

### LESOTHO

**Ms. Ntho Tholoana**

*Central University of Technology*

**Ms. Tholoana Ntho**

*Central University of Technology*

### MAURITIUS

**Dr. Deoraj Caussy**

*Mauritius Academy of Science and Technology (MAST)*

### MOROCCO

**Prof. Hoummada Abdeslam**

*Hassan II Academy of Science and Technology*

**Prof. Rajaa Cherkaoui El Moursli**

*Vice-President, Policy Review and Administration,*

*NASAC;*

*Hassan II Academy of Science and Technology*

**Prof. Rajae El Aouad**

*Hassan II Academy of science and technology*

### NIGERIA

**Dr. Oladoyin Odubanjo**

*The Nigerian Academy of Science (NAS)*

**Ms. Angie Olanipekun**

*The Nigerian Academy of Science (NAS)*

**Mr. Balogun Oluwaseun**

*Nigerian Academy of Science (NAS)*

**Dr. Egbetokun Abiodun**

*Nigerian Young Academy*

**Prof. Mosto Onuoha**

*President, Nigerian Academy of Science (NAS)*

**Mr. Oluwaseun Balogun**

*Nigerian Academy of Science (NAS)*

**Ms. Onyema Blessing**

*Nigerian Academy of Science (NAS)*

**Mr. Shofuyi Samuel**

*The Nigerian Academy of Science (NAS)*

**Ms. Gertrude Ogieguata**

*Nigerian Academy of science (NAS)*

### RWANDA

**Prof. Manasse Mbonye**

*President, Rwanda Academy of Sciences (RAS)*

**Prof. Marie Christine Gasingirwa**

*Rwanda Academy of Sciences (RAS)*

### SENEGAL

**Mrs. Mame Bineta Gaye**

*Académie des Sciences et Techniques du Sénégal*

*(ANSTS)*

**Mrs. Aissatou Ndiaye**

*Académie des Sciences et Techniques du Sénégal*

*(ANSTS)*

**Prof. Sock Oumar**

Vice-President for Resource Mobilization and Development, NASAC;  
President, Académie Nationale des Sciences et Techniques du Sénégal

**SOUTH AFRICA**

**Mrs. Ana Bigara**

Mangosuthu University of Technology

**Prof. Anna Kramvis**

University of the Witwatersrand

**Prof. Budeli-Nemakonde Mpfariseni**

University of South Africa

**Dr. Caradee Wright**

South African Medical Research Council

**Prof. Charles Shey Wiysonge**

South African Medical Research Council

**Prof. Faizal Bux**

Durban University of Technology

**Dr. Glover Richard Lander Kwame**

International Science Council Regional Office for Africa (ISC ROA)

**Prof. Minrie Greeff**

North-West University

**Mr. Khaya Sishuba**

The Department of Science and Innovation (DST)

**Prof. Himla Soodyall**

Academy of Science of South Africa (ASSAf)

**Ms. Kalele Phyllis**

Academy of Science of South Africa (ASSAf)

**Mr. Kholani Mbhiza**

ASSAf/TWAS Sub-Saharan Africa Regional Partner

**Dr. Mabothe Tebogo**

Academy of Science of South Africa (ASSAf)

**Prof. Makondelele Makatu**

University of Venda

**Dr. Manjoro Marizvikuru**

University of Venda

**Ms. Thato Morokong**

Academy of Science of South Africa (ASSAf)

**Prof. Mpfariseni Budeli-Nemakonde**

University of South Africa

**Prof. Parker M. Iqbal**

University of Cape Town

**Prof. Stephanie Burton**

University of Pretoria

**Ms. Van Heerden Louise**

Academy of Science of South Africa (ASSAf)

**Prof. Chinwe Iwu**

Stellenbosch University

**SUDAN**

**Prof. Mohamed Hassan**

Sudanese National Academy of Sciences (SNAS)

**Prof. Suad Sulaiman**

Sudanese National Academy of Sciences (SNAS)

**TUNISIA**

**Prof. Habiba Bouhamed Chaabouni**

Tunisia Academy of Sciences Arts and Letters

**UGANDA**

**Dr. Betty Kivumbi Nannyonga**

Uganda National Academy of Sciences (UNAS)

**UNITED STATES OF AMERICA**

**Dr. Hamburg Peggy**

InterAcademy Partnership (IAP)

**Dr. Teresa Stoepler**

InterAcademy Partnership (IAP)

**VENEZUELA**

**Prof. Rodríguez-Román Eduardo**

Instituto Venezolano de Investigaciones Cientificas

**ZAMBIA**

**James Phiri**

Zambia Academy of Sciences (ZaAS)

**Dr. Odubote Kolawole**

Zambia Academy of Sciences (ZaAS)

**Prof. Phillip Nkunika**

University of Zambia

**Prof. Fastone Goma**

Zambia Academy of Sciences (ZaAS)

**ZIMBABWE**

**Prof. Charles Nhachi**

President, Zimbabwe Academy of Science (ZAS)

**HOST:**

NASAC secretariat, Nairobi, Kenya



**The Network of African Science Academies (NASAC)** was established on 13 December 2001 in Nairobi, Kenya, and is currently the affiliate Network for Interacademy Partnership (IAP) in Africa. NASAC is a consortium of merit-based science academies in Africa and aspires to make the “voice of science” heard by policy and decision makers within Africa and worldwide. NASAC is dedicated to enhancing the capacity of existing national science academies and champions the cause for creation of new academies where none exist.

***As at November 2019, NASAC comprised of the following twenty-eight members:***

Academie Nationale des Sciences et Technologies du Senegal (ANSTS)

Academy of Scientific Research and Technology of Egypt (ASRT) - *Provisional Member*

Academie Nationale des Sciences du Burkina (ANSB)

Academie Nationale des Sciences et Technologies du Congo (ANSTC)

Academie Nationale des Sciences, Arts et Lettres du Benin (ANSALB)

Academie Nationale des Sciences, Arts et Lettres du Togo (ANSALT)

Academy of Science of South Africa (ASSAf)

Academy of Sciences of Mozambique (ASM)

African Academy of Sciences (AAS)

Algerian Academy of Science and Technology (AAST)

Botswana Academy of Science (BAS)

Burundi Academy of Science and Technology (BAST)

Cameroon Academy of Sciences (CAS)

Ethiopian Academy of Sciences (EAS)

Ghana Academy of Arts and Sciences (GAAS)

Hassan II Academy of Science and Technology, Morocco

Kenya National Academy of Sciences (KNAS)

Madagascar National Academy of Arts, Letters and Sciences

Mauritius Academy of Science and Technology (MAST)

National Academy of Cote d'Ivoire

Nigerian Academy of Science (NAS)

Rwanda Academy of Sciences (RAS)

Sudanese National Academy of Science (SNAS)

Tanzania Academy of Sciences (TAS)

The Uganda National Academy of Sciences (UNAS)

Tunisia Academy of Sciences (TAS)

Zambia Academy of Sciences (ZaAS)

Zimbabwe Academy of Sciences (ZAS)

**For more information, please contact us on:**

**The NASAC Secretariat**

**Miotoni Lane, Off Miotoni Road**

**P.O. Box 201-00502, Karen, Nairobi, Kenya | Tel: +254 712 914 285**

**Email: [nasac@nasaconline.org](mailto:nasac@nasaconline.org) | Website: [www.nasaconline.org](http://www.nasaconline.org)**