What the Covid-19 pandemic reveals about the evolving landscape of scientific advice

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Contested perspectives

The relationships between science, society, policy and politics have always been complex and contested. We only need to consider the headwinds encountered by the scientific community over the past few decades in their attempts to persuade the global political community to recognize and act on anthropogenic-driven climate change, or the ongoing contestation over the role of genetically modified crops in ensuring food security, or the difficulty in persuading governments to address obesity and its consequences.

Many, if not most, policy decisions have a scientific dimension. Whereas science advisory systems originally evolved in large advanced economies to deal largely with matters of defence and technology, they now have critical roles to play in areas such as the environment, social progress and health.

The Covid-19 pandemic has brought these relationships into unprecedented focus. From the earliest days of the pandemic, governments have had to make far-reaching decisions in the context of incomplete and evolving knowledge about the virus. These decisions have been perceived by many as involving trade-offs between health, economics, social well-being and individual rights, such as the lockdowns which have slowed economic activity and curbed individual mobility. Many governments have acknowledged the critical importance of scientific analysis and advice in assisting their decision-making.

Although the present essay focuses on the interaction between science and the policy community during the current Covid-19 pandemic, effective use of science in informing policy-making ultimately springs from public trust in both the scientific community and the institutions of government. The lessons learned during the Covid-19 pandemic may, thus, have broader implications for how countries might better use scientific evidence to develop and implement policies in the future.

Beyond the essential and ongoing role of new knowledge generation by the scientific community during the pandemic, the two central components of scientific advice have been in play: *evidentiary synthesis* (synthesizing available and often incomplete scientific evidence to assist governments) and *evidentiary brokerage* (communicating synthesized and interpreted scientific evidence to both governments and their citizens).

Vectors of evidentiary synthesis

To be of value, evidentiary synthesis must be a balanced and comprehensive presentation of what is known and not known, as opposed to biased advocacy. Evidentiary synthesis

Box 1: **Uruguay: the public and private research sectors step up to the plate**

After the first four cases of Covid-19 were detected in Uruguay on 13 March 2020, the government immediately declared a 'state of health emergency'.

Weeks earlier, in anticipation of the inevitable arrival of the virus, the health authorities had contacted a team of researchers at the main public university, the Universidad de la República, and the Institut Pasteur de Montevideo, to explore the potential for local development of diagnostic testing. This led to the signing of an agreement in March between the academic sector and the government which saw much of the scientific biomedical community shift its focus towards providing expertise, personnel, equipment and reagents to combat the virus.

Within about a month, the locally produced molecular tests had been validated for distribution. In parallel, research laboratories began designing and developing serological tests to detect antibodies in patients with acquired immunity that were validated in August 2020 by the Ministry of Public Health.

The efforts of the public sector were paralleled by private initiatives, generating a large and well-distributed testing capacity.

In April 2020, the government created a Scientific Advisory Group composed of three coordinators, one with a general mandate and one each for health and data science and modelling. This trio selected a group of 55 top national scientists and experts to generate weekly reports for the government whose advice ranged from recommended health measures to reviewing and reducing social restrictions.

The Scientific Advisory Group also gave interviews to the press and held press conferences to provide the public with scientific evidence of the biological, epidemiological and pathological dimensions of the virus and the rationale for social and public health interventions, such as the re-opening of schools as part of the deconfinement process.

There is a national consensus that this multifaceted strategy has succeeded in minimizing the disease burden at the individual and social levels in Uruguay.

Source: Prof. Rafael Radi, MD, PhD, Professor and Chair of Biochemistry, Director, Centro de Investigaciones Biomédicas (CEINBIO), Facultad de Medicina, Universidad de la República Montevideo, Uruguay

should be informed by a plurality of disciplines, as illustrated by the case study of Uruguay (Box 1).

Too often in the past, perspectives from the social sciences and humanities have been overlooked, despite the reality that human behaviour and sociological dimensions are key to successful decision-making, as demonstrated by the debates on both the Covid-19 pandemic and climate change.

Evidentiary synthesis is most often conducted by national science academies. However, national technical and science-based commissions, scientific advisory offices, ad hoc committees, research institutes and university departments can all provide evidentiary synthesis.

It is gratifying that a growing number of lower-income countries have invested in developing science academies in recent years, including 28 African countries. The South African academy has produced evidentiary synthetic reports for policy-makers which are particularly robust and of global value.[1]

Prof. Madiagne Diallo of the Economic, Social and Environmental Council of Senegal[2] observes that a growing number of African governments had already been reaching out to science academies for advice prior to the pandemic. For example, in 2015, the Government of Cameroon tasked its science academy with developing a national biotechnology policy framework. In 2019, the Government of Senegal tasked its science academy with providing an evidentiary synthesis of the state of the art of genetically modified organisms and related challenges and prospects for Senegal.

In addition, there is a growing body of young academies, as well as international groups such as the World Association of Young Scientists and the Global Young Academy. These young academies are providing a valuable intergenerational voice and have been proactive in grasping the importance of transdisciplinary approaches.

The emergence of a regional or subregional approach to the provision of scientific advice has been an important development. This approach may take the form of regional agencies. For example, the Pacific Community based in Noumea, New Caledonia (France), provides many small Pacific island states with technical and scientific support in areas such as public health and marine resources. The African Academy of Sciences also provides evidentiary analyses for African nations.

Notwithstanding this co-operation, institutional and individual capacities and capabilities still need building in many countries and regions. With pilot funding from the International Development Research Corporation, the International Network for Government Science Advice (INGSA) established the Southeast Asian Science Advice Network (SEA-SAN in 2020) to facilitate joint evidentiary synthesis and information-sharing among senior scientists with advisory responsibilities via an online platform; the focus is on issues of shared regional concern related to the United Nations' Sustainable Development Goals to 2030. This platform will develop, share and access reports and analyses of common relevance and undertake evidentiary synthesis on common issues, allowing each individual country to consider how to incorporate that knowledge appropriately into its policy-making. Over time, as the benefits of structured inputs become visible, it is hoped this initiative will lead to greater institutionalization of scientific advice.

Global assessments are a further form of evidentiary synthesis. Two examples are the assessments undertaken by the Intergovernmental Panel on Climate Change, sponsored by the World Meteorological Organization and United Nations Environment Programme (UNEP), and those undertaken by the Intergovernmental Policy Platform on Biodiversity and Ecosystem Services (IPBES), sponsored by UNESCO, UNEP, the Food and Agriculture Organization and United Nations Development Programme.

The facets of evidentiary brokerage

Evidence brokerage is the process of effectively transferring scientific understanding to the policy community and political decision-makers, while acknowledging that many other factors affect policy decisions. Brokerage may, or may not, be provided by the same actors who undertake evidentiary synthesis.

Brokerage must be sensitive to the reality that policy decisions are based on many other factors beyond the scientific evidence. Societal values, public acceptance, political ideology and priorities, electoral contracts, diplomatic and economic factors are all part of decision-making.

Although science advice may have its historical origin in the natural sciences and technology, effective brokerage is increasingly transdisciplinary. Increasingly, social sciences and the humanities are central to both evidentiary synthesis and brokerage. A particularly sensitive aspect is how to deal with other sources of knowledge that claim authority but are not based on scientific processes. Integrating indigenous knowledge with formal scientific knowledge requires particular understanding and respect.

Evaluating options

All policy-making involves choosing between options (including that of maintaining the status quo), each of which has different implications and trade-offs. When offering scientific advice, the primary objective is to assist the policy community in choosing between the available options.

In so doing, the brokerage function must always consider inferential risk, namely, what are the implications of uncertainties (which are always present)? In order to reduce the risk, the broker defines what is known and not known and the caveats of any synthesis, particularly in relation to probabilities and an explanation of assumptions made. The decision-maker must understand the potential implications of different options in the context of uncertainty. This challenge is apparent in the different choices that countries have made in how they approached Covid-19. For example, early decisions made by some countries appear to have been based on inferences about the early development of herd immunity that were not substantiated by later events. Having recognized the risk in that inference, other countries chose much more restrictive approaches.

It is also critical for the broker to avoid the trap of selecting the evidence to meet predetermined political outcomes.

The difficulties of decision-making and balancing competing interests, even when informed by evidence, has been illustrated repeatedly by the Covid-19 crisis. When most countries in Africa and many around the world chose to impose strict lockdowns, Ethiopia took a different path. It focused on enforcing public health measures, including the promotion of personal hygiene, the wearing of protective masks and social distancing in public places. Although strict lockdown measures made sense from a public health perspective, it would have made life unbearable for many poor households reliant mainly on income from the informal sector. Even though the jury is still out on the long-term effectiveness and benefit of these alternative choices, the policy decisions made need to be understood in the local context of competing demands. This highlights the need for a plurality of scientific input, including from the humanities and social sciences but it also illustrates the reality that decision-making ultimately depends on a range of values-based judgments by politicians.

Navigating the interface

The interface between synthesis and brokerage is, of course, complex. Whereas evidentiary synthesis tends to be transparent in the form of a policy brief or report, and while some brokerage is similarly in the form of formal reports, much is informal, particularly in the early stages of policy formulation or in emergencies, and takes the form of a conversation between the broker and the policy community. Who participates in this dialogue will depend on the mechanism in play, whether the brokerage mechanism is a committee or commission, a science advisory panel or whether the national science academy takes on that role. In emergencies, effective ad hoc mechanisms can be created, as in Sri Lanka (Box 2) and Jamaica (Box 3) but such ad hoc approaches will not ensure appropriate input for the myriad of non-acute policy-making domains where science can assist.

Brokerage often involves direct interpersonal contact with the political decision-maker and, thus, involves individuals such as a science advisor or a senior academician. It is increasingly recognized that the brokerage function requires a particular set of skills and contextual understanding of both the science and policy systems. Specific training programmes have been developed by INGSA and partners to support development of these skills.

Science, policy and values

It is important to recognize that science has embedded values. These include considerations of what questions to study, how to study them and what use to make of the information acquired. However, the scientific method also demands that scientists set aside their individual biases and values when collecting and analysing raw data, as these biases and values may distort empirical observations or evidentiary synthesis, the basis of good science.

By contrast, policy-making is largely a values-based process of choosing between options that affect different stakeholders in different ways. Even the decision as to whether to take any policy action at all is a values-laden decision. The values at stake include political ideology, world view, the fiscal situation, public opinion and reputational issues.

Furthermore, scientific assessments of risk are different to the perceptions of risk by citizens, the latter being primarily

Box 2: **Sri Lanka's generous prevention programme**

After the first Covid-19 patient was identified in January 2020, an ad hoc Presidential Task Force and separate Technical Committee were set up to prevent and manage the spread of infection in Sri Lanka, in the absence of an established science advisory body.

The need for a strong preventive strategy was recognized as a key priority, in light of the health system's limited curative capacity, in particular as concerns intensive care services. The medical profession made a strong case for a complete nationwide lockdown accompanied by the closure of international airports to passengers, as well as contact tracking and tracing.

More than nine months into the pandemic, life in Sri Lanka has gradually returned to normal. As of November 2020, the caseload has been limited to a little over 17 000 confirmed infections, with a low death rate of just 0.27 per 100 000 population – even if the threat of an uptick remains. Success thus far has been attributed to the following factors:

- focused, harmonized and coordinated strategies mobilizing all stakeholders and both public and private resources;
- prevention of community spread, thanks to prompt and stringent contact-tracing enhanced by the intelligence services, quarantine and follow-up measures;
- the rapid conversation of existing institutions into dedicated quarantine centres, Covid-19 hospitals and polymerase chain reaction testing laboratories;
- clear messaging to the nation on the code of conduct to follow, conveyed by a single authority, the director-general of health services;
- frequent programmes promoted through digital and social media to make people aware and accepting of the preventive measures they needed to adopt at individual and societal level during lockdown and re-opening phases; for example, all households were provided with essential items during lockdown and returning Sri Lankan students and migrant workers were given a comfortable stay in quarantine centres.

Source: Prof. Sirimali Fernando, Professor and Chair of Microbiology, Faculty of Medical Sciences, University of Sri Jayewardenapura, Gangodawila, Sri Lanka

Box 3: **Jamaica: a wide range of expertise**

The government has not developed a permanent mechanism for the provision of scientific advice, even though it places a premium on the role of science in informing policy. Rather, it has chosen to use a fit for purpose, ad hoc approach, wherein the government, politicians and technical ministerial staff identify institutions and individual experts from academia, the business sector and civil society to form multidisciplinary, multi-agency teams, with the participation of international agencies. These teams are co-chaired by a government technocrat and an independent expert.

This model was used in the Covid-19 pandemic. Rather than appoint a Covid Czar, the government used the pre-existing Essential National Health Research framework put in place a decade ago to respond to such crises and appointed government technocrats, academics, business owners and civil actors to fulfill specific technical roles. The team has produced a twice-weekly briefing for the Cabinet and the Parliamentary subcommittee established specifically to assume this oversight role.

Three factors stand out as having contributed to Jamaica's relative success in managing the early stages of the pandemic. Firstly, there was a widely felt public sentiment of legitimacy towards the government of the day, resting as it does on an electoral system. Secondly, the pre-existing framework acknowledged the vital role played by scientific evidence in informing policy. The third factor has been the enormous commitment needed in a low-resource country to collect, curate, analyse, interpret, share and utilize a range of data. This has been largely a manual exercise conducted in silos that has only produced the requisite information thanks to a Herculean effort.

Source: Prof. Terrence Forrester, Professor of Experimental Medicine and Chief Scientist at UWI Solutions for Developing Countries at the University of the West Indies (UWI)

determined by cognitive biases. In turn, politicians will understandably look at issues through the lens of their political risk. Translating and communicating between these two domains is, thus, a sensitive and evolving boundary function.

Inferential risk can affect the policy process

From the perspective of scientific advice, the most important value concerns the sufficiency and quality of evidence on which inferences are made by scientists and policy-makers alike in reaching conclusions that might affect the policy process, or, in other words, inferential risk.

Often, decisions must be made on the basis of complex science where many uncertainties remain, owing to the superior value of science in the policy process. Even so, normative arguments would suggest that effective and timely insertion of appropriate knowledge into policy decisions will lead to better policy-making.

Different perceptions of uncertainty by science and policy

However, due to the different perceptions of uncertainty by science and policy-making, collaboration between the two groups does not always go smoothly. Whereas scientific knowledge is always provisional and accepts both epistemic and methodological uncertainties, policy-makers need to act, especially in times of crisis. Politicians prefer to be certain in their communication.

This divergent understanding of the quality of evidence can make collaboration between the scientific and policy-making communities a challenging affair. Hence why one cannot overemphasize the crucial role of effective communication between the policy and scientific communities in such a context.

Developing the advisory ecosystem

No singular model for a science advisory ecosystem has demonstrated its effectiveness in all situations. These range from the provision of advice in an emergency to advice and dealing with longer term issues of sustainability and human development. Even in the mature systems of many high-income countries, multiple components are needed to create a complete science advisory ecosystem, although, in some cases, the pandemic has exposed issues of effectiveness.

The emergence of the Covid-19 pandemic serves as a stark reminder of the crucial importance of establishing well-functioning, formal science advisory institutions, processes and guidelines in low-and middle-income countries and, indeed, in many higher-income countries.

For instance, in Ethiopia over the past two years, politicians and policy-makers have openly requested support from the scientific community in reforming existing policies and developing new ones – an unprecedented move. However, the promising engagement between scientists and policy-makers noted in this period of social and political reform still lacks institutionalization in Ethiopia, being largely ad hoc. This is also true of Sri Lanka (Box 2) and Jamaica (Box 3).

The relatively successful response to Covid-19 from several African countries, including Ethiopia and Ghana (Box 4), throws light on the importance of building on previous experience in tackling an epidemic, to ensure preparedness and effective communication. In particular, handling a crisis efficiently is less a matter of financial means than of effectively communicating options that are well informed by evidence.

One may even go further and conclude from the experience of some lower-income countries which have done relatively well in terms of disease control during the Covid-19 pandemic[3] that there does not seem to be a correlation between their public health response and the country's research intensity. Indeed, as the examples in the present essay demonstrate, the political leadership in many lower-income countries reached out rapidly and effectively to their scientific community.

Box 4: **Ghana: public–private partnerships have boosted self-reliance**

With the closure of many borders around the world, Ghana has had to turn inwards for survival and sustenance. In the face of disrupted supply lines and difficulties in importing goods, local ingenuity has proved vital. Research institutions and universities have provided gene sequencing research and assisted in the production of sanitizers, test kits, ventilators, tracker software and so on. Individuals, state institutions and corporate institutions have come up with innovative ways of manufacturing personal protective equipment, solar and touchless handwashing basins, walk-through full body sanitizer spray machines and so on.

A national Covid-19 team with a strong background in public health was set up to advise the president. The team consists of the Presidential Adviser on Health, a former Deputy Director-General of the World Health Organization and the Deputy Minister of Health.

The strategy adopted by Ghana has focused on regular information updates, including periodic addresses by the president, and a massive public education campaign. The Ministry of Health and Ghana Health Services continue to use their websites and social media platforms to educate the public. Pedagogical materials were translated into eight local languages early on in the fight to boost the uptake of information.

By the time the first two cases of Covid-19 were detected on 12 March 2020, there had already been some public education on safety protocols, as well as checks of body temperature for travelers crossing the border.

Collaboration between the public and private sectors has cushioned the impact of the pandemic. The Ghana National Trust Fund set up by the president in 2020 to alleviate the burden on the poor has attracted contributions in cash and in kind. Some faith-based organizations and individuals have also offered their facilities to the government for conversion into treatment centres.

A new centre for the treatment of infectious diseases was constructed in mid-2020 through a public–private partnership. The 100-bed centre was constructed by the Ghana Armed Forces at the Ga East Municipal Hospital in Accra. The Ghana Medical Association ensured that the centre would be fit for purpose; it houses a biomedical laboratory, pharmacy, recovery court yard and 21-bed intensive care unit, among other facilities. The project was carried out by the Ghana Covid-19 Private Sector Fund, in conjunction with the Ministry of Health.

By November 2020, Ghana had a caseload of just over 50 000 and a low mortality rate of 1.08 per 100 000 inhabitants.

Source: Prof. Marian Asantewah Nkansah, Department of Chemistry. Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Ad hoc scientific advice has its limitations

For scientific advice to be effective, there are at least two essential prior considerations. Firstly, the government and policy community must accept the value of scientific advice across a broad range of issues.

The first of these criteria is not broadly appreciated in many countries lacking formal advisory mechanisms. A further limitation of ad hoc mechanisms is that they may be biased in terms of the knowledge presented, if the experts consulted lack the requisite skills for advisory mechanisms.

Secondly, there must be a local scientific and academic community that can contribute scientific advice; this is amply demonstrated by the integrated Ghanaian response to Covid-19 (Box 4). This does not mean that the only knowledge of value is locally derived. Indeed, most scientific knowledge is inevitably transnational in origin but existing knowledge must, nevertheless, be interpreted in the local context. Institutions like universities are critical to the development paradigm. They must have the necessary skills to transmit knowledge to the policy community and the political process must be willing to incorporate that knowledge into its decision-making. The public will feel confident when it is communicated to them that policy is informed by evidence (Box 2). In communicating scientific evidence and ensuing recommendations both to policy-makers and the wider public, advisors must be transparent about the sources of this evidence to garner trust.

Although ad hoc science advice mechanisms can deal with a particular issue, they do not create long-term value. We suggest that scientific advisory mechanisms be institutionalized. Simple but effective mechanisms have been developed and institutionalized in countries such as New Zealand (Box 5), albeit that the shape of such advisory systems may vary, depending on constitutional, cultural and historical contexts.

Although institutionalizing the scientific advisory process obviously has great longer-term benefits and permits forward planning, it runs the risk of politicization and institutional competition. Appropriate protections need to be in place to ensure the independence and integrity of the advice given. Academia has a critical role to play in providing that accountability, as long as it enjoys sustained independence itself.

Scientific advice must not be limited to crises

Effective and trusted scientific advice is not simply a function of linkages with the policy-maker. It also involves an effective conversation with stakeholders and the public. In the presence of misinformation, a growing challenge globally, trusted honest communication to all citizens takes on critical importance.

The role of structured scientific advice must not be limited to emergencies. Much of a government's decision-making in areas ranging from education to transport, from energy to agriculture, from innovation policy to social welfare, can

Box 5: **New Zealand has managed to eliminate the virus**

New Zealand has done well in handling the pandemic since the first case was reported on 28 January 2020. Arguably key to New Zealand's success was the relatively early clear scientifically informed determination that elimination rather than suppression was a viable option, even if this policy took time to put in place. Elimination was a feasible option, as New Zealand is made up of a group of islands.

A strict border closure was introduced on 20 March 2020, accompanied by a two-week period of quarantine for returning New Zealanders, aggressive contact tracing and a seven-week national lockdown.

The virus was considered to have been eliminated after more than 100 days without any community cases. A subsequent small outbreak was nipped in the bud by locking down the country's largest city, Auckland, for a few weeks. A handful of isolated cases have been rapidly identified and managed through well-developed testing and contact tracing.

The population has been highly compliant and co-operative, reassured by clear communication on the different levels of social restraint and lockdown. The prime minister used sporting analogies to encourage a united ambition. She referred, for instance, to the New Zealand population being 'a team of 5 million'. Both the prime minister and director-general of health held daily press conferences for many months. The quality of science communication by scientists both within and without the advisory system was exemplary.

A novel aspect of the response was the establishment of a parliamentary select committee headed by the leader of the opposition to monitor the response. The committee's deliberations were webcast live, thereby giving the public insights into the complexities of the national response. This served to enhance the transparency of decision-making and build trust in the system.

There is a lot of respect for science in New Zealand, which has a well-developed science advisory system. The country's emergency response system was largely built to handle natural disasters. It is based on a co-ordination committee chaired by the Chief Executive of the Department of the Prime Minister and Cabinet. The Chief Science Advisor to the Prime Minister sits on the committee. The lead ministry for the emergency response to the Covid-19 pandemic was the Ministry of Health. It has well established scientific advisory mechanisms and its own science advisor. The ministry brought in appropriate modelling and epidemiological expertise.

The whole of government response included working with research institutes, universities and the private sector to build testing and other requisite capacities.

The challenge now will be to judge when and how to re-open the border, the closure of which over the past eight months has had significant implications for many families and for components of the economy.

Source: Prof. Peter Gluckman, former Chief Science Advisor to the Prime Minister of New Zealand

be assisted by appropriate skilled evidentiary synthesis and brokerage. Issues such as whether to adopt new technologies such as gene editing or how to use artificial intelligence and big data to enhance productivity will be best addressed when the science is properly considered. Anthropogenic climate change creates particular challenges which demand input from both natural and social sciences. With the rapid pace of technological development, governments will be faced with many expectations and choices to make on a regular basis. Sound, holistic scientific advice can do much to assist governments in such contexts.

Currently, advisory systems are at highly variable stages of development across high-, middle- and low-income countries. They cannot be effective or meet their objective if they are unable to present and digest the evidence independently of political interference. This requires maturity within the political and policy communities.

Ultimately, it is up to government to make decisions that incorporate a broader range of input. However, these decisions will have a greater likelihood of meeting government objectives when properly informed by evidence.

There is no singular model to copy but recent experiences highlighted in the examples on these pages suggest that low- and middle- income countries are finding a range of approaches to meet their acute needs in effective ways.

The challenge will be to learn from these lessons, to determine how the science advisory ecosystem and related institutions might evolve in every country.

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ENDNOTES

1 See : http://research.assaf.org.za/handle/20.500.11911/81
2 Professor Diallo is also an executive member of the African chapter of the International Network for Government Science Advice (INGSA).
3 See: https://www.ingsa.org/covid/policymaking-tracker-landing/