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Skills for future pandemics unpacked

What has the SARS-CoV-2 pandemic taught us? What skills should be prioritised to enable South Africa to better prepare for future pandemics? What specialists and further research are needed?

Over the past two years, the pandemic has taught humanity how to manage disease outbreaks more effectively, and how to prevent them altogether. Now, as we look to the future, we need to look ahead at how these lessons can be used to shape humanity's approaches to pandemics and to ask questions around skills development, research, education, training and data management.

The National Science and Technology Forum (NSTF) hosted a panel discussion at the annual Science Forum South Africa (SFSA) on 'Skills to prepare South Africa for future pandemics' under the sub-themes of specialised research areas to prioritise, monitoring, modelling and communication. This 90-minute panel discussion took place on 1 December 2021 and highlighted the importance of skills in communication, specialised monitoring, data management and mathematical modelling, among others, in addressing future pandemics or epidemics.

The NSTF provides neutral collaborative platforms where issues and sectors meet

- One of the National Science and Technology Forum (NSTF) functions is to hold discussion forums, bringing the private and public sector together to address important issues and engage with government policy.
- Feedback from these discussion forums is given to role players and stakeholders.
- Recommendations are put forward to government as part of the SET community's (science, engineering and technology) efforts to make input into SET-related policies and implementation.
- It was hosted with the NSTF Science Councils and Statutory Bodies Sector. This sector has 17 member organisations participating as key stakeholders of the science, engineering and technology (SET) and innovation community.

Focusing on the future

Prof Stephanie Burton, the session Moderator, pointed out that skills in the specialised monitoring of outbreaks of communicable disease, virology, and epidemiology are clear priorities, but that there is also a need for skills in data management, mathematical modelling to monitor trends, and public communication. As has been seen in the current pandemic, the ability to engage the public and provide them with information that will ensure they make appropriate decisions is key in minimising the impact of a pandemic. (Burton is Professor at Future Africa and Professor in Biochemistry at the University of Pretoria).

The value of waste

Dr Eunice Ubomba-Jaswa, who is the Research Manager: Water Resources Quality at the Water Research Commission (WRC), holds a PhD in Microbiology from the Royal College of Surgeons in Ireland, presented on 'How can the skills for wastewater monitoring and early warning systems for pandemics be acquired and promoted'. She unpacked the lessons learned from all the great plagues on historical record that had a major impact on society, and how these had informed each successive plague and lead to methods to curtail it. Plagues aren't new, but the technology that has evolved to manage them is. She looked at how wastewater-based surveillance could enable the development of an early warning system, providing insight into when infection rates were about to rise. This can potentially be used to identify areas that appear to be free from infectious cases but are not, and to determine re-emergence and persistence of infections. The challenge in South Africa is that many communities are not connected to the sewer line.

Ubomba-Jaswa also highlighted some of the key skills she felt could make a significant difference going forward, including: molecular biology; computer programming; bioinformatics; computational biology; epidemiology; biostatics; data mining and database management. These are the skills needed to achieve next-generation sequencing using high-performance computing that can improve pathogen culture analysis capabilities. These skills need to be aligned with joint pathogen detection programmes and laboratory administration to coordinate laboratory networks so information can be effectively collated when the infection rates rise. She raised the issue of ethics around how waste is handled. It is something shared from someone's body and there has to be thought put into privacy and the storage of personal information.

These skills are not just for managing the pandemic, but for other diseases, and this requires continuous education and skills development from the primary level to the laboratory.

Investing in virus skills – a multi-sectoral, transdisciplinary approach

Prof Marietjie Venter has a PhD in Medical Virology from the University of the Witwatersrand and postdoctoral training from the National Institute for Allergy and Infectious Diseases in the United States, on the West Nile Virus. She has worked on respiratory- and zoonotic arboviruses since 1999, at the National Institute for Communicable Diseases (NICD), in South Africa, and University of Pretoria. Her focus was on 'How can more investment in virology research and skills help SA to be better prepared for pandemics'.

The NSTF Awards, since 1998, recognise outstanding contributions to science, engineering, technology (SET) and innovation in South Africa:

- Known as the 'Science Oscars of South Africa', the NSTF Awards profile scientific research that is professional, innovative, forward looking and relevant to both SA and the rest of the world.
- The solution-driven work of the Award Winners raise awareness among the general public about local research and its relevance to socio-economic issues.
- Award Winners are profiled to Youth as role models through the NSTF Share 'n Dare Programme providing inspirational and knowledge sharing talks to encourage them to study in SET-related fields.
- **Prof Marietjie Venter** is also the winner of the 2013 NSTF Researcher Award for her outstanding contributions to science.

She unpacked the circular virus route from animal to human to animal and back again, and the importance of developing different diagnostic techniques to drive virus discovery and genomic surveillance. This not only allows for the rapid detection of other variants, but can assess the impact of different waves and whether or not there's some level of herd immunity.

She further explained the best example of how South African skills rose to the top in the

early detection of the Omicron variant in late 2021. South Africa detected it thanks to its excellent scientific teams. Now, as the scientific community has learned a great deal about how to deal with a pandemic, and create a vaccine at extraordinary speed, the goal is to focus on multi-sectoral, transdisciplinary collaboration. For Venter, this approach is extremely important, along with laboratory capacity, as a major part of a pandemic plan. She said that the role of the virologist needs to ensure the development of diagnostics, both rapid identification and multi-pathogen tools, and virus discovery to quickly identify what's circulating and implement syndromic surveillance.

Venter underscored the value in training scientists so they can work safely in these areas and contribute to understanding, eventually developing vaccines and antivirals that can protect humanity. She also highlighted the need for epidemiology training which has been neglected in the past.

The maths equation: data and modelling to aid decision making

Prof Sheetal Silal, Director of the Modelling and Simulation Hub, Africa (MASHA) and associate Professor at the University of Cape Town (UCT) addressed the topic of: 'How should the skills for mathematical modelling for pandemics be acquired and promoted?' She explained that mathematical modelling supports decision makers in determining critical factors such as facility readiness, hospital preparedness, medication availability and more. It also offers insight into the potential size of the pandemic's infection waves and disruption to the economy in terms of macro-economic impact.

Other presentations

- The session moderator, **Prof Stephanie Burton** had presented at a previous NSTF Discussion Forum on 'Preparing for epidemics in South Africa – human and animal'. Her presentation on 'Where do you get your information during times of pandemics' made it very clear that certain areas of academia and research have become increasingly important in the context of pandemics and epidemics. She is also the winner of the 2021 NSTF Management Award for her outstanding contribution to science through management and related activities.
- **Ms Tessa Dooms**, a development consultant and a member of the COVID Comms Board, examined 'How the skills for communicating during pandemics should be acquired and promoted'.

As mathematical modelling informs a variety of decisions from district planning and dealing with an epidemic at a low level, all the way to the National Coronavirus Command Council (NCCC), the necessary skills are varied. It requires biology, maths, computer science, an understanding of the public healthcare system, private healthcare, health-related economics, and training in systems thinking. Silal believes it's important to invest in skills development with both a long- and short-term view to transforming these skillsets across Africa. (She is also a winner of the 2021 NSTF Emerging Researcher Award for her outstanding contribution to science.)

Dr Jabu Mtsweni is the Head of Information and Cyber Security Centre at the Council for Scientific and Industrial Research (CSIR), Research Fellow at University of South Africa (UNISA), and Technical Leader of the National Policy Data Observatory. His presentation looked at 'How the skills for data management, analysis and modelling for pandemics can be acquired and promoted'. He underscored the importance of data and decision support capabilities in the time of pandemics, as data insights are critical to understanding the trends and issues across provinces and districts. The virus doesn't behave the same way across each district or community, and the data provided by the digital transformation era can be used to understand the spread of diseases and the effectiveness of restrictions.

Mtsweni believes that the skillsets and capabilities required to effectively achieve this are a combination of various factors across social understanding, technical skills, health expertise, mathematics, behavioural insights, and communication skills. The goal is to ensure that the scientific community has the technology and skills it requires to deal with the significant volumes of data. This includes artificial intelligence and machine learning platforms as well as the infrastructure required to help ensure that teams can leverage innovation, and play a role in driving proactive decision making and data discovery.

The future unpacked

The pandemic has taught the world how to put words into action, to derive learnings from complexity, and to engage in multi-sectoral collaborations to effect long-term change. To put South Africa on a firm foundation for the future, it's important to continue investing into the skills and collaborations that will empower the discovery of future pandemics or epidemics, and minimise their impact through proactive action and technology. Each speaker highlighted the very specific skillsets relevant to their field, but the golden thread that ran through them all is that we must never stop with skills development, and investment in education so that every generation is prepared for what lies ahead.

The speakers or the spokesperson, Ms Jansie Niehaus, Executive Director of the NSTF, can be contacted through media@nstf.org.za. Further information can be found on the NSTF website and the vidoes of the speakers can be found on the NSTF YouTube channel.

Read about previous NSTF Discussion Forums on related topics:

- Preparing for epidemics in South Africa – human and animal, 25-26 February 2021
- Career paths for researchers – where to in a changing world?, 2-3 December 2019

About the NSTF

The National Science and Technology Forum (NSTF), established in 1995, is a broadly-representative stakeholder body for all science, engineering and technology (SET) and innovation organisations in South Africa, which seeks to influence policy formulation and delivery.

The NSTF Awards are unique in SA, recognising the outstanding contributions of individuals, teams and organisations to SET and innovation.

The science bursaries page provides information on bursaries and bursary providers for science, engineering and related studies.

STEMulator.org attracts learners and students to the exciting world of science, technology, engineering and mathematics (STEM). It provides a virtual world full of stimulating content to excite and inform the youth, including STEM career guidance. Established under the auspices of the NSTF pro*SET* membership sector (Professionals in *science, engineering and technology*).

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