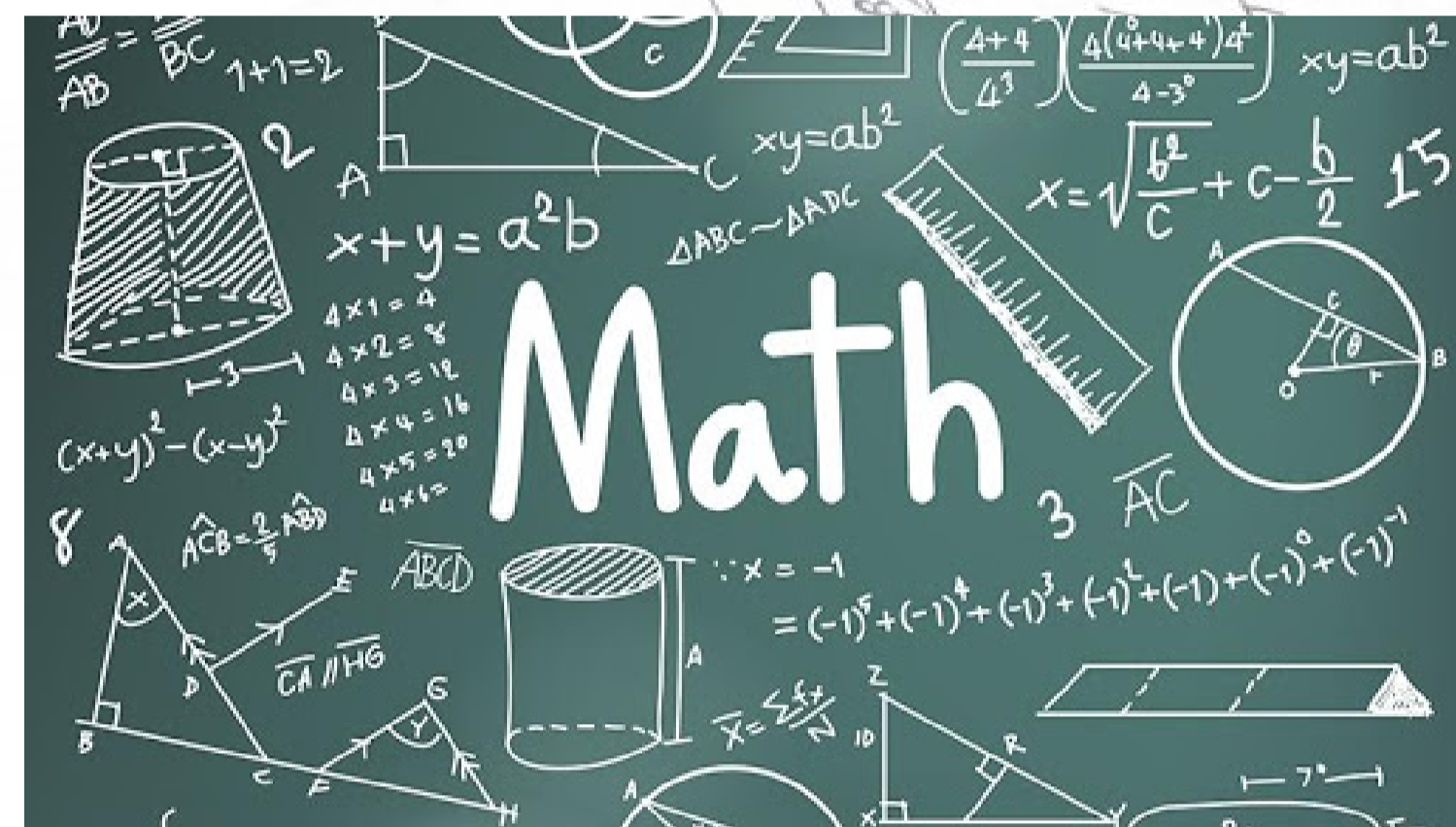


# How Maths Is Helping With Covid-19

## A message of hope and how mathematics will solve Covid-19

Department of Mathematics and Applied Mathematics  
Faculty of Science  
University of Johannesburg

Heritage/Diversity Month  
September 2020



### Introduction

In 2020, the whole world came to a standstill and humanity was under threat because of an invisible enemy, the coronavirus (Covid-19). This is a disease that affects the poor or the rich, it knows no race nor age, knows no profession and nonpartisan, it has taught us numerous critical lessons which include that:

1. Frontliners such as the healthcare workers, the food producers, manufacturing, distribution, and retailers, policy makers and implementors were among the most critical personnel in the, so far, six months of COVID-19 pandemic.
2. The importance of personal hygiene in the fight against infections.
3. The need for unified responses to pandemics rather than diverse disconnected strategies [1]. South Africa, in particular, is reeling from this pandemic but one thing, among others, kept her intact in the fight; Scientific Collaboration.

Science is in the forefront in the fight against Covid-19 and has even seen mathematicians gaining momentum using the various predictive toys to map and advise the country's leadership.

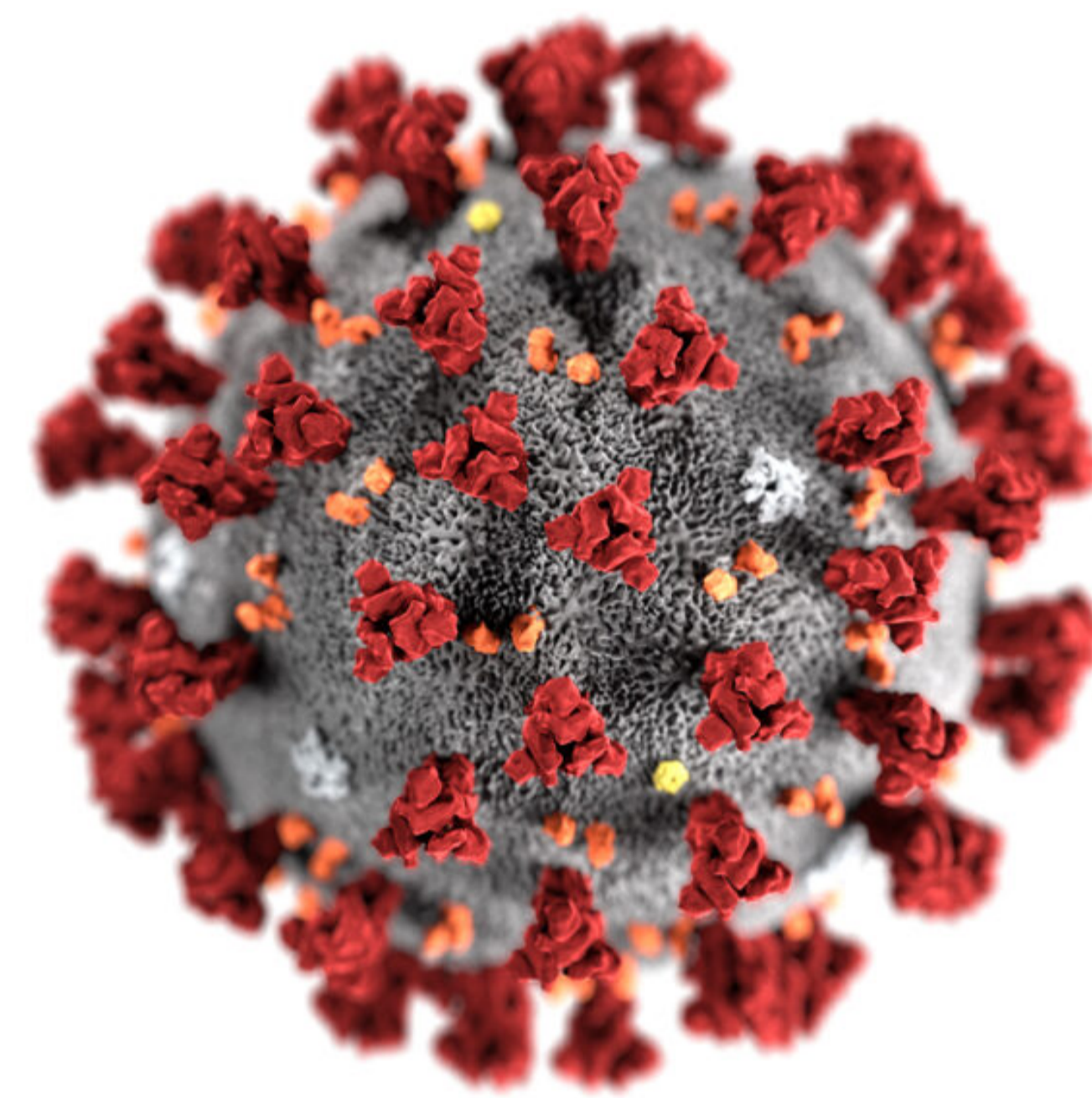
### Mathematics and Covid-19

Mathematics, especially mathematical modelling can be used to understand how a virus spreads within a population. The essence of mathematical modelling lies in writing down a set of mathematical equations that mimic reality. These equations are then solved for certain values of the parameters within the equations. The solutions of the mathematical models can be refined when we use data from what we already know about the virus spread. This process of model calibration can be done a number of times until the solutions of the mathematical equations agree with what we already know about the virus spread [2]. The calibrated model, can then be used to tell us more about future behavior of the virus spread. One outcome of mathematical models is the predicted epidemic curve representing the number of infections caused by the virus over time. Using different

parameters in the model, which may illustrate different interventions, or calibrating the model against different data, can change the predicted epidemic curve.

Although there are numerous models out there predicting the spread Covid-19 spread, we should all be aware that a mathematical model is as good as the assumptions it makes and the data it uses. This in turn leads to these models predicting different results. These seemingly differing results started a discussion on which model is more accurate in predicting COVID-19 spread. People wonder whether the seemingly different conclusions drawn exposed problems with using models for infectious diseases transmission as key drivers of policy decision making.

The key question is not **which model is correct** but that **all models are correct for answering subquestions** that together will build the big picture. It is therefore important to put these developed models, and their conclusions, in the context of the big picture around COVID-19 spread and interventions to halt it.



### Messages of hope to all Covid-19 fighters in South Africa

This heritage month, **we salute our front line workers**. To all the health care workers and everyone involved in the fight against COVID-19, the Department of Mathematics and Applied Mathematics would like to say bravo, kudos and THANK YOU ♡. We appreciate all your efforts, hard-work, dedication, bravery, commitment and passion for the job. In a truly AFRICAN way, we say:

*"Met inagneming van die COVID19-pandemie is die volgende aanhaling, gedateer uit 1812, steeds relevant: "The theory of probabilities is at bottom nothing, but common sense reduced to calculus". Hierdie aanhaling van Pierre-Simon Laplace, 'n Franse wiskundige, het daarop gewys hoe die waarskynlikheid van allerhande gebeurtenisse en hipoteses bereken kan word. Verder het Laplace gewys hoe 'n bekende spel van verandering n objektiewe gemiddeld bied vir die berekening van waarskynlikheid, en hoe dit uiteindelik 'n spel van gesonde verstand is!!" By Durandt R. (Afrikaans)*

*"Go lena badiredi ba maphelo, re re seatla godimo ga se sengwe. Le ka noso!!" By Seloane P. (Sepedi)*

*"Re rata hole leboha lona ba lekala la bophelo ka mosebetsi o motle oo le o etsang. Ka ho fetisisa re leboha baoki ka ho beha maphelo a bona paneng le tlokotsing hore ba re fumanele bophelo bo botle ho sa tsotellehe tlokotsi eo bona ba leng ka hara yona. Le ile la peseletsa, la noa mathe le madi le ha disebediswa di ne li fokola. Laba dinatla, la ema ka pele moleng wa ntwa, la bontsha boikarabello le boitlamo ba hore mokodi o itla pele, kaha ele kano yeo le ileng la ikana ka yona. A mang a masole a lona a ile a lahlehelwa ke maphelo ntweng ena (meya ya bona e phomole ka kgotso), likwankweila li setse hore lwanela, ho beha maphelo a bona paneng kaha bophelo e le ntwa. Re leboha ho menahane!!" By Paepae T. (Sesotho)*

*"Re rata go leboga badiri botlhe ba eteletseng kwa pele mo ntweng kgatlanong le bolwetsi jwa COVID-19. Re akaretsa mapodisi, baoki, dingaka le badiri ba tshoganyetso. Re leboga go menagane!!" By Letlhage K. (Setswana)*

*"Covid-19 chirwere chakatambudza pasi rose tenderere, chisingarudzi murombo kana mufumi, chisingazivi rudzi kana zera, chisinabasa nedzidzo kana kwaunoshanda uye zematongerwe enyika, chakatarangardza rimwe remadimikira epasi chigare rinoti: "Kuwanda huuya". Nyika ye South Africa yakaoneswa uye ichirikuona ndondo nedenda iri asi mushandirapamwe wakaitwa nevemabasa akasiyana-siyana mubazi reScience panyechete nemamwe mabazi ose kwakaita kuti hondo iyi ive nyore-pakurwisa nekusunungura nyika mudambudziko iri. Rimwe davi rinobva muScience reMasvomhu rakaonekwawo richiita mukurumbira wekufungira zvizere zvezvaizoitika mukufamba kwenguva, zvakaikawo kuti vatungamiriri venyika vakwanise kurongedza zvombo zvakawana zvekurwisa hoshwa iyi. Apo kushunguridzika kwava kuserera, tinokurudzira mubatirapamwe we Science nemamwe mabato ese uyu kuti uyenderere mberi kunyange mumatambudziko mamwe akasiyana ne Covid-19. Iri ngarive donzvo rekushandidzana kutsva kunoenderera nekusingaperi, KUWANDA HUUYA!!" By Chirove F. (Shona)*

*"Sitsandza kutsatsa lelitfuba kubonga hulumente, bodokotela, nebahlengikati labadlala indzima lenkhulu kulwa nateligciwane lelikhungetse umhlaba wonkhe. Sibonge bonkhe labalandzela*

*imilayeto lesinikwa yona yekutivikela. Seswele imilomo letinkhulungwane yekutibonela. Nasidvonsa ndzawonye, sonkhe sitawincoba!!" By Dlamini P.G. and Simelane S.M. (SiSwati)*

*"Tatalahote bahlonitshwa, songcwabana!!" By Sixaba V. (Xhosa)*

*" "Krag deur kennis" was die slagspreuke van my horskool. Te danke aan die harde werk deur ons land se mediese en wetenskaplike personeel en al die kennis wat hul geskep het in die stryd teen hierdie pandemie is ons land meer kragtig as tevore. Suid-Afrika kan hoop weens hierdie krag en kan hoop dat ons hierdie pandemie sal oorwin." By Anderson K. (Afrikaans)*



### Conclusions

Mathematical modelling is a powerful tool for understanding transmission of Covid-19 and exploring different scenarios. But, instead of focusing on which model is correct, we should accept that one model can not answer it all and that we need more models that answer complementary subquestions that can piece together the jigsaw and halt COVID-19 spread [2].

As the pandemic is seemingly easing down, we call for the scientific bond created during the pandemic to be nurtured and finish off the fight for pandemic beyond the current one. Let this unity be the new science normal of perception against world problems.

### References

- [1] Forman, R., Atun, R., McKee, M., and Mossialos, E., (2020). 12 lessons learned from the management of the coronavirus pandemic. Health Policy. 124:577-580.
- [2] Panovska-Griffiths, J., (2020). Can mathematical modelling solve the current Covid-19 crisis?. BMC Public Health. 20:551.