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Antimicrobial Resistance In The COVID-19 Era: A Global Literature Review Highlighting The Need For Focused Surveillance In South Africa's Free State And Northern Cape Provinces

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Abstract
Antimicrobial resistance (AMR) represents a mounting global health crisis that transcends geographic, political, and economic boundaries, with its presence documented across every continent. Since 2017, the burden of AMR has surged sixfold globally, signalling an urgent call for coordinated intervention. This literature review synthesizes current findings from peer-reviewed academic databases to examine the role of the COVID-19 pandemic in accelerating the trajectory of AMR and highlights persistent gaps in the global research agenda. Notably, the United States reported a 20% increase in six major bacterial antimicrobial-resistant hospital-onset infections during the pandemic compared to pre-pandemic periods. This surge peaked in 2021 and, alarmingly, remained elevated throughout 2022, underscoring the pandemic's compounding effect on existing resistance trends and the fragility of global healthcare infrastructures.

Keywords: *COVID-19 pandemic, antimicrobial resistance, multi-drug resistance.*

INTRODUCTION

The impact of the coronavirus disease of 2019 (COVID-19) on South Africa was undeniably significant, affecting not only the country's financial landscape but also leaving its mark on the medical sector. Hospitals were drastically understaffed during this period and without the necessary equipment, drugs, and infrastructure to fight this pandemic lead to a poor health outcome which was unavoidable in certain situations. There was a wide range of adverse impacts on the health services and one of the impacts that were not noticed was the further development of antimicrobial resistance (AMR) (Shomuyiwa , et al., 2022). The antimicrobial stewardship programs were shifted aside during the pandemic and more focus was put on the lockdown, rapid testing and vaccinations for COVID-19. Virtual patient consultations and intensive care units with the focus on treating COVID-19 patients unintentionally contributed to the further development of multi-drug resistant bacteria, while the laboratories were flooded with COVID samples there was a decrease in the testing of bacteria (Khaznadar, et al., 2023).

Factors that contributed to the increased consumption of antibiotics included misconceptions, lack of awareness about the virus outbreak, cultural stigma, misinformation and the overall fear of the population to get infected with the virus lead to patients asking for antibiotics without a bacterial infection being present. This especially occurred in low-and-middle-income countries for example South Africa (Djuikoue, et al., 2023). In 2017 a list was released by the World Health Organization (WHO) to researchers and doctors that included 12 of the families of bacteria that was the most resistant to antimicrobials, to promote the development of new antimicrobials by researchers. The organisms that were on the list included multi-drug resistant (MDR) bacteria that can be found in hospitals or that poses a threat to patients with indwelling devices (Med, 2019). Bacterial infections could be fatal if left untreated due to the unavailability of antimicrobials to which it is sensitive to, these infections included pneumoniae and blood infections. This was done in an attempt to decrease the further development of AMR, but before any plans or strategies could be put in place the COVID-19 pandemic occurred and since then the attempts have been placed on hold (Djuikoue, et al., 2023).

When looking at low-and-middle-income countries it is noted that most of the prevalent illnesses shows resistance to at least one of the antibiotics that are commonly utilized for that specific bacterium. This clearly highlights the severity of the new pandemic that could be seen as AMR in these countries (Murray , Ikuta , & Sharara , 2022). Further research confirmed that there is a direct correlation between the high levels of resistance and the overuse and misuse of antibiotics (Gulumbe , et al., 2023). South Africa lacks the presence of a proper and working antimicrobial stewardship program (ASP). Without this program in place the presence of AMR will increase further due to the lack of education regarding proper use of antimicrobials. A WHO report stated that in South-East Asia and in Africa 45% of deaths are due to MDR bacteria. These troubling number are said to increase even more since this data was collected before the COVID-19 pandemic and current research confirms that the pandemic might have increased the prevalence of MDR bacteria across the world (Gulumbe , et al., 2023).

AMR causes prolonged hospital stays for the patients with an increased risk for the further development of a hospital acquired infection. The effects of AMR do not only stop at the patient but it also has a tremendous impact on the strain of the economy. An increased amount is spent on treatment of patients in the public hospitals, which could be avoided. This causes a decrease in the finances that are made available to other clinics or other areas in the health sector that is in dire need of funding (Thermo Fischer Scientific , 2024). Examples of this financial implication in other countries includes 9 billion euros that are spent in Europe each year due to AMR. AMR also adds 20 billion dollars in direct healthcare costs according to the Centre for Disease Control and Prevention (CDC) in the United States. Another 35 billion dollars is lost annually due to a decrease in productivity (Dadgoster , 2019). These numbers are drastically high especially since these two countries are high income populations, and this should be taken in consideration when looking at the impact that AMR had on South Africa. There is no definite number to say how much money South Africa has lost in productivity or how much is spent in healthcare costs, but since it is a middle-income country and just by looking at the high-income countries it can clearly be estimated to be billions of rands (Dadgoster , 2019).

PROBLEM STATEMENT

Antimicrobial resistance (AMR) continues to be a growing global health crisis, significantly contributing to prolonged hospital stays, increased patient morbidity, and substantial economic strain on healthcare systems. While countries such as the United States and members of the European Union have quantified the financial and productivity losses associated with AMR estimated at over 20 billion USD in direct healthcare costs and an additional 35 billion USD in lost productivity annually, the burden in middle-income countries like South Africa remains largely undocumented. The lack of consistent, region-specific AMR research and surveillance data in provinces such as the Free State (FS) and Northern Cape (NC) represents a critical gap in the country's public health preparedness.

Recent global studies highlight the importance of microbial profiling both pre- and post-COVID-19 in identifying emerging pathogens, understanding polymicrobial infections, and informing infection control strategies. However, these efforts have not been sufficiently mirrored in the FS and NC provinces, where public health infrastructure is already stretched. The absence of research and localized disease monitoring systems undermines the ability to respond effectively to hospital-acquired infections and evolving resistance patterns, especially in post-pandemic contexts where bacterial dynamics may have shifted significantly.

This gap in bacterial profiling and disease monitoring not only compromises patient outcomes but also diverts already limited financial resources, thereby amplifying inequities in healthcare service delivery. Without robust and continuous AMR surveillance, including region-specific bacterial profiling, policymakers and healthcare practitioners in FS and NC remain ill-equipped to mitigate future outbreaks, optimize antibiotic use, or prioritize critical funding. There is an urgent need for systematic investigation and establishment of surveillance frameworks in these provinces to understand the current AMR landscape and respond proactively to emerging threats. Hence, a comprehensive understanding derived from this literature review (2017–2025) will underscore the urgent need for evidence-based disease surveillance and control strategies in South Africa, particularly within the Free State and Northern Cape provinces. The findings will highlight the critical gaps in bacterial profiling

and antimicrobial resistance monitoring especially in the post-COVID-19 era where shifts in pathogen dynamics demand localized, data-driven public health interventions

METHODOLOGY

A systematic search was done by using various academic databases to identify relevant studies that were published. The following keywords were used to narrow down the search, COVID-19 pandemic, antimicrobial resistance, multi-drug resistance, resistance patterns in South Africa.

The studies that were included in this transcript were studies that focused on how antimicrobial resistance occurred and how COVID-19 could possibly have contributed towards it, impact of COVID-19 on antibiotics and antimicrobial resistance patterns.

LITERATURE REVIEW

Social distancing, masks and travel restrictions were implemented to prevent the spread of COVID-19, and isolation was requested for patients that tested positive for the virus. The travel restrictions that were implemented could decrease the presence of AMR since people that travel to countries that have a higher prevalence of AMR could become infected and move these pathogens from one country to another. This then causes the further spreading of AMR pathogens. These restrictions were only short term, so their effect on AMR could not exactly be determined. The scientific community agrees that the face masks greatly reduced germ transmission. This fact is supported by the decrease in the influenza and pneumonia cases that were reported. But on the other hand, these face masks are a great hiding spot for antimicrobial resistance genes especially in the marine ecosystem and it could contribute to the increased AMR (Khaznadar, *et al.*, 2023).

While most could say that COVID-19 could only have had a positive effect on the development of AMR due to isolation and personal protective equipment, some research suggests otherwise. Due to the attention being mostly on COVID-19 patients, samples were mostly not tested for any bacterial organism and only tested for the virus. Bacterial co-infections could also occur in these hospitalized patients and this requires antibiotics, but data suggests that the prescription of antibiotics to these patients are much higher than the actual prevalence of antimicrobial co-infections. This also contributes to the overuse of antibiotics and further development of AMR. While most healthcare workers were obligated to attend to the COVID-19 patients, not allot of attention was placed on AMR. This allowed self-medication of antibiotics to increase and the testing of sample for antimicrobial susceptibility to decrease (Khoshbakht , *et al.*, 2022).

Around 50% of the overall antibiotics that are prescribed to patients, are done so unnecessarily. In general prescriptions are given to patients that present with cold or flu-like symptoms by doctors, but these illnesses are caused by viruses and antibiotics have no effect on a virus. A study that was done in 2015 by the WHO indicates that South Africans held the belief that flu, colds, HIV, measles, headaches and body aches could be cured by antibiotics. Since COVID-19 had cold or flu like symptoms patients requested for antibiotics since they believed it would help them (Mendelson , 2017).

Due to the high pressure that was placed on the health care system during the pandemic antibiotics were prescribed to patients due to the initial uncertainty in the patients that were presenting with a respiratory illness. This was made even more difficult due to the possibility of a co-infection with COVID-19 or a secondary infection in the COVID-19 positive patients. Virtual consultations also contributed to the increased prescriptions of antibiotics due to the difficulty in diagnosis over the phone (Langford, et al., 2023).
According to the CDC there has been a 20% increase in the amount of six bacterial antimicrobial-resistant hospital-onset infections during the COVID-19 pandemic compared to the period before the pandemic In the United States. This has reached a peak in 2021 when compared to pre-pandemic levels and still remains higher in 2022 (CDC, 2025) .

DISCUSSION

The literature strongly indicates that the pandemic has had a negative effect on antimicrobial resistance especially in low- and middle-income countries. Antimicrobial stewardship programmes were mostly placed on hold during the pandemic period to focus on the containment and treatment of COVID-19. This led to the overprescription of antibiotics especially in cases where bacterial infections were diagnoses where viral symptoms were present. Public fear and virtual consultations further contributed to unnecessary antibiotic prescriptions and use. Laboratories focused mainly on the testing of COVID-19 samples and this caused a decrease in bacterial cultures. Even though there were preventative measures in place such as social-distancing and masks, it only temporarily the spread of only a few infectious diseases, it was not enough to prevent the rise of AMR.
In the post covid era there is now a serious threat to national and global health due to the accelerated AMR due to decreased AMR monitoring, antibiotic misuse and reduced public health infrastructure.

CONCLUSION

The COVID-19 pandemic has without a doubt had a negative impact on the treat of antimicrobial resistance, especially in areas that have limited resources. While focus was placed on combating the virus, this came at a tremendous cost of the resistance monitoring and antimicrobial stewardship. The often inappropriate and widespread used of antibiotics, with public misinformation and reduced diagnostic testing led to the further spread and development of resistant pathogens. These finding confirms the importance of reinstating the antimicrobial stewardship programs and to improve the publics knowledge to mitigate any long-term consequences of AMR in the post-pandemic era. While the impact is greatly known in developed countries, the impact in South Africa is greatly unknown in literature.

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