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Narrative Reviews

COVID-19: a boon or a bane for the microbiologists

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ABSTRACT

Background: In the situation where COVID-19 pandemic has placed unprecedented demands and pressure on the health care system, we wanted to analyze how the medical microbiologists of our country were affected. Was it actually an opportunity to showcase the specialty or was it a doom? A debate was organized as a key session in the national e-conference of the Indian Association of Medical Microbiologists, held on 10 December 2020.

Objectives: The objective of the debate was to examine and analyze the various positive as well as negative impacts of COVID-19 on the discipline of the medical microbiology of our country.

Content: Before the debate a voting session was conducted to assess the opinion of the audience followed by a very interesting debate where both the speakers presented their view points. The points in favor of the discipline were, mainly up-gradation of the specialty of microbiology in terms of learning, skill development, infrastructure, networking & research opportunities related to COVID-19. While the main points against were, nerve wracking work load without much acknowledgement, performance pressure from hospital administration to maintain rapid turnaround time, and a forceful neglect of all other infectious diseases like tuberculosis and antimicrobial resistance which were the key battle fields of the medical microbiologists. Postgraduate & even undergraduate training programs got completely derailed to their disadvantage. By the end of the debate, it was concluded that COVID-19 was neither a boon nor a bane to the microbiologists. A balanced approach to the problem in hand is required without ignoring the pre-existing infectious diseases in our country. The post debate voting swayed the audience considerably for it to be a bane & the faculty debating for boon had a huge margin to begin with but finally won with a whisker indicating the intensity of the debate.

The ongoing outbreak of Corona virus disease (COVID-19) has changed the life and daily routine of people of all walks of life, medical microbiologists being no exception. Medical microbiology is a profession which came in the spot light during the current pandemic with the news media regularly discussing COVID-19 testing and reporting. So what has happened to the Medical microbiologists of our country during this pandemic, was this an opportunity or was it a doom?

To address these issues, for the first time in the country, a debate was organized in the national e-conference of Indian Association of Medical Microbiologists which was held on 10 December 2020 with the aim of unraveling various aspects of this ongoing challenge. The session started with a voting by the audience, where 91% of the audience was of the opinion that COVID-19 is indeed a boon for the microbiologist and 9% felt it to be a bane. The debate started with this preconceived notion of the floor.

1. Why COVID-19 is a boon for microbiologists

The dictionary meaning of the word “boon” is something beneficial to a specific person, entity or cause. The most important point in favor of this thought process is the upliftment of the specialty. There occurred a tremendous up-gradation of the fraternity of microbiology in terms of learning, up gradation of skills, infrastructure, networking, opportunities for inter disciplinary collaboration & research opportunities. Over the past century, humanity has witnessed the emergence of numerous zoonotic viral infections that have resulted in varying number of human fatalities. Yet none of them have given the opportunity to learn the kind of lessons we have learned during the current COVID-19 pandemic. The benefits incurred by the specialty may be discussed under the following headings:

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1. Learning opportunities

COVID-19 pandemic has provided great learning opportunities for microbiologists.

It has made all microbiologists learn virology & a great deal of epidemiology. Another area which got strengthened during the season is outbreak investigation. COVID-19 provided an opportunity to microbiologists to get out into the field & get involved in the outbreak investigation which is otherwise not a strong area in microbiology curriculum & training.

2. Enhancement of worthiness & value:

Rapid & accurate laboratory diagnosis is central in controlling the spread of the virus because of its widespread asymptomatic and pre-symptomatic transmission [1]. This, in effect has brought the clinical microbiology laboratories into the spot light. The pandemic is also providing an opportunity for laboratory professionals to effectively communicate their insights to patients, policy makers, and the public. The media experiences, lessons in public communication & relationships developed during this time may be utilized for further upliftment of the branch in future [2].

3. Teaching opportunities

Most noticeable change in teaching practice has been that COVID-19 replaced conventional education platforms with online platforms; whether it has been in-house, national or international. Participants could attend conferences and listen to the deliberations provided by the world's best experts in comforts of their safe spaces. This may be considered as a great advantage for teaching medical microbiology. The biggest opportunity COVID-19 gave us is to preach and teach infection control practices to the masses.

4. Up gradation of skill & technology

Acquiring skills is spread across many parameters right from laboratory techniques, communication & inventory and supply chain management. PCR training in many laboratories brought to focus skill development in various aspects right from handling of biohazard samples, pipettes, PPE usage & waste disposal practices. Also pre-analytical skills in terms of specimen collection, transport and analytical & interpretation skills of very-very sophisticated techniques improved considerably. Even communication skills have improved with clinicians, bureaucrats and politicians, something which no other disease has given. It has been a great opportunity in a short time!

There is a tremendous boost in the range of technologies microbiologists have been exposed to and have acquired (Fig. 1). This may include newer assays, using electromechanical sensors & other devices, electron microscopy, sequencing, CRISPER Cas 9 technology & even more as depicted in Fig. 1.

5. Infrastructure development

COVID-19 provided great opportunities for laboratory expansion with easy approval from the hospital management. National Medical Commission issued a gazette notification that mandated every medical college to establish a bio-safety level (BSL) 2 laboratory & provide facilities for viral diagnosis [3]. Many microbiology laboratories were facilitated for COVID-19 testing at District & Taluk level hospitals which would have almost never happened but for COVID-19 pandemic! [4].

6. Clinical correlation & clinical inputs

COVID has brought in great focus the clinical correlations, clinical inputs & patient outcomes. In many areas, microbiologists were involved

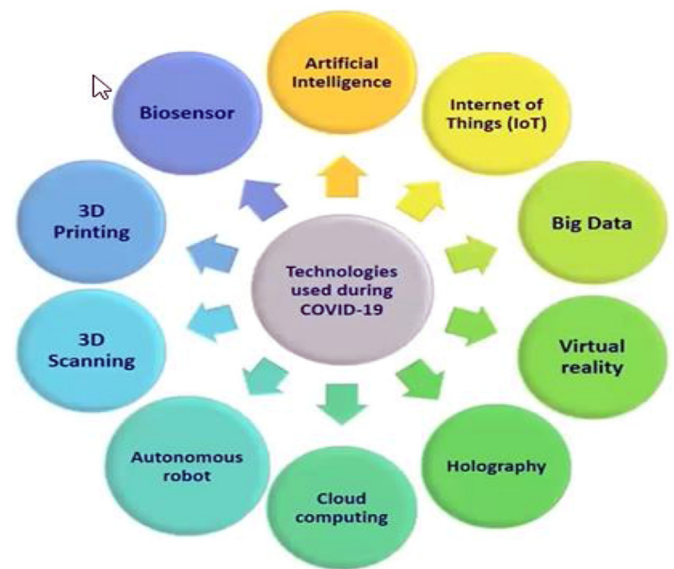


Fig. 1. Various technologies which microbiologists have been exposed to during the COVID-19 pandemic.

in formulating infection control practices, follow-up testing guidelines & isolation policies. Working in close association with clinicians even in developing the COVID-19 Reporting and Data System (CO-RADS) score for surveying pulmonary involvement of affected patients was developed with good precision.

7. Networking

COVID-19 has provided us with opportunities to build bridges and break down barriers. Well established laboratory net working is being practiced at state level, national level, and international level. The Indian Council of Medical Research (ICMR) has done a wonderful job in networking all COVID labs at national level. The number of samples being tested in a day was 10,22,712 as of December 8, 2020 [5]. This already established networking system may help us in many future ventures like strengthening surveillance machinery for various infectious diseases like tuberculosis (TB). In addition, the opportunities obtained for networking with health administrators, bureaucrats and politicians are very important to bring about a change in their perception and may support us in our future work & development of policies. Another important aspect is networking with media & journalists. Microbiologists, as experts in the field, can provide accurate information about lab testing & communicate in a more compelling manner [2]. It also boosts the self esteem of medical microbiologists to be considered as an expert whose opinion matters. It also helps them to provide the public with accurate scientific and medical information to apply in their day-to-day life. Information directly from a microbiologist may limit the society getting misinformed from the various social media platforms which is a common scenario of the present day [6].

8. Interdisciplinary collaboration

Unprecedented collaboration was observed within the discipline of microbiology; among mycologists, bacteriologists, parasitologists & virologists. Even doctors in other branches of Medical science including general medicine, critical care, ENT, ophthalmology, hematology, pharmacology & biochemistry have all shed their barriers and come forward to work together in this pandemic. This was extended even beyond hospitals to public health professionals, statisticians on statistical modeling & industry personnel for diagnostics & vaccines.

9. Focus on methods of prevention & control

Medical microbiologists & infection control officers had always been struggling to teach hand hygiene to their colleagues, now it is being taught to masses which are more receptive from all categories of people. This could hold a long lasting behavioral change in medical fraternity as well as population at large leading to a much larger impact in prevention of infections by droplets or contact transmission. Evidence has proved that the impact of wearing mask, hand hygiene & social distancing has reduced influenza and other viral infections [7,8].

10. Increased research opportunities

Research opportunities COVID-19 pandemic has provided includes funding opportunities and collaborations with eminent international bodies in addition to intellectual stimulation, opportunities for publications and even obtaining patents. Two fungal species now have pandemic-inspired monikers. Mycologists have named the one found in Netherlands as *Diadolocovida claustris* and the one found in US is being called *Laiboulbenia quarantanae* [9,10]. These names arose out of frustration of trying to keep research alive in a pandemic affected world.

Medical microbiologists in our country are getting more research opportunities in COVID-19 related researches. DBT-BIRAC COVID-19 research consortium has recommended 70 proposals for funding in the fields of vaccines, diagnostics, therapeutics & other technologies [11]. Department of Science and Technology has announced allocation of over Rs. 200 core for projects to scientific institutions, industries and startups to develop innovative solutions that can help fight the COVID-19 pandemic in India [12].

In terms of vaccines, whether it is development, standardization or evaluation, microbiologists have contributed a great deal. In terms of vaccine development we have learnt to develop vaccines in 9 months vs. the traditional pathways which used to take anywhere between 3 and 6 years [13] Also the wide variety of vaccine candidates made available including mRNA vaccines, viral vectored vaccine, subunit vaccine, inactivated vaccines, has also never seen before during any other pandemics. In India, we have contributed in development of indigenous vaccines (whole virus killed vaccine by Bharat Biotech and DNA vaccine by Zydus Cadila) and large scale production of vaccines developed outside country (Astra-Zeneca Oxford vaccine by Serum Institute, Pune & Sputnik Vaccine by Reddy laboratories). In addition, we have participated in great numbers in phase III trials of various vaccines where the contribution of microbiology department was invaluable in terms of periodic assessment of immune response in vaccinees. In addition, the longing for a vaccine which will protect people from COVID-19 is likely to positively affect peoples' perception about vaccination programs in general, making them more likely to accept other vaccines [14].

11. Opportunity to assess self & finding improvements in professional development

COVID-19 has enhanced the worthiness and the value of microbiologists [15]. People are seeing career opportunities in medical microbiology leading to postgraduate (PG) seats in microbiology being filled & opening up of new opportunities for microbiologists. COVID-19 has given many of us a wake-up call to ensure appropriate allocation of time & resources.

The concepts of boosting immunity with healthy diet, regular exercises & reducing stress is also gaining momentum in the society. The concept of "One Health" (Fig. 2) is also becoming more meaningful in the current scenario. Many viruses jump species to infect humans, so we should learn to respect other forms of animals & birds, avoid devastation of the environment and learn to live in harmony with the environment & other living organisms. New viruses emerge periodically due to spill over events. Many of the emerging pathogens that jump into people do so from rodents, bats and non-human primates. We are all susceptible to new

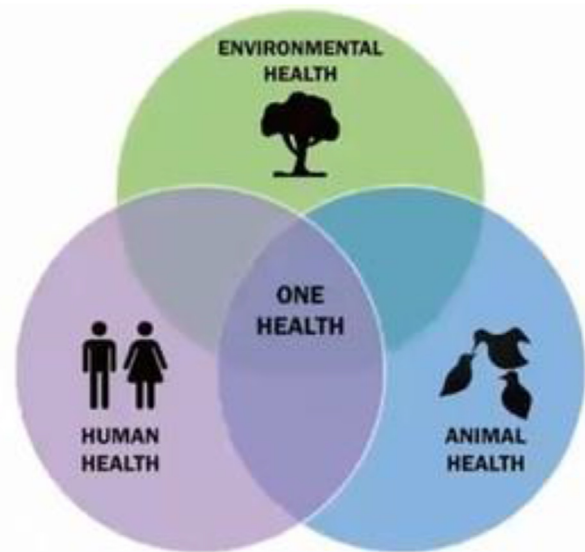


Fig. 2. The concept of 'One health'.

viruses that emerge from birds and animals. This occurs due to some combination of these species' abundance, proximity to people and biological similarities to humans [16,17]. In terms of viruses, this is not the last pandemic due to spill over events. While many pathogens periodically infect humans, few become adept at transmitting or propagating themselves. Human activity is making this transmission increasingly easy by creating efficient pathways for pathogen transmission around the world [16]. We should learn to respect other forms of animals, avoid overcrowding, avoid devastation of the environment and also learn to live with viruses. Since we know what is responsible for emerging infections, we should be able to prevent them at least to some extent by global surveillance, diagnostics, research and also political will to make this happen [16].

12. Expanded English vocabulary

Another striking impact is on the English vocabulary of non-medicos. COVID has brought in words like pandemic, social distancing, disinfection, droplets, aerosol etc. into the usage of common man which were used mainly by microbiologists.

2. Why COVID-19 is a bane for microbiologists, the flip side of the story

The vast specialty of medical microbiology is reduced to just 'covidology' in the last one year period. The staff, students & researchers of microbiology specialty are working major hours in COVID-19 diagnosis leaving their usual activities.

The concentric attention on COVID-19 has swept away all other major national control programs against infections which had gained momentum in the past few years. The long term impact of this neglect on major infectious diseases like TB including drug resistant TB, malaria, dengue and chikungunya as well as *Candida auris* infection in ICU patients is under estimated. The diversion of all resources including manpower for the control of COVID-19 has pushed all other major infectious diseases to a back seat. By the time we realize the impact, it may be too late to reverse the damage. This would lead to 'Syndemic condition (synergistic epidemic or aggregation of two or more concurrent disease clusters in a population). TB would be the worst affected infectious disease in India, which being the highest TB endemic country accounting for >25% of all TB cases in the world [18]. In many health care facilities, health care workers working in the area of other communicable diseases were

reassigned & diverted to support COVID-19 [19,20]. Even CBNAAT machine meant for diagnosis of TB, has been used for COVID-19 exclusively. According to the Central TB-division in Nikshay portal, a 78% drop in the diagnosis of new TB cases in April 2020 was noted in India compared to the same month in 2019 [21]. A modeling study done by Stop TB partnership to examine the potential impact of COVID-19 response on TB patients concluded that, TB incidence and deaths may go considerably high [22]. These results illustrate that it can take years for TB burden to return to pre-lock down levels.

Rational use of antimicrobials and antimicrobial stewardship has also gone for a toss during this pandemic. Antimicrobials are being widely prescribed in COVID-19 patients even on OPD basis, though there is insufficient evidence to support the widespread empirical use of antimicrobials in COVID-19 patients. Data from a meta-analysis done in 5 countries suggest that only 6.9% of COVID-19 diagnoses are associated with bacterial infections, and was more common in critically ill patients [23]. However, a multi-centre study from United States has reported 72% of COVID-19 patients received antibiotics even when not clinically indicated [23]. Other multiple factors also contributed in the misuse of antibiotics during the pandemic. These include [24,25].

- Redirection of health system resources to the pandemic response leading to less attention & focus on antimicrobial resistance (AMR) surveillance & antimicrobial stewardship
- Increase in pre-emptive antibiotic prescription to prevent secondary bacterial infections in COVID-19 patients
- Reduced adherence to antimicrobial policy even in settings with established antimicrobial stewardship programs (AMSP)
- Increased use of restricted antimicrobials, broad spectrum agents & multiple agents are reported in patients with COVID-19 [26].
- Increased duration of antimicrobials & difficulty in de-escalation
- Decreased screening for multi drug resistant organisms
- Reduced communication between local teams, stoppage of academic meetings, new doctors being recruited for managing crisis situation in health care facilities.
- The risk of contracting COVID-19 by medical staff also has led to a reduced sample collection for microbiological evaluations leading to empiric therapy than evidence based therapy [27].

Medical microbiologist has been reduced to 'Covidologist' because of the pressure of pandemic. Increased pressure on laboratories to improve number and turnaround time of COVID-19 test with limited manpower and facilities have stressed the microbiologists. The entire limited manpower has been diverted to COVID-19 tests, mass skill training for RT-PCR and setting up new labs for COVID testing. Though the microbiologists worked overtime in the laboratory, maximum attention of media has been on clinicians who are directly treating patients and microbiologists receive little attention. However, a small mistake by microbiologists in this stressful condition has been highlighted in the media and microbiologists receive brick batting [28]. Even when the laboratories were over worked due to COVID-19 related work pressure, it was observed that, there was an overall decrease in laboratory test volume including blood cultures in most laboratories considerably affecting the income from laboratories [28].

An important aspect to be considered is the impact of COVID-19 on laboratory professionals. They had to deal with various challenges during the outbreak when they themselves were at increased risk of contracting the infection. A survey conducted in Pakistan on laboratory technicians observed the financial challenges and job lay-off faced by the staff due to repeated and usually unreasonable cost-cutting practices leading to a miserable state of laboratory professionals [29]. In addition to all challenges faced at work place, many doctors including microbiologists faced threats of eviction from rented accommodation, ban entry to their own house, denial of services & even physical assault. We even lost some of our eminent colleagues to COVID-19 disease.

The training of PG students in the field of medical microbiology has also been affected. Their training got severely compromised as many of them posted on COVID-19 emergency duty on rotation in order to compensate for staff crunch. Medical microbiology residents posted for COVID-19 work got absolutely no collateral exposure in different fields of microbiology. Even when they are on departmental duty, they were primarily doing COVID-19 related reporting. Closure of OPDs, transportation restrictions and dedicating beds only for COVID-19 patients lead to a depletion in varied types of samples leading to lack of exposure for the students. Also, there was closure of academic activity and regular training sessions in the departments due to lack of time and social distancing guidelines. The PG students trained during this period may be incapable of doing quality microbiology work other than that is related to SARS CoV-2. Another major change in PG training is shift to remote teaching (online).

Research in different fields of medical microbiology is another area which has been compromised during the pandemic. The pandemic caused disruption on most research projects or redirected research to COVID-19. Other than COVID-19-related and other essential research got largely suspended. Pandemic related closure of research labs and universities challenged many researchers in achieving deadlines. They were struggling to pay laboratory staff engaged on bonafide projects with slashed institutional budgets, grants or other post-doctoral funding sources. This caused considerable disruption in the research activity [30, 31]. This has mostly affected the junior researchers because they were already grappling with limited funds, intense job competition and career uncertainties. A survey by United Kingdom Research & Innovation found a high impact on research activities. As per the survey 61% of researchers reported that lockdown had negatively impacted their research. Various factors contributed to this scenario included redirection of funds, researchers assigned to do other responsibilities like administrative activities during the pandemic, inability to conduct experiment or collect data, difficulty in discussing their research ideas with faculty besides COVID-related mental stress [31,32]. A survey conducted on 881 researchers from 8 different countries had shown that the research hours have got considerably reduced [33].

Even microbiology journals also have been converted to COVID journals. Space in microbiology & related journals has been almost completely consumed by COVID-19 related literature. Peer review standards have declined in the mad rush to publish anything & everything related to COVID-19. Even many substandard articles has been finding their way if related to COVID-19 in journal of repute. At the same time it has become more difficult to publish on any other topics in medical microbiology.

By the end of the debate, all the positive as well as negative aspects of COVID-19 in relation to the discipline of medical microbiology were brought in for discussion. Voting at the end of debate showed 54% of the listeners were of the opinion that COVID-19 is a boon whereas 46% felt it is a bane for the microbiologists. The debate was so intense that the faculty contending it as a bane could be seen to sway the audience, as proven by the post debate re-polls.

3. Conclusions

To conclude, COVID-19 is neither a boon nor a bane to the medical microbiologists. A balanced approach to the current problem in hand without ignoring all other pre-existing challenges is the need of the hour. No investment in time, infrastructure or knowledge will go waste. Whatever we have learnt during the pandemic should help us perform better in future to make the world a better place to live. And many collateral effects which we have faced during COVID-19 may be mitigated by a responsible behavior. As per the popular saying 'with freedom comes a great sense of responsibility'. Even though we were swept away by many things like fear, insecurities and political & administrative pressure, we as medical microbiologists have done a great job that we all should feel proud of.

CRedit authorship contribution statement

Vasanthapuram Ravi: Acquisition of data, analysis & interpretation of data, review & editing, final approval of the version. **Arunaloke Chakrabarti:** Acquisition of data, analysis & interpretation of data, review & editing, final approval of the version. **Chand Wattal:** Conception and design of the study, Supervision, Revising the article critically for important intellectual content, Review & editing, final approval of the version. **Reena Raveendran:** Acquisition of data, analysis & interpretation of data, Writing, review & editing.

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