






Academic research challenges in Brazil and its impairment by COVID-19 pandemic: a medical students point of view

O impacto da pandemia COVID-19 na iniciação científica brasileira: ponto de vista de estudantes de medicina

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ABSTRACT

Background: The COVID-19 pandemic and its control measures, which have not been experienced in the world in the last hundred years, have impacted academic scientific production, which, in Brazil, was already in the process of progressive erosion of its foundations. Thus, scientific initiation during medical graduation, which depends on funding and institutional structure, and extremely beneficial to the graduation process, was jeopardized due to restrictive measures.

Objective: This article aims to expose the point of view of undergraduate medical students enrolled in a scientific initiation program about the panorama of Brazilian academic scientific production and the impact of the COVID-19 pandemic in its multiple aspects.

Discussion: The lack of an effective scientific initiation is one of the many factors that lead to a decline in the number of medical researchers. The way that scientific initiation is placed, as part of a parallel curriculum, and a whole scrapped public production structure are impairing, chronic and noteworthy features. The apparatus of national scientific production is mostly structured in Higher Education Institutions and research institutions, both public. Within the scope of graduation, it can be didactically subdivided into four pillars: financial support, structure, student proactivity and the advisor's aptitude. The COVID-19 pandemic has been an additional blow to this weakened and fragile structure. Scientific initiation was thus negatively impacted. Public opinion and political aspects further influence an imbroglio of "scientific denial" and a craving for effective information and solutions to the unprecedented problem of a pandemic of this proportion.

Conclusion: It is clear that national scientific production is placed in a survival situation in the face of new challenges posed by the pandemic. Likewise, scientific initiation is less and less stimulating during graduation, even though it is an experience of great value in medical and personal development.

Keywords: Undergraduate medical education, Biomedical research, Fellowships and scholarship, Pandemic, COVID-19.

RESUMO

Introdução: A pandemia pelo COVID-19 e suas medidas de controle, não vivenciadas no mundo nos últimos cem anos, impactou a produção científica acadêmica, a qual, no Brasil, já se encontrava em processo de erosão progressiva de seus alicerces. Por conseguinte, a iniciação científica durante a graduação, extremamente benéfica na formação médica, que é dependente de fomento e estrutura institucional, sofreu um impacto negativo com as medidas restritivas.

Objetivo: O artigo discorre em um ponto de vista de estudantes de medicina, envolvidos em pesquisas, acerca do panorama da produção científica acadêmica brasileira e o impacto perante a pandemia COVID-19 em seus múltiplos aspectos.

Discussão: A falta de uma iniciação científica efetiva é um dos muitos fatores que levam ao declínio do número de médicos pesquisadores. Nesse ínterim, o modo como a iniciação científica está inserida, como parte de um currículo paralelo, e toda uma estrutura de produção pública sucateada são aspectos danosos, crônicos e dignos de nota. O aparato de produção científica nacional é majoritariamente estruturado nas instituições de ensino superior e institutos de pesquisa, ambas públicas. No âmbito da graduação, pode ser didaticamente subdividido em quatro pilares: fomento, estrutura, proatividade do estudante e aptidão do orientador. A pandemia do COVID-19 tem sido um golpe adicional a essa estrutura debilitada e frágil. A iniciação científica foi, com isso, negativamente impactada. A opinião pública e aspectos políticos influenciam adicionalmente em um imbróglio de "negacionismo científico" e anseio por informações e soluções eficazes para o problema inédito de uma pandemia dessa proporção.

Conclusão: Percebe-se que produção científica nacional é colocada numa situação de sobrevivência diante de novos desafios postos pela pandemia. Da mesma forma, a iniciação científica é cada vez menos estimuladora durante a graduação, apesar de ser uma experiência de grande valor na formação médica e pessoal.

Palavras-chave: Educação de graduação em medicina, Pesquisa biomédica, Bolsas acadêmicas, Pandemia, COVID-19.

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BACKGROUND

Since the outbreak of a pneumonia of unknown etiology in December 2019 in the Chinese province of Wuhan, followed by the declaration of the World Health Organization on March 11, 2020, that the world was facing a pandemic, an unprecedented challenge within the last one hundred years has been faced worldwide. Although pandemics have occurred in recent decades, the proportions reached by the SARS-Cov2 pandemic (COVID-19), with the need for strict social isolation, were only seen for the last time with the Spanish flu of 1918. The lack of information and treatment protocols, as well as the poor experience of the population regarding pandemics, raised fear, society's dysfunction and unanswered questions that are still in force today. In this context, a society eager for solutions has placed great expectations on researchers, especially in the biomedical area¹⁻³.

This demand for solid and reliable information brought the topic of scientific production to the fore in a more capillarized debate, meaning less restricted to the walls of academy. Nonetheless, this discussion is unipolarized, deeply focused on COVID-19, which is the immediate need. On the other hand, social isolation, a primary measure to control the spread of the disease, has placed research in a paradoxical situation, especially at the academic level. Laboratories and research structures of public Higher Education Institutions (HEIs), the largest science producers in Brazil, were closed and many ongoing projects were interrupted. Considering this context, this article discusses the impact of the pandemic on Brazilian academic scientific production in its multiple aspects from the point of view of medical students who are enrolled in research.

Voluntary Extracurricular Research in Medical School

Physician scientists have the *sui generis* ability to bring the *expertise* of rigorous scientific research to patient care in the clinical-surgical routine⁴. However, this class of professionals is currently less likely to play an important role in biomedical research in relation to the past, a situation attributed, among other factors, to a decline in the engagement of medical students in research^{4,5}.

Although most medical students show interest and awareness about the importance of scientific research,

only a minority of them is truly involved in and committed to scientific initiation and even more scarce are those who devote their time to producing something suitable for publication in medical journals and congresses. This fact is described in the medical literature and is corroborated by the experience of students in the academic environment⁵. Inadequate exposure to research opportunities, that is, a lack of effective scientific initiation, is one of the factors that contribute to a decline in the number of medical researchers.

In addition to the benefits provided by the integration of the researcher's view with clinical and surgical practice, by supporting an evidence-based practice of medicine and improving the decision-making capacity, the exposure of medical students to research activities is also associated with a better performance in the course, with increased critical and reflective thinking⁶⁻⁹. This explains why improving the research and reflective learning capacity of medical students is one of the global concerns of medical education¹⁰.

This justifies the integration of research with the undergraduate medical curriculum. In Brazilian medical schools, however, it is clear that integral and effective scientific initiation is considered an extracurricular activity that aims to fill curricular gaps, supplement the course itself or even representing a parallel curriculum, i.e., an experience spontaneously sought by students within the institution itself⁷. As an explanation for this phenomenon, some authors suggest a kind of crisis in the medical curriculum, which requires the student to overexpand his parallel curriculum¹¹. When focused on research, this practice would be indeed very profitable for the already detailed reasons; however, it does not occur effectively during medical graduation for several reasons not yet clarified.

This scenario is a daily reality for students graduating from a public HEI in the state of São Paulo. Despite the heterogeneity of HEIs, with some being more privileged in public promotion of research incentives through scholarships, the situation is diffusely precarious and unfavorable to scientific initiation¹². It is easy to see how distressing the environment can become when undergraduate students aware of the intellectual, technical and curricular benefits of scientific initiation are often prevented from participating due to a faulty research structure, including shortage of willing, trained advisors and lack of public support in their HEI. The result of this whole situation can only lead to reduced engagement.

After exposing the importance of contact and commitment of undergraduate medical students with

scientific production, as well as peculiarities and difficulties already chronically present for such engagement in these activities, we go forward in the unprecedented scenario of a pandemic that has unsettled an entire social structure and in particular the fraction of medical students who were committed to ongoing research.

Thrown Into Limbo

Given the impossibility of students to attend face-to-face activities, whether regular, extracurricular or voluntary, there has been a certain delay in Open and Distance Learning (ODL) implementation and its timetable structuring¹³. Alongside the implemented curricular adaptations of e-learning and the shorter time devoted to transportation and to the preparation of academic activities, undergraduate students have ultimately become idlers.

Without regular curriculum guidance, with an ODL prototype under construction and mainly without the stimulus of experiencing clinical-surgical internships, practical classes and simulations, even the students most engaged in extracurricular activities have been thrown into limbo. Laboratory research, including that carried out on animals, and case reports are study designs widely explored in scientific initiations during graduation that have been completely interrupted by quarantine.(Figure 1)

In addition, the student’s perennial fear of the damage to his education caused by interruption of academic activities is pertinent and hard to rate. Thus, time and fear form substrates that will encourage the student to take advantage of the overtime provided by the quarantine in order to boost his curriculum. Proof of this are the numerous courses and medical events of the most diverse specialties, as well as online conferences, mostly with the issuance of certificates, which only reinforce the idea of what is being explored in this target audience.

It is also noteworthy that some qualitative descriptive studies point out the lack of time as one of the main obstacles mentioned by medical students to justify their poor engagement in scientific initiation. This occurs due to a full-time course and dense workload, with high demand for a commitment to the disciplines. As described above, increased free time due to the quarantine has created an unusual situation with an inversion of this kind of struggle⁹.

Brazilian Scientific Production: A National Outlook

In recent years, national scientific research has suffered successive blows with budget cuts, especially since 2016¹⁴. The National Council for Scientific and Technological Development (Conselho Nacional de

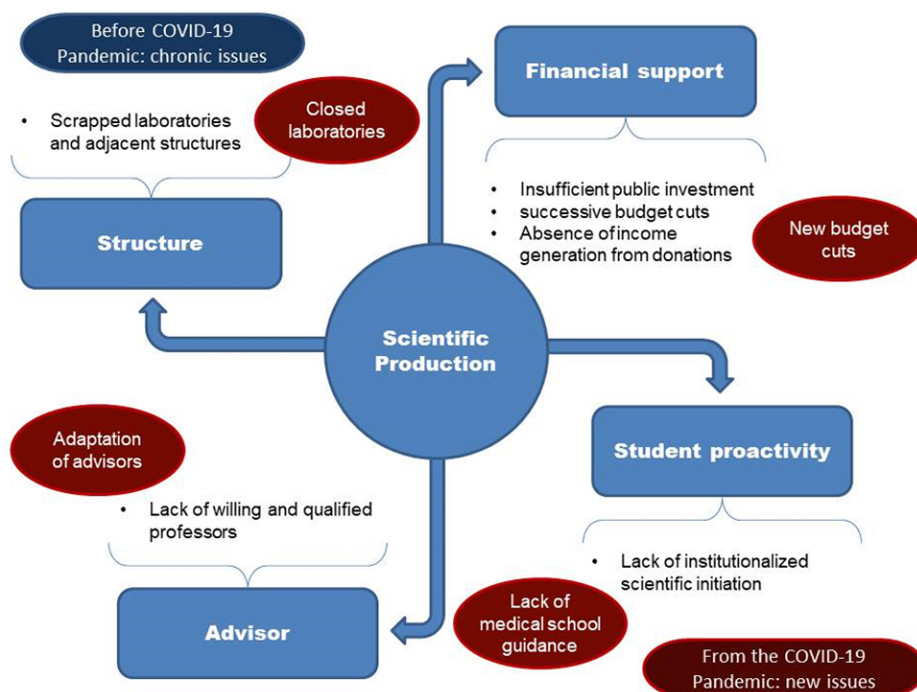


Figure 1. Diagram summarizing scientific production with its mainstream aspects: chronic obstacles versus the new ones posed by the COVID-19 pandemic.

Desenvolvimento Científico e Tecnológico – CNPq) is one of the main research promotion agencies in Brazil and, along with the Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - CAPES), represents the main support of science policies, technology and innovation. Both agencies have been targeted by severe budget cuts year after year. CNPq, notably, has been hampered by the embarrassments created by the federal government regarding public education institutions. The difficulties faced by CNPq have had a direct impact on the Institutional Scientific Initiation Scholarship Program – (Programa Institucional de Bolsas de Iniciação Científica – PIBIC), whose creation made it possible to provide scholarships in an institutionalized way^{14, 15}. The PIBIC is, therefore an opportunity and a stimulus to students who have started research, providing the opportunity for growth and future researcher shaping. Given that the development of a country is closely linked to its technology production capacity, i.e., the production of goods with high added-value and the generation of services, what is currently witnessed in Brazil is self-inflicted harm¹⁶.

In a situation of scarce resources, serious problems of inequality in their application can arise. Brazilian development agencies have been striving to enhance the qualification of national scientific production. In the last decades, Brazilian scientific production has grown significantly in quantitative terms, and the current challenge is to improve the quality of production. Hence, the internationalization of research projects, the exchange of advisors and students, the publication in high impact vehicles and a higher h-index are increasingly required. These requirements are coherent and necessary, but the time for their implementation must be thought out with great care¹⁷. If these requirements are imposed very abruptly, without taking into account the difficulties faced by each HEI, especially during a pandemic, only the most structured and traditional ones will be able to fulfill. Thus, scientific research will always be more restricted to large and prestigious Brazilian universities.

Noteworthy is the example of the Marília Medical School - Famema - an HEI with more than half a century of existence, dedicated to the training of doctors, which was a pioneer in teaching by active methodologies such as “Problem-Based Learning” decades ago¹⁸. This method mainly aims at the scientific insertion of undergraduate students, with consequent refined

teaching of evidence-based medicine. Famema is an isolated institution located in the interior of the State of São Paulo, despite its major and historical importance in the scenario of Brazilian medical education. However, ironically, nowadays this institution provides no scientific initiation scholarships, at least until this paper publication^{19, 20}. It is regrettable to note that one of the pioneering institutions using a teaching method of evidence-based medicine is currently in this declining situation, which is also shared by other Brazilian HEIs.

This is an example of the two greatest difficulties in implementing scientific research in Brazil: the lack of financial incentives and the non-institutionalization of scientific initiation programs. The former hardly exists without the support of the latter, showing the importance of introducing initiation into the formal curriculum. Furthermore, in Brazilian public HEIs, there is still no generation of income or formation of institutional funds from donations, remaining this institution exclusively dependent on public funds²¹.

Academic Scientific Research: A paradox between boost and barring

The emergence of the new coronavirus and its containment measures has generated important changes in the community's *modus operandi*, affecting the economy and social dynamics. Within this context, scientific knowledge, which is one of the most valuable assets of society, acquires even more added value. And this is due to having no effective solution to the health crisis other than guidance by scientific knowledge, whose production, in Brazil, is centered on research institutes, colleges and public universities^{14,22}.

Scientific research is then facing a paradoxical situation. On the one hand, science can develop technologies and knowledge capable of mitigating the damage of unprecedented challenges. This scientific apparatus is available in Brazilian public HEIs, framing and setting up real arenas to formulate of measures and the socialization of knowledge. In this regard, all of the media's attention is focused on these institutions, with these HEIs being valued as developers of the research so essential during these times. On the other hand, these same HEIs are damaged as victims of successive budget cuts, being just survivors of a policy that relegates them to the background. Most striking is the fact that

this neglect is allowed or even orchestrated by the Government managers themselves.

This contradictory situation can asphyxiate the entire research structure as well as the hope provided by its contributions, an attitude that can jeopardize the country, relegating it to an inferior position in the globalized world. In addition, it delivers the message that budget cuts have an impact not only on scientific production, but also on all types of services provided by HEIs to the population, such as medical assistance and outpatient care, among many others. It is tempting to envision a situation of sufficient support for the full functioning of such institutions and their potential return to society in the form of services, knowledge and technology.

On the other hand, it is true that the Brazilian government has not remained completely inert and has resorted to economic measures to combat COVID-19, among them, 466.5 million reais were allocated to research and innovation in the presence of the current crisis²³. However, research takes time, making it less responsive to aimless investments and very vulnerable to budget cuts. Furthermore, this amount did not repair the negative impact of the cut of scholarships or even contributed to the systemic improvement of the chronically careless research structure of HEIs, two major stalemates already known by the undergraduate student involved in research.

It may be presumptuous to attribute to undergraduate research based on scientific initiation, or even at the postgraduate level, in the health care field, the role of offering support and answers to solve or mitigate losses resulting from the greatest epidemic of the century. However, research is a progressive process and not very flexible in terms of development time. Thus, the restriction of any stage of this process implies losses in the future, both in the medium and long term. In this regard, immediate policies are practically pointless since punctual and unsustainable incentives are unlikely to have an effect and, as mentioned above, cuts will have an impact on the future. In addition, continuous investment in public education institutions seems to increase the number of publications produced²⁴.

Truly Impacted Production: Experimental and Descriptive Studies

In theory, there are no restrictions to the study design pursued by an undergraduate student.

However, randomized double-blind clinical trials, as well as systematic reviews with meta-analyses, are considered hierarchically superior in the pyramid of scientific evidence. Obviously, since they are more sophisticated and rigorous studies, they cannot always be conducted within a scientific initiation program. Thus, experimental laboratory studies on animals and test-tube research, case reports and, more rarely, case-control studies represent the most suitable types of research to be carried out by medical students, and all of them depend on the academic structure, including the laboratory or the hospital itself and its patients.

In contrast, cross-sectional and ecological studies and literature reviews, in theory, have not suffered major impacts during the quarantine, although less obvious difficulties can be identified. Students who intended to start their research through the approval of the projects were at the mercy of the HEIs Research Ethics committees, which took a long time to adapt to the model of non-face-to-face meetings, further extending previous brief deadlines. Another dilemma faced by the students interested in scientific initiation is the relationship with their supervising professor, which is an experience of great value and impact. In this type of relationship, the student has personal contact with his advisor, with a unique type of benefit based on the values and knowledge transmitted²⁵. Within this context, the adaptation of advisors to the new demands and resources required by the quarantine has been heterogeneous, leading to losses in this relationship in some cases and, consequently, in scientific production. (Figure 1)

Even clinical trials that are essential for the establishment of new guidelines and treatments options have suffered from the pandemic. To mitigate this problem, the National Health Surveillance Agency (Agência Nacional de Vigilância Sanitária - ANVISA) established a technical standard for conducting clinical research during the COVID-19 pandemic²⁶, based on a guide from the US Food and Drug Administration - FDA²⁷. This document describes how these studies can be affected: the quarantine of clinical research participants, the possibility of infection by the new coronavirus of both participants and involved researchers, interruptions in the material supply chain and the closure of the research centers. It is important to highlight that many of these difficulties were also experienced by undergraduate students in their scientific research.

Furthermore, it may be suggested that perhaps academic research could have been less severely impacted if clear guidelines for mitigating these difficulties had been developed by competent bodies. More specifically, in the case of medical graduation, previous knowledge about the use of Personal Protective Equipment (PPE) would support safe practice in laboratories with the presence of a limited number of researchers, mitigating risks and permitting good progress of this fundamental practice in graduation.

Society's Paradigm for Research and Impacts on Pre-Initiation Students

Historically, public discourse and debate have been superficial in Brazil concerning scientific production and its public financial backing, despite the fact that public institutions are the largest structures devoted to scientific production. Financial incentives are chronically insufficient and have been the target of budget cuts^{28, 29}. The lack of public concern about this problem may be related, in part, to a shallow coverage of the problem by the media.

Furthermore, the worldwide phenomenon of scientific denial, which currently reverberates in Brazil, is a major factor in the actual context. This phenomenon is sometimes associated with extremist political spectrums and often enhanced by the algorithms of social networks with their brutal ability to share data, without distinction between true and fallacious information, whether inspired by belief, conspiracy theories, bad faith and so on. Regardless of these reasons, the point is that public debate becomes shallow, sometimes childish and even fanatical. The debating process resembles, in a way, our football crowd environment and mirrors the elections, placing a political label on both science and opinion. Thus, the current crises extend beyond economic and health issues, also involving a disregard for science and its institutions.

A technical note published by IPEA (2020)²³ corroborates the above statement. The document points out that the country does not use its scientific potential to face the pandemic and to elaborate public policies, despite the existence of the National Council of Science and Technology (CCT), formed by representatives of industry and academia, whose objective is to assist the State in the implementation

of national scientific and technological policies. The contempt for this organ is frightening: it was extinguished by the government in 2019 and reactivated in October of the same year, with no record of activity by May 2020²³.

CONCLUSIONS AND PERSPECTIVES OF A 'NEW NORMAL'

Scientific production and its ability to improve people's lives in society and to offer solutions for mainstream problems is simply enchanting. It is impossible to consider the quality of life without health or to further improve it without scientific commitment.

The scientific method brings us closer to a better understanding of a phenomenon, with reproducibility and confidence. However, there are problems in the national scientific production. The base has been shown to be chronically fragile and its foundations, which were expected to be strengthened at least in biomedical research during these times of demand for solid information, have reached an even more disturbing situation.

Research at undergraduate and postgraduate levels tends to remain at the mercy of public funding, with fluctuating budgets and, therefore, staggering in terms of its structure. On the other side of this coin, the student's interest in initiation as a promising future researcher depends on more varied objective and subjective issues. Objectively, there is the institutional structure itself and the initiation grants, which consist of more tangible stimuli. Subjectively, there is the commitment, preparation and disposition of the advisor, who has the power to provide a unique experience, an intellectual exercise in the search for a scientific methodology that can be applied anywhere for the rest of the professional. Still regarding subjective issues, it is worth reiterating the importance of the curricular organization, since currently in most courses scientific initiation consists of a mere parallel curriculum. Formal curricular incorporation involving training, and medical training in particular, would be a stimulating mechanism⁷.

In addition to such more evident and palpable points there is a social pattern of scientific denial and political articulation with information sharing provided by powerful social networks, which is something historically known by analogy, but unique in magnitude. Even the phenomenal example of developing a vaccine for COVID-19 in record time comes with a dichotomy.

Political maneuvers, mysticisms and conspiracy theories of all types have spread even faster than the virus itself in the form of fake news. Repercussions on public opinion have emerged through media even before the beginning of vaccination of the Brazilian population. Similarly, during the Vaccine Uprising of 1904, a health campaign led by Osvaldo Cruz in Rio de Janeiro, called at that time “the grave of foreigners” due to yellow fever, smallpox and plague that ravaged the city, a group of the most varied social strata, along with media support rebelled against the mandatory nature of the campaign³⁰. Brazil relives its history, up to a point, as the social pattern of contempt for science manifests itself at all socioeconomic levels and the media is now more democratized, with a range of immeasurable influencers and digital followers.

It is naive, therefore, to imagine a scenario of scientific production with full encouragement and unanimous support from society, mainly with bottom support at the undergraduate level. Brazil, and perhaps other countries in a similar situation and with a similar culture, urgently needs to regard research as the largest and most valuable asset that society can produce and has a demand for. Only in this way can the crisis be reversed; more researchers can be generated, especially in the biomedical area; the training of future professionals in this area can be improved by learning the scientific methodology, and, who knows, may lead to the development of the practice of research support funds in HEIs, as is the case for developed countries where alumni and engaged people can contribute financially.

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Author participation

EAR: Manuscript writing; Critical revision

EIF: Critical revision.

TMNF: Critical revision.

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