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Health research: the development of a horizontal curriculum in a Medical school

Pesquisa em saúde: a construção de um eixo horizontal e transversal no curso de Medicina

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ABSTRACT

Introduction: Research plays an essential role in the training of medical students by providing opportunities for in-depth learning, the development of critical skills, an understanding of scientific literature, and the application of acquired knowledge. These research experiences contribute to a more comprehensive medical education and prepare students for evidence-based clinical practice. The aim of this study was to describe the implementation of a health research horizontal experience on the curriculum of a medical course at a private university located in the city of São Paulo, Brazil.

Experience report: A Health Research axis was included in the medical course curriculum in 5 semesters, from the 3rd to the 7th. The presentation of the research products occurred in the 8th semester.

Discussion: There has been significant participation in the institutional undergraduate research program since the implementation of this axis. The consequence of this effort was an increase in the publication process in national and international events, and indexed journals. However, the national scientific literature highlights the necessity of encouraging students to develop deeper commitment in scientific research, which depends on the engagement of teachers, and challenges educational institutions.

Conclusion: The implementation of the Health Research axis in the medical course curriculum has encouraged students to recognize the importance of searching in safe clinical database for the practice of evidence-based medicine.

Keywords: Research; curriculum, medical education, scientific publication; evidence-based medicine.

RESUMO

Introdução: *A pesquisa desempenha um papel essencial na formação de estudantes de Medicina, proporcionando-lhes oportunidades de aprendizado aprofundado, desenvolvimento de habilidades críticas, compreensão da literatura científica e aplicação prática do conhecimento adquirido. Essas experiências de pesquisa contribuem para uma formação médica mais abrangente e preparam os estudantes para a prática clínica baseada em evidências. O objetivo deste estudo foi descrever a experiência de implementar um eixo de pesquisa em saúde no currículo de um curso de Medicina de uma universidade particular localizada na capital paulista.*

Relato de experiência: *No currículo do curso de Medicina, inseriu-se o eixo de pesquisa em saúde em cinco semestres do curso, iniciando no terceiro e finalizando no sétimo, e realizou-se a apresentação dos produtos no oitavo.*

Discussão: *A partir da implementação do eixo de pesquisa em saúde, percebeu-se uma participação expressiva dos alunos do curso de Medicina no programa institucional de iniciação científica. Também houve aumento na produção científica com artigos publicados em periódicos indexados nacionais e internacionais. Muitos trabalhos também foram apresentados em simpósios acadêmicos, congressos nacionais e internacionais. Apesar dos desafios institucionais, há alguns estudos que apontam para a necessidade de o estudante adentrar no universo da pesquisa científica e a importância do docente como orquestrador do processo de iniciação à ciência.*

Conclusão: *A implementação do eixo de pesquisa em saúde na matriz do curso de Medicina promoveu uma reflexão dos alunos sobre a busca segura por referências científicas relacionadas à teoria e prática clínica, cumprindo dessa forma um papel fundamental no que tange à medicina baseada em evidências.*

Palavras-chave: *Pesquisa; Currículo; Educação Médica; Publicação Científica; Medicina Baseada em Evidências.*

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INTRODUCTION

Health research is a fundamental part of the training of new medical professionals and is in line with the National Curriculum Guidelines (DCN, *Diretrizes Curriculares Nacionais*) of the medical course and with international studies[1]. Research is the opportunity for those involved to reflect on the acquired knowledge and communicate the findings to the scientific community[2].

The implementation of research axes or modules is still an important challenge for national medical schools. According to the literature, the choice of teachers to provide methodological and scientific guidance to students, the physical structure available for this purpose, and the lack of institutional stimulus are the points of greatest difficulty for the implementation[3,4].

Between 2016 and 2018, researchers linked to Brazilian institutions produced just over 237,000 publications cataloged by the Scopus database. The vast majority of these publications are articles, but they are also considered books, book chapters, reviews, and other types of scientific documents. This is equivalent to 2.6% of the world's scientific production in the same period. Specifically, the area of medicine corresponded to almost a quarter of the Brazilian production in the analyzed period[5].

The level of the subcategories in the area of medicine stands out in terms of the volume of publications, in part because it has greater thematic diversity: there are 46 specialties, five of them among the ten most productive in the country. First, comes the subcategory "general medicine", with 6,304 publications, followed by "public, environmental and occupational health" with 6,016 publications. The area of "biochemistry, genetics and molecular biology" accounts for four of the ten most productive specialties, including biochemistry, in third place, with 5,522 documents. Among those with the highest production volume, we also have: infectious diseases (5,479 documents), molecular biology (5,099), biochemistry, genetics and molecular biology – general (4,973), genetics (4,847), surgery (4,834), general dentistry (4,373) and pharmacology (3,419)[5].

The number of scientific studies in health and its publications is useful for knowing the installed capacity of health research in Brazil, especially in the area of medicine and its thematic distribution. This distribution reflects, in part, the contours of global science: the size of the scientific community in certain areas of knowledge, the level of maturity of different fields of research, the number of journals that cover certain topics, among other factors. These points reflect the importance of building a health research axis in the curriculum of medical courses to improve and develop students' skills to carry out a research project that results in publications of relevance to health research in Brazil.

Health research in the medical field corroborates the attributes of evidence-based health, as better scientific evidence reinforces more adequate subsidies for clinical practice and patient autonomy[6]. Considering this scenario, the aim of this study was to describe the experience of implementing a health research axis in the curriculum of a medical course at a private university located in the city of São Paulo, Brazil.

EXPERIENCE REPORT

Curricular proposal

Health research is a horizontal and transversal axis that includes modules distributed in five academic semesters. The modules are mandatory, being offered from the third to the seventh semesters of the medical course, and the presentations of the final product are allocated in the eighth academic period, before the beginning of the internship period, in line with the institutional guidelines for fostering academic production and the training of professionals capable of acting based on evidence (Figure 1). Each module is structured to culminate in the preparation, defense and potential publication of a scientific work, developed individually or in groups of up to five students, under the permanent guidance of a teacher from the institution. The activities include practical workshops focusing on scientific methodology, academic writing, and critical analysis of articles, complemented by other methodological strategies, such as problem-solving, gamification, and the creation of mind maps. The assessment of learning combines formative (continuous feedback during the workshops) and summative methods, using instruments such as partial reports, oral presentations, peer evaluation and rubrics that measure methodological mastery, originality and work applicability.

Syllabuses, contents and educational and assessment strategies

In health research I, students were introduced to the universe of scientific research, in a more content-oriented way. The module program covered topics that included active search in virtual libraries, use of Boolean operators and concepts of biostatistics. Moreover, topics related to evidence-based medicine (EBM) were also addressed, which included the different types of studies found in the literature.

The general objective established for the module was that students would be able to understand the specialized literature in health and use it effectively in the solution of problems and in the development of future research projects. It was also pursued that students could apply the concepts of evidence-based health, understand evidence-based practices in the use of knowledge obtained in different scientific databases, develop scientific reasoning, self-learning attitudes and the

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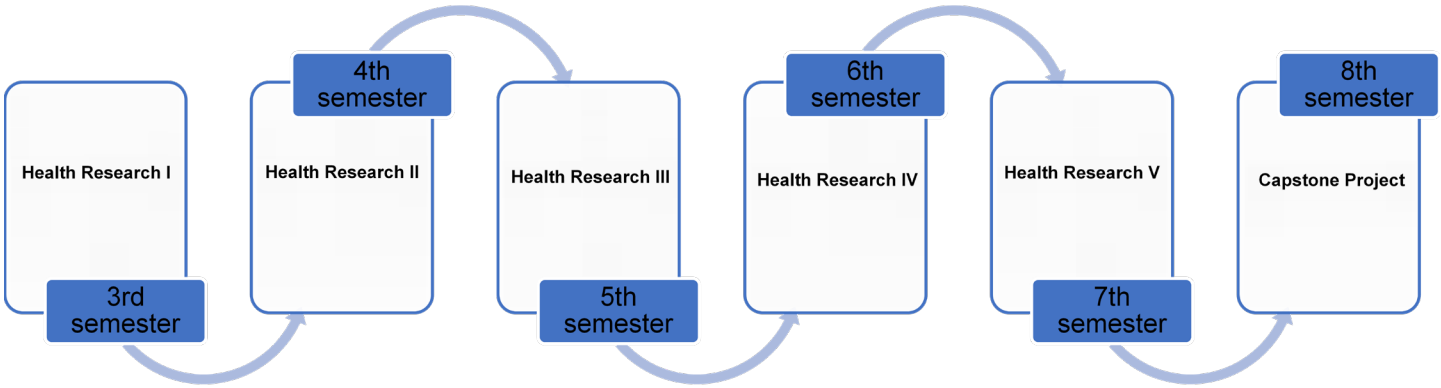
Figure 1. Organization of health research modules along the curricular matrix of the Medicine course



Health Research I: Evidence-Based Medicine and Critical and Reflective Analysis of Medical Literature; health research II: introduction, active search in the literature, objectives, justification, hypothesis, references and Lattes Platform; health research III: method, ethics committees, notions of biostatistics and project submission; health research IV: results, discussion and conclusion, data collection, analysis of results, discussion and conclusion; health research V: scientific dissemination, title, abstract, keywords, submission of articles and adaptation for congresses; Capstone Project: presentation of the course completion work.
Source: Prepared by the authors.

ability to integrate knowledge from different areas, develop and discuss studies critically, know the main tools of scientific studies to interpret data and criteria, and to understand and evaluate the scientific quality of the health literature.

In this academic semester, classes take place based on the use of active strategies, such as problematization and gamification, in which teachers present the different types of epidemiological studies to be developed. Mind maps are also used to expose the main concepts of scientific studies. The concepts of biostatistics are presented through lists of exercises and interpretation of data present in the different types of scientific articles studied. The evaluations in this semester are collaborative and group-based, since the evaluated items are based on the reading and critical interpretation of scientific articles.

In the following period, the health research module II started with the resumption and developing of the previously proposed topics. The university research structure was presented to all students, including the dedicated laboratories for research. The lines of research and the available and interested advisors were also introduced. In this unit, the proposal for the construction of a research project was also initiated, when students were encouraged to build their own research problems, their hypotheses and their justifications. The idea was to work on setting goals, writing the introduction and searching for references.

Thus, the overall objective of the unit was that students could get to know the literature of the proposed topic for the preparation of the capstone project and start organizing the text. At the same time, it was established that at the end of the unit, the students would be able to know and use the platforms for active search for scientific articles, use the platform of health descriptors and make compound searches, select articles for the research topic, analyze and interpret articles selected for study and, in writing the introduction of the work, follow the rules of institutional formatting. In addition, the Lattes Platform was presented so that students could build their own curricula.

The semester was organized in two interconnected pedagogical phases, aiming to integrate theory and practice and promote autonomy in the construction of scientific knowledge. In the first phase, the teachers return to the pyramid of evidence, developing the critical analysis of the study designs (cohort, randomized clinical trial, systematic reviews, etc.) and their relationship with the strength of scientific evidence. These discussions are based on actual cases, allowing students to debate the effectiveness and limitations of each model. In the second phase, the focus shifts to active workshops, in which students apply the learned concepts in the creation of research projects, with an emphasis on creativity and methodological rigor.

Regarding the evaluation process, it is progressive and aligned with the competencies of Bloom's Taxonomy. In the first stage, students demonstrate theoretical mastery by identifying study designs in scientific articles and relating them to the corresponding level of evidence. Then, they move on to the creation of a research project, based on a specific command (for example, "prepare an observational analytical cohort study"). In this task, they must define dependent and independent variables, select adequate statistical measures, and justify the clinical-epidemiological relevance of the topic. Thematic freedom (as long as they respect the proposed methodological design) stimulates creativity and the practical application of knowledge, consolidating synthesis and analysis skills. Collaboration between peers is encouraged during the

workshops, with collective discussions for the refinement of the projects. The assessment combines structured rubrics (with criteria such as originality, methodological coherence, and statistical clarity) and continuous formative feedback, ensuring transparency and targeting. After the first evaluation, the choice of advisors begins from a list predefined by the teachers of the discipline, with individualized monitoring for the creation of the introduction, the bibliographic review and the study objectives. Thus, the evaluations were proposed in the format of achieving goals and corrections were made based on rubrics proposed by the teachers. The rubrics were presented at the time of individual feedback to ensure better use by each group or student.

In health research III, the central proposal was the creation of the methods, including the structuring of the study designs, the research ethics committee and the institutional flow of research, in addition to the presentation of proposals for the analysis of the results by statistical methods that are best related to the type of selected study. During this period, the students were equipped to submit research projects for evaluation by the ethics committee and to register their studies at the institutional research committee.

In the following semester, in health research IV, the students were able to learn about the techniques for structuring research results. Therefore, they were instructed on how to carry out data collection, the organization of research information and the interpretation of data, so that they could write the results, discussion and conclusion chapters. The construction of figures and tables, and the use of Excel and statistical programs were the most addressed contents during this school period.

And, finally, in health research V, topics related to scientific production, the writing of articles for publication in scientific journals, the analysis of the Qualis Capes impact factor and the methods of scientific dissemination were addressed. During this period, students were also given the opportunity to bring research demands to the teachers in charge. The main objective of this module is the production of scientific articles and posters developed from the students' research projects.

In the eighth academic semester, the students presented their work at the University Medical Academic Symposium to a panel appointed in thematic rooms of the major areas of medicine. All studies were evaluated from the point of view of scientific writing, oral presentation, the group's ability to synthesize, in addition to argumentation. The abstracts, in turn, were submitted for publication in the scientific annals of the institutional library and in special issues of institutional scientific journals. The approach proved to be effective in the development of critical and methodological skills, with emphasis on the articulation between theory and practice and the increase of student motivation. However, limitations were identified, such as difficulty in aligning the topics chosen by the students and *the* advisors' expertise; overload of tasks due to the complexity of reconciling the creation of the project with other disciplines; variability in the quality of feedback between groups, depending on the students' previous experience with scientific methodology.

Faculty

The teachers selected to teach the classes of the modules have experience in the area of research and proven degrees. The team includes PhDs (69.2%), PhD students (15.4%) and Masters (15.4%). Among the doctors on the team, five (55.6%) developed a postdoctoral training and four (44.4%) have international experience. Four teachers (30.8%) are linked to institutional *stricto sensu* graduate programs and one teacher (7.7%) is the institutional director of research and internationalization.

Regarding the role of teachers in research, one teacher (7.7%) is the Chief Editor of a nationally indexed journal, another (7.7%) is a scientific editor, and eight (61.5%) are editors of at least one scientific journal in the health area. In addition, three (23.1%) are members of a research ethics committee.

DISCUSSION

The health research axis was structured based on the guidelines contained in the DCN of the Medicine course[1], especially in article 3, which establishes the need for a generalist, humanistic, critical and reflective medical education. In this context, subsection III reinforces the importance of building an education focused on the development of scientific and critical thinking, going beyond the simple reading and understanding of the medical literature, and promoting the ability of students to analyze, judge and produce scientific knowledge.

The valorization of scientific training is also reflected in the selection processes of medical residency programs, many of which attribute relevance to previous research experience. Daus et al.[6] observed an increase of 33% to 50% in the interest shown by interviewers of academic residency programs in the research projects developed by the candidates. According to the authors, this interest is related to the interviewers' intention to use the knowledge in research as a means of better understanding the applicants' professional attributes.

From the implementation of the health research axis, a significant participation of medical students in the evaluated institutional undergraduate research programs from 2022 to 2024 was noticed. Another highlight was the increase in scientific production in the academic period, prior to the internship period, with articles published in national and international indexed journals. In addition, there was a significant increase

in the quality of the produced studies, which provided greater engagement in participation in institutional scientific events, as well as in congresses, symposiums and conferences of national and international scope.

When browsing the scientific literature, one perceives the great challenge of institutionalizing and increasing the engagement in undergraduate research programs in medical schools[3-5;7-9]. However, it is common for several authors to emphasize the importance of scientific research for physicians in training. Several studies[7-9] also discuss and reflect on the importance of the curricularization of undergraduate research programs in the matrices of medical courses, as the knowledge, skills and attitudes developed during this practice are extremely beneficial for students in their scientific production, as well as in the construction of their development for later entry into medical residency. In addition, according to the Institute of Applied Economic Research (Ipea, *Instituto de Pesquisa Econômica Aplicada*)[5], health research, especially in the medical field, contributes greatly to the scientific advancement of Brazil.

Despite the low supply and institutional organization, the development of research in the educational field plays an important role in the generation of new knowledge and new technologies, and in the improvement of critical and reflective thinking in academic training. Not only reading is stimulated, but mainly the ability to carry out a critical analysis of the medical literature and the correct interpretation of the results of scientific research. Both are a valuable method of continuing education with reinforcement of the use of EBM tools[3-5].

From the point of view of the students, the literature has been pointing out that the vast majority of them (91.9%) revealed that the carrying out of undergraduate research influences the vocation and training of new researchers and can also contribute to the community. In addition, approximately 75% of the students stated that scientific research is an important institutional experience and agreed with the possibility of making undergraduate research mandatory in medical education[3]. It is also noted that students in more advanced semesters of the medical course tend to seek more undergraduate research and areas of knowledge such as gynecology/obstetrics and public health were the most pursued ones, according to a study carried out at a federal university in the Northeast region[6].

With this, the structuring of the curricular matrix with the inclusion of five academic semesters with classes related to the topic of scientific research enables students to participate in institutional undergraduate research programs in a natural way. Having an extremely qualified faculty with extensive experience in research encourages students to do so, since there is a certain complexity for a student or for other teachers who are not familiar with or who know the institutional flows of research, especially those related to the Brazil platform for approval of research projects in the Ethics Committee.

In addition, students have the opportunity to structure a study: they build the content of an introduction, pay attention to the importance of a clear objective, are asked about the methodology as the body of the study and learn to organize their scientific evidence to create a robust, cohesive discussion that is capable of responding to the their research objective, supported by the guidance of a teacher from the educational institution.

In this context, the role of the teacher in guiding undergraduate research projects is crucial for the consolidation of a critical and investigative academic training. Tenório et al.[4] highlight that the dialogical and collaborative relationship between teacher and student, promoted in this process, favors a student-centered teaching model, which manifests itself in a clearer and more effective way in undergraduate research activities. This interaction, by going beyond the mere transmission of contents, contributes to the collective construction of knowledge, stimulating the student's scientific interest and, simultaneously, strengthening the pedagogical bonds with the teacher. In this dynamic, there is a significant sharing of knowledge, values and even affective aspects, which enhance the formative process of both subjects involved[2]. In addition, this experience favors the development of scientific competencies essential to professional practice in health.

Corroborating these findings, Amgad et al.[10] demonstrated that medical students who participated in research activities during their undergraduate studies showed a threefold-greater interest in getting involved with scientific research in their future professional trajectory, evidencing the positive impact of undergraduate research on the development of a continuous investigative posture.

Finally, it is important to emphasize that the teacher-student relationship established in this context must be continuously monitored and evaluated, with special attention to the quality of communication, mutual expectations and agreements established throughout the process. Considering that human interactions in the academic environment are subject to challenges inherent to educational and social life, the sensitive and reflective management of these relationships is essential for maintaining a healthy and productive educational environment.

CONCLUSION

The implementation of the health research axis in the matrix of the Medicine course was able to promote greater reflection by students on the safe search for scientific

references related to clinical theory and practice, thus fulfilling a fundamental role with regard to the use of EBM tools. It also contributed to exercising communication skills during research and, thus, the establishment of new professional skills for future medical graduates.

AUTHORS' CONTRIBUTIONS

Marcelo Andreetta Corral and Cintia Leci Rodrigues designed the study, collected the data, discussed the results, and edited the manuscript, analyzed the data, and reviewed the manuscript. Paula Yuri Sugishita Kanikadan pooled the data, discussed the results, edited the manuscript, analyzed the data, and reviewed the manuscript. Patrícia Colombo-Souza, Júlio Cesar Massoneto, and Ana Paula Ribeiro analyzed the data and reviewed the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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