

Medical graduation research: scientific production of a compulsory course

Pesquisa na graduação médica: produção científica de uma unidade curricular obrigatória

João Marcos Arantes Soares¹, João Vitor Liboni Guimarães Rios², Juliana Moreira Maia³,
Tiago Mello Rigo², Dan Reuter Ferraz de Araújo², Gabriel Costa Camuñas²

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ABSTRACT: *Introduction:* In contrast to the specific insertion which occurs in research projects developed in scientific initiations in the Medicine Course at the Federal University of São João Del Rei, the activities which contemplate executing research practices are concentrated in Scientific Research Practice (*Prática de Investigação Científica - PIC*), a mandatory course unit in which a group of students must start a research project and complete it by going through all of its construction stages. *Objective:* To quantify the scientific production generated by the mandatory course unit in Scientific Research Practice in the Medicine Course at a Federal University. *Methods:* Data collection was carried out through interviews and by analysis of the Lattes curriculum of *PIC* teachers. Fisher's Chi-Squared tests were used for statistical analysis between quantitative variables related to the scientific production of the discipline and academic information from the advisors. *Results:* A total of 30 professors were selected to guide 47 research groups in all, making it possible to identify 19 published articles, 32 presentations at conferences, 09 scientific initiations, 01 awards at congresses, 01 patent and 01 Master's thesis as scientific production, totaling 63 works. The results showed relevant scientific production of the unit, which was influenced by the academic degree, participation in graduate programs and the exclusive dedication regime of the teacher. *Conclusion:* The inclusion of mandatory scientific research practice in the medical curriculum during undergraduate studies can be an efficient strategy to generate scientific production for the university.

Keywords: Medical education; Search; Curriculum.

RESUMO: *Introdução:* Em oposição à inserção pontual que ocorre nos projetos de pesquisas desenvolvidos em iniciações científicas, no Curso de Medicina da Universidade Federal de São João Del Rei, as atividades que contemplam a execução de práticas de pesquisa estão concentradas na Prática de Investigação Científica (PIC), uma unidade curricular obrigatória na qual um grupo de alunos deve iniciar um projeto de pesquisa e finalizá-lo passando por todas as etapas de sua construção. *Objetivo:* Quantificar a produção científica gerada pela unidade curricular obrigatória em prática de pesquisa no curso de Medicina em uma Universidade Federal. *Métodos:* A coleta de dados foi realizada por entrevistas e análise do currículo Lattes dos docentes do Pic. Para análise estatística, utilizaram-se testes Qui-Quadrado de Fisher entre variáveis quantitativas relacionadas à produção científica da disciplina e informações acadêmicas dos orientadores. *Resultados:* Foram selecionados 30 docentes que orientaram 47 grupos de pesquisa ao todo, sendo possível identificar como produção científica 19 artigos publicados, 32 apresentações em congresso, 09 iniciações científicas, 01 premiação em congresso, 01 patente e 01 tese de mestrado, totalizando 63 trabalhos. Os resultados apontaram uma produção científica relevante da unidade, que foi influenciada pelo grau acadêmico, participação em programas de pós-graduação e regime de dedicação exclusiva do docente. *Conclusão:* A inclusão da prática de pesquisa obrigatória no currículo de Medicina durante a graduação pode ser uma estratégia eficiente para gerar produção científica para a universidade.

Palavras-chave: Educação médica; Pesquisa; Currículo.

1. Médico. Doutor. Professor Adjunto da Faculdade de Medicina da Universidade Federal de São João del Rei, Divinópolis, Minas Gerais, Brasil. ORCID: <http://orcid.org/0000-0002-9735-3026>. E-mail: jmarcoscep@uol.com.br.
2. Graduando em Medicina na Universidade Federal de São João del Rei, Divinópolis, Minas Gerais. ORCID: RIOS JVLG - <https://orcid.org/0000-0002-9841-0328>; Rigo TM - <https://orcid.org/0000-0002-3180-5085>; Araújo DRF - <https://orcid.org/0000-0001-5404-0380>; Camuñas GC - <https://orcid.org/0000-0003-0608-6266>. E-mail: jvliboni@gmail.com; mello.lattes@gmail.com; danferraz21@gmail.com, gabrielcostacamunas@gmail.com.
3. Médica graduada pela Universidade Federal de São João del Rei, Divinópolis, Minas Gerais, Brasil. ORCID: <https://orcid.org/0000-0002-9731-6815>. E-mail: juliana.mmaia@hotmail.com.

Correspondence: Rua Sebastião Gonçalves Coelho, 400 – Chanadour. Divinópolis, MG. CEP: 35501-296.

INTRODUCTION

The National Curriculum Guidelines (*Diretrizes Curriculares Nacionais - DCN*), approved by the Ministry of Education in 2014, consider it important to use “methodologies which privilege the student’s active participation in knowledge construction and integration between the content, in addition to encouraging the interaction between teaching, research and extension/assistance”¹ in the Medicine Course organization.

Although medical schools adopt Scientific Methodology subjects in their curricula, it is common for them to be offered for the duration of one or two semesters, but limited to the theoretical part. This content is used to carry out mandatory course completion work (*TCC*) in some institutions under the guidance of a teacher².

The syllabus of the Scientific Methodology disciplines of medical schools addresses basic concepts of science, biostatistics, ethics and bioethics, as well as research methods in qualitative, quantitative and statistical research. However, these disciplines have a greater focus on theoretical classes, without the practical construction of a research project and active methodologies³.

The scientific methodology pedagogy at the Federal University of São João Del Rei (UFSJ) has an innovative proposal. In addition to three semesters with theoretical content from the 4th semester onwards, students start taking a mandatory course unit called Scientific Investigation Practice (*PIC*). The theoretical content of the scientific methodology is worked through elaborating a scientific project. This production includes all the research stages from its conception to its completion. Students in the *PIC* discipline are guided by the same teacher for seven consecutive semesters. All the methodology, search, selection and critical reading concepts of scientific articles, study designs and research ethics are addressed in a practical way^{4, 5}. In addition, there is the data collection part, the use of statistics for data analysis and production of an article at the end of the seven semesters.

This model differs from insertions in Scientific Initiation and Extension programs. The research design and its execution is mainly the responsibility of the group of students. The teacher guides within a topic of their domain, but the work proposition comes from the students⁵.

PIC is relevant because it is an instrument capable of articulating theory and practice, thereby enabling knowledge (re)construction, since the mere transfer of content does not seem to meet the needs of current training⁶. The objective of Scientific Investigation Practice at UFSJ is to train more critical medical students with greater problem-solving skills, which is in line with the new Curricular Guidelines for training doctors in Brazil^{1,4}.

Exposure to research activities can not only stimulate scientific reasoning by students, but also by teachers, who end up improving their development as a

researcher at the institution, in addition to encouraging the participation of recent graduates in graduate programs. Furthermore, since it is about elaborating and executing research, it is expected that there will be presentations of the works produced in congresses, seminars and publications of articles in journals^{7,8}. As a professor’s evaluation takes place through scientific publication, *Pic* can be beneficial for both, because at the end of the course the student and the teacher may have an increase in their academic production^{7,9,10}.

OBJECTIVE

The objective of this study is to quantify the scientific production generated by the mandatory course unit in Scientific Research Practice in the Medicine Course at a Federal University.

METHOD

This is a retrospective, quantitative study based on the scientific production of the *PIC* teachers in the period between implementing the course from the second semester of 2009 to the second semester of 2014. These groups guided by the *PIC* finalized their production between the second half of 2012 and the second half of 2017.

The inclusion criteria for participating teachers were: having guided the students in the *PIC* work and having a curriculum in the Lattes Platform of the National Council for Scientific and Technological Development (*CNPq*). The exclusion criteria were defined as: teachers with a Lattes curriculum which only contained identification and lacked information about their scientific production.

The list of teachers who guided the *PIC* groups was obtained from the Medical Course coordination. Data collection was carried out in two stages. The teachers participating in the *PIC* were contacted to conduct a structured interview. This was done through a questionnaire which evaluated the number of *PIC* groups guided by the teacher, the study titles and the scientific production derived from these works. The second part of data collection took place through documentary analysis of the teachers’ Lattes curriculum. The scientific production initially reported in the interviews were investigated.

Published articles, presentations at congresses, symposia, scientific initiations with scholarships from funding agencies, production of theses and patents were considered as scientific production. The presentations at congresses were stratified according to their scope: local, regional, national and international. The articles were classified using Qualis *CAPES* - 2013-2016 Quadrennium (QC), and the reference used for classification was the Medicine II area, which includes courses and programs with wide coverage in the medical field, in addition to greater proximity to the operation area of the research groups of

the *PIC* discipline.

Through the Lattes Platform, it was assessed whether the teacher works on a 20 or 40-hour weekly basis and is exclusively dedicated or not; the undergraduate course of origin; their titles and degrees obtained after graduation (Master's and Doctorate) and their participation in graduate programs. These variables were correlated with scientific production, and the Chi-squared or Fisher's exact test was used to assess the statistical significance level. A p-value of 0.05 was considered significant.

This research project was approved by the Research Ethics Committee of the University following the ethical requirements in research involving human beings advocated by Conep Resolution 466/2013, of the National Health Council (CNS), under the opinion number: 2,677,243.

RESULTS

A total of 31 teachers who guided 48 *PIC* groups were identified in the selected period. Of these, 30 teachers participated in the study totaling 47 oriented groups. One teacher was excluded from the sample due to unavailability to contact.

The group of teachers was stratified according to their degree of origin: 46.6% of the teachers had graduated in Medicine compared to 53.34% of those from other areas. The sample stratified according to the academic graduation degree indicated that 76.66% had a Doctorate degree and 23.33% had a Master's degree. The work regime was 63.33% for exclusive dedication and 36.68% for 40 or 20 hours a week. Half of the teachers participated in graduate programs and half did not. Table 1 presents the data described above.

It was possible to identify 19 published articles, 32 presentations at congress, 09 scientific initiations, 01 award at the congress, 01 patent and 01 Master's thesis from the data collected from the 47 oriented research groups. Thus, the total scientific production derived from these groups counted according to the criteria of the present research was 63 productions. Table 2 describes all *PIC* scientific productions.

The production of scientific articles and presentations at conferences were compared according to the stratification by characteristics of the groups of teachers (graduation of origin; academic degree; work regime and participation in graduate studies). The following characteristics were identified in the statistical analysis as positive impacting factors on the production of scientific articles with significance: exclusive work regime ($p = 0.03$); participation in graduate studies ($p = 0.02$) and academic degrees equivalent to doctorates ($p = 0.01$). Furthermore, working regime with a time of 40 or 20 hours was found as a positive factor with statistical significance regarding presentations at congresses (Table 3).

Table 1: Stratification of the sample of teachers according to the undergraduate course of origin; academic degree; work regime and participation in graduate programs. Data collected during the period from 2017 to 2018 at the Federal University of São João del Rei – Center-West Campus, Divinópolis, Minas Gerais, Brazil

	Frequency (n)	Percentage (%)
Graduation		
Doctors	14	46.66
Non-Doctors	16	53.34
Academic degree		
Doctorate	23	76.66
Master's	7	23.33
Work regime		
Exclusive Dedication	19	63.33
Time – 40 or 20 hours	11	36.68
Participation in post-graduation		
Yes	15	50.00
No	15	50.00

Table 2: List of scientific production originated from *PIC*: Articles stratified according to QUALIS CAPES classification (2013-2016 Quadrennium), Medicine II (19); congress presentations stratified according to the scope of the event (32). Data collected during the period from 2017 to 2018 at the Federal University of São João del Rei – Center-West Campus, Divinópolis, Minas Gerais, Brazil

Scientific production derived from <i>PIC</i>	Number (n)
Published scientific articles/Qualis classification	19
A2	01
B1	01
B3	03
B4	02
B5	06
C	01
No classification	05
Presentations in congress	32
International	04
National	08
Regional	04
Local	05
Not specified	11
Scientific initiations	09
Awards in congress	01
Patents	01
Master's thesis	01
TOTAL	63

Table 3: Comparison of scientific production according to differences in teacher profiles: undergraduate degree; work regime; participate in graduate program and academic level. * ED: Exclusive dedication. Sample size of teachers: 30. Data collected during the period from 2017 to 2018 at the Federal University of São João del Rei – Center-West Campus, Divinópolis, Minas Gerais, Brazil

	Doctor	Non-Doctor	
Produced scientific articles			p = 0.13
Yes	4 (28.6%)	9 (56.3%)	
No	10 (71.4%)	7 (43.8%)	
Presentation in congresses			p = 0.28
Yes	8 (57.1%)	6 (37.5%)	
No	6 (42.9%)	10 (62.5%)	
	ED	Not ED	
Produced scientific articles			p = 0.03
Yes	11 (57.9%)	2 (18.2%)	
No	8 (42.1%)	9 (81.8%)	
Presentation in congresses			p = 0.05
Yes	8 (42.1%)	6 (54.5%)	
No	11 (57.9%)	5 (45.5%)	
	Participated in post-graduation	Did not participate in post-graduation	
Produced scientific articles			p = 0.02
Yes	10 (66.6%)	3 (20%)	
No	5 (33.3%)	12 (80%)	
Presentation in congresses			p = 0.06
Yes	4 (26.6%)	10 (66.6%)	
No	11 (73.3%)	5 (33.3%)	
	Master's	Doctorate	
Produced scientific articles			p = 0.01
Yes	0 (0%)	13 (56.5%)	
No	7 (100%)	10 (43.5%)	
Presentation in congresses			p = 0.06
Yes	4 (57.1%)	10 (43.5%)	
No	3 (42.9%)	13 (56.5%)	

DISCUSSION

The insertion of research practice in undergraduate studies is a controversial subject. The benefits include increasing students' learning capacity, developing critical thinking, better performance in problem solving and better understanding and communication of data from scientific research^{11,12,13,14}.

In addition to improving medical training, research activities can increase the students' scores during curriculum analysis in medical residency competitions^{7,12,15}. In addition, scientific production generates learning and recognition for the teachers, as well as enabling professional advancement^{12,13}.

On the other hand, there are authors who believe that the time spent on research during graduation could be better used in studying other areas such as clinical, public health and nutrition¹⁶. They also point out that there is no variation in knowledge in scientific methodology when comparing groups of graduates and residents who participated or not in scientific research practices during their undergraduate studies in Medicine and in medical residency¹⁷. Another

study associated participation in research during academic training with a lower performance in public job sector tenders and a lower salary gain¹⁸.

Studies defend and show positive impacts on the motivation of medical students, who in turn are interested in scientific research, but point out problems in carrying out these activities at the university level. A study of sixth year students from six Brazilian medical schools showed that 93% of students were interested in research. However, student involvement in these activities was 28%¹⁹. These numbers reach 87% and 90% in countries such as Norway and the United States, respectively^{20,21}.

In this context, the political-pedagogical project of the Federal University of São João Del Rei proves to be innovative in medical education in research in Brazil. It incorporates a mandatory research discipline into the medical curriculum. Thus, the project is able to cover all students of the course and at the same time enable the teacher to integrate research activity with the undergraduate program⁵. Each semester, an average of five to six professors become involved in scientific research practices through the discipline.

The guiding professors in the *PIC* have the sole prerequisite for qualification of being able to work in the basic area, in the clinical area, in both or even belong to other courses in the health area. This orientation format is an important feature, as it covers the various knowledge areas in the health field and enables interdisciplinarity.

Medical teachers are primarily generally dedicated to clinical assistance and teaching. However, this situation has been changing in Brazilian medical schools, as more and more involvement in research by teachers is being noticed, even if less frequent when compared to other academic activities^{22, 23, 24}. The proportion between medical and non-medical teachers was similar, with 14 (46.66%) doctors and 16 (54.44%) from another training area, respectively. Moreover, there was no statistical significance when comparing scientific article publication and presentations at congresses between these groups. It should also be noted that only three of the 14 supervising doctors worked exclusively. This finding challenged the hypothesis that a teaching physician would present less scientific production than other groups of teachers²¹ due to dedicating most of their time to medical activities.

Some of the teachers have been willing to guide more than one group of students over the years since the implementation of the course. It was observed that 16 of the 30 teachers interviewed supervised more than one group, as some teachers were supervising their third group of students. It is understood that teachers are interested in the course and they realized the importance of scientific research in the exercise of their professional activity and as a means of learning and teaching.

In the evaluation of academic degrees, all professors had a postgraduate level equal to or higher than a Master's degree. There was a total of 23.33% with a Master's degree and 76.66% with a Doctorate degree. The prevalence of professors with a doctorate in *PIC* was higher than that found by Cyrillo et al.¹⁰ at the *Universidade Federal Fluminense*, in which 52.62% of the professors participating in a scientific initiation discipline had a doctorate and 21.54% had a Master's degree.

When the publication of articles was compared between the Master's and Doctorate groups of professors, it was observed that the Master's group produced less scientific articles ($p = 0.01$). A similar study pointed out that Master's degree professionals have their research activity more limited and less encouraged because they cannot supervise graduate students¹⁰.

There was greater publication with regard to the publication of articles in the groups whose supervisors participated in graduate studies ($p = 0.02$). As a possible explanation for this fact, we point out the demand for producing articles which graduate students have under their professors. Research funding agencies also take into account a greater amount of scientific production for granting scholarships and financing research. In addition, it

can be assumed that professors working in graduate school would have an easier time publishing articles, since they have previous experience in guiding students in research activities¹⁰.

Regarding the analysis of the teacher's profile according to their work regime, 19 (63.33%) were identified as ED and 11 (36.68%) as non-ED. There was a higher rate of publications for ED teachers ($p = 0.03$). However, the relationship is reversed when it comes to presentations at congresses ($p = 0.05$). This situation may be related to the fact that ED professors have more time to conduct research, which culminates in a greater probability of publishing the scientific article. Congress presentations are usually activities of greatest interest to students. It is therefore possible that groups which were unable to publish their work in journals were interested in taking them to presentations at congresses.

It was also noted that 31.25% of the 47 *PIC* groups published articles, and 41.66% presented their work at scientific events in the present study. Similar studies in Brazil describing the scientific production originating from a mandatory curricular unit in scientific research are not described. However, our results can be compared to those found in undergraduate Scientific Initiation (SI) programs. A study conducted at the Faculty of Medicine of the *Universidade Estadual Paulista* (UNESP) in Botucatu showed that 67.9% of the students participating in *PIC* presented works in scientific meetings or congresses, and that only 5.1% published their projects in scientific articles in the researched period²⁰.

When investigating the Qualis-periodical of the articles produced in the *PIC*, it was observed that about 12% of the production is concentrated in the upper strata from A1 to B1. However, the relevance of Qualis-periodical for the productions of this curricular unit is questionable because the focus of the discipline is more focused on the pedagogical part than on the production of works²⁵. In addition, it should be considered that the choice of evaluating articles based on Medicine II in the QC may harm the stratification of non-inherent articles to that area.

Most of the *PIC* works were projects carried out with the community and in laboratories. The latter generally occurred when the supervisor made the *PIC* an unfolding of a previous project linked to postgraduate studies. There has been no government or institutional funding for *PIC* groups to date. All the resources spent on research development were the responsibility of the research group, so they were low-budget projects compatible with the reality of the students and supervisors.

In summary, *PIC* generated 19 scientific articles, 32 presentations at congresses, nine scientific initiations, a patent, a congress award and a Master's thesis in the analyzed period, constituting productions which certainly would not exist without the implantation of the unit. The groups of professors who produced the most scientific

articles were those who worked under the Exclusive Dedication regime, who participated in graduate programs and had a Doctorate degree.

It is important to highlight the limitations present in the methodology used in this research. As this is a retrospective study, there is the possibility of memory bias, which in this case would impair quantifying the scientific production of *PIC* due to forgetfulness by the professor of some work published in the past. In addition, the Lattes platform which was used as a data source for the research can also be a bias for the study, as it is edited by the professors themselves and often has errors in filling it out²⁶.

Furthermore, it should also be noted that despite the significant number of publications, *PIC* has a total workload of 252 hours, about 3.4% of the total medical workload of 7,432 hours⁴. This fact raises a question about the opinion of some authors who refer that the time spent to perform research activities in undergraduate courses could be better used in other related areas of the medical course¹⁶. However, when analyzing the percentage of time dedicated to *PIC*, it is noticed that this value is relatively small. In view of the advantages found in the literature on performing scientific research during medical graduation, a counterpoint to the opinion of these authors must be established.

CONCLUSION

Conducting research during a medical degree is still infrequent even though it is one of the principles of the

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