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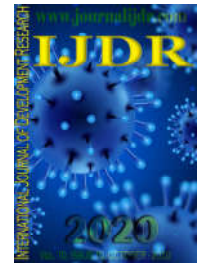
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RESEARCH ARTICLE

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DISTRIBUTION IN THE NATIONAL TERRITORY OF MEDICAL COURSE DEGREES FROM A PUBLIC AND A PRIVATE MEDICAL SCHOOL: ROLE IN MEDICAL DEMOGRAPHY

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ABSTRACT

Aims: Adding information on the place of training, displacement and transfer of doctors, variables which add complexity to the territorial concentration of professionals, is at the core of the present study, which aims to trace the distribution of doctors in Brazilian territory in relation to the institution that trains a given loco-region, in order to obtain the effective contribution, or not, of this training institution for the distribution of medical professionals in order to meet the needs of the Brazilian population. **Methods:** Descriptive, exploratory and retrospective study with data processing about doctors, extracted from different secondary sources: data obtained from the training institution and data from the administrative record of the Regional Councils of Medicine (RCMs), integrated into the database of the Federal Council of Medicine (FCM). Time frame from 2008 to 2016. **Results:** 1,124 doctors included in the study; most of the graduates from the Medical School of São José do Rio Preto (FAMERP), São Paulo have active registration at the UF of origin and of HEI, 498 (91.7%) and 515 (94.8%) and respectively, while the graduates of the São Lucas University center (UniSL), Rondônia are registered mostly outside the UF of origin (415 - 75.6%) and outside the UF of the HEI (375 - 68.3%). When the two variables are associated, FAMERP graduates are registered, mostly, in the UF of origin and of HEI (515 - 94.8%) while the graduates of UniSL are registered, mostly, outside the UF of origin and of HEI (305 - 55.6%). All these results are statistically significant ($p < 0,001$). **Conclusions:** The data presented herein traces the distribution of graduates in the Brazilian territory in relation to the HEI that trains a given loco-region, and puts in question the contribution of this HEI to the distribution of medical professionals in order to minimize regional inequalities, respecting their vocation. The results of the present study show that the settlement of doctors in unassisted areas transcends the governability of training institutions and seems to demand the confrontation of socio-cultural, economic and political factors.

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INTRODUCTION

Numbers of Medical Courses in Brazil and in the World
Between 1808, when the first medical teaching schools were created in Brazil and that until the first decade of the twentieth century there were only three, until October 2020, 342 medical

schools were created, which in the international scenario places Brazil behind India only, currently with 392 schools and with a population x medical schools ratio of 3,088 thousand/school, and followed by the United States of America with 184 schools and a population x medical schools ratio of 1,726 thousand/school. (BRAZIL, 2020; NASSIF, 2020).

There were three important periods related to the increase in the number of medical schools in the country. The first between 1962 and 1972, the second between 1994 and 2008 and the last one between 2012 and 2020. Most schools and medical graduation vacancies are under private management. Among public education institutions, most of them are from the federal administration. Most schools are located in the capitals and metropolitan regions (MRs) of the Units of Federation (UFs) and a smaller percentage in the countryside. Large population cities are home to a significant percentage of these schools. The Southeast Region is home to most of these schools, while the North and Midwest, is home to the smallest part (OLIVEIRA *et al.*, 2018; BRAZIL, 2020; NASSIF, 2020).

Geographic Distribution of Doctors in Brazil: Although the irregular geographic distribution of doctors is not only a problem in Brazil (PAHO, 2003; WHO, 2009), we will stick to the data of the same and make a brief comparison with global data. In January 2018, Brazil had 452,801 doctors, which corresponds to the ratio of 2.18 doctors per thousand inhabitants. The evolution of the population growth rate, the number of medical records and the ratio of doctors per thousand inhabitants, between the years 1980 and 2015, calls attention to its linear and constant growth of the ratio of doctor/inhabitant. The ratio went from 1.15 doctors per thousand inhabitants in 1980 to a ratio of 2.11 in 2015. In all five years, the growth rate in the number of doctors is at least twice that of the population. The slower growth rate of the general population is related to significant changes in the levels and patterns of vital fertility and mortality events. The fastest pace of the increase in the population of doctors occurs in periods subsequent to the opening of new medical courses and the authorization of more graduating vacancies. Considering that the graduation in Medical Course lasts six years and that there is practically no dropout or failure along the trajectory of the students, each vacancy offered in 2017 will correspond to a new doctor in 2023. In that year, it is estimated that 27,487 new doctors will be registered. In 2024, there will be 28,792, or three times the 2004 balance, when 9,299 new entries were registered. In two decades (considering the year 2004), the expected growth is 200% in the number of new registrations (SCHEFFER *et al.*, 2018).

Inequality in Distribution: Despite all this projection, there are still huge inequalities in the distribution of doctors across the national territory, reinforcing trends already observed previously (SCHEFFER *et al.*, 2011; 2013; 2015). The geographic distribution of doctors in Brazil can be assessed by different criteria such as macro-regions, units of federation, capital and countryside, and groupings of municipalities by population strata. The hyper-concentration of doctors coexists with real “deserts” of professionals in Brazil, disparities verified by any of the criteria defined above. Therefore, while there are 2.18 doctors per thousand inhabitants in the whole country, there are capitals with more than 12 doctors per thousand inhabitants - such as Vitória, in Espírito Santo - and regions of the countryside of the Northeast with numbers lower than one doctor per thousand inhabitants. The Southeast is the region with the highest medical density per inhabitant, with a ratio of 2.81, against 1.16 in the North and 1.41 in the Northeast. In its four states, the Southeast has 244,304 doctors for a population of 86,949,714 inhabitants. The state of São Paulo, in turn, has the same ratio as the Southeast, 2.81 and concentrates 21.7% of the country's population and 28% of the

total number of doctors. (SCHEFFER *et al.*, 2018). Almost all cities with more than 500 thousand inhabitants in all regions have a ratio of doctor/inhabitant below 1, both in relation to the country and the region in which they are located. Likewise, most municipalities with up to 10,000 inhabitants have a ratio above 5.0. In the Northeast, almost all cities with up to 20 thousand inhabitants have a ratio above 10, reaching 19.47 in the range of 5 thousand to 10 thousand in relation to the country. (SCHEFFER *et al.*, 2018). Taking into account the indicator ratio of doctors per thousand inhabitants, Brazil, using the ratio of 2.1 doctors per thousand inhabitants, although close to South Korea, Mexico and Japan, is below all 34 countries considered in the survey, with the exception of from Turkey, which has 1.8 professionals per thousand inhabitants. Of the 34 selected countries, 23 have ratios above 3 doctors per thousand inhabitants. Below are, for example, the United Kingdom (2.8), the United States of America and Canada (2.7). It should be noted that these general data do not consider the unequal distribution in the territories or the distribution of doctors and services in the health systems. (OECD, 2017). But this most used indicator –doctors per thousand inhabitants - has little expression if used in isolation. For this reason, the World Health Organization (WHO) and the Pan American Health Organization (PAHO) do not recommend or establish ratios of doctors per inhabitant as a reference, as they depend on regional, socioeconomic, cultural and epidemiological factors. These agencies emphasize that there is little point in establishing a generalized “ideal ratio” for all countries (PAHO, 2003; WHO, 2009). A national ratio does not reach inequalities in the concentration of professionals within countries, which tend to be bigger or smaller according to the extent of the territory, the characteristics of the health system and regional socioeconomic inequalities (OECD, 2017). The WHO points out that estimates of doctors are drawn from multiple administrative sources, population censuses, surveys on employment and health facilities. The great diversity of sources implies considerable variability in both the scope and quality of the data. The OECD also sees limitations when comparing countries using only the ratio of doctors per thousand inhabitants (OECD, 2017).

Factors for Settlement of Doctors: Attracting and settling doctors is a complex problem, involved in intrinsic and extrinsic motivations that influence the choice of the professional's place of work. The study of strategies that take into account the conditioning factors for attracting and settling professionals must be a constant exercise among health human resources planners, in order to support evidence-based decision making. (VAN STRALEN *et al.*, 2017). Knowing what attracts and especially what retains these professionals in remote and unassisted areas is essential to guide public policies. VAN STRALEN *et al.* (2017) have investigated the main factors of attraction and retention in municipalities that had a shortage of doctors, composing the so-called "shortage routes". In-depth interviews were carried out with 51 doctors on 10 routes covering the five regions of Brazil and in the content analysis, six categories and 27 subcategories were identified: remuneration (subcategories: salary, payment on time, housing allowance, transport allowance and food allowance), employment relationship (subcategories: stable relationship and unstable contract), working conditions (subcategories: flexibility/day-off, health unit infrastructure, availability of equipment, workload, availability of exams, availability of medicines and reference/specialist doctors),

professional factors (subcategories: updating and training and residency and specialization), local factors (subcategories: leisure options, infrastructure of the municipality, distance from the municipality, access to the municipality, quality of life, education for children and employment for the spouse) and personal factors (subcategories: origin of the professional, social bond, recognition community and vocation). There was emphasis on the items of salary, flexibility of the workday, infrastructure of the health unit, origin of the professional, infrastructure and leisure options of the municipality. Thus, the challenge of attracting medical professionals to work in unassisted areas in Brazil has been faced over the years through various policies that had as common objectives to promote changes in training, reduce the shortage of these professionals in areas of difficult provision and improve health. geographic distribution of these in the regions of Brazil and, thus, the impeding factors in the provision and settlement of doctors in these regions continue to prevail and, as mentioned above, among the main ones are the characteristics of the regions that are not favorable to good quality of life for themselves and family members, the impossibility of continuing education with professional isolation, the value and receipt of remuneration with inadequate working conditions, precarious employment contracts and the absence of a career plan and professional recognition by peers and society (BACH, 2006; LEHMANN *et al.*, 2008; WHO, 2014; DAL POZ *et al.*, 2015).

Expansion of Medical Schools in Brazil: The need to guarantee medical care in a universal manner, respecting one of the three principles of the Unified Health System (UHS) is one of the justifications for the Brazilian State to use intervention programs in the provision and distribution of doctors in Brazil on a constant basis. From the Rondon Project in 1966 to the current MaisMédicos Program (More Doctors Program) instituted in 2013 (BRAZIL, 2013, among the motivating objectives, there was always one in common, the attempt to minimize the inequalities of medical professionals sown in the countryside of the immense country. These expansion policies were directly involved with Brazilian economic, technological, political and social development. Between 2011 and 2018, 119 medical schools were opened. This number shows a high growth of training institutions in the seven-year period, given that in 194 years of the country's history (1808 to 2002), only 114 (OLIVEIRA *et al.*, 2019) were instituted. Between the years 2018 and 2020, the number of new institutions made a new leap, totaling 357 schools nationwide (PADILHA, 2019). The literature shows that throughout history the concentration of doctors and teaching vacancies has always been in large urban centers and in regions of greater development (ALESSIO & SOUSA, 2017; SCHEFFER *et al.*, 2018; MORAIS *et al.*, 2018; PADILHA, 2019; SORDI *et al.*, 2019). Not far from this, the precarious distribution in the countryside of the states is also an international reality, as many countries suffer from these imbalances and point out deficits in rural institutions (ALESSIO & SOUSA, 2017). To illustrate this point, the Medical Schools of Brazil website indicates that 28% of institutions are based in Brazilian capitals. It can also be said that they are concentrated in the South and Southeast, in the proportion of 6 in every 10 schools. Of all training institutions, 60% have ties to private institutions (NASSIF, 2020). Of this total of active graduations, most are in the State of São Paulo (67), followed by Minas Gerais (48). States like Bahia, Paraná, Rio de Janeiro and Rio Grande do Sulgo together in the home

of the 20 courses in operation. The other states stand out in the ranking as follows: Santa Catarina (16), Goiás (15), Pernambuco (11), Paraíba (9), Pará (8), Ceará (8) and Piauí (7). The Federal District, MatoGrosso, Rio Grande do Norte, Maranhão, Tocantins and Espírito Santo, each have 6 medical schools, followed by Amazonas (5), MatoGrosso do Sul (5), Alagoas (5), Rondônia (5), Sergipe (3), Roraima (2), Acre (2) and, finally, Amapá (1). (NASSIF, 2020). Regarding the number of vacancies, the percentage order follows: Southeast Region with 45.26%; Northeast Region 23.90%; South Region with 14.94%; Central West with 8.37%, followed by the Northern Region, 7.51% 3. These data point to the heterogeneity of Brazil and the unequal distribution of training centers, making evident the need for these and other health professionals to meet the demands of health care to population in the different health services. (ALESSIO & SOUSA, 2017; SCHEFFER *et al.*, 2018; MORAIS *et al.*, 2018; PADILHA, 2019).

Educational Aspects Determinants of the Settlement of Doctors in Unassisted or Professional Shortage Regions:

Possible predictors of settlement related to medical training can be analyzed based on the positive results of specific schools or programs. The selection process of students for medical graduation has been pointed out, in most studies, as an important factor for settlement in rural or urban areas with professional shortages (RABINOWITZ *et al.*, 2008; WILSON *et al.*, 2009; VISCOMI *et al.*, 2013; FARMER *et al.*, 2015; MYHRE *et al.*, 2015; GOODFELLOW *et al.*, 2016; REEVE *et al.*, 2016). Countless studies have even shown that the link with the region is the most important isolated criterion, corroborating previous evidence from the literature on the subject (RABINOWITZ *et al.*, 2008; WILSON *et al.*, 2009; VISCOMI *et al.*, 2013; FARMER *et al.*, 2015; SAPKOTA & AMATYA, 2015). It is important to highlight that this bond is characterized both by the student's naturalness and by the time of residence and / or having attended high school in these areas (ROCHA *et al.*, 2020). The curricular structure of undergraduate courses has a determining role, with emphasis on community-based curricula, with a focus on Primary Health Care (PHC) and which adopt longitudinal practices arranged throughout the course, starting in the first periods and continuing until the last year, with increasing complexity and workload (RABINOWITZ *et al.*, 2008; WILSON *et al.*, 2009; VISCOMI *et al.*, 2013; MYHRE *et al.*, 2015; GOODFELLOW *et al.*, 2016; REEVE *et al.*, 2016; GUILBAULT & VINSON, 2017).

The location of medical schools in unassisted, rural or urban areas was a prominent predictor in several of the analyzed researches, being associated with higher rates of professional settlement (BARRETT *et al.*, 2011; CRAMPTON *et al.*, 2013; FARMER *et al.*, 2015; GOODFELLOW *et al.*, 2016; GUILBAULT & VINSON, 2017). Starting the medical residency soon after graduation is the desire of more than 80% of newly graduated doctors. In 2017, Brazil had 35,187 doctors attending medical residency (MR), in 6,574 programs from 790 institutions accredited by the National Medical Residency Commission (NMRC). There are authorized MR programs in 55 medical specialties and in 59 areas of expertise recognized by the Joint Specialties Commission (JSC). In the distribution by unit of federation, São Paulo concentrates 34.5% of all resident doctors, that is, more than a third of the national total. Next comes Rio de Janeiro, with 11.4% of inhabitants; Minas Gerais, with 11%, followed by Rio Grande

do Sul, with 7.1%. Twelve of the 27 units of federation each have 1% or less of the country's resident doctors. Among the 7 northern states, only Pará is slightly above that line, with 1.7% of resident doctors across the country. (SCHEFFER *et al.*, 2018). Adding information on the place of training, displacement and transfer of doctors, variables which add complexity to the territorial concentration of professionals, is at the core of the present study, which aims to trace the distribution of doctors in Brazilian territory in relation to the institution that trains a given loco-region, in order to obtain the effective contribution, or not, of this training institution for the distribution of medical professionals in order to meet the needs of the Brazilian population. It is hoped that the data obtained from the present study will provide material for research analysis and developments, while contributing to a permanent dialogue between the actors involved.

MATERIALS AND METHODS

Type of study: Descriptive, exploratory and retrospective study with data processing about doctors, extracted from different secondary sources: data obtained from the training institution and data from the administrative record of the Regional Councils of Medicine (RCMs), integrated into the database of the Federal Council of Medicine (FCM). Time frame from 2008 to 2016. The initial milestone 2008 was determined to be the year of graduation of the first class of UniSL. FAMERP had its first group graduated in 1972.

Study participants: The study individuals were graduates of two higher education institutions (HEIs), from one of the following regions: Southeast, in the case of São José do Rio Preto, São Paulo, the Medical School of São José do Rio Preto (FAMERP), and Northwest, Porto Velho, Rondônia, the São Lucas University Center (UniSL), the first being public and the second private. The study sample consisted of 1,124 graduating doctors from the two HEIs, with 570 graduated by FAMERP and 554 graduated by UniSL. Data obtained from the medical school graduates of these institutions from the years prior to 2016, inclusive, were located on the websites of the regional councils of medicine (RCMs). Graduates from 2017 were not considered since many of them would still be in the training process, considering an average residence time of 3 (three) years. From the training institutions, the personal data of the graduates were obtained, including the location of their origin when joining the institution, and their registration status was obtained on the websites of one of the 27 Regional Councils of Medicine (RCMs). The present study was previously approved by the Ethics Committee on Research in Human Beings of the Medical School of São José do Rio Preto (FAMERP) according to the opinion number 1.778.417/2016.

Statistical analysis: The exploratory analysis of the data included descriptive statistics, mean, median, standard deviation, minimum and maximum values for numerical variable and number and proportion for categorical variables. For the analysis of the behavior of the numerical variables "time since graduation until 2020", descriptive statistics, histogram and boxplot graphs and the specific test for the theoretical assumption of normality Kolmogorov-Smirnov (CONOVER, 1998) were considered. The comparison between two independent groups of graduates (FAMERP and UniSL) was performed using the Mann-Whitney test for non-normal numerical variables and Pearson's chi-square test for categorical variables (CONOVER, 1998; SIEGEL &

CASTELLAN, 2006; FIELD, 2009). The analysis of migratory movements of medical graduates in the present study was carried out using a Markov Chain transition matrix with a mathematical model. Statistical analysis was performed using IBM-SPSS Statistics version 24 (IBM Corporation, NY, USA) and R software, markovchain package (R CORE TEAM, 2015), for the implementation of the Markov Chain calculation program. All tests were two-tailed and p values <0.05 were considered significant.

RESULTS

Sample Characterization: The demographic and graduation data of the 1,124 doctors included in the study showed a predominance of females (670 - 59.6%), predominantly born between 1980 and 1990 (916 - 81.5%), with 3 to 12 years of graduation. In 2020, considering the time frame (2008 to 2016). The descriptive analysis of the units of federation (UF) of origin (UF indicated at the time of registration at the HEI) of the doctors included in the study, shows the origin of 24 UF, with predominance for the state of São Paulo (833 - 74.1%) and Rondônia (174 - 15.5%), respectively the UF of the HEIs studied (FAMERP and UniSL). The comparison of the proportion of doctors whose UFs of their origin are the same as the UF of HEI can be seen in Table 1.

Table 1. Comparative analysis of the proportion of doctors whose Unit of Federation of their origin are the same as those of Higher Education Institutions

	Total n = 1124	FAMERP n = 570	UniSL n = 554	Valor p
UF of their origin are the same as those of HEI, n (%)				
Yes	725 (64.5)	551 (96.7)	174 (31.4)	< 0,001
No	399 (35.5)	19 (3.3)	380 (68.6)	

Categorical variables are described in number (percentage). UF, Unit of Federation; HEI, Higher Education Institutions; FAMERP, Medical School of São José do Rio Preto; UniSL, São Lucas University Center.

Table 1. Comparative analysis of the proportion of doctors whose Unit of Federation of their origin are the same as those of Higher Education Institutions. Thus, most of the FAMERP graduates are from the UF of HEI, São Paulo (551 - 96.7%) and the same is not true with the UniSL graduates who come from UF other than HEI (380 - 68.6%), these results being statistically significant (p < 0,001).

Migratory movements of graduates: The sample of graduates available for analysis of migratory movements in 2020 was composed of 1,092 doctors, since 32 of them were not active in any UF, due to the following reasons: 28 records not found; 2 inactive and 2 deceased. The comparative analysis of the proportion of graduating doctors with active registration in different UFs in 2020, according to the HEI, can be seen in Table 2. Table 2. Comparative analysis of the proportion of graduating doctors with active registration in different Units of Federation in 2020, according to HEI. Thus, the majority of FAMERP graduates have active registration at the UF of origin and of HEI, 498 (91.7%) and 515 (94.8%) and respectively, while the graduates of UniSL are registered mostly outside the UF of origin (415 - 75.6%) and outside the UF of the HEI (375 - 68.3%). When the two variables are associated, FAMERP graduates are registered, mostly, in the UF of origin and of HEI (515 - 94.8%) while the graduates of UniSL are registered, mostly, outside the UF of origin and of

Table 2. Comparative analysis of the proportion of graduating doctors with active registration in different Units of Federation in 2020, according to HEI.

	Total n = 1092	FAMERP n = 543	UniSL n = 549	Valor p
Active registration at the UF of HEI, n (%)				
Yes	689 (63.1)	515 (94.8)	174 (31.7)	< 0,001
No	403 (35.9)	28 (5.2)	375 (68.3)	
Active registration at the UF of origin, n (%)				
Yes	632 (57.9)	498 (91.7)	134 (24.4)	< 0,001
No	460 (42.1)	45 (8.3)	415 (75.6)	
Active registration at the UF different of origin and of HEI, n (%)				
Yes	333 (30.5)	28 (5.2)	305 (55.6)	< 0,001
No	759 (69.5)	515 (94.8)	244 (44.4)	

Categorical variables are described in number (percentage).

UF, Unit of Federation; HEI, Higher Education Institutions; FAMERP, Medical School of São José do Rio Preto; UniSL, São Lucas University Center.

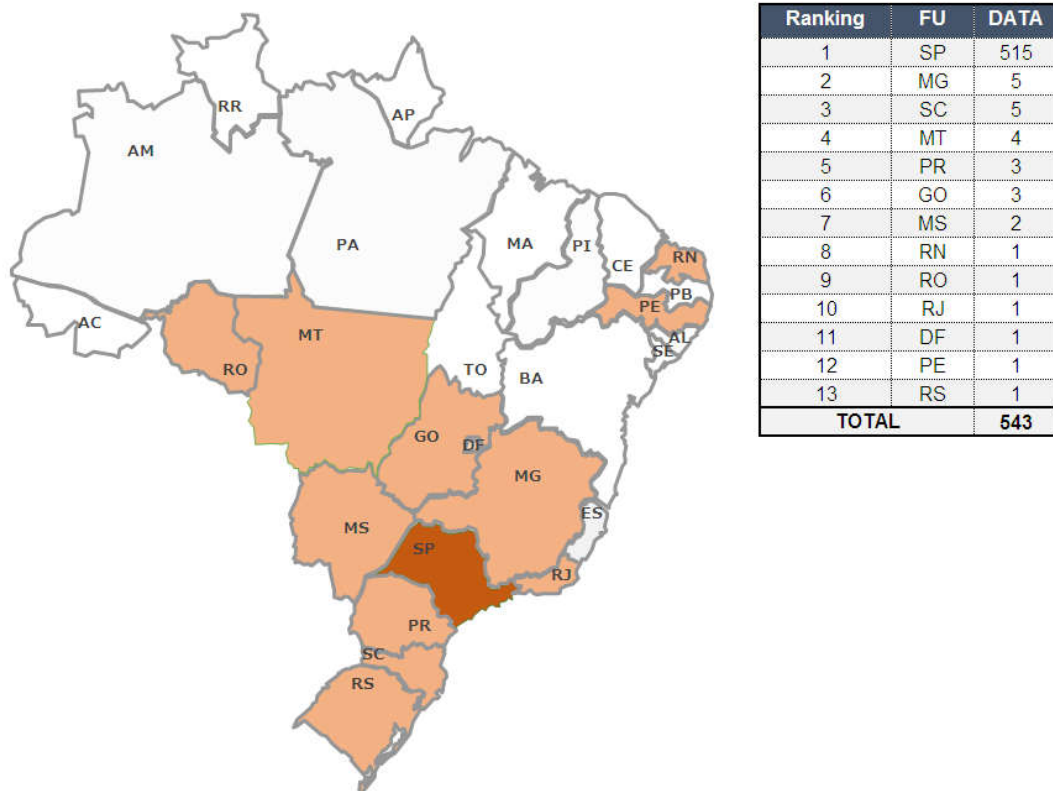


Figure 1. Map of Brazil with emphasis on the Units of Federation where graduating doctors from FAMERP were active in the year 2020 (The Units of Federation of white color did not contain a record of medical activity of these graduates)

HEI (305 –55.6%). All of these results are statistically significant ($p < 0.001$). Figures 1 and 2 show the location in UF of graduating doctors from HEI FAMERP (SP) and UniSL (RO), according to the active registration situation in the Regional Councils of Medicine in 2020, respectively. Figure 1. Map of Brazil with emphasis on the Units of Federation where graduating doctors from FAMERP were active in the year 2020 (The Units of Federation of white color did not contain a record of medical activity of these graduates). Figure 2. Map of Brazil with emphasis on the Units of Federation where graduating doctors from UniSL were active in the year 2020 (The Units of Federation of white color did not contain a record of medical activity of these graduates)

Transition Matrix with Markov Chain mathematical model: The verification of the probability of transition of the graduating doctors in an interval of 3 years, of the average duration of the residency programs was carried out, using the Markov Chain mathematical model and for this purpose we took the records in 2017 and 2020 as data.

The probability of transition, in the interval of three years, of active registration in UFs different from the origin and HEI of the graduating doctors is shown in Table 3. Table 3. Probability of transition, in the interval of three years, of active registration in UFs different from the origin and HEI of the graduating doctors ($n = 1092$). Thus, the probability of an graduate who was active in UF different from his origin and HEI in 2017, to continue exercising this activity outside the UF of his origin and HEI in 2020 is 0.92, and the probability of an graduate who performed his activity, whether in UF of his origin or his HEI in 2017, to continue in this way in 2020 is 0.99. When analyzing the transition matrix separately for the 2 HEIs, the probability of a FAMERP graduate who was active in UF different from his origin and HEI in 2017, to continue exercising this activity outside the UF of his origin and HEI in 2020 and the probability of this same graduate who exercised his activity, whether in UF of his origin or his HEI in 2017, to continue in this way in 2020 are 1 and 0.18, respectively.

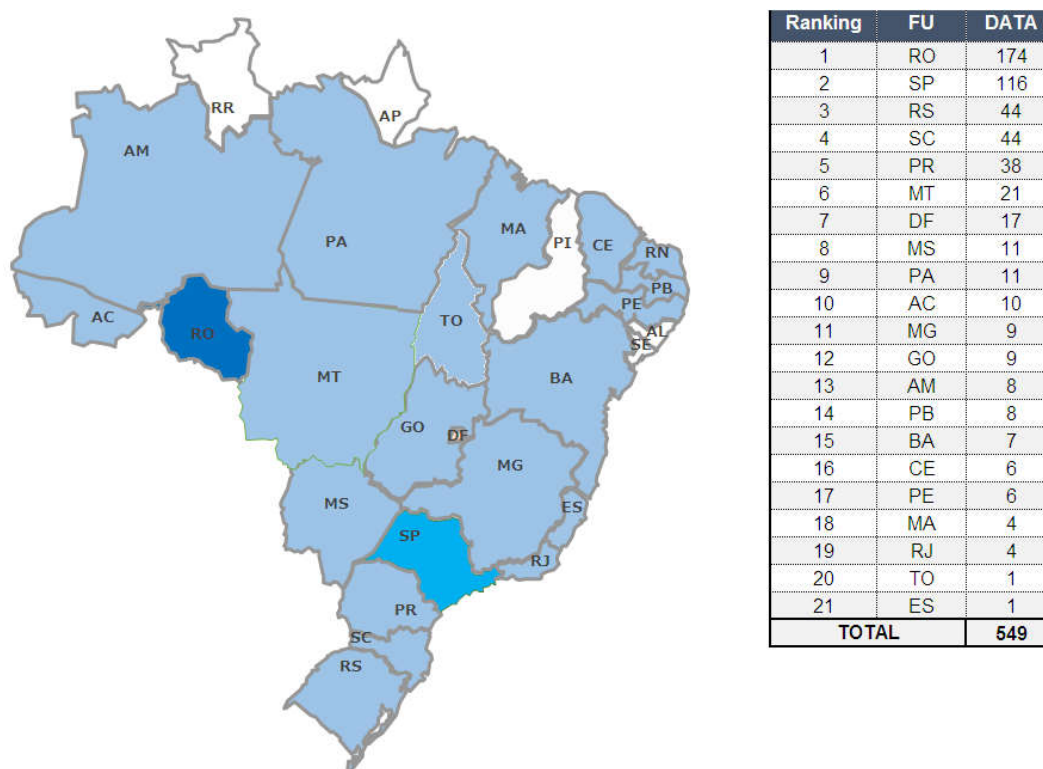


Figure 2. Map of Brazil with emphasis on the Units of Federation where graduating doctors from UniSL were active in the year 2020 (The Units of Federation of white color did not contain a record of medical activity of these graduates)

Table 3. Probability of transition, in the interval of three years, of active registration in UFs different from the origin and HEI of the graduating doctors (n = 1092).

Active registration in UFs different from the origin and HEI in 2020			
		No	Yes
Active registration in UFs different from the origin and HEI in 2017	No	0.99	0.01
	Yes	0.08	0.92

UF, Units of Federation; HEI, Higher Education Institutions.

As for the UniSL graduate, the probability of being active in UF different from his origin and HEI in 2017, to continue exercising this activity outside the UF of his origin and HEI in 2020 and the probability of this same graduate who exercised his activity, whether in UF of his origin or his HEI in 2017, to continue in this way in 2020 are 0.99 and 0.98, respectively.

DISCUSSION

To delimit the public or private nature of medical schools, this study has considered the Law of Directives and Bases of National Education (LDB), 1996, which defines two administrative categories of educational institutions: the public ones, “created or incorporated, maintained and managed by the Public Power”, and the private ones, “maintained and managed by individuals or legal entities under private law”. (SCHEFFER & DAL POZ, 2015). Taking as a base a HEI public (FAMERP - Southeast) and a private one (UniSL - North) is directly related to the distribution of vacancies for public and private medical courses in the Brazilian territory since in the Southeast, which concentrates almost half of all Brazilian vacancies, only a quarter of them (25.8%) are in public institutions, and in only ten UFs the public presence in medical education is greater than 50%, including four from the North, among them Rondônia. (SCHEFFER *et al.*, 2018)

The option for an HEI located in the countryside of the state (FAMERP, São José do Rio Preto, countryside of the state of São Paulo) and another in a capital city (UniSL, Porto Velho,

capital of the state of Rondônia) is based on the data in the literature that 43 % of medical vacancies are in the capitals. In the North region, three quarters of the vacancies (75.6%) are in courses in the capital, while in regions with important regional economic centers there are more vacancies in the countryside - in the Southeast and South, about 70% of the vacancies are in schools in the countryside, including São Paulo that has exactly 70% of vacancies in the countryside. (SCHEFFER *et al.*, 2018). In Brazil, women already represented 45.6% of the total number of doctors in 2017. When compared to other countries, 16 of them have a percentage of women doctors above the Brazilian proportion, and 10 have more women than men. As in Brazil, where there are more and more women in the profession, Portugal and the United Kingdom increased by almost 10%, Spain by around 15% and the Netherlands by 17% the percentage of women doctors, since 2000. (SCHEFFER *et al.*, 2018). The feminization of Medicine has been the subject of several studies that seek to point out the impact of this phenomenon on the health system, in addition to assessing gender inequalities in remuneration, in the fields of activity and in the occupation of specialties. (SOARES *et al.*, 2019; VERAS *et al.*, 2020). Although there are no studies that specifically address the origin of medical students in medical schools in the country, correlating this origin with the location of the HEI in which they were trained, the sociodemographic data of the different studies with medical students show that more than half of them always come from the same UF where the HEI is

located and with representatives from several UFs, but always in low numbers (BAMPIL *et al.*, 2013; ALMEIDA & SILVA, 2017; MESSIAS *et al.*, 2018; SILVA *et al.*, 2020) partially corroborating our data in which the majority of the graduates of FAMERP are of origin from the UF of the HEI, São Paulo (551 - 96.7%) and the same is not true about the graduates of UniSL who come from UF other than HEI (380 - 68.6%), these results being statistically significant ($p < 0,001$). Strategies to reduce or eradicate the shortage of doctors have been reported in several countries with varying degrees of success. Canada and the United States are among these countries, with numerous programs and studies focused on this issue, such as the Underserved Area Program (UAP) and the Health Professional Shortage Area (HPSA), which have proved to be quite useful, respectively, in orientation of the resource allocation processes (professionals and programs) aimed at alleviating the needy situations of the communities, and in the definition of priorities according to the intensity of the problem they experience (GAO, 2006). The Brazilian government has also used policies and strategies to face the problem of attracting and settling medical professionals.

They are: the policies for extending coverage and internalizing medicine, such as the Program of Interiorization of Health Actions and Sanitation (PIASS) and the implementation of rural boarding schools in undergraduate courses in the health area; the system for the reduction of debts contracted to finance the undergraduate course, through the Student Financing Fund (SFF); and the Family Health Strategy (FHS), a policy that guides the public offer of primary health care services in the country and is perhaps the best example of expanding the coverage of doctors in the national territory, although it was not specifically designed for this purpose. In addition, municipal managers adopt various types of incentives in an attempt to attract and settle doctors in their respective municipalities, such as increased wages and more flexible working hours (MACIEL FILHO, 2007; GIRARDI *et al.*, 2011). In 2011 and 2013, the government launched two provision programs, the Primary Care Professional Valorization Program (PROVAB) and the MaisMédicos Program (More Doctors Program (PMM), which, given the persistence of vacant posts in remote and unassisted areas, recruits, in addition to doctors trained in Brazil and/or registered in the Regional Councils of Medicine (RCMs), doctors graduated abroad, Brazilian citizens and other nationalities. These programs seek, through financial and non-financial measures and incentives, to attract doctors to remote and unassisted areas (BRAZIL, 2011; BRAZIL, 2013). Anyway, single and isolated measures have not been shown to be enough to solve the problem of shortage and poor distribution of doctors and there is no single formula to promote the attraction and settlement of doctors in remote and unassisted areas.

The literature shows that although important factors that support the professional's decision to move and/or stay in a specific job, such as remuneration and other financial incentives, these do not necessarily express a linearity, many of which are of subjective origin, imponderable and uncontrollable, such as personal and local factors and, although the medical provision programs launched during the last years, PROVAB and PMM, are based on this perspective, combining different types of incentives, such as financial, specialization courses, allowances and bonus on the test of residency, these programs, despite attracting professionals,

may still not be sufficient to settle them. This is the case of PROVAB, which encourages the doctor to an existing practice, that of working in PHC until being approved in a medical residency program. (VAN STRALEN *et al.*, 2017)

A review study on the PMM points out that 14,462 vacancies were filled in 3,785 municipalities, for a demand from managers of about 15,460 medical vacancies. In addition, from the PMM onwards, family health coverage increased significantly, especially in poorer cities and regions, such as the North, which provided 4.9 doctors per municipality, on average (KEMPER *et al.*, 2016). In another review work it is argued that, although it is recognized that there was a reduction in the shortage of doctors in Brazil as a whole and a decrease in the shortage of doctors in regions with a high ratio of need for doctors, such as in the North and Northeast, some systematized works show evidence of replacement of existing teams, with effects on provision and settlement. This same study reiterates previous results, which show low adherence of doctors to units with the worst working conditions (OPAS, 2017). But the problem of providing and settling professionals in unassisted regions requires a deep and permanent dialogue between managers, after all, these are structural and institutional problems that cannot be overcome only with isolated programs or strategies and, moreover, the debate about stable financing sources (for municipalities) and investments to enable the expansion of the offer of actions and services must take into account the socioeconomic inequalities and peculiarities of each municipality, resulting from historical-structural characteristics and their trajectories in the field of health policies (ANDRADE *et al.*, 2019). Thus, the data pointed out in the reviews (KEMPER *et al.*, 2016; OPAS, 2017) do not minimize the inequalities in the distribution of medical professionals.

Regarding a practice that encourages the doctor to work in PHC until being approved in a medical residency program (VAN STRALEN *et al.*, 2017) and which has a direct influence on medical demographics and on the provision of doctors for the so-called "sanitary voids" (SILVEIRA & PINHEIRO, 2014; SANTOS, & GIRARDI, 2015) the question becomes plausible when observing that the literature points out that the vast majority of graduates (80.2%) intend to attend medical residency and in this group, 57, 8% intend to attend residence in another school or institution other than the one where they studied, the other 22.4% intend to go to the same school where they completed the course - among those graduating from public schools, 34% have this intention, and that 16% of respondents intend to start medical practice immediately - among those in public schools, they are 22,3% (SCHEFFER *et al.*, 2018). Although the distribution of residency vacancies is not uniform among all UFs, there are vacancies in the main specialties in all UFs, so that those who really want to stay closer to their place of origin or training could. However, disparities such as the fact that in 2017, 13 units of federation, more than 40% of the vacancies were not filled, that São Paulo had 37.1% of unfilled vacancies, that Maranhão, which already has the lowest ratio of authorized vacancies per 100 thousand inhabitants, also had the highest percentage of unfilled vacancies: of the 406 authorized vacancies (57.9% were idle in 2017) and that in Ceará 53.7% of vacancies were not filled (SCHEFFER *et al.*, 2018), we point out the "attractiveness" factor, which does involve the question of an "unfaithful" portrait of the intended or potential capacity, but not implemented or used, but which cannot be the only "villain".

Again, the nonsense is present since one of the specialties with an increase in the offer of medical residency in recent years, Family and Community Medicine, a specialty that can greatly contribute to minimize the inequalities in the distribution of medical professionals in Brazilian territory, is the first option for only 1.5% of newly graduates. (SCHEFFER *et al.*, 2018)

The minimization of inequalities in the distribution of medical professionals necessarily involves the interest of professionals in working in Basic Health Units and the Family Health Strategy, the real points of access of the population to health. This interest varies between regions: it is the preference of more than a third of those graduated in the Northeast and North but decreases in the Southeast and South (SCHEFFER *et al.*, 2018). It would be up to public managers to bring the interests and expectations of newly graduates closer to the real occupation of more jobs in primary care, as well as in other UHS care levels.

About the distancing of doctors from UHS, verified today in the lack of professionals in various public services, and about the hypothesis that it is not a crystallized fact a priori since graduation, based on the data that when asked about a hypothetical scenario, if the working conditions, remuneration and the number of hours were equivalent in the public and private sectors, 47% of graduates would choose to work in UHS and only 12% for private services, while the rest of them were indifferent (SCHEFFER *et al.*, 2018), it is questionable. Taking as an assumption that the curricular structure of undergraduate courses has a determining role in the settlement of doctors in unassisted or professional shortages regions, with emphasis on community-based curricula, with a focus on PHC (RABINOWITZ *et al.*, 2008; WILSON *et al.*, 2009; VISCOMI *et al.*, 2013; MYHRE *et al.*, 2015; GOODFELLOW *et al.*, 2016; REEVE *et al.*, 2016; GUILBAULT & VINSON, 2017), this does not happen in relation to FAMERP, as since 2011 it has adopted in its curricular structure “longitudinal practices arranged throughout the course, starting in the first periods and continuing until the last year, with increasing complexity and workload”. The same is true with UniSL.

According to data from the Medical Demography 2018 (SCHEFFER *et al.*, 2018) in the item “Where do newly graduates intend to work?”, four out of ten graduates (44.5%) intend to practice medicine, in the city where they were born, another 20, 4% mentioned the city where they completed their graduation, 12.7%, the same city where they completed their medical residency and 22.4% intend to practice the profession elsewhere. In these data, the place of origin appears as the doctor's main settler. Our results, although restricted to only 2 forming HEIs, are not in line with this. It should be noted that the item extracted from Scheffer *et al.* (2018) expressly mentions the verb “to intend”, which does not seem to be materializing, endorsing our hypothesis that the “intention”, although extremely praiseworthy, such as the place of origin, do not seem to “resist” the attraction that the other factors offered by major centers can exercise. Thus, the data presented herein and which trace the distribution of graduates in Brazilian territory in relation to the HEI that trains a given loco-region shows that FAMERP has in no way contributed to the distribution of medical professionals in order to minimize regional inequalities (Figure 1), as this previously demonstrated in a smaller cutting (SANTOS *et al.*, 2017), and which has been kept in line with its vocation to train specialists. For UniSL, this also occurs, to a lesser extent, no

doubt (Figure 2) but with the aggravation that there is a great migration of these graduates to the South and Southeast regions, particularly to São Paulo. These findings reinforce others already observed in the country (SEIXAS *et al.*, 2017) and are similar to those reported by some authors (HOLMES & FRAHER, 2017; XIERALI, 2018) when dealing with interstate medical migrations. And this panorama seems devoid of perspectives for changes in the medium term if we consider the data presented herein about the probability of transition of the graduating doctors in an interval of 3 years shown in Table 3. Thus, the socioeconomic profile of the regions and their assistance structure have great explanatory power when related to the supply and distribution of professionals, as well as to migratory movements and medical specialization. (SEIXAS *et al.*, 2019). It seems to us to focus on the analysis of international experiences (OLIVEIRA *et al.*, 2015) in the provision and retention of professionals in areas of high social vulnerability and that encompass a range of strategies, from incentive to mandatory, such as selection, education, mandatory civil service, regulation, incentives and support (ROURKE, 2010) is the right way. Most of these strategies correspond to the recommendations developed by the World Health Organization (WHO) to improve the retention of health workers in rural and remote areas (CENTRO BRASILEIRO DE ESTUDOS DE SAÚDE [CEBES], 2016), since the shortage of health professionals in remote and vulnerable areas is an important obstacle to universal access to health in different countries and health systems worldwide (WILSON *et al.*, 2009; OLIVEIRA *et al.*, 2015).

Conclusion

The percentage of women in the total population of doctors in Brazil follows the world trend of feminization of Medicine, while the higher proportion of young doctors in Brazil, above the world average, already reflects the policy of opening vacancies and courses in Medical Course. Most of the FAMERP graduates are from the UF of the HEI itself and the same is not true about the UniSL graduates who are from other UFs than the HEI. Regarding the curricular structure of undergraduate courses, having a determining role in the settlement of doctors in unassisted or professionally shortage regions, with emphasis on community-based curricula, this does not happen in relation to FAMERP, as since 2011 it has adopted in its curricular structure “longitudinal practices arranged throughout the course, starting in the first periods and continuing until the last year, with increasing complexity and workload”. The same is true with UniSL. Thus, the results about the migratory movements of the graduates and the transition matrix do not corroborate the curricular structure of the undergraduate courses with a determining role in the settlement of doctors in unassisted or professional shortages regions. The data presented herein traces the distribution of graduates in Brazilian territory in relation to the HEI that trains a given loco-region, and puts in question the contribution of this HEI to the distribution of medical professionals in order to minimize regional inequalities, respecting their vocation.

Future directions and limitations: The results presented herein have limitations, after all, medical demography is a dynamic process, influenced by behavior and professional choices, by the market and by economic interests, by corporate agendas and, in the recent case of Brazil, strongly induced by

state regulation on training and the medical profession, which makes accurate projections difficult, requiring permanent monitoring and research efforts. These limitations include possible absences, inaccuracies or incompleteness of the information contained in the sources used. The study of medical demography is in line with global initiatives that seek to fill gaps in evidence about doctors, but gains new contours and possibilities, as recent policies have a significant effect on the training and increase in the number of these professionals in Brazil. Assessing the availability, distribution and capacity of the medical workforce is essential for the future of a health system that needs to offer qualified services to the population. (LIMA, 2018) Attracting and settling doctors is a complex problem, involved in intrinsic and extrinsic motivations that influence the choice of the professional's place of work. The study of strategies that consider the conditioning factors for attracting and settling professionals must be a constant exercise among health human resources planners, in order to support evidence-based decision making. It is necessary to mobilize sufficiently coordinated academic and governmental institutions, medical and health entities, public and private employers, in addition to the cooperation of researchers in research networks, in order to move forward in the production and promotion of knowledge about doctors in Brazil. However, it is also necessary, and just as much, to ask about the consequences of this dynamic driven by the policies and legislation in force since, in addition to the urgent evaluation of trainers and the current quality of all undergraduate and specialized education, there is an urgent need to plan and monitor the quantitative increase in doctors, bringing it closer to the needs of the health system and the population of the country.

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