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Statistical training in stricto sensu postgraduate courses in Epidemiology, Collective Health and Public Health at Brazilian public universities[1]

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ABSTRACT

This work aims to provide an overview of training in Statistics in Stricto Sensu Postgraduate courses in the area of Collective Health. In Brazil, there are 32 public universities that offer postgraduate degrees in the area, 22 (68.75%) Federal and 10 (31.25%) State and Municipal. The document analysis was carried out on 391 syllabuses of Statistical subjects. Of these, 13.25% were classified as basic, 16.62% as intermediate and 70.13% as advanced. It was observed that the North Region has the fewest Postgraduate programs in the area, therefore indicating the need for more investment. The syllabi involve complex Statistical concepts and indicate intense use of computational resources. Therefore, it is interesting that postgraduate students have high levels of statistical literacy and computational thinking to ensure good performance. It seems that the PPG curricula in Epidemiology, Collective Health and Public Health are promoting knowledge that favors the development of comprehensive statistical thinking and the

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development of autonomy for the application and interpretation of statistical concepts by postgraduates.

KEYWORDS: Curriculum. Postgraduate studies. University education. Statistic.

Formação estatística nas pós-graduações stricto sensu em Epidemiologia, Saúde Coletiva e Saúde Pública das universidades públicas brasileiras

RESUMO

Este trabalho tem como objetivo traçar um panorama da formação em Estatística dos cursos de Pós-Graduação *Stricto Sensu* da área de Saúde Coletiva. No Brasil, são 32 universidades públicas que oferecem pós-graduações na área, sendo 22 (68,75%) Federais e 10 (31,25%) Estaduais e Municipais. Realizou-se análise documental de 391 ementas de disciplinas de Estatística. Dessas, 13,25% foram classificadas como nível básico em estatística, 16,62% como intermediárias e 70,13% como avançadas. Observou-se que a Região Norte é a que tem menos programas de Pós-Graduação na área, indicando, portanto, a necessidade de mais investimento. As ementas envolvem conceitos complexos de Estatística e indicam uso intenso de recursos computacionais. Portanto, é interessante que os pós-graduandos tenham elevados graus de letramento estatístico e pensamento computacional para seu bom desempenho. Parece que os currículos dos PPG em Epidemiologia, Saúde Coletiva e Saúde Pública estão promovendo um conhecimento que favorece o desenvolvimento de pensamento estatístico abrangente e o desenvolvimento de autonomia para aplicação e interpretação dos conceitos estatísticos pelos pós-graduados.

PALAVRAS-CHAVE: Currículo. Pós-Graduação. Ensino Superior. Estatística.

Formación estadística en programas de posgrado en Epidemiología, Salud Colectiva y Salud Pública en universidades públicas brasileñas

RESUMEN

Este trabajo tiene como objetivo brindar una visión general de la formación en Estadística en los cursos de Postgrado Stricto Sensu en el área de Salud Pública. En Brasil, hay 32 universidades públicas que ofrecen posgrados en el área, 22 (68,75%) federales y 10 (31,25%) estatales y municipales. Se realizó análisis documental de 391 planes de estudio de asignaturas de Estadística. De ellos, el 13,25% se clasificaron como nivel básico en estadística, el 16,62% como avanzado y el 70,13% como avanzado. Cabe señalar que la Región Norte tiene menos programas de Postgrado en el área, por lo que se reduce la necesidad de mayor inversión. Los programas de estudios involucran conceptos estadísticos complejos e indican un uso intenso de recursos computacionales. Por lo tanto, es interesante que los estudiantes de posgrado tengan altos niveles de conocimientos estadísticos y de pensamiento computacional para tener un buen desempeño. Parece que los planes de estudio del PPG en Epidemiología, Salud Pública y Salud Pública están promoviendo conocimientos que favorecen el desarrollo del pensamiento estadístico integral y el desarrollo de la autonomía para la aplicación e interpretación de conceptos estadísticos por parte de los posgraduados.

PALABRAS CLAVE: Plan de estudios. Posgraduación. Enseñanza superior. Estadística.

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Introduction

In Brazil, the responsibility for research in the most diverse areas of knowledge lies with stricto sensu Postgraduate courses, which train masters and doctors in this country, disseminating their work in the academic world through publications in scientific journals (dos Santos, 2017).

In the area of scientific research, which is supported by the qualification and empirical study of what is observed daily in an extensive and non-definitive universe of reality, Statistics have been gaining more and more space in curricular matrices (Ruis Diaz, 2007). Therefore, postgraduate students must have a solid background in Statistics content and know how to associate them with the analysis needs of their research, interpreting the results obtained.

Considering the objectives of statistical training for students, and even citizens in general, it is important to comment on three skills that must be developed: thinking, literacy and statistical reasoning.

Statistical thinking has the characteristic of promoting the ability to see the problem in a global way, relating data to concrete situations, understanding their different relationships, appropriately choosing tools, exploring data beyond what is prescribed in the texts and promoting questions (Campos, 2013).

According to Wallman (1993), statistical literacy is portrayed as the ability of subjects to interpret, critically evaluate and communicate statistical information and messages, that is, statistical literacy can be defined as the ability to understand and critically evaluate statistical results that permeate our daily lives, being a key skill expected of citizens in information-laden societies. It is often considered an expected outcome of schooling and a necessary component of adult literacy. It is portrayed as the ability to interpret, critically evaluate, and communicate statistical information and messages (Wallman, 1993).

Statistical reasoning is the way a person reasons with statistical ideas and makes meaning from statistical information. This involves making interpretations of data, graphical representations, building tables, etc. In many cases, statistical reasoning involves ideas of variability, distribution, chance, uncertainty, randomness, probability, sampling, hypothesis testing, which leads to interpretations and inferences about the results (Garfield, 2002).

There is no hierarchy between the afore mentioned skills, one may have an independent domain from the others, at the same time that there are partial intersections between two domains and an intersecting part of the three skills.

The Mathematics/Statistical approach to Epidemiology began in the 17th century, with the use of probabilistic reasoning in health practices, which is now widely used in all areas of Medicine. Despite being content that arouses little empathy and, sometimes, negative attitudes on the part of students in the health area, learning Statistics is becoming increasingly necessary. This behavior was observed in research carried out by Giordani (2021), in which students in the area of Health, despite understanding the importance and value of Statistics, consider it difficult and have a negative attitude towards it.

Evaluating the statistical training of students can allow us to improve the educational process and, consequently, improve the quality of what is produced/published. Therefore, this work aims to provide an overview of the training in Statistics of students on Stricto Sensu Postgraduate courses in Epidemiology, Collective Health and Public Health, at Brazilian public universities.

Method

This is a qualitative-quantitative research. Qualitative research was carried out through documentary analysis of the course syllabi offered in the Postgraduate Programs (PPG) in Epidemiology, Collective Health and Public Health at Brazilian public universities, related to the statistical training of students. In the quantitative part, descriptive statistics were used.

To obtain information for this study, consultations were made on the official CAPES website (Capes, 2019), referring to data from 2018, which was the latest information updated at the time of carrying out this work. Among the indicators, the name of the program and linked institution, geographic location, grade awarded, area of knowledge, year

of beginning, subjects, syllabi and number of students enrolled for all postgraduate programs are available.

From the consultation, the quantification and geographic distribution of PPGs was obtained. After identifying these programs, information was collected from the curricula of each program: workload and content of the syllabi, highlighting topics related to Statistics.

To select the subjects of interest, we first included all those that, in the title, contained one or more of the 22 previously selected keywords, referring to the content of statistics (Sampling, Analysis, Bayesian(s), Biostatistics, Computing, Data, Epi-Info, Statistics, Excel, Inference, Computer Science, Mathematics, Modeling, Model, Multivariate, Probability, Quantitative, R, Regression, Software, SPSS, STATA). As an exclusion criterion, after the first step, subjects in which the syllabi did not have statistical content or did not have syllabi available were excluded.

The next stage, the syllabi were analyzed to draw an overview based on verifying the presence of Statistical content in the courses. In this documentary analysis, the subjects were classified into three levels, considering the contents presented in the syllabi: (i) basic, which include subjects whose syllabi refer essentially to Descriptive Statistics content; (ii) intermediate, subjects that had Descriptive Statistics content and an introduction to Inferential Statistics; and (iii) advanced, referring to subjects that presented Inferential Statistics content. The classification of syllabuses into the three levels, according to the analysis categories, is based on how the contents are presented in reference books, like Callegari-Jacques (2009), Glantz (2014), Soares e Siqueira (2002) or Morettin e Bussab (2017).

The contents presented in Descriptive Statistics provide an overview of statistics, presenting a set of introductory techniques that assist in problem solving. Descriptive Statistics is considered an initial step in the choice and appropriate use of statistical tests and its understanding provides a reduction in errors in reporting the results of studies carried out and in the interpretation of their conclusions (Rodrigues, 2017), from this perspective,

disciplines whose syllabi refer to, essentially, Descriptive Statistics contents are considered basic. Disciplines classified as intermediate, had Descriptive Statistics content and an introduction to Inferential Statistics or just an Introduction to Inferential Statistics (Table 1).

Inferential Statistics is concerned with the reasoning necessary to obtain a conclusion from the data, comprising the techniques through which decisions are made about a population, based on the observation of a sample (Bello, 2007). Therefore, the contents covered in Inferential Statistics require prior knowledge of Descriptive Statistics subjects, and subjects whose syllabuses presented the complex contents of Inferential Statistics were classified as advanced.

TABLE 1. Content used as a basis for classifying the PPG syllabi in Epidemiology, Collective Health and Public Health obtained from the CAPES website in 2019.

Subdivision of Statistics	Content	Content Description
Descriptive statistics	1 - Exploratory data analysis	Population and Sample; Variables, Organization and presentation of data; Sampling.
	2 - Frequency distribution	Grouped data; Frequency; Tables; Graphs.
	3 - Measures of Central Tendency	Mean; Median; Quartile; Mode.
	4 - Measures of Dispersion	Amplitude; Variance; Standard deviation; Coefficient of variation.
Inferential statistics	5 - Probability distributions	Probability; Normal or Gauss; Binomial; Chi-square, Sampling Distribution.
	6 - Estimation theory	Sampling; Estimation; Confidence intervals.
	7 - Hypothesis and significance tests	Hypotheses; Parametric tests; Non-parametric tests; Analysis of variance (ANOVA); Chi-square; Significance.
	8 - Regression and Correlation Analysis	Correlation; Regression

Source: the authors

The classification of the syllabi (Table 2) was carried out independently, by two researchers and authors of this work. In case of disagreement, regarding the classification of the subject, there was a discussion to define the final classification. Table 2 shows examples of syllabi that were classified according to each of the three levels. It is worth noting that the syllabi classified as 'intermediate' presents content from the basic level, just as the advanced level syllabi contains items from the basic and intermediate levels.

TABLE 2. Examples of the classification of PPG syllabuses in Epidemiology, Collective Health and Public Health according to levels.

Classification Level	Syllabi
Basic	Introdução à bioestatística: histórico e conceitos básicos; o estudo das variáveis; apresentação gráfica e tabular de dados; bioestatística descritiva: medidas de tendência central, medidas de variabilidade e dispersão. Introduction to biostatistics: historic and basic concepts; the study of variables; graphical and tabular presentation of data; descriptive biostatistics: measures of central tendency, measures of variability and dispersion.
Intermediary	Exploratory analysis of secondary data: classification of variables, measures of central tendency and dispersion, identification of typical values (outliers), graphical presentation. Notions of probability and validity of instruments (specificity, sensitivity and predictive values). Sampling principles. Statistical inference and hypothesis testing.

Advanced	Questionnaires/forms suitable for assembling databases. Tabular presentation and graphical representation. Classification of variables. Position and variability measurements; Frequency distribution. Notions of Probability. Quality Assessment of Tests and Diagnostics. Statistical Models: Binomial, Poisson, Normal and t-Student. Statistical Inference: Point Estimation, Interval Estimation and Hypothesis Testing. Comparison of Two Populations and Measures of Effect. Sampling Techniques. Simple and Multiple Linear Regression. Association Measures and Logistic Regression. Study and application of non-parametric statistics. Introduction to R software.

Source: the authors

The following variables were analyzed: number of people enrolled in the programs, segmentation by geopolitical region of Brazil; training modality; status of the institution; level of training offered to students and number of teachers in each program.

The analysis used was descriptive statistics, using SPSS version 18 software, presenting the results in graphs and tables. Word clouds were built in the WordArt application. In order to build the cloud, the frequency of some words was considered along with their variations, for example, the occurrences of the words analysis and analyzes were added together. To construct the geographic distribution map of the programs, the software QGIS 3.18.3 was used.

Characterization of Postgraduate Degrees in Epidemiology, Collective Health and Public Health

In Brazil, among the 32 public universities that offered PPG's Stricto Sensu in the CAPES “Collective Health” assessment area in 2018, nine (28.13%) were State, 22 (68.75%) were Federal and 1 (3.12%) Municipal. It

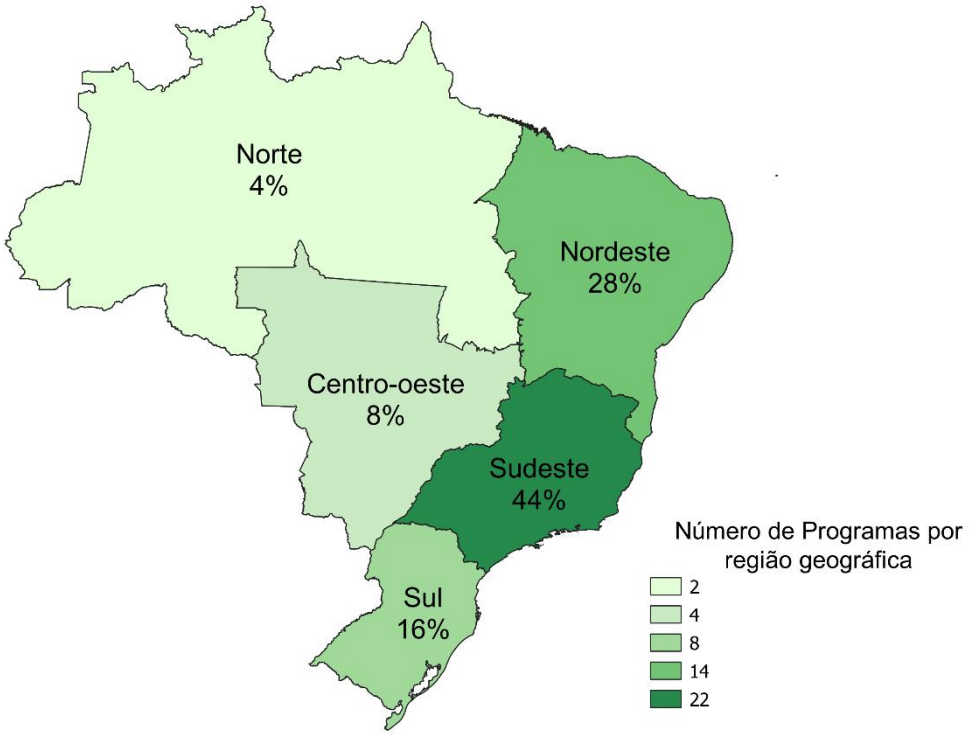
should be noted that there may be more than one program per institution and the institution may have more than one campus. In this work, all existing programs were considered, even if they were from the same institution.

50 postgraduate programs were identified, six in Epidemiology, 33 in "Collective Health" and 11 in "Public Health". Considering the total number of programs, in relation to the regions of Brazil, the Southeast region had the highest frequency of programs and the North region, the lowest (Figure 1), as can be seen on the map shown in Figure 1.

Collective Health is the program with the highest absolute frequency, among the Northeast, Central-West, Southeast and South regions. And Epidemiology, the one with the lowest absolute frequency, with the exception of the North region.

Considering the training modality, 39 (78%) of the programs are academic, while only 11 (22%) are professional.

FIGURE 1. Geographic distribution of Stricto Sensu Postgraduate programs in the area of "Collective Health" evaluation in Brazil, in 2018.



Source: the authors

Regarding the students' level of education, 58% of the programs offer academic Master's and Doctorate degrees, 18% programs offer exclusively an academic Master's degree, 2% exclusively an academic Doctorate and 22% only a Professional Master's degree. In 2018, the programs had 4963 students enrolled, 2115 at academic Master's level, 2271 at academic Doctorate level and 577 at professional Master's level.

Among the master's courses offered in the area of Collective Health, 20.8% of students are enrolled in professional courses and 79.2% in academic courses. The relationship between courses offered is similar, with 22% for professionals and 78% for academics. For Doctorate, only the academic modality is offered in the area of Colletctive Health, with a total of 2271 students enrolled, reflecting 45.76% of enrollments compared to 54.24% of enrollments in the master's degree.

Analysis of the syllabi of Statistics subjects

Of the 391 selected syllabuses, 75 belonged to the Epidemiology programs, 195 in Colletctive Health and 121 in Public Health. The average workload was 54 hours (SD = 27) for the master's degree and 56 hours for the doctorate (SD = 27). There is only a small difference between the average master's and doctorate workloads, of 2 hours. This is probably due to the fact that almost all subjects are offered for both the master's and doctorate degrees.

Regarding the content, 171 syllabuses presented Descriptive Statistics content, representing 43.85% of the total subjects, and 339 Inferential Statistics, representing 86.92%. After being grouped as established in the methodology, 51 (13.04%) menus were classified as basic level, 64 (16.37%) as intermediate and 276 (70.59%) classified as advanced (table 1).

TABLE 1. Number of Statistics subjects classified into levels according to Stricto Sensu Postgraduate programs in the "Collective Health" assessment area.

	Epidemiology		Collective Health		Public health		Total	
	n	%	n	%	n	%	n	%
Basic level	8	10.7	21	10.8	22	18.2	51	13.0
Intermediate level	12	16.0	17	8.7	35	28.9	64	16.4
Advanced level	55	73.3	157	80.5	64	52.9	276	70.6
Total	75	100.0	195	100.0	121	100.0	391	100.0

Source: the authors

From the syllabuses of the selected subjects, word clouds were created for each classification level (Figure 2). The words with the highest frequencies for the Basic Level were: Data (152), Health (71), Analysis (51), Variables (17) and R (16). For Intermediate Level subjects, the highest frequencies were for Data (139), Statistics (96), Analysis (92), Health (78) and Probabilities (49). And finally, in the Advanced Level subjects, the words with the highest frequencies were Analysis (645), Models (526), Data (396), Regression (356) and Statistics (271). It is worth mentioning that for each of the word clouds, only the syllabuses classified at each level were considered, for example, in figure 2A only the words from the syllabuses classified as basic were used.

FIGURE 2. Word clouds from syllabuses collected in Postgraduate programs by Level.

2A – Basic Level word cloud.

2B – Intermediate Level word cloud.

2C – Advanced Level word cloud.

Of the total number of subjects evaluated, indications for the use of software appeared in 142 syllabuses. Eight software programs were mentioned: Epi Info, Mplus, R, Reclink, SAS, SPSS, STATA and WinBUGS. The most cited software was R, used in 67 subjects, followed by STATA, used in 19 subjects. Some syllabuses did not present specific software, but reported the use of this tool in the discipline.

Discussion

According to the history presented by Novaes et al. (Novaes, 2018), there was a decentralization in the number of higher education institutions that offer PPG in Collective Health towards the Northeast region. The portrait of this scenario can be seen in the results of this research, where there was a higher percentage of PPG in the Northeast region, when compared to the North, Center-West and South regions. A centralization was observed in the Southeast and Northeast regions, which together represent 72% of PPG. According to Novaes *et al*. (2018):

> The growth of the strict sense postgraduate course in Collective Health from 1990 onwards in terms of the number of programs was intense, and in a less geographically concentrated way than the set of programs, with emphasis on the Northeast Region. Regarding the number of academic master's and doctorate graduates, and their proportionality, the area followed the general trend. Collective Health had a prominent position in the creation of MP, with a significant volume of graduates in the Northeast Region, through network MPs coordinated by Fiocruz. The growing and prominent presence of a health research institute such as Fiocruz as a proponent of PPG in Collective Health can be considered as a relevant way of bringing together the strict sense postgraduate public policy with the SUS, which is uncommon in other areas. (NOVAES, 2018, p.2023)

The North and Central-West regions are those with the lowest numbers of PPG. From this perspective, there is a need for greater investments in these regions. As an alternative to intensify possible decentralization towards the North and Central-West, there is an Interinstitutional Master's Degree (Minter) and an Interinstitutional Doctorate (Dinter). Ordinance No. 23722 from 2017 regulated Minter and Dinter Projects, with the objectives of enabling the training of masters and doctors outside consolidated teaching and research centers to work in teaching and/or research; subsidize the creation of new stricto sensu postgraduate programs; assist in strengthening research groups; and promote cooperation between teaching and research institutions. According to Moraes and Schetinger (2019), the implementation of these interinstitutional projects in the expansion of the National Postgraduate System (SNPG) was successful and contributed positively to addressing budgetary problems and was efficient in the qualified training of human resources.

With the advent of the COVID-19 pandemic, the growth of remote teaching and the use of digital technologies in the teaching-learning process enabled a different perspective and a new possibility for carrying out Interinstitutional Masters and Doctorates at a distance (Santos, 2020), which are *stricto sensu* courses.

In this study, it was observed that the number of students enrolled in academic courses is greater when compared to professional courses. Although CAPES recognizes the equivalence in training between these modalities, some rules are more flexible for the professional master's degree, such as the possibility of temporarily interrupting the offering of classes, which may be a justification for this smaller number of students enrolled in professional courses. As for the courses offered, the relationship is also similar, with a greater number of academic master's degrees.

With regard to curricula, the Statistics contents in the syllabuses of subjects in the Health area cover not only Descriptive Statistics, but also topics such as: probability, random variable, probability distribution, in

addition to Statistical Inference, which includes topics on sampling techniques, confidence intervals, hypothesis tests and multivariate models, constituting a minimum curriculum for the study of Statistics in Health Sciences schools (Ruis Diaz, 2007).

Scientific research is inherent to the performance of professionals in the Health area, however the curricula in this area still teach Statistics focused on traditional teaching methodologies, which convey the idea that it is totally separate from professional work, which can lead to the perception that Statistics does not contribute to their training (Santos, 2017). If healthcare professionals consider Statistics only as a tool, they run the risk of diminishing its importance and simplifying its use (Hollas, 2020). With the information collected in the syllabi, it is clear that the technical part of Statistics is heavily covered in the subjects, however it is not possible to know what the teaching methodologies used in classes are like. Other work, to investigate how content is transmitted, can be carried out.

Among the contents proposed in the syllabi, it was found that the majority of subjects presented Inferential Statistics content, involving complex Statistics concepts. In order for postgraduate students to adequately grasp such concepts, there is a need for them to have a high degree of developed statistical literacy.

For the student to develop this statistical literacy, it is important that two other skills are developed: reasoning and statistical thinking (Novaes, 2018). The development of skills can be mobilized from a critical perspective, being a way to avoid practices that only use memorization of formulas and statistical concepts (Barata, 2008).

Considering the word clouds presented, the change between the most frequent words at different levels stands out. At the basic level, the highlighted words refer to the most introductory content of descriptive statistics. The intermediate includes inferential statistics content, such as probability. While at the advanced level, we can see the emergence of analyses, models and tests. The

occurrence of subjects at all three levels in the PPG curriculum can help students develop different levels of statistical reasoning.

According to what was presented by Campos (2013), the levels of statistical reasoning studied by Garfield (2002) are divided into five levels: Level one: idiosyncratic reasoning, the student uses statistical words and symbols even without fully understanding them; Level two: verbal reasoning, the student, despite having a verbal understanding of some concepts, does not fully understand these concepts; Level three: transitional reasoning the student has the ability to correctly identify some dimension of the statistical process, but is unable to integrate these dimensions completely; Level four: processive reasoning, in which the student is able to identify these dimensions, but does not fully understand the process; Last level: integrated procedural reasoning, there is a complete understanding of a statistical process, coordinating the rules and behavior of the variable. At this level, the student is able to confidently explain the process (Garfield, 2002).

The different classifications of the syllabi analyzed in this study, basic, intermediate and advanced, indicate a relationship with these different levels of statistical reasoning.

From this perspective, it is noted that this complexity of the content presented in postgraduate courses is also related to the need for good statistical training at undergraduate level (Lima, 2010). The importance of this knowledge, both at postgraduate and undergraduate levels, can be well exemplified in the current pandemic context, in which professionals in these areas find themselves in a scenario where statistics is present in a more expressive way. With the integration of Statistics, Epidemiology and Public Health, all the knowledge generated by data can generate more objective information, which effectively portrays the current situation and which is useful and relevant for adapting citizens' behaviors and attitudes (Ambrosano, 2004).

The deficiency in the statistical training of researchers can be reflected in the quality of information published in journals, as it is not uncommon for problems to be present in the statistical content presented in these

publications (González-Torres, 2013). Given this, it is essential that disciplines present inferential analysis topics in their syllabi, preparing researchers for the execution and adequate interpretation of statistical results, as postgraduate courses prepare students to be researchers. Based on the results obtained in this study, it appears that such content is being covered, inferring that graduates of Postgraduate courses in the area of Collective Health from public institutions in Brazil have the necessary preparation to properly execute and interpret statistical information. In other words, postgraduates have the possibility of developing the necessary statistical skills in their areas of expertise.

Also in relation to the contents proposed in the syllabi, it was observed that several disciplines use computational resources to teach statistics, enabling a practical approach to the concepts studied. The use of software for analyzing statistical data plays an important role in science, and can be used from the application of methods to analysis of results (Dovigo, 2012).

According to Saraiva (2017), the constant and rapid development of the computing area, associated with the dissemination of computer use in educational institutions as a complementary tool to the teaching-learning process, has stimulated a promising scenario for the development of computational tools focused on the educational area. These tools can assist in the construction of graphs, simulations and optimization of calculations that may involve the manipulation of a large amount of data, which if carried out manually becomes a time-consuming and tiring process. According to what was observed by Karsburg (2019), with the use of technologies in teaching statistics, students feel motivated during learning, as they can see the application of the content and consequently establish a link with the discipline and its course.

According to Sturion (2018), for effective learning of Statistics and Probability it is important that students interact with problems to be solved and that they can consider the various possibilities to choose their own solutions. And for students to be able to find these solutions, without an excessive calculation

process, it is necessary to use modern tools, such as specific software that will make learning more consistent, expanding the researcher's ability to deal with large volumes of data, in addition to enable the development of autonomy in carrying out analyzes (Sturion, 2018; Silva, 2020).

Among the available software programs, the greatest indication of use was R. This may have occurred because, amongst the various statistical software programs available on the market, R is free and open source, allowing development and modification of scripts by any user (Silva, 2017). Furthermore, R is a high-level language and programming environment that provides a wide variety of statistical techniques expandable with the use of specific libraries (Dovigo, 2012).

Given the emergence of this indication of software use in various disciplines, postgraduate students are expected to have a basic grasp of computational tools and languages, as well as the development of computational thinking, which consists of the mental process to formulate and express computational solutions to a problem. (Wing, 2014).

Mastery of tools, language and computational thinking can help improve analyzes and the interpretative process. Furthermore, including data exploration techniques and the use of technology helps in the formation of critical citizens, with the ability to understand and interpret problems with real data (Novaes, 2018).

Conclusions

Given the information collected, it is noted that the teaching of Inferential Statistics is highlighted within the curriculum of Postgraduate courses in the area of Collective Health. It is considered that the study of advanced Statistics concepts represents an important part of the researcher's training in PPG, as they are fundamental for the application, contextualization and the development of a real intuitive understanding of the meaning of the data.

The importance and need for Statistical Literacy can be seen, for example, with the advent of COVID-19 in which Statistics is a key point for understanding, processing and interpreting the large sets of data that are constantly being generated.

Technological resources have contributed in several aspects to teaching and learning Statistics, as well as processing large volumes of data and heavy calculations. From this perspective, mastery of the tools and development of computational thinking is fundamental, and is an important ally in students' professional careers.

Therefore, it was observed that the PPG curricula in Epidemiology, Collective Health and Public Health are promoting knowledge that favors the development of comprehensive statistical thinking and the development of autonomy to apply and interpret statistical concepts.

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