

v.6 n.2 (2023) p. 518-527

Digital Object Identifier (DOI): 10.38087/2595.8801.209

BIostatISTICS ASSOCIATED WITH EPIDEMIOLOGY IN PRIMARY HEALTH CARE

Bruno Rocha de Souza¹
Luigi Santacroce²
Henry Oh³

ABSTRACT

The aim of this study is to understand how knowledge in biostatistics associated with epidemiology influences and can be applied in primary health care. This study was carried out in Portuguese language where the scientific articles and literary works corresponding to the questions raised, without time frame, were researched in LILACS, MEDLINE, BDTD, Google academic, SciELO and CAPES journals. It is concluded that biostatistics and epidemiology, when associated, provide primarily health professionals in primary care with the essential knowledge to help them understand better the behaviors or situations that involve the population as a whole or part of it.

Keywords: Biostatistics. Basic health care. Applicability, Epidemiology.

RESUMO

O objetivo deste estudo é compreender como o conhecimento em bioestatística associado à epidemiologia influencia e pode ser aplicado na atenção primária à saúde. Este estudo foi realizado em língua portuguesa, onde os artigos científicos e obras literárias correspondentes às questões levantadas, sem prazo, foram pesquisados em revistas LILACS, MEDLINE, BDTD, Google acadêmica, SciELO e CAPES. Conclui-se que a bioestatística e a epidemiologia, quando associadas, fornecem principalmente aos profissionais de saúde no atendimento primário o conhecimento essencial para ajudá-los a entender melhor os comportamentos ou situações que envolvem a população como um todo ou parte dela.

Palavras-chave: Biostatistics. Cuidados básicos de saúde. Aplicabilidade, Epidemiologia.

¹ PhD in Collective Health from UniLogos University, Logos University International (UNILOGOS).

E-mail: Nursebrunorocha@yahoo.com.br

Orcid: <https://orcid.org/0000-0003-2232-8923>

² MD, MSH - Interdepartmental Department of Medicine, section of Microbiology and Virology, School of Medicine, University of Bari, Italy, Piazza Giulio Cesare 11, 70124 Bari, Italy, Logos University International (UNILOGOS). Email: luigi.santacroce@uniba.it

Orcid: <https://orcid.org/0000-0001-5671-8124>

³ PhD, MLS, RRT-NPS, FACSc, FAARC, FRSB, Honorary Professor, Department of Health, Administration and Education, Logos University International (UNILOGOS), Department Chair of Business Professions, American College of Education, Indiana, USA.

E-mail: deanhenryoh@gmail.com

1 INTRODUCTION

Biostatistics poses numerous challenges for every researcher working in the health sector, especially for those working in primary health care, as well as for all students of health courses, especially for those researchers who use evidence-based medicine to find and formulate answers to the questions raised.

Based on the concept of evidence-based medicine, Lopes et al. (2014, p.17) state that, “[...] knowledge in Biostatistics is a fundamental skill to carry out, evaluate or properly interpret a scientific work”.

In this sense, for Chaoubah (2021), understanding the fundamentals of biostatistics is a prerequisite for understanding the specialized literature, in addition to being a prerequisite for carrying out biological experiments and clinical research in the field of health, also becoming essential when making decisions regarding clinical diagnoses, examinations and treatments directed at patients.

Given the above, the present study raised the following guiding question: how can knowledge in biostatistics, associated with the concept of evidence-based medicine, contribute to primary care services?

In this sense, the objective of the present study is to understand how knowledge in biostatistics associated with epidemiology influences and can be applied in primary health care.

1.1 BIOSTATISTICS IN US BASIC HEALTH

Biostatistics plays a fundamental role in basic health in the United States, which allows us to compare the principles applied across countries, allowing the health system to analyze data, make informed decisions and plan strategies to improve the health of the population. The main areas where biostatistics is applied in the US healthcare system are:

1. Population health monitoring: Biostatistics is used to monitor and track basic health indicators, such as mortality rates, disease incidence, prevalence of chronic conditions, vaccination, among others. This data is collected at the national, state and local levels to identify trends, disparities and areas of concern.

2. Epidemiological studies: Biostatistics is fundamental in conducting epidemiological studies to understand the distribution and determinants of diseases in the population. These studies can be observational (cohort, case-

control studies) or experimental (randomized controlled clinical trials). Biostatistics is used to calculate sample size, perform statistical analyses, control for bias, and establish associations between risk factors and health outcomes.

3. Evaluation of health interventions: Biostatistics is applied in the evaluation of basic health interventions, such as disease prevention programs, awareness campaigns and public health policies. Data collected before and after implementing an intervention are statistically analyzed to determine its effectiveness, impact on population health, and cost-effectiveness.

4. Health Data Analysis: Biostatistics is used to analyze large sets of health data such as electronic medical records, health surveys, and health insurance data. This statistical analysis can reveal patterns, correlations, and associations between health variables, providing insights into population health conditions, risk factors, and treatment effectiveness.

5. Statistical Modeling and Prediction: Biostatistics is used to develop statistical models that can predict disease occurrence, hospitalization rates, demand for health services, and other basic health measures. These templates help healthcare professionals plan resources, implement prevention strategies, and respond to disease outbreaks.

In the US healthcare system, government agencies such as the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) play an important role in applying biostatistics to improve basic health. In addition, hospitals, clinics, health insurers and academic researchers also use biostatistics in their respective fields to improve the quality of healthcare and inform healthcare policy.

2 MATERIALS AND METHODS

The present study deals with an exploratory and descriptive approach, adopting a qualitative methodology to answer the questions raised.

Data collection was carried out during the period from December 2022 to February 2023, where the search for complete scientific articles and literary works, with no time frame, in Portuguese, using previously selected descriptors, was adopted as a selection criterion, with queries being carried out in the databases of the Virtual Health Library (VHL): Latin American and Caribbean Literature in Health Sciences

(LILACS), MEDLINE (Medical Literature Analysis and Retrieval System Online) Digital Library Brasileira de Teses e Dissertação (BDTD), in Google academic databases, SciELO (Scientific Electronic Library Online) and CAPES journals.

For exclusion criteria, the following previously established criteria were adopted: (1) articles in a foreign language, (2) not available in full (3) duplicated scientific articles.

In the search for scientific articles selected for this research, the following descriptors were used: Biostatistics. Basic health care. Applicability, Epidemiology.

For a better understanding of the theme, the following descriptors were included in the research in question: “evidence-based medicine”, “collective health”, “interpretation” and “statistics”.

After the prior selection of the selected literary textual material, a thorough reading and analysis was carried out, in order to verify whether the previously selected literature positively meets the initial objectives stipulated for the study.

From the previous reading and analysis of the selected material, a structured data collection instrument was developed, containing title, author, source and year of publication, which are explained in the table below.

Table I – Selected literary works

TITLE	AUTHORS	SOURCE	YEAR OF PUBLICATION
The importance of Biostatistics in the training of a health professional	CHAOUBAH, A.	Brazilian Journal of Ophthalmology	2021
Health indicators. Conceptual and practical elements	OPAS	OPAS	2018
Epidemiology, natural history, social determination, disease prevention and health promotion	ROUQUAYROL, M.Z. <i>et.al.</i>	Medbook Publisher	2018
Epidemiology concepts and tools	GOMES, E. C.de S.	UFPE University Publisher	2015
Importance of Statistics for the Process of Knowledge and Decision Making	IGNÁCIO, S. A.	Paraná Development Magazine	2014
Biostatistics: fundamental concepts and practical applications	LOPES, B. et al.	Brazilian Journal of Ophthalmology	2014

An overview of biostatistics and fundamental concepts	RODRIGUES, M.A.S.	Person University Library	2014
Introducing the basic concepts in Epidemiology	TIETZMANN, D. C.	Pearson Education do Brasil	2014
Health indicators: A public health vision, with an interest in General and Family Medicine	DIAS, C. M.; FREITAS, M.; BRIZ, T.	Portuguese Journal of General and Family Medicine	2007
Health and environment indicator systems in health institutions	KLIGERMAN, D.C. <i>et al.</i>	Science and Collective Health	2007
Epidemiology and health indicators	SOARES, D.A.; ANDRADE, S.M.; CAMPOS, J.J.B.	EDUEL Publisher	2001
Evidence-Based Medicine: the art of applying scientific knowledge in clinical practice	LOPES, A. A.	Journal of the Brazilian Medical Association	2000

Source: Prepared by the Authors, 2023.

3 THEORETICAL REFERENCE

3.1 BIOSTATISTICS AND EPIDEMIOLOGY: IMPORTANCE FOR BASIC HEALTH

Measuring the quality of services provided to the population, verifying whether a pathology is on the rise in a given region, requires the researcher to have adequate planning to carry out data collection, analysis and interpretation and the exposure of the data collected through graphs and tables, where through the knowledge applied in biostatistics this becomes more evident.

From this perspective, it is first necessary to define statistics for a better understanding of the topic addressed. According to Ignacio (2010)

Statistics is defined as a set of methods and techniques that involve all stages of a survey, from planning, coordination, data collection through sampling or census, application of questionnaires, interviews and measurements with the maximum amount of information possible for a given cost, to the consistency, processing, organization, analysis and interpretation of data to explain socioeconomic phenomena; inference, calculation of the level of confidence and error in the response to a given variable and dissemination of information (IGNÁCIO , 2010, p.179-180).

When it comes to basic health, if we analyze the concept of statistics previously defined, and apply the field of epidemiology, it can be observed that the association of both becomes fundamental, considering that the two complement each other.

Moreover, through epidemiology, we can verify the incidence and prevalence of certain diseases in a specific area or population and plan actions aimed at health with the objective of promoting, preventing, controlling and eradicating diseases (ROUQUAYROL ; GOLDBAUM ; SANTANA , 2013 apud GOMES, 2015).

Based on the above, elucidating the concept of epidemiology is necessary for a better understanding. Thus, Rouquayrol et al. (2018), clarify that epidemiology is the science capable of analyzing and explaining the entire health-disease process, including the risks and determinants of the disease in addition to those related to the health of individuals, individually or collectively, with the objective of creating goals, capable of promoting better and decision-making, as far as prevention, protection and recovery are concerned, of individuals, whether collectively or individually.

In this sense, undoubtedly, the greatest challenge of researchers today is to know how to analyze and interpret the compiled data to draw better conclusions and draw appropriate actions, given the existence of technological advances that provide better compilations of data (RODRIGUES, 2014).

3.2 THE IMPORTANCE OF HEALTH INDICATORS IN EPIDEMIOLOGY

Health indicators are designed to present, compare collected data, and provide a comparative analysis of a population's current health status, assessing likely changes over the years (SOARES; ANDRADE; CAMPOS , 2001).

The Pan American Health Organization (PAHO, 2018) defines health indicators as aggregated measures containing relevant information about certain attributes and dimensions of health status and health system performance, in which they are designed to describe and monitor the health status of a population.

In epidemiology, indicators are used so that we can formulate appropriate conducts that benefit the health of a population.

Segundo Dias, Freitas and Briz (2007)

The simplest indicators used in Public Health are generally epidemiological measures of one of two types: 1. Prevalence (number of people with a certain characteristic living in a certain population in a certain period of time); 2. incidence (number of new cases of a health problem that occur in a given population during a known period of time) (DAYS ; FRENCH; BRIZ , 2007, p.442).

In epidemiological terms, some health indicators are analyzed and applied mainly by primary health care, such as indicators of mortality, morbidity, indicators

related to nutrition, child growth and development, etc. In this study, the indicators of morbidity and mortality will be briefly presented because they are more commonly used in primary health care.

Morbidity indicators are designed to show the behavior associated with a disease in a population, in a given time interval (TIETZMANN, 2014).

In this model, indicators of incidence and prevalence are included, whose formulas are presented in the table below.

Table I – Formulas used to calculate health indicators in epidemiology

<p>Incidence: Number of new cases of the pathology in a period of time</p> $\frac{\text{Number of new cases of the pathology in a period of time}}{\text{Population exposed to risk}} \times 10^n$
<p>Prevalence: Number of cases of the pathology already known (whether new or old)</p> $\frac{\text{Number of cases of the pathology already known (whether new or old)}}{\text{Population number}} \times 10^n$
<p>Caption: 10ⁿ = Constant</p>

Source: prepared by the authors, 2023.

With regard to the mortality indicator, its objective is to analyze the deaths that occur in a population in a given time interval, as well as to predict and analyze the risk of a population developing death due to a disease condition (TIETZMANN, 2014).

In this model, the indicators of general mortality and infant mortality are included, whose formulas are presented in the table below.

Table II – Formulas used to calculate health indicators in epidemiology

<p>Mortality Indicator: Number of deaths occurred in a given period of time</p> $\frac{\text{Number of deaths occurred in a given period of time}}{\text{Population}} \times 1000$
<p>Infant Mortality: Number of deaths of children under 1 year in a period of time</p> $\frac{\text{Number of deaths of children under 1 year in a period of time}}{\text{Number of live births}} \times 1000$
<p>Caption: 1000 = Constant</p>

Source: prepared by the authors, 2023.

Otherwise for Kligerman et al. (2007)

The indicators should be as specific as possible to the issue addressed; sensitive to specific changes in the conditions of interest; scientifically reliable, impartial and representative of the conditions of interest, in addition to providing maximum benefit and utility (KLIGERMAN , et al. , 2007, p.200).

4 FINAL CONSIDERATIONS

The present study sought to understand how knowledge in biostatistics associated with epidemiology influences and can be applied in primary health care, in which the main objective was achieved.

It was observed in the study that biostatistics associated with epidemiology helps health professionals, especially in primary care, to understand and understand behaviors or situations that involve the population as a whole or part of it.

With regard to the academic training of health professionals, it was observed that higher education institutions need to invest in new teaching models that emphasize the teaching of biostatistics, given that most students arrive at higher education already having a deficit in the teaching-learning process, a deficit acquired since the initial teaching classes, such as a deficit in reading and interpreting data. Students need to be encouraged to interpret the data, compile and analyze them for better decision making, and demonstrate them by making graphs or tables, throughout the graduation process and not just at the time of the course.

Carrying out new research involving the topic addressed is necessary because, although there are vast bibliographies in the area, presented and viewed individually with the proposed theme, there is still a shortage of scientific articles when we associate the topics addressed.

REFERENCES

CHAOUBAH, A. **The importance of Biostatistics in the training of a health professional.** Brazilian Journal of Ophthalmology, [s. l.], v. 80, n.2, p. 89-90, 2021. ISSN: 1982-8551 online version.. Available at: <https://doi.org/10.5935/0034-7280.20210016> . Accessed: 22 Dec.2022.

DIAS, C.M.; FREITAS, M.; BRIZ, T. **Health indicators: A public health view, with an interest in General and Family Medicine.** Portuguese Journal of General and Family Medicine, [s. l.], v. 23, no. 4, p. 439–50, 2007. Available at: <https://www.rpmgf.pt/ojs/index.php/rpmgf/article/view/10388> . Accessed on: 19 Feb. 2023.

DAVID S. MOORE; GEORGE P. MCCABE; BRUCE A. CRAIG. **Introduction to the Practice of Statistics.** W.H. Freeman and Company. 2017 (9th edition)

GOMES, E. C.de S. **Concepts and tools of epidemiology.** Recife: Ed. UFPE University, UNA-SUS UFPE, 2015. 83 p.ISBN: 978-85-415-0721-9 Available at: https://ares.unasus.gov.br/acervo/bitstream/ARES/3355/1/3con_ferra_epidemiolo_2016-2.pdf. Accessed on: Feb. 01, 2023.

IGNÁCIO, S. A. **Importance of Statistics for the Process of Knowledge and Decision Making.** Paranaense Development Magazine - RPD , [s. l.], n. 118, p. 175–192, 2012. ISSN 2236-5567 online version. Available at: <https://ipardes.emnuvens.com.br/revistaparanaense/article/view/89>. Accessed on: 17 Feb. 2023.

KLIGERMAN, D.C. et al. **Health and environment indicator systems in health institutions.** Science and Collective Health, [s. l.], v. 12, no. 1, p.199-211, 2007. Available at: <https://doi.org/10.1590/S1413-81232007000100023> . Accessed on: Feb 18, 2023.

LOPES, A. A. **Evidence-Based Medicine: the art of applying scientific knowledge in clinical practice.** Journal of the Brazilian Medical Association, [s. l.], v. 46, n.3, p.285-288, 2000.ISSN: 1806-9282 online version. Available at: <https://doi.org/10.1590/S0104-42302000000300015> . Accessed on: 15 Dec.2022.

LOPES, B. et al. **Biostatistics: fundamental concepts and practical applications.** Brazilian Journal of Ophthalmology, [s. l.], v. 73, n.1, p.16-22, 2014. ISSN: 1982-8551 online version. Available at: <https://doi.org/10.5935/0034-7280.20140004> . Accessed on: 18 Dec.2022.

PAN AMERICAN HEALTH ORGANIZATION. Health indicators. **Conceptual and practical elements.** Washington, D.C.: PAHO; 2018.ISBN: 978-92-75-72005-9 online version. Available at: <https://iris.paho.org/handle/10665.2/49057>. Accessed on: 15 Jan. 2023.

RODRIGUES, M.A.S. **An overview of biostatistics and fundamental concepts.**In: RODRIGUES , M.A.S.(Org.). Biostatistics. 1 ed. São Paulo: Person Education do Brasil, 2014 .p.1-33.

ROUQUAYROL, M.Z. et al. **Epidemiology, natural history, social determination, disease prevention and health promotion.** In: ROUQUAYROL, M.Z., GURGEL, M. (Org.) .Epidemiology & health. 8 ed. Rio de Janeiro: Medbook: 2018.

SOARES, D.A.; ANDRADE, S.M.; CAMPOS, J.J.B. **Epidemiology and health indicators.** In: ANDRADE, S.M. in; JUNIOR, L.C.; CARVALHO, B.G.; GONZÁLES, A.D.; SILVA, A.M.R.(Org.). Bases of collective health. Londrina: EDUEL, 2001. p. 183-210.

TIETZMANN, D. C. **Introducing the Basics in Epidemiology.** In: TIETZMANN, D C. (Org.). Epidemiology. São Paulo: Pearson Education do Brasil, 2014. p. 29-55. Ebook.