Brazilian Journal of Functional Health
ISSN online: 2358-8691
DOI: 10.25194/rebrasf.v10i2.1508
Faculdade Adventista BAHIA | RBSF Revista Brasileira de Saúde Funcional

PHYSIOTHERAPY IN THE AGE OF BIG DATA: A SYSTEMATIC REVIEW

FISIOTERAPIA NA ERA DO BIG DATA: REVISÃO SISTEMÁTICA

Beatriz Santos Miranda - beatriz.miranda@ufba.br
Physiotherapy student at the Federal University of Bahia (UFBA), Salvador, Bahia, Brazil.

Sarah Souza Pontes - sarahpontes@gmail.com
Physiotherapist and Nurse, Master in Human Development and Social Responsibility and Doctoral Student in Medicine and Health. Training in Data Science, Salvador, Bahia, Brazil.

Abstract: Introduction: Physiotherapy is considered a new science, however, with the number of recognized specialties and the expansion of knowledge, there is an increase in the growth of historical data and, consequently, of the scientific literature. For the production of evidence from large health databases, such information is organized and systematized through Big Data, in order to generate significant corpora. **Objective:** Review Physiotherapy in the Age of Big Data. **Method:** The present study consists of a systematic review carried out in January 2022 in databases. The descriptors "Big Data" and "Physiotherapy" were used with the Boolean employer "and". At first, titles and abstracts were analyzed, and then a full reading was performed, confirming the inclusion of the manuscript. **Results:** The initial search pointed to a total of 61 titles. After removing duplicates and applying inclusion criteria, a total of 10 studies were used. There are a variety of applications of Artificial Intelligence (AI) in healthcare for numerous purposes. However, it was observed that there is no specific design in the studies. The studies, in general, have the same objective and arise to discuss the impact of AI and health. **Conclusion:** In order to direct and support clinical reasoning, AI appears to add to the health professional's performance as a tool that directs him to reduce medical errors, as well as financial costs, directing diagnosis and treatment safely.

Keywords: Bigdata; Physiotherapy; Health.

1 INTRODUCTION

In Brazil, Physiotherapy emerged at the Santa Casa de Misericórdia de São Paulo in 1929, but it was only in 1951 that training for physiotherapists began. Therefore, it is a relatively new science[1]. The Federal Council of Physical Therapy and Occupational Therapy recognizes as specialties:

Physiotherapy in Acupuncture; Aquatic Physiotherapy; Cardiovascular Physiotherapy; Dermatofunctional Physiotherapy; Sports Physiotherapy; Physiotherapy in Gerontology; Occupational Physiotherapy; Neurofunctional Physiotherapy; Physiotherapy in Oncology; Respiratory Physiotherapy; Traumato-Orthopedic Physiotherapy; Physiotherapy in Osteopathy; Chiropractic Physiotherapy; Physiotherapy in Women's Health; Physiotherapy in Intensive Care[2].

The expressive performance, as well as the quantity of care and data generation in the evaluations, preventive and rehabilitative measures of this profession, offer a possibility of broad gathering of information, adding to knowledge and advancement in health. It is noteworthy, in this sense, that the World Health Organization (WHO) has as one of its missions the production of th e Health Classification, through conceptual models to be introduced into science and professional practice. This unifies the language of managers and users, thus favoring the better description of human health conditions, intended for a standardization of the information extracted through health data[3].

Currently, evidence-based practice is in the midst of dysfunctions, in order to conduct the best available clinical evidence, from systematic investigation. However, with the amount of large volume data being produced at high speed and in the most varied ways, a new tool is needed that has the ability to promote changes in the forms of data analysis. This demand gave rise to Big Data[4].

Considering that the scientific literature guides decision-making based on health data, it is understood that, for better intervention, historical data are indispensable. However, the increase in knowledge and the increasing and faster generation of data in all areas, especially in health, require systematizing and organizing these databases to generate information. It is understandable, therefore, that the era of data volume needs to be discussed. Therefore, the present study aims to systematically review Physiotherapy in the era of Big Data.

2 METODS

The present study consists of a systematic review. The bibliographic search was carried out in the period from January 2022, in the following databases: *Latin American and Caribbean Literature in Health Sciences* (LILACS), *Medical Literature Analysis and Retrieval System Online* (PubMed/Medline), *The Scientific Electronic Library Online* (Scielo) and Regional Library of Medicine (BIREME). The descriptors indexed in the Health Science Descriptors (DECS) and the *Medical Subject Headings* (MESH) were used: *"Big Data"; "Physiotherapy"*.

In the bibliographic search strategies, the Boolean employer "*and*" was used. A temporal space has not been delimited. The languages included were Portuguese, English and Spanish. The

bibliographic search was carried out by two independent researchers. For the selection of studies, the titles and abstracts of each article were initially evaluated. In a second moment, the articles were analyzed in full, in order to confirm the relationship with the theme of Big Data and Physiotherapy.

Table 1 – Bibliographic search strategy in the databases. Salvador, BA, Brazil, 2021

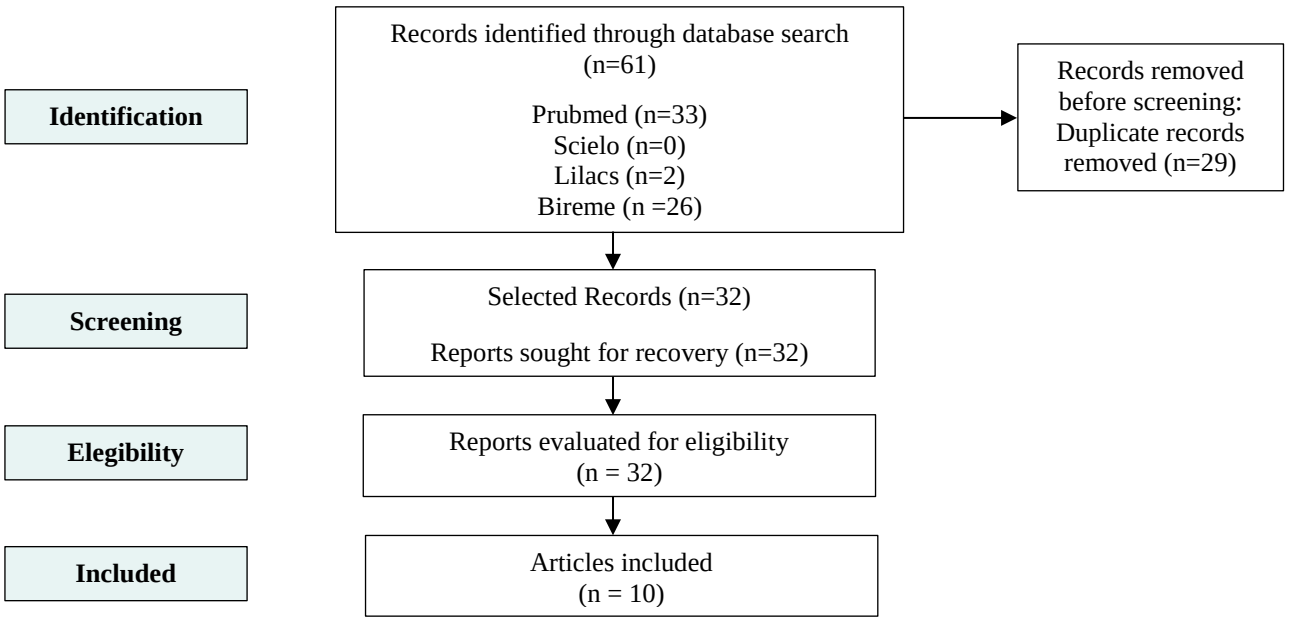
Database	Keywords MESH/ DECS EXAMPLES
PubMed/Medline	*(Big Data) AND (Physiotherapy)*
Scielo	*Big Data AND Physiotherapy*
LILACS	*Big Data AND Physiotherapy*
BIREME	*(Big Data) AND (Physiotherapy)*

Source: Own elaboration.

3 RESULTS

After the initial search, a total of 61 titles were found. 33 at PubMed/Medline, zero at Scielo, two at Lilacs and 26 at Bireme. After the removal of the duplicates, 32 studies remained. All were read in full to confirm the relationship with the theme of Big Data and Physiotherapy. Finally, only ten were included in the study, as illustrated in the flowchart below.

Figure 1 - Flowchart of the identification of studies through database and records. Salvador, BA, Brazil, 2021.



Source: Own elaboration.

Table 2 – Result of the bibliographic search in the databases. Salvador, BA, Brazil, 2021

Title (Author, year)	Local and Outline	Main Findings
Stroke Recovery Working Group: Big data neuroimaging to study brain-behavior relationships after stroke. (Liew *et al.*, 2020)[5].	2,100 patients with stroke, whose information was collected in 39 research studies in ten countries. He sought to develop neuroinformatics protocols and methods to manage brain magnetic resonance, behavioral and demographic data. Data entry and pre-processing, harmonization and analysis data were used.	Each brain has 84 subcortical and cortical regions that take about 20 minutes for inspection. Visual quality control is subjective, and needs to be trained to ensure reliability among evaluators. About 1,000 Magnetic Resonance and behavioral data tests were collected, including measures of cognition, mood, dysphagia and psychosocial well-being, function tests and motor activity. Information was also collected such as comorbidities, sex, race, time from the last event to imaging, type of stroke, number of previous strokes, location, risk factors for cardiovascular diseases, dementia status. Images of eight regions of interest were evaluated bilaterally and cortical thickness, as well as cortical surface area in order to detect algorithms based on cortical surfaces. For the analysis of the algorithms, software for the purposes of programming and statistical analysis by Python and statistical packages such as R and SQLite were used. One of the main future priorities for updating the data entry process is to use artificial intelligence to improve the manual quality control process.

Protocol for Project Fizzyo, an analytic longitudinal observational cohort study of physiotherapy for children and young people with cystic fibrosis, with interrupted time-series design (Raywood, 2020)[6].	Method of remote capture of longitudinal data with clinical outcomes, adherence and prospectively evaluating the associations with the results. Cohort of 145 children and young people with Cystic Fibrosis, aged 6 to 16 years, recorded for 16 months in the physiotherapy sessions. Sensors were used. Real-time breathing pressure was measured during adherence to airway clearance techniques, Heart Rate (HR) and daily step counting by software. Data on spirometry, exercise capacity, quality of life and data from longitudinal clinical records were also collected.	It was developed using preliminary data collected in the first three months of collection and then tested on a larger data set. The pipeline processes data through three main steps: cleaning data to remove errors, labeling data to mark and measure predefined constructions of raw data and finally the characterization of the data, the quantification of variables for cluster analysis. The large amount of heterogeneous data to be recorded and collected for each participant will be analyzed using R and visualized using R Shiny applications. Any changes in adherence to physiotherapy prescriptions or recommendations over time or in relation to gambling or feedback will be quantified. As CF phenotypes and adherence to physiotherapy are complex and multifactorial, cluster analisis will define groups of individuals based on the measurement of characteristics to identify subgroups of participants with different profiles of physical activity and/or adherence to airway clearance techniques. The Fitbit sensor data set and pathway clearance techniques currently contains more than 50 variables, which can be added from the extraction of ongoing clinical records. A correlation analysis of the characteristics that describe therapy behaviors will remove resources that are highly correlated. Variables with a Gauss distribution will be normalized. Dimensionality reduction will be carried out via principal component analysis. These methods will identify the most relevant and independent variables for cluster analysis in order to ensure robust cluster definition and visualization.

Exploring Associations Between Children's Obesogenic Behaviors and the Local Environment Using Big Data: Development and Evaluation of the Obesity Prevention Dashboard (Filos, 2020)[7].	OPdashboard allows you to assist in the real-time monitoring of childhood obesity behaviors. 3700 children from 33 schools and two clinics in five European cities were monitored through software to search for behavior patterns by capturing accelerometer and geolocation data in order to obtain the description of the environment.	In April 2020, BigO was implanted in 33 schools and two pediatric clinics in five different European cities. Each child was asked to use the myBigO app for at least two weeks. Most of the schools included in the analysis are located in the city of Thessaloniki, Greece, and Stockholm, Sweden and focused on comparing the steps of the population per hour before and after the implementation of national health policies due to COVID-19. The main screen of the interface is divided into two main areas, one focusing on the selection of the variables to be analyzed, while in the second area the results are visualized. The available selections include behavioral and environmental characteristics, as well as the city of interest, in terms of the wider metropolitan area, which can be subdivided into the level of available municipalities. Filters related to the Body Masa Index (BMI) score and gender can also be applied to focus on specific groups of children. A list of regional socioeconomic information related to the total population, their educational level, the percentage of young people and the unemployment rate is also provided in tabular format. For the period prior to the closure of schools, 1,802 geohashes were analyzed in which at least one visit of one child was carr ied out and one behavior was detected. On the other hand, in the period after closure, 427 geohashes were analyzed. This expected reduction in the number of geohashes is attributed to restrictions on the mobility of the population as a result of the COVID-19 pandemic. There was a decrease in the average number of steps per hour for metropolitan municipalities and a slight increase in physical activity in municipalities with suburban areas, due to open spaces. This observation implies that the closure of schools provided an opportunity for children to exercise outdoors. Unlike in regions with a lack of open spaces.

Outpatient physical therapy population has been aging faster than the general population: a total population register-based study. (Arnadottir *et al.*, 2021) [8].	Describe 17 years of demographic changes among outpatient physiotherapy clients and determine whether these changes reflect aging in the total population. The data were obtained from a national registry with information about all customers reimbursed by Icelandic health insurance, from 1999 to 2015, and data from the general population from the Statistical Registry.	From 1999 to 2015, the proportion of older adults (≥65 years) increased in both populations and this proportional increase was more prominent in the older elderly group (≥85 years). In these two moments, women were more prevalent among older patients, however, within this group of older clients, the proportion of men increased from 36.1% to 38.1%. In Iceland's oldest general population, the proportion of men has increased from 44.9% to 47% over these 17 years. In 1999, the elderly represented 18.3% of all physiotherapy clients and, in,a proportion had increased to 23.5%. Based on the RR calculations, this means a 23% increase in the proportion of elderly people in 2015, compared to 1999. This increase in the proportion of elderly people was significant in all subgroups, except among women aged 65 to 74 years. The increase was more pronounced (247%) in men ≥ 85 years of age. In the general population, the elderly accounted for 11.6% in 1999 and 13.5% in 2015. Based on the RR calculations, this means a 15% increase in the proportion of elderly people in the general population in 2015, compared to 1999. This increase was significant in all subgroups, except for women aged 75-84 years. The increase was more pronounced (58%) in men aged ≥85 years. There was a clear increase in the percentage of the general elderly population using physiotherapy services each year. The linear modeling of all data fromphysiotherapy clients revealed how the proportion of elderly people in the population increased linearly by 3.45% for each year from 1999 to 2015. This annual change varied according to age group and sex, with the largest annual increase in men aged ≥85 years and no change in women aged 65-74 years.

Prevalence and clinical characteristics associated with peripheral neuropathy amongst persons on HAART in Busia County, Kenya. (Mukoma *et al.*, 2020)[9].	Determine the prevalence and clinical characteristics of peripheral neuropathy among people on highly active antiretroviral therapy (HAART) who attend Comprehensive Care Clinics in Busia County, Kenya.	A total of 300 questionnaires administered, 289 were completed correctly, resulting in a response rate of 96.33%. Of these, 76.8% were women, 38.1% were adults between 41 and 50 years old, followed by those aged 51 years or older, 36%. In addition, 35% were widowed, while only 28% were married. Most respondents, 53.6%, had elementary school, and 27.7% had high school. Individuals with symptomatic Peripheral Neuropathy (NP) had a prevalence of 68.1%. The main signs and symptoms reported were reduced vibration of the right big toe (76.8%), pain in the right foot (69.5%) followed by a reduction in the right ankle reflex (74.7%). The results indicate that there was some relationship between PN and demographic characteristics. The results show a strong positive relationship between foot pain and disease. Similarly, there was a strong positive relationship (r=0.896, p=0.0001) between numbness in the feet and disease, and the relationship between age, sex, education, marital status and numbness in the feet was positive, but weak. There was a strong positive relationship (r=0.621, p=0.0) between the loss of the sensation of vibration of the foot and the disease. There was a weak positive relationship between sociodemographic data and loss of the sensation of vibration of the feet. There was a moderate positive (r=0.541, p=0.0001) with regard to the relationship between ankle reflex reduction and disease. Likewise, there was a weak positive relationship between sociodemographic data and reduction of the ankle reflex. The results indicate a strong and positive relationship (r=0.670, p=0.00) between foot vibration and education. Thus, it can be argued that there was a strong relationship between PN and the disease. There was also a statistically significant influence on the PN domain and on the demographic characteristics of people in HAART, since they were responsible for 98.5% of the variation (R2=0.985).

A New Design Scheme for Intelligent Upper Limb Rehabilitation Training Robot (Zhao *et al.*, 2020)[10].	An intelligent upper limb rehabilitation robot was designed through artificial intelligence with combined knowledge, virtual reality, multichannel information fusion interaction technology and Big Data analysis, an intelligent, efficient and collaborative remote rehabilitation system based on human physiological response and other Big Data information.	The robot was assembled to assist in the traditional rehabilitation process, so first the robot's external sensor system was built, which can perceive the patients, health team and the environment and obtain relevant information. The sensors involved include a stereo vision sensor, auditory sensor, force sensor, proximity sensor and electromyographic sensor (EMG). Building a multisensor system can reduce the shortcomings of using a single sensor, such as limited or incomplete information and uncertainties, and can describe the robot's human-machine environment comprehensively. Each piece of information is different in space, time, expression and purpose. Therefore, a method of multi-information processing is necessary for information processing and management to coordinate the work of each sensor with each of the other sensors and deal with all types of system information from multiple sensors more effectively. Complementary information can improve the integrity and correctness of the system description environment. Secondly, the coordinated management of multisensor information is achieved by sensor selection, coordinate transformation, data transformation and using a sensor model database. The robot can intelligently assist the patient in carrying out rehabilitation training and ensure patient safety during training.

Do therapist effects determine outcome in patients with shoulder pain in a primary care physiotherapy setting? (Koojiman *et al.*, 2020)[11].	Identify whether the personality traits of the physiotherapist influence the outcome of patients. For the study, patients with shoulder complaints who entered treatment between 2009 and 2012 were observed. 2,814 patients and 56 physiotherapists were analyzed using multilevel linear regression. The severity of the complaint was measured on a 10-point Likert scale, the physiotherapist's personality traits were identified using the *Big Five Inventory*.	2,814 patients were included in the study, of which 2,116 had complete data. The average severity of shoulder complaints at the beginning of treatment was 6.5, the average severity at the end of treatment was 1.8. During treatment, the severity of complaints on the shoulder decreased significantly ($p < 0.001$) with 5.0 points, adjusted for the variables of the patient and therapist. The proportion of the total variance explained in the change in severity was 0.88 at the patient's level and 0.12 at the physiotherapist's level, which means that 12% of the variance in the change in shoulder severity was explained by physiotherapists. Significant variables at the p level <0.25 were included in the multilevel analysis. It shows that personality trait extroversion has a significant relationship with the change in the severity of shoulder complaints. This suggests that therapists tend to be more energetic and positively influence the outcome of treatment. In the patient level, older age, longer duration and recurrent complaints had a statistically significant value in relation to the change in the severity of complaints and the worst predicted result.

Precision health: a primer for physiotherapists. (Dickson e*t al.*, 2020)[12].	Genetics and Big Data' are under discussion in the context of clinical practice. From this, a primer was elaborated, providing an introduction to current primary health challenges.	Variants of COMT (catecol-o-methyltransferase) are associated with pain sensitivity and vulnerability to persistent pain, affect the probability of reporting moderate to severe sore throat, headache, dizziness, dissociative symptoms and emotional estimation and physical recovery time. Migraine is related to the MTHFR gene. MTHFR variant that is known to increase plasma levels of homocysteine. Homocysteine levels can be reduced directly and relatively inexpensive supplementation with vitamins B6, B9 and B12. The UK National Health Service (NHS) provided the 'Genomics Education Program', a valuable initiative that provides a range of education programs and resources for primary health professionals. In terms of application, genetic and intestinal microbiome screening are currently available as needed within the NHS through a general practitioner or referral from a specialist.

Use of Functional Assessment to Define Therapeutic Goals and Treatment. (High, 2019)[13].	It is based on the presentations and discussions of a workshop, "Using Functional Assessment to Define Therapeutic Goals and Treatment", which took place in 2017. The topics covered included evaluation of health, clinical, musculoskeletal, cognitive and sensory outcomes. Professionals ensure the need for more research in the area to allow "Big Data" analysis.	Function is impacted in a sensory and cognitive way, reaching active health. The domains that decrease with age cause a substantial impact on function, it was emphasized the distinction between the measures that assess functional status, or what activities someone actually does, and the measures that assess functional capacity, or the maximum activities that someone is able to do. The construction of "intrinsic capacity" was defined as the compound of all the mental and physical capacities of an individual. It was observed that the functional status of the elderly and functional capacity usually fluctuate. The dynamic nature of function means that we must be careful before important treatment decisions in a single function measurement and implications of how the function should be measured and analyzed as a result. Disability is influenced by health and the environment and social context. The term "fragility" was often used, as well as that of physical "resilience" and are related to the probability of future health. Frailty implies a risk of future death or loss of function, while resilience refers to the ability to retain or recover function after a health stress. It was also noticed that function measurements are used to predict results after surgery, or other interventions being labeled as frailty indices, perhaps inadequately. Some gaps limit the complete integration of functional evaluation, such as a viable set of measures for use in clinical conditions performing in a standardized way for comparison in a reliable and reproducible way. The data sets that clinically characterize the relevant aspects of function to validate and explore the role of function in health and clinical decision-making. As well as the creation of Population Norms of function and their determinants, including populations that are underrepresented in clinical research, in order to promote early detection and segmentation for intervention.

Data Science in Physical Medicine and Rehabilitation: Opportunities and Challenges. (Ottenbacher *et al.*, 2019)[14].	Data-driven health science has been expanding and is used to meet disability reduction and health improvement goals. This science assists in the storage, analysis and interpretation of scientific knowledge.	Expands the knowledge of the Strategic Plan for Data Science of the National Institute of Healt (NIH). The implementation of the Affordable Care Act is producing changes in health care delivery that are resulting in the creation of new large data sets within Medicare and private health systems designed to measure the value of patient care, rather than the volume of services and procedures provided. Hospital mergers, expansion of the health system and federal requirements for the development and implementation of new payment systems and quality measures are resulting in the creation of data warehouses and private, commercial and federal repositories. Examples include data warehouses such as MarketScan, Clinometrics and OPTUM. These data warehouses contain electronic health records (EHRs) and patient information that can be used to develop patient assessment and management programs in large health systems or individual health units. The National Patient-Centered Results Network (PCORnet) is a national network supported by the Patient-Centered Results Research Institute, which includes a consortium of hospitals, health systems , clinics and patient partnerships. The network offers workshops and training programs, at which events data scientists and clinical research teams can learn how to develop proposals and request data from PCORnet. The Center for Large Data Research and Data Sharing in Rehabilitation (CLDR) aims to build scientific capacity by increasing the quantity and quality of rehabilitation research using large complex data sets.

Investing in big ideas: utilisation and cost of Medicare Allied Health services in Australia under the Chronic Disease Management initiative in primary care. (Cant, Foster, 2011)[15].	Critically examine the use of the 13 allied health services provided through the Medicare Chronic Disease Management program and general practitioner care planning initiatives. In the period between 2005 and 2009, data were extracted from Medicare..	There were 1.9 million allied health services in the year 2008-09, at a cost of almost AU $92 million for Medicare. There were also almost 18,000 Group Medicare services for educating small groups of patients with type 2 diabetes. The seven most billed services are podiatry, physiotherapy, dietetics, chiropractic, speech pathology, exercise physiology and diabetes education. The number of individual services provided grew exponentially from 2005-06. The differences in the use of services by the states were apparent, including when the data were compared with the data of the state population by Medicare and the statistics presented as frequency per 100,000 of the population. In some states, there was a high use of some services per capita and, alternatively, low or very low per capita use in others. In relation to patients with chronic diseases, most were female with a broad age group, who were referred to professionals such as aboriginal health worker; dietetics, exercise physiology, mental health worker, physiotherapy, podiatry, chiropractic, osteopathy and psychology. In contrast, education in diabetes, audiology, occupational therapy (OT) and speech pathology treated more men than women and, for the last three, children constituted the majority of clients. These statistics show that a higher proportion of referrals involved female patients and also indicate unique referral patterns according to the allied health specialty.

Source: Own elaboration.

It was observed that, in the literature found, there is no specific design of the studies, since it was not possible to outline a study design protocol. The objective of the research found encompasses several domains of technology and health, most of which arises from the purpose of discussing the impact of Artificial Intelligence (AI) and health.

About 1,000 Magnetic Resonance images of the brain were recorded in order to make the interpretation of the images as less subjective as possible, improving the process of controlling information. These actions also leave the possibility of the emergence of new studies that can cross-reference the sociodemographic information of the participants.[5]

Unlike this, a longitudinal study to measure data from 145 individuals with Cystic Fibrosis,

who underwent physiotherapy. This analysis allowed us to identify the different profiles of individuals with the pathology and what type of treatment can be of best application, depending on their sociodemographic variables.[6]

Another, online, monitors children to identify possible patterns of behavior that justify childhood obesity. However, with the closure of schools in the pandemic, the number of children was restricted. In addition, a reduction in the level of physical exercise performed by children living in metropolitan areas, with fewer outdoor areas, could also be perceived.[7]

Other types of studies use Big Data for commercial purposes, such as the analysis of plans that offer private health services[15]. Accordingly, the crossing of information from the clients of a health insurer, who were using the Physiotherapy service, and the data of the general population from the Icelandic statistical registry. As a result, a linear increase in the search for the elderly for the physiotherapy service has been perceived, as well as the increase in its population.

The prevalence and clinical characteristics of Peripheral Neuropathy (NP) among people on highly active antiretroviral therapy, who attend a clinic in Kenya, have been studied. Thus, a large number of demographic variables have been described, enabling the association of these factors, and concluding a strong relationship between PN and Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS).[9]

AI has been used in combination with virtual reality, interaction technology and a rehabilitation system to base physiological human responses. A robot was built with sensors, including stereo vision sensor, auditory sensor, force sensor, proximity sensor and electromyographic sensor. This AI arose with the purpose of training the individual who needs to undergo some kind of rehabilitation and ensure their safety.[10]

A more subjective analysis using Big Data can be seen by observing the evaluation of the personality traits of the physiotherapist, if they influence the result of the therapy. It was observed that the more energetic the professional in offering stimuli, it positively influences the therapy and, consequently, the treatment.[11]

A booklet with the current primary health challenges and a gene screening program that cause some of the possible complaints that arrive at the health service, such as sore throat, headache, rehabilitation time and others were also studied by AI.[12] These themes can lead to debates such as those that arose during a workshop with the discussion of terms used, such as fragility, function and resilience. The clinical data of individuals when grouped form large databases, but they are of great importance for assessing function, health and directing clinical decisions.[13]

Thus, the importance of large databases and their science is given. This is in order to store them in the best way, analyze them and perform interpretations that meet goals and are able to reduce

deficiencies, as well as cause improvements in health[14].

4 CONCLUSION

AI arises in the health field in order to support and direct clinical reasoning and not to replace the health professional. The greater the quality and speed support the health professional has to direct his activity, the greater confidence he will have in his activity, as well as reduce possible errors and direct the correct diagnosis with greater agility. This will also help to reduce personal exhaustion, financial costs and lead to the completion of treatment early and more efficiently.

REFERENCES

1. Marques AP, Sanches EL. Origem e evolução da fisioterapia: aspectos históricos e legais. Rev Fisioter e Pesq. 1994;1(1):5-10. Disponível em: https://doi.org/10.1590/fpusp.v1i1.75027. Acesso em: 19 jul. 2022.

2. Brasil. Ministério da Saúde. Gabinete do Ministro. Lei n. 6.316, de 17 de dezembro de 1975. Cria o Conselho Federal e os Conselhos Regionais de Fisioterapia e Terapia Ocupacional e dá outras providências. Disponível em: https://www.coffito.gov.br/nsite/?p=3318. Acesso em: 19 jul. 2022.

3. Sampaio RF, Luz MT. Funcionalidade e incapacidade humana: explorando o escopo da classificação internacional da Organização Mundial da Saúde. Cad. Saúde Pública. 2009;25(3). Disponível em: https://doi.org/10.1590/S0102-311X2009000300002. Acesso em: 19 jul. 2022.

4. Chiavegatto Filho ADP. Uso de big data em saúde no Brasil: perspectivas para um futuro próximo. Epidemiol. Serv. Saúde. 2015;24(2):325-332. Disponível em: https://doi.org/10.5123/S1679-49742015000200015. Acesso em: 19 jul. 2022.

5. Liew SL, Zavaliangos-Petropulu A, Jahanshad N, Lang CE, Hayward KS, Lohse KR et al. The ENIGMA Stroke Recovery Working Group: Big data neuroimaging to study brain-behavior relationships after stroke. Hum Brain Mapp. 2020. Disponível em: https://doi.org/10.1002/hbm.25015. Acesso em: 19 jul. 2022.

6. Raywood E, Douglas H, Kapoor K, Filipow N, Murray Nick, O'Connor R et al. Protocol for Project Fizzyo, an analytic longitudinal observational cohort study of physiotherapy for children and young people with cystic fibrosis, with interrupted time-series design. BMJ Open 2020;10(10):e039587. Disponível em: http://dx.doi.org/10.1136/bmjopen-2020-039587. Acesso em: 19 jul. 2022.

7. Filos D, Lekka I, Kilintzis V, Stefanopoulos L, Karavidopolou Y. Exploring Associations Between Children's Obesogenic Behaviors and the Local Environment Using Big Data: Development and Evaluation of the Obesity Prevention Dashboard. JMIR mHealth uHealth. 2021;9(7):e2629. Disponível em: https://mhealth.jmir.org/2021/7/e26290. Acesso em: 19 jul. 2022.

8. Arnadottir SA, Jonsson BG. Outpatient physical therapy population has been aging faster than the general population: a total population register-based study. BMC Health Serv. Res. 2021;21(1):1-9. Disponível em: https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-021-06738-0. Acesso em: 19 jul. 2022.

9. Mukoma JN, Matheri JM, Tawa N. Prevalence and clinical characteristics associated with peripheral neuropathy amongst persons on HAART in Busia County, Kenya. S AFR J Physiother. 2020;76(1). Disponível em: http://dx.doi.org/10.4102/sajp.v76i1.1430. Acesso em: 19 jul. 2022.

10. Zhao Y, Liang C, Gu Z, Zheng Y, Wu Q. A New Design Scheme for Intelligent Upper Limb Rehabilitation Training Robot. Int. J. Environ. Res. Public Health. 2020;17(8):2948. https://doi.org/10.3390/ijerph17082948. Acesso em: 19 jul. 2022.

11. Koojiman MK, Buining EM, Swinkels ICS, Koes BW, Veenhof C. Do therapist effects determine outcome in patients with shoulder pain in a primary care physiotherapy setting?. Physiotherapy. 2020;107:111-117. Disponível em: https://doi.org/10.1016/j.physio.2019.08.009. Acesso em: 19 jul. 2022.

12. Dikson C, Hyppönen E. Precision health: a primer for physiotherapists. J. Physiother. 2020;107:66-70. Disponível em: https://doi.org/10.1016/j.physio.2019.08.004. Acesso em: 19 jul. 2022.

13. High KP, Zieman S, Gurwitz J, Hill C, Lai J, Robinson T, Schonberg M, Whitson H. Use of functional assessment to define therapeutic goals and treatment. J. Am. Geriatr. Soc. 2019;67(9):1782-1790. Disponível em: https://doi.org/10.1111/jgs.15975. Acesso em: 19 jul. 2022.

14. Ottenbacher KJ, Graham JE, Fisher SR. Data science in physical medicine and rehabilitation: opportunities and challenges. Phys. Med. Rehabil. Clin. 2019; 30(2):459-471. Disponível em: https://doi.org/10.1016/j.pmr.2018.12.003. Acesso em: 19 jul. 2022.

15. Cant RP, Foster MM. Investing in big ideas: utilisation and cost of Medicare Allied Health services in Australia under the Chronic Disease Management initiative in primary care. Aust. Health Rev. 2011; 35(4):468-474. Disponível em: https://doi.org/10.1071/AH10938. Acesso em: 19 jul. 2022.