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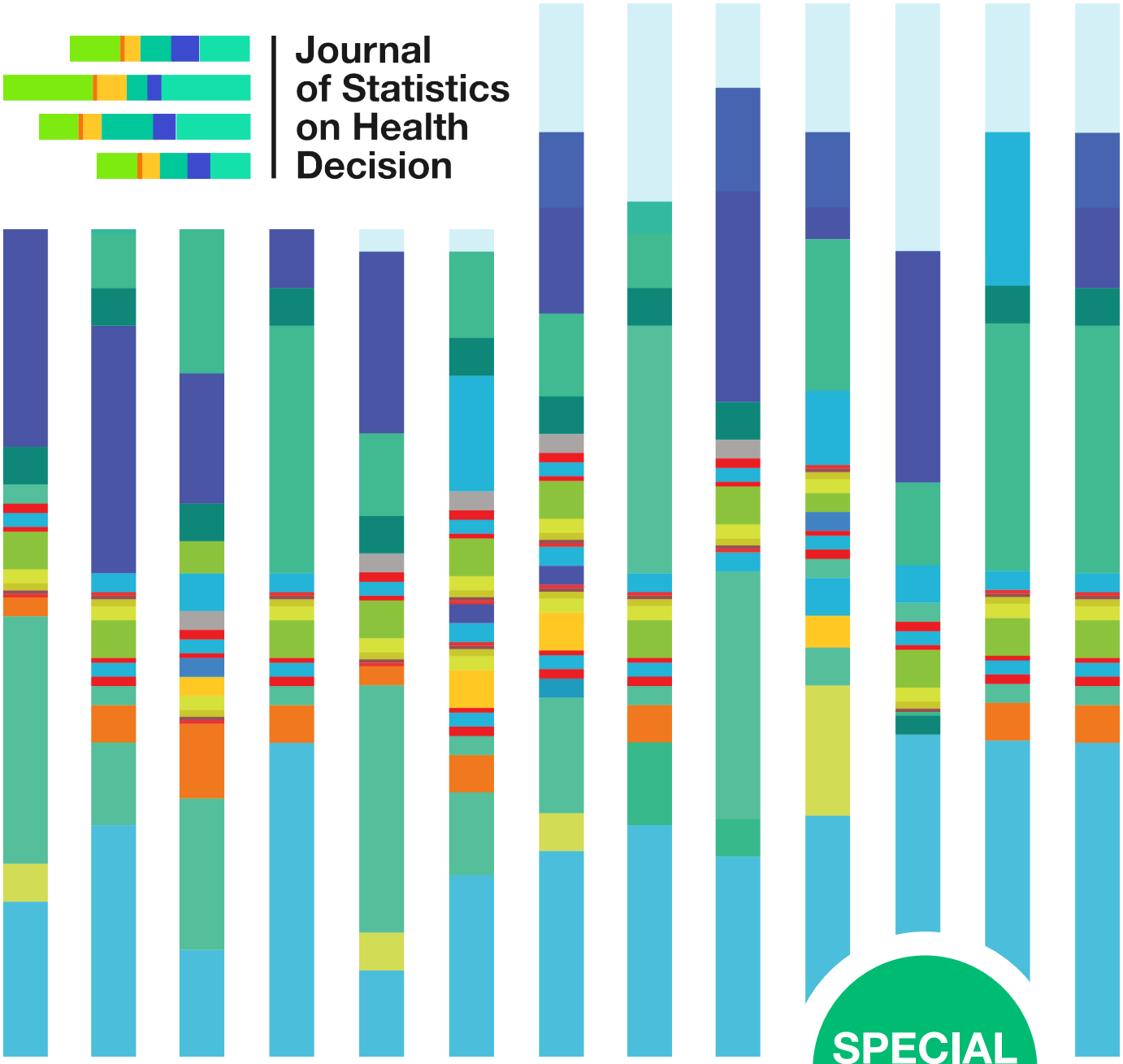

SPECIAL ISSUE

# 6th Statistics on Health Decision Making: Artificial intelligence

## July 4-5, 2024 | University of Aveiro

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2024 | Volume 6 | Issue 1

Journal of Statistics on Health Decision



# 6th Statistics on Health Decision Making: Artificial intelligence

## July 4-5, 2024 | University of Aveiro

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# P01
# How old are you? Are you a minor? Artificial Intelligence on decision making in Forensic Medicine: Where are we?

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Keywords: Dental Age Assessment, Supervised Machine Learning, Convolutional Neural Network, Legal Age Thresholds

**Background:** A broader practical application of Artificial Intelligence in forensic medicine and forensic dentistry has yet to emerge, mainly in the field of age estimation. Age estimation is one of the fundamental steps of the forensic process. Knowing the age is an important factor considered in many facets of a person's life and death. Age estimation is used in legal proceedings to protect the rights of people without proper documentation, be it for seeking asylum or when taking care of a found child. Dental age is estimated by comparing the developmental stages of temporary and permanent teeth in humans with dental development charts prepared by different researchers, such as, for scoring system methods we used: Moorrees, Fanning, and Hunt, Haavikko, Kullman, Demirjian and Gleiser and Hunt, whereas for the age estimation methods, we used: Mincer et al., Caldas et al., Lee et al., Köhler, and Liversidge.The purpose of this pilot study was to develop an accurate diagnostic system based on Artificial Intelligence for age-group estimation using a convolutional neural network (CNN).

**Methods:** 876 orthopantomographs (OPGs) from Portuguese population (451 females and 425 males) aged between 10 to 25 years old were collected from the database of Lisbon North University Hospital Center, using a procedure approved by the Ethic Committee. Data were randomly divided into 70% for training, 15% for validation, and the remaining 15% for testing. After the learning procedure (model estimation), the classification reliability assessment was performed on the test data to evaluate the model's ability to properly generalize to new data.

**Results:** Using Tensorflow and Keras packages on Python, through the VGG16 architecture with pre-trained weights (deep transfer learning) we obtained more than 90% accuracy for classifying minors by teeth number 38 and 48, as well as a reasonable capacity to classify stages for Demirjian and Moorrees, Fanning, and Hunt stages of tooth development.

**Conclusions:** From this study, we can conclude that the results obtained tend to reveal better accuracy than the usual results obtained by traditional methods. Nevertheless, increasing the size of the training sample is required to obtain a model suitable for expert practice.

**Ethics committee and informed consent:** The investigation has been approved by the Ethics Committee of the Lisbon Academic Center of Medicine – Ref.ª N.o 04/23, 3rd March 2023. **Conflicts of interest**: No conflict of interest to be declared. **Acknowledgements**: Research partially financed by national funds through FCT– Fundação para a Ciência e a Tecnologia under the project UIDB/00006/2020 (https://doi.org/10.54499/UIDB/00006/2020) and by the project Tooth Analysis in Forensic and Archaeological Research IP 2020-02-9423

# P02
# Comparison of Therapy for Vesiculobullous Diseases Pemphigus/Pemphigoid: Observational Study at Unidade Local de Saúde Santa Maria (ULS Santa Maria).

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Keywords: Epidemiology, Pemphigus, Pemphigoid, Therapeutics, Vesiculobullous Dermatoses.

**Introduction:** Autoimmune bullous dermatoses constitute a group of diseases clinically characterized by the formation of blisters, as a result of the specific action of autoantibodies. Pemphigus vulgaris is a chronic and systemic bullous vesicle dermatosis, which results from the production of pathogenic autoantibodies against desmogleins 1 and 3. The intraepithelial blister that characterizes this disease is the result of the phenomenon previously described. Otherwise, when antibodies show specificity for components of the epithelial-connective junction, subepithelial blisters are formed, characteristic of pemphigoid pathology. Thus, pemphigoid is a bullous disease of autoimmune origin and chronic character. The aim of this study is to assess the epidemiological characteristics of pemphigus vulgaris and pemphigoid and evaluate the therapeutic management.

**Methods:** Two 10-year's observational case series studies were carried out at the Dermatology Service of Hospital de Santa Maria, ULS Santa Maria for each 2 types of bullous disease. The study included 99 patients diagnosed with pemphigus vulgaris and 236 patients with a diagnosis of pemphigoid diagnosed between 2013 and 2022. Clopper-Pearson 95% confidence intervals (95% CI) were calculated through SPSS (Statistical Package for the Social Science) version 29.0.

**Results:** Considering pemphigus vulgaris, corticosteroids were the most prescribed pharmacological group (63.4%), being prednisolone used in 84.8% of patients who underwent corticosteroid therapy, with statistically significant differences from the other types of therapeutics, with a probability of 40.9% to 58.4% of prescription considering all patients (95% CI). Immunosuppressants were the second most used drug group (22.1%), with azathioprine being the preferred active ingredient with a probability of 44.3% to 73.6% (95% CI). Rituximab was used in 21 patients. Furthermore, antihistamines were prescribed to 31 patients (14.6%). The most used drug combination was one systemic corticosteroid, one topical corticosteroid, and one immunosuppressant, in 14 patients (14.1%). The average disease duration was 304 days, and the time without active disease for individuals who experienced relapse (35.4%) averaged 415 days. Considering pemphigoid, the most used corticosteroids were prednisolone (90.5%), with statistically significant differences from the other types of therapeutics, with a probability of 18.1% to 23.6% (95% CI) and clobetasol propionate (66.0%) with a probability of 12.8% to 17.7% (95% CI). The most prescribed antihistamine was hydroxyzine (57.9%), the most prescribed antibiotic was doxycycline (42.3%), and the drug of choice among immunosuppressants was azathioprine (76.8%). The average cure time was 148 days and 32.0% of patients experienced relapses.

**Conclusions:** Regarding pemphigus vulgaris, corticosteroid therapy was the most prevalent treatment. However, currently, first-line treatment is increasingly directed towards the use of rituximab, employed in approximately 25% of the study sample. On the other hand, corticotherapy proved to be the first line of treatment for pemphigoid, however, antibiotics were also widely used.

**Ethics committee and informed consent:** The 2 protocols designed were approved by the Lisbon Academic Center of Medicine (CAML) and the Lisbon North University Hospital Center (CHLN), approval numbers 19/23 e 30/23. **Acknowledgements:** This work is partially financed by national funds through FCT – Fundação para a Ciência e a Tecnologia under the project UIDB/00006/2020. . https://doi.org/10.54499/UIDB/00006/2020

# P03
# Dental Trauma and Forensic Medicine: Is the Civil and Labor Portuguese National Disability Table Update?

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Keywords: Assessment of Bodily Injury; Impairment Assessment; Civil and Labor Portuguese Disability Tables; Dentoalveolar trauma; Forensic Medicine.

**Introduction:** Dental trauma is complex, as it includes a wide range of different injury types with each type requiring specific considerations. It constitutes the fifth-most prevalent disease, and nearly 900 million individuals from 7 to 65 years of age are affected. Dental expertise is crucial to assess the permanent functional impairment that result from it in terms of Civil and Labor Law, through the Table of Disabilities. In 2022, the World Health Organization recognizes the Andreasen Classification of Traumatic Dental Injuries. The aim of this study is to analyze epidemiological and etiological aspects of the traumatic dental injuries and their sequelae in patients treated in Hospital Santa Maria with regard to the civil and labor Portuguese disability tables.

**Methods:** A retrospective observational case series study was conducted from 2016 until 2022, in the emergency service in Hospital Santa Maria. The inclusion criteria were presence of dentoalveolar trauma in the emergence service. The data were then analyzed and statistically treated through SPSS (Statistical Package for the Social Science) version 29.0. Hypotheses were tested using the one-sample binomial and chi-square tests, and Clopper-Pearson 95% confidence intervals (95% CI) for proportions and contingency coefficients were calculated.

**Results:** The total sample comprised 1678 patients, 1042 male (62.1%) and 636 female (37.9%). Males and individuals younger than 10 years were the most affected. The falls are the main etiology with statistically significant differences, with a probability of occurrence between 40.1% to 44.9% (95% CI), followed by school accidents between 27.8% and 32.3%, due to labor accidents between 1.1% and 2.4%, due to aggression between 5.6% and 8.1%, due to domestic accidents between 0.6% and 1.6%, due to sports accidents between 1.9% and 3.5%, due to car accidents between 1.4% and 2.8%, due to a fall after lipothymia/seizure/vasovagal reaction/syncope between 1.5% and 2.9%, due to a clash between 3.9% and 6.0%, due to hit by a car between 0.7% and 1.8%, due to accidents with animals between 0.2% and 0.9%, and due to attempted suicide between 0.001% and 0.3%.There is a statistically significant relationship between the variables etiology/sex and etiology/age ($p = 0.000$). Fracture was the most common of all, affecting mainly the anterior teeth, with statistically significant differences occurring between the maxillary anterior teeth (57.5%) and the remaining teeth. The most affected locations were the incisal edge (20.4%) and enamel plus dentin (18.3%), revealing statistically significant differences in relation to the remaining locations. Regarding the occurrence of pre-existing conditions to the trauma, the most frequent one was malocclusion (1.4%). Facial injuries associated with dentoalveolar trauma were observed being the most common injury lip laceration (37.2%), followed by lip contusion (23.6%). The most applied treatment was immobilization (24.91%), analgesics were frequently prescribed and soft and cold diet was the most indicated postoperative care (13.83%).

**Conclusions:** Males and school-aged children have a higher incidence of dentoalveolar trauma. Enamel fracture is the most frequent injury occurring, mostly, in the anterior teeth. The Portuguese National Table of Disabilities due to Work Accidents and Illnesses Professionals and the Permanent Disability Assessment Table in Civil Law needs a reevaluation of the dental sequelae according to Andreasen Classification, since it is under valuated.

**Ethics committee and informed consent:** The current research was approved by the Lisbon Academic Center of Medicine (CAML) and the Lisbon North University Hospital Center (CHLN), and subjects gave their informed consent before they were enrolled in the study, approval number 385/21. **Acknowledgements:** This work is partially financed by national funds through FCT – Fundação para a Ciência e a Tecnologia under the project UIDB/00006/2020. https://doi.org/10.54499/UIDB/00006/2020.

# P04
# Outpatient oral surgery. Which NSAIDs/Analgesics to prescribe? A systematic review and meta-analysis

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Keywords: Analgesics; Anti-inflammatory drugs; Oral surgery; Postoperative pain.

**Introduction:** The prescription of anti-inflammatory drugs after oral surgery plays a fundamental role in the control of postoperative pain and inflammation. Drugs, such as non-steroidal anti-inflammatory drugs (NSAID's) and analgesics, decrease discomfort, edema and promote faster scarring, depending on the dosage and posology prescribed. The aim of this systematic review with meta-analysis is to characterize the current situation regarding the prescription of steroidal/analgesic or NSAID's in several oral surgery situations, to establish a clinical consensus about the preemptive administration for pain, swelling and trismus.

**Methods:** A systematic review and meta-analysis comprising 36 articles from 2013 to 2023 were conducted, adhering to predetermined inclusion and exclusion criteria, to address the PICO question: "What is the recommendation for prescribing anti-inflammatories and the respective therapeutic regime for different situations of oral surgery in a hospital setting?". According with the PRISMA recommendations, the protocol was subsequently registered in the PROSPERO database. Two reviewers conducted an independent analysis to mitigate the risk of bias and assessed the quality of the generated evidence. Cohen's kappa coefficient was used to establish the agreement between the two observers and the I2 statistics to assess heterogeneity between studies.

**Results:** 36 articles were selected, 6 retrospective and 30 prospective. According to Joanna Briggs Institute checklist, 15 articles were obtained with low, 18 moderate and 3 high risk of bias. Through GRADE system 1 article obtained very low quality, 11 low, 20 moderate and 4 high quality of evidence. The Cohen's Kappa coefficient obtained a result of 1. To carry out the meta-analysis, the active substances were divided considering the intensity of their duration of action (short <6h, medium 6-10h, long >10h) and chemical structure, with pain, edema and trismus being evaluated for each group. Ibuprofen 400mg was the most prescribed drug. When prescribed drugs with a medium duration of action, pain levels appear to be lower (day 1 – 2.5421 based on 6 studies). In relation to edema, in an initial phase, drugs with a long duration of action showed lower values and, in a final phase, those of medium duration stood out. Furthermore, the drugs that presented the best relationship for pain parameter, were the propionic acid derivatives (day 1 – 3.8227 based on 5 studies; day 2 – 0.9661 on 3 studies; day 3 – 0.4388 on 3 studies; day 4 – 0.1270 on 2 studies), while for the edema parameter, they were the acetic acid derivatives (day 2 - 12.1051, based on 3 studies; day 3 - 18.1617, on 2 studies; day 4 - 10.2886, on 4 studies).

**Conclusions:** The findings suggest that Ibuprofen emerged as the most frequently prescribed medication for alleviating postoperative pain, edema and trismus, with its analgesic efficacy deemed comparable or superior. The therapeutic regime demonstrating greater effectiveness involved administering Ibuprofen 400mg tablet every 8 hours.

**Clinical study registration number**: The systematic review was registered in the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42023420629).

# P05
# Retrospective analysis of a case series of patients with traumatic injuries to the temporomandibular joint in Hospital Santa Maria: A Medico-legal Framework for Impairment Assessment

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Keywords: Civil and Labor Portuguese National Disability Tables; Impairment Assessment; Medico-legal Assessment of Bodily Harm; Temporomandibular Joint; TMJ trauma.

**Introduction:** The assessment of bodily harm is based on a medico-legal analysis of the victim, particularly to their psychophysical integrity, with reference to the National Table of Disabilities. The traumatology of the temporomandibular joint results in varying levels of disability, hence the need to evaluate its etiologies, types of injuries and sequelae, considering a medico-legal framework within the scope of Civil and Labor Law. The aim of this study is to characterize the most frequent injuries resulting from temporomandibular joint trauma episodes, distributed by sex, age, etiology and experienced pain. In addition, it is intended to carry out a medico-legal framework of the resulting injuries and their sequelae.

**Methods:** A retrospective observational case series study was carried out, in individuals aged 16 and above, through the collection of data from clinical records related to temporomandibular joint trauma, which occurred between 2016 and 2022 in the Department of Stomatology in Hospital Santa Maria. The data were then analyzed and statistically treated through SPSS (Statistical Package for the Social Science) version 29.0. Clopper-Pearson 95% confidence intervals (95% CI) for proportions and contingency coefficients were calculated.

**Results:** During 7 years in Hospital Santa Maria the sample consisted of 59 patients, being 34 males (57.6%) and 25 females (42.4%). Regarding the traumatic etiology, falls were the most frequent (44.1%), followed by aggression (22.0%) and accidents (16.9%). The types of injuries were divided into joint, skin, bone, dental and muscle injuries. More than one type of injury may occur in the same individual, being the most common one joint injury (88.14%), with statistically significant differences when comparing with the other types. Within the bone injuries, the most common one was the unilateral subcondylar fracture (15.25%), followed by unilateral condylar fracture (13.56%). Male individuals recorded the maximum value obtained on the pain scale. Most individuals sought care on the day of the traumatic event, and the duration of treatment was, on average, 3.07 days, considering that in general there was no hospitalization. Several injuries and their sequelae are not contemplated in the Portuguese National Tables of Disabilities for civil and labor evaluation.

**Conclusions:** It was possible to establish a relationship between traumatic injuries due to falls and older female individuals, while younger male individuals suffer a greater number of traumatic injuries caused by aggression. The Oral Health Professional has a central role in the assessment of bodily damage, being the consultation of the National Table of Disabilities due to Work Accidents and Illnesses Professionals and the Permanent Disability Assessment Table in Civil Law essential in the medical-legal scope. However, the Portuguese National Table needs a reevaluation of the stomatological injuries and sequelae most frequently recorded, as well as its valuation.

**Ethics committee and informed consent:** The current research was approved by the Lisbon Academic Center of Medicine (CAML) and the Lisbon North University Hospital Center (CHLN), and subjects gave their informed consent before they were enrolled in the study, approval number 233/22. **Acknowledgements:** This work is partially financed by national funds through FCT – Fundação para a Ciência e a Tecnologia under the project UIDB/00006/2020. https://doi.org/10.54499/UIDB/00006/2020

# P06
# Analysis of the progression of Age-related Macular Degeneration using the novel Variable Influence Analysis model

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Keywords: Age-related Macular Degeneration, Belief Propagation, Factor Graphs, Personalised Medicine

**Introduction:** Age-related macular degeneration (AMD) disease is the leading cause of irreversible vision loss in the developed world at ages from 55. Its risk estimation was attempted using "genetic risk scores" and lifestyle and clinical characteristics, but is still difficult to acknowledge the characteristics' individual influence on the development of AMD. "Characteristics influence scores" (CISs) could be inferred from data-driven methodologies, but there are still limitations: machine learning and deep learning provide little interpretability, while Bayesian Networks (BNs) require large amounts of data and the events to be independent, which is not always the case (e.g. diabetes may be related to cardiac diseases).

Our goal is to obtain each CISs, for any transition between consecutive AMD stages, using a novel Variable Influence Analysis (VIA) model, as a Belief Propagation based generalisation of BNs, without the need to verify the independence condition and with the versatility to incorporate any number and kind of relations – to which we call "metrics" - between the characteristics and the disease, so to deal with unbalanced datasets. We also developed a variation of the VIA model that, taking the CISs, provides a patient-specific AMD "risk score" for any adjustable set of conditions.

**Methods:** The dataset used to test the model was obtained under the Coimbra Eye Study - a epidemiological study (NCT01298674, NCT02748824) of the prevalence, incidence after 6.5 years, and risk factors of AMD in the Mira cohort. Taking the dataset characteristics, we build a factor graph where to apply the VIA model. Being the dataset unbalanced at the level of the characteristics, we resort to the literature to choose the metrics that lead to the best suited CISs.

**Results:** The results were discussed by a medical team, who found interesting to compare CISs (e.g. the higher influence of genetic variants in ARMS2 and CFH genes, comparing to characteristics like diabetes) and see the changes when considering different stages transitions (e.g. the higher influence of smoking for higher transition stages).

**Conclusions:** The VIA model has the potential to guide the medical team in the best interventions for the reduction of the AMD risk, particularly in personalised medicine, but the same model could also be applied to other use cases, such as other root cause analysis problems. Being the model highly adaptable to the training dataset, its results are not meant to extrapolate to other populations over the same problem. A limitation, however, is the need to resort to some prior knowledge to choose the best suited metrics.

**Ethics committee and informed consent:** Signed informed consent was obtained for all participants, the study adhered to the tenets of the Declaration of Helsinki (2008) and was approved by the Association for Innovation and Biomedical Research on Light and Image (AIBILI) Ethics Committee. **Clinical study registration number:** The Coimbra Eye Study is composed of three studies: the Epidemiological AMD study (NCT01298674), the AMD Incidence Study (NCT02748824) and lifestyle and food habits questionnaire in the Portuguese Population aged 55 or more (NCT01715870). **Conflicts of interest:** The authors declare no conflict of interests. **Acknowledgements:** The authors would like to thank to the AMD Research Group at Association for Innovation and Biomedical Research on Light and Image (AIBILI): Rufino Silva, MD, PhD; Cláudia Farinha, MD, PhD and Patrícia Barreto, PharmD, Msc.

Journal of Statistics on Health Decision



# P07
# Evaluation of the antimicrobial resistance in a clinical laboratory: Python software development

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Keywords: Antimicrobial resistance, epidemiological chart, monitor, Python, software.

**Background:** Antimicrobial resistance is one of the biggest threats to global health. Identifying bacteria and their antimicrobial profile is a crucial step in the surveillance of the growing prevalence of multi resistance. Creating laboratory reports for this surveillance process is resource-intensive in time and cost. Developing custom software tools using informatics can enhance the efficiency of specific areas within the health care system. A software program will significantly enhance data collection processes, improving efficiency in identifying resistance profiles. These software tools can facilitate the continuous monitoring process and will benefit from the inclusion of future abilities like machine learning. Our study aims to develop a Python software tool to generate a statistical report based on the bacteria antimicrobial-resistance profiles. This will reduce the time spent by healthcare professionals and building up other possibilities in data analytics.

**Methods:** Python programming involving the usage of different libraries like Pandas, Streamlit, Matplotlib, Plotly, for analysing excel files containing the profiles of 65 antibiotics for each bacteria identified in the laboratory of ULSRA. Duplicate removal was based on a fifteen days collection time frame. Calculation of the percentage of resistance was based on definitions of susceptibility testing categories: susceptible, susceptible with increased exposure and resistant (EUCAST guidelines). A custom-made report was created with the resistance profile calculated based on the results of antimicrobial and of the statistical thresholds. Bar charts, treemaps and dataframes are formulated based on programming inputs.

**Results:** This software produces a generated epidemiological chart based on the upload of a .xls file. The chart is a dataframe that includes the relevant microorganisms with their specific resistances in percentage based on the statistical results. The user-friendly interface allows an exploratory data analysis, quickly enabling users to perceive the prevalence of the microorganisms and resistances by selection. The distribution of microorganisms can be perceived by bar charts and the resistance profile with tree maps. The generated infographic with side line information helps the user to have a descriptive analysis of the results by Service, Product and Antibiotic/Class of Antibiotic.

**Conclusions:** The development and use of this program in the hospital allows a local monitoring and reporting of antimicrobial resistance, promoting a more responsible use of antibiotics and reducing the spread of antibiotic-resistant organisms. It is essential for all hospitals to have tools for easy monitoring, interpretation, and communication to ensure the best support for decision making when prescribing of antimicrobial therapy. This software could be the basis for a sum up of future data analysis like machine learning, creating predictive analysis of sensibilities/resistances as also tendencies for the future.

**Conflicts of interest:** The authors declare no conflict of interests.

# P08
# Perspectives for a Conversion Model of 2 different OCTA devices in diabetic patients with correlated data.

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Keywords: Diabetic Retinopathy, Optical coherence tomography angiography (OCTA), correlated data analysis.

**Objective:** Diabetic retinopathy (DR) is a vascular eye disease caused by diabetes complications and a major cause of vision-loss in the working-age population. To assess agreement between eye-specific measurements produced by different optical coherence tomography angiography (OCTA) devices with correlated data and to develop a conversion model that translates vascular metrics into a standardized and comparable value.

**Methods:** A cross-sectional study was conducted in 118 subjects (n=231 eyes) with type 2 diabetes, distributed along 4 groups: 55 eyes with no DR, 69 with mild nonproliferative DR (NPDR), 54 with moderate NPDR and 53 with severe NPDR. Each eye underwent OCTA scans from different devices: Angiovue® and Angioplex® and measurements of Vessel Density (VD) in the Inner Ring (InR) and Full Area (FuA) were collected.

Agreement between measurements was assessed by Intraclass Correlation Coefficient (ICC) and Bland-Altman plots. ICC was calculated using a linear mixed model (LMM), with device as a fixed effect and eye level random effect nested within each subject, with parametric boosting for 95 % CI estimation. A conversion equation was established to transform values from Angiovue into Angioplex-equivalent, using generalized estimating equations, considering the correlation between both eyes of the same patient with an exchangeable correlation matrix. The dataset was split into 70%|30% for training and testing the model while keeping the proportion between the number of eyes in each severity group. Bland-Altmann plots were used for visualization of the agreement and bias between predicted vs observed measurements. Limits of agreement and 95% CI on the differences between the observed and predicted measurements were computed using LMM, including subject random effect and severity group as fixed effect.

**Results:** From the 118 subjects included in the analysis, 74% were males, with an overall median (IQR) age of 68.5 (13.0) years. ICC between both devices showed a poor measurement agreement in the InR ICC= 0.25 [0.24,0.27]) and FuA (ICC=0.28 [0.26,0.30]). For each conversion equation, differences between predicted and observed values were visualized with Bland-Altman plots and the mean differences and the limits of agreement were calculated -0.87 (95% CI [-5.73,3.99]).

**Conclusions:** Both OCTA devices use distinct algorithms to measure VD. In this study, we propose a conversion model to obtain comparable VD measurements in eyes of diabetic patients with distinct DR severity levels. This conversion model may allow to pool data from different OCTA devices, allowing comparison of results within and between groups in clinical trials using both instruments.

**Ethics committee and informed consent**: The current research was approved by an independent ethics committee and subjects gave their informed consent before they were enrolled in the study. **Clinical study registration number:** NCT05112445 **Conflicts of interest:** None; Chingning T. Yamaguchi is a Boehringer Ingelheim employees.

# P09
# Profile of non-communicable disease risk factors among workers in a higher education institution.

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Keywords: Cardiometabolic risk factors; Healthy workplace; non-communicable diseases.

**Background:** Most academic workers have higher educational and economic levels than the general population. Given the position they occupy in relation to the young people who depend on them academically, it is expected that their health behaviours tend to be good examples for others to follow, constituting as a lower group risk of developing non-communicable diseases (NCDs). This study was carried out to estimate the prevalence of NCD risk factors among workers at a higher education institution (HEI) and determine the factors associated with them.

**Methods:** We conducted a cross-sectional study among workers (teachers, researchers and remaining staff) who were at the Occupational Medicine (OM) waiting room from June 2017 to June 2018. We assessed NCDs behavioural, physical and biochemical risk factors using an anonymous self-applicable questionnaire (e.cuidHaMUs). The chi-square test was employed to determine the association between socio-demographic variables and NCD risk factors (tobacco use, harmful alcohol consumption, overweight or obesity, hypertension, diabetes mellitus physical and hypercholesterolemia). The version 28 software of SPSS was used to analyse data, and the level of statistical significance was set at $p < 0.05$.

**Results:** The response rate was 93.3%, and 50.2 % of the participants were women. Current tobacco use, and alcohol consumption were 15.0% (95% CI: 11.2-19.3) and 61.6% (95% CI: 56.0-66.9) respectively with significantly higher prevalence among men ($p<0.001$). Overweight or Obesity (BMI >25 kg/m2) was 47.0%, with a significantly higher prevalence among men ($p=0.004$) and those who were married ($p=0.002$). Prevalence of hypertension was 19.6 % (95% CI: 15.4-24.2), and diabetes mellitus was 10.1 % (95% CI: 7.0-14.0) were significantly higher among men ($p=0.006$) and those aged ≥55 years ($p=0.032$). Almost of half of workers, 56.8% (95% CI: 51.1-62.4), had hypercholesterolemia and a quarter (25.0%) reported having some type of pain (acute or chronic), with a significantly higher prevalence among women ($p=0.004$).

**Conclusions:** The high prevalence found for several risk factors studied for NCDs requires urgent attention by responsible of HEI to take advantage of working hours to encourage participation in lifestyle programs that can control or reduce high cholesterol, such as physical activity, nutrition, abstain from using tobacco and addressing obesity.

**Ethics committee and informed consent:** The current research was approved by an independent ethics committee and subjects gave their informed consent before they were enrolled in the study. **Conflicts of interest:** The authors declare no conflict of interests. **Acknowledgements:** The authors wish to thank the workers and Rectory team of University of Aveiro. This work is financed by national funds through FCT Fundação para a Ciência e a Technology, I.P., within the scope of the project "RISE - LA/P/0053/2020" a through CIDMA - Center for Research and Development in Mathematics and Applications, within project UIDB/04106/2020 (https://doi.org/10.54499/UIDB/04106/2020) and UIDP/04106/2020 (https://doi.org/10.54499/UIDP/04106/2020).

# P10
# Physical Activity and Anxiety facing musical performance - an observational study on young musicians

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Keywords: Anxiety; Musical Performance; Physical activity

**Introduction:** Anxiety about musical performance is well-known among amateur or professional musicians. Adopting strategies to deal with this emotion is very diverse among different musicians, but the practice of physical activity has been described as one of the most prevalent. The objective of this work was to analyze the association between the practice of physical activity and levels of anxiety self-reported by young musicians.

**Methods:** An observational study carried out on young musicians through an online questionnaire, which included scales about the levels of anxiety in musical performance (KMPAI-A), physical activity habits (IPAQ-SF), depressive and anxiety symptoms (PHQ-9 and GAD-7, respectively), and questions about the sociodemographic data of the participants. Data analysis included descriptive and inferential statistics. To compare the variables of interest between two groups (independent samples) Student's t-test or the Mann-Whitney U test were used. The association of quantitative variables was analyzed using Spearman's correlation coefficient when the assumptions for using the coefficient of Pearson's correlation were not met.

**Results:** One hundred fifty-two questionnaires fulfilled the established requirements. The mean age of the participants was 20.7y±2.7y (min-max, 16y-25y). Most participants were female (n=94, 61.8%) and lived in the North of Portugal (n=96, 63.2%). The mean value for anxiety in musical performance was 51.9±16.7. The mean value of the PHQ-9 was 7.8±5.4, and for GAD 7 was 8.4±4.9. Most practice regular physical activity (n=94, 61.8%), with the median of vigorous and moderate activities being, for each, 60 minutes per week (IQ1-IQ3, 0-240), while for walking the median was 210 minutes per week (IQ1-IQ3, 100-420). A statistically significant difference occurred between participants who practice physical activity or sport regularly, with smaller values in KMPAI-A, compared with those who do not (49.2±17.4 vs 56.3±14.6, p=0.010). An association between values of the KMPAI-A and the time spent practicing vigorous physical activity was weak but statistically significant (Spearman's rho=-0.25, p=0.002). An identical relationship was found for the GAD-7 (7.6±4.6 vs 9.7±5.2, p=0.011) and for the PHQ-9 (6.8±4.7 vs 9.3±6.2, p=0.015), with lowest values in those who reported practicing physical activity or sports regularly. Also, a weak association was found between the time spent practicing vigorous physical activity with the GAD-7 (Spearman's rho=-0.21, p=0.010), and with the PHQ-9 (Spearman's rho=-0.17, p =0.036).

**Conclusions:** Young musicians should be aware of the potential benefits of vigorous physical activity for dealing with anxiety facing musical performance. Future work should include other age groups.

**Ethics committee and informed consent:** Subjects gave their informed consent before they were enrolled in the study. **Conflicts of interest:** The authors declare no conflict of interest

# P11
# Machine learning algorithms for enhanced thyroid disease classification

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Keywords: Classification; Decision trees; K-nearest neighbors; Support vector machine; Thyroid disease

**Introduction:** The thyroid gland produces hormones that regulate body functions like metabolism, heart rate, and temperature. Disruptions in this balance lead to two main conditions:

- Hyperthyroidism (excess hormone production), causing rapid heart rate, weight loss, anxiety, tremors.
- Hypothyroidism (underproduction), causing fatigue, weight gain, sensitivity to cold, depression.

Traditional thyroid disease diagnosis involves extensive clinical evaluation and lab tests. Machine Learning (ML) offers a promising approach to improve accuracy and diagnostic efficiency. This study explores various ML techniques for thyroid disease classification. By leveraging comprehensive datasets and advanced analytics, we aim to enhance diagnostic accuracy, aiding healthcare professionals and ultimately improving patient care, and enable earlier diagnoses, reducing wait times and optimizing resource allocation.

Previous research has shown that ML models can significantly improve diagnostic processes. For instance, a study by Asif et al. demonstrated that a deep learning approach utilizing neural networks outperformed traditional diagnostic methods in identifying thyroid abnormalities, leading to more precise treatment plans [1]. Additionally, another study by Lee and Park highlighted the effectiveness of support vector machines (SVM) in classifying thyroid nodules with high accuracy, further validating the potential of ML in this field [2]. The integration of ML techniques in thyroid disease diagnosis holds considerable promise, potentially transforming clinical practices and improving patient outcomes through more accurate and efficient diagnostic processes.

**Methods:** In our pursuit of effectively detecting the three target conditions, healthy, hypothyroidism, and Hyperthyroidism, we employed a diverse set of machine learning classification algorithms, including Support Vector Machines, Decision Trees, and Kernel Nearest Neighbors (see [3] for more details). To enhance the generalizability and performance of these models, we implemented a two-pronged pre-processing approach. This involved feature selection based on the Pearson correlation coefficient to identify the most relevant features and dataset balancing using oversampling to address class imbalance, specifically focusing on increasing the representation of the less frequent class.

**Results:** Model performance was assessed using accuracy, recall, precision, and F1-score, with focus on F1-score, because it helps to strike a balance between catching all the true cases (high recall) and minimizing incorrect diagnoses (high precision). The best model achieved a value of 0.92 for this metric using Machine Learning Feature Selection and a Decision Tree model.

**Conclusions:** Our findings suggest that ML algorithms have potential for diagnosing thyroid disorders. Further research is needed to optimize model parameters and validate them on independent datasets.

**Conflicts of interest:** the authors declare no conflict of interests. **Acknowledgements:** This work is supported by CIDMA – Center for Research and Development in Mathematics and Applications through FCT – Fundação para a Ciência e a Tecnologia, within projects UIDB/04106/2020 and UIDP/04106/2020, with links https://doi.org/10.54499/UIDB/04106/2020 and https://doi.org/10.54499/UIDP/04106/2020.

**Supplementary material:** Available online

# P12
# Detecting outliers in the clinical pathways of patients with cataracts

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Keywords: Outlier Detection, Sequence Analysis, Clinical Pathways, Cataracts

**Background**: Cataracts are a multifactorial and chronic medical condition, marked by a decline in visual acuity due to lens opacification. Without appropriate treatment, this condition can progress to blindness. As the population ages, there is a gradual increase in both the incidence and prevalence of cataracts, resulting in augmented pressure on the Portuguese National Health Service. This scenario emphasizes the necessity for efficient management of the clinical resources associated with this condition. Therefore, this study aimed to identify outliers in the sequence of clinical activities experienced by cataract patients.

**Methods**: A total of 1949 clinical records from 2022 to 2023 of patients diagnosed with cataracts were studied using sequence analysis. Each analyzed sequence represents a chronological succession of clinical activities that make up each patient's clinical pathway (CP). The patients' CPs were categorized based on the eye that was operated on: those who had surgery on only one eye (A1) and those who had surgery on both eyes (A2). The longest common subsequence (LCS) (dis)similarity measure was applied for the pairwise comparison of the CPs and, subsequently, the application of four unsupervised machine learning algorithms for detecting outlier pathways, namely k-nearest-neighbor, local outlier factor, density-based spatial clustering of applications with noise and hierarchical density-based spatial clustering of applications with noise. We used the Mann-Whitney U test ($\alpha = 0.05$) to determine if outlier CPs differed significantly from normal ones, based on 9 clinical resource consumption variables.

**Results**: Of all CPs, 1326 corresponded to A1 and 623 to A2. Using a conservative approach where all algorithms classified the pathway as an outlier, we identified 31 (2.34%) outlier pathways in A1 and 11 (1.77%) in A2. With a less conservative approach, where at least 3 out of 4 algorithms identified the observation as an outlier, we found 60 (4.52%) outliers in A1 and 25 (4.01%) in A2. In the conservative approach, 8 and 7 out of the 9 variables evaluating clinical resource consumption were statistically significant for A1 and A2, respectively. In the less conservative approach, all 9 variables were statistically significant for A1, and 8 were significant for A2.

**Conclusions**: The two groups differ in terms of clinical resource consumption, with the presumption that outlier pathways incur higher resource expenditures. The applied methodology appears promising in identifying these unusual cases, which could be valuable for a more comprehensive analysis aimed at reducing costs and improving the delivery of healthcare services.

# P13
# Exploring the topological properties of Gait time series as a complementary tool in levodopa dose decision in Parkinson's disease

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Keywords: Topological data analysis, Gait time series, Levodopa, Idiopathic Parkinson's disease and Vascular Parkinsonism

**Introduction**: Topological data analysis (TDA) has recently been used to generate topological features that allow distinguishing gait patterns [1,2]. These features have also been used to improve the performance of machine learning classifiers in identifying different pathologies based on gait [3,4]. The evaluation of the response to levodopa medication in Parkinson's Disease (PD) is useful for adjusting treatment and is considered a good biomarker for the diagnosis of Vascular Parkinsonism [5]. Our study aims to explore the potential of analysing gait time series data, focusing on its topological properties through TDA, as a complementary information for evaluating the response to levodopa.

**Methods**: The gait data used in this study is the same as those described in [5], captured Physilog sensors (GaitUp®) to measure spatiotemporal and foot clearance gait variables while the participants walked along a 60-meter corridor at self-selected speeds. The study comprised 29 patients with Parkinsonism, including 15 patients diagnosed with Idiopathic Parkinson's Disease (IPD) and 14 with Vascular Parkinsonism (VaP). Participants were assessed during both the "Off" phase (after 24 hours without levodopa) and the "On" phase (following a supra-threshold levodopa challenge, set at 150% of their morning dose). In the "On" phase, levodopa dosage was standardised to a supra-threshold challenge, providing a consistent measure of the medication's effect on gait. Stride length time series data were analyzed using computational topology techniques, focusing on persistence diagrams. Different features were extracted from the persistence diagrams, including Bottleneck and Wasserstein distances, mean lifetime, total number, and maximum lifetime of the holes in dimension 1, as well as the number of holes that persist beyond a given threshold in dimension 1. These features were faced with the traditional measures, such as mean and coefficient of variation. Wilcoxon test were used to compare differences between "Off" and "On" phases across various patient subgroups, evaluating the statistical significance of the features in comparison to traditional measures.

**Results:** Preliminary findings suggest that the response to levodopa influences the topological features of stride length patterns in patients with Parkinsonism. In some subgroups of patients, no statistical differences were found in the mean and coefficient of variation, but significant differences were observed in certain topological features. Specifically, in one case, this difference manifested as a more unstable dynamic of the stride length, suggesting that the medication may not have a beneficial effect. In other cases where improvements in mean values were not statistically significant, significant changes were observed in some topological features.

**Conclusions:** Our results indicate that topological properties derived from TDA can provide valuable complementary information for assessing the impact of levodopa. This information could be useful for refining levodopa dose prescriptions with Parkinson's Disease and related conditions.

**Acknowledgements:** We thank the Fundação para a Ciência e a Tecnologia (FCT) for the financial support provided through the doctoral scholarship with reference 2023.02242.BDANA and the support of Portuguese funds through the Center of Mathematics of the University of Minho and FCT, within the projects UIDB/00013/2020 and UIDP/00013/2020.

**Supplementary material:** Available online

# P14
# Epidemiological study on central venous catheter infections in a burn unit over three years

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Keywords: Infection; central venous catheters; fluid therapy; burns

**Introduction**: Extensive burns represent a type of traumatic injury, affecting the skin and often involving underlying tissues, associated with substantial loss of fluids and proteins due to increased vascular permeability. If not properly treated, they can lead to hypovolemic shock, necessitating adequate fluid replacement. The large volume of fluids to be administered often requires the use of central venous catheters (CVCs), which is associated with an increased risk of infection, both at the insertion site and systemically. Thus, the primary objective of this article is to understand the characteristics associated with CVC infection and identify statistically relevant risk factors for mortality and CVC infections between 2020 and 2022.

**Materials and Methods**: For the present study, information was collected from the Burns Unit database and from the Clinical Pathology Service database of the Centro Hospital e Universitário de Coimbra (CHUC) regarding patients with CVCs hospitalized between January 2020 and December 2022. The patients age ranged from 44 to 77 years with mean of 62. A comparative analysis of the characteristics and clinical outcomes of these patients, with and without CVC infection, was conducted using various statistical tests, including logistic regressions to assess the risk factors associated with infection and mortality.

**Results**: Throughout the study period, 398 patients were analyzed and the demographic characteristics of them remained consistent for the variables analyzed, whether in the presence or absence of CVC infection. However, statistically significant differences between these two groups of patients were found regarding the percentage of total body surface area burned (OR=1.06, p-value=<0.001) and the average length of hospital stay (OR=1.10, p-value=<0.001), all of which were higher in patients with CVC infection. Furthermore, it was observed that the probability of death increased with both the percentage of burned body surface area (OR=1.06, p-value=<0.001) and the patient's age (OR=1.05, p-value=<0.001).

**Conclusions**: In summary, over these three years, from 2020 to 2022, there has been a decrease in the likelihood of patients developing an infection, with the last year being the only significant one. Conversely, patients with larger percentages of burned body surface area and/or longer hospitalization days are statistically associated with a higher risk of infection. Regarding the patient's outcome, it was shown that the probability of death is directly related to the percentage of burned body surface area as well as the patient's age.

**Ethics committee and informed consent**: The current research was approved by an independent ethics committee and subjects gave their informed consent before they were enrolled in the study.

# P15
# The Importance of Measurement Scales Continuous versus Ordinal in Model-Based Clustering Methods – A Case Study on Maternal Health Risk Data

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Keywords: Clustering, EM algorithm, Maternal health, Ordinal data, URV approach

**Objective**: Several clustering methods have been developed for continuous multivariate data. However, these methods are often applied to analyse and cluster ordinal data as if they possess metric properties, thereby overlooking their ordinal nature. This study focuses on model-based clustering methods based on parameterized finite Gaussian mixture modelling, which utilize Expectation-Maximization (EM) algorithms to identify clusters. Using a public data set of maternal health risks, the recovery ability of these types of clustering methods is investigated when the ratio scale of the data is changed to an ordinal scale.

**Methods**: The EM algorithm clustering method for ordinal data considered was the pairwise likelihood approach developed by Ranalli and Rocci (2016). This EM algorithm approach was used to estimate the parameter of the mixture model. For a standard URV (Underlying Response Variable) approach, it is assumed that the ordinal variables are generated by a discretization of underlying multivariate normal variables. In this work, an extension of the URV approach was applied by taking a mixture of multivariate normal distributions. The pairwise EM algorithm was compared with a model-based clustering (EM algorithm) method, the Mclust function, developed in R. The maternal health risk data set consists of 1014 observations where each observation (pregnant woman) is categorized into one of three risk levels (groups): "high risk", "mid risk" and "low risk". The measurements taken are age, systolic blood pressure (mmHg), diastolic blood pressure (mmHg), blood glucose levels (mmol/L) and heart rate.

**Results**: The continuous variables in the maternal health risk data were discretized to analyse them as ordinal data. Since the underlying latent mixture is known, the thresholds used for discretization of the latent variables, in the Pairwise EM algorithm, were those that maximized the adjusted rand index (ARI). The URV extension method recovered the cluster structure with an ARI of 0.38. Applying Mclust on the datasets an ARI of 0.15 was obtained.

**Conclusions**: The URV extension method can recover the cluster structure of the data even when it is applied to incomplete data and also to data that do not completely represent the original data (due to discretization). The present application shows that changing measurement scales from continuous (original data) to ordinal (via discretization) using URV method, can enhance the recovery ability of model-based clustering (EM algorithm) methods. The URV approach categorizes a pregnant woman as having a low, mid or high health risk during pregnancy with a higher degree of accuracy.

**Conflicts of interest**: The authors declare no conflict of interests. **Acknowledgements**: This work was supported by CIDMA and is funded by the Fundação para a Ciência e a Tecnologia, I.P. (FCT, Funder ID = 50110000187) under Grants https://doi.org/10.54499/UIDB/04106/2020 and https://doi.org/10.54499/UIDP/04106/2020

# P16
# Extending Survival in Octogenarian Patients through Coronary Artery Bypass Grafting: Survival Analysis using One-sample Log-rank Test

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Keywords: Coronary Artery Bypass, Octogenarians, Survival, Population Surveillance, Life Expectancy

**Background**: As life expectancy rises, coronary artery bypass grafting (CABG) is becoming more common among octogenarians. However, there's still limited data on the prognosis post-surgery for this population. The aim of this study was to compare long-term survival in octogenarian patients after CABG with a sex and aged-matched general population using 1-sample Log-Rank test.

**Methods**: Longitudinal, retrospective, single-center study including consecutive patients who underwent primary isolated CABG at an age of 80 or older, between 2004 and 2014. The primary outcome was all-causes mortality accessed in February 2023. Long-term survival was evaluated through survival curve in the octogenarian cohort and general population. Portuguese life tables were taken from the INE (Instituto Nacional de Estatística), specifically for the study period plus follow-up (2004-2022), to estimate the expected number of deaths, using the age-specific death rate. To construct the survival curve for the reference population, estimate standardized mortality ratio (SMR = observed deaths/expected deaths) and to conduct the one-sample Log-Rank test, comparing expected with observed deaths, we used a specific software provided by Massachusetts General Hospital Biostatistics Center. The median follow-up was 8 years, maximum of 15 years.

**Results**: Between 2004-2014, 184 octogenarian patients underwent primary isolated CABG, 68% being male, with age between 80 and 88. The majority of patients (73%) presented 3-vessels disease, 76% were classified as class IV according to CCS and 54% had experienced a recent myocardial infarction (<90 days). With respect to surgical techniques, the median [min-max] of implanted grafts was 2.0 [1.0- 5.0], 16% had bilateral internal mammary grafting and 48% were off-pump. Hospital mortality (within 30 days or before hospital discharge) occurred in 5% and the cumulative 1-year survival was 88%.. Of note, from the surviving patients in February 2023 (n=34), the median follow-up time was 10 years (ranging from 8 to 14 years). After excluding patients who had deceased earlier, i.e. before 1-year of follow-up (n=22), survival analysis comparing octogenarian CABG with the expected survival among an age/gender matched sample of the Portuguese population revealed that CABG could extend survival in octogenarian (SMR = 0.67, 95%CI: 0.55-0.82; p< 0.01).

**Conclusions**: This single-center retrospective study using one-sample Log-Rank test evidenced that CABG could offer a significant survival benefit in carefully selected octogenarian patients. Further analyses, with a larger sample, are needed to better understand which clinical characteristics and/or operative details are playing a relevant role on this result.

**Ethics committee and informed consent:** Considering the retrospective nature of the study patient informed consent was waived. This work was approved by the Ethics Committee of Centro Hospitalar de São João (ref: 279-19). **Conflicts of interest:** The authors have no conflict of interest to disclose. **Acknowledgements**: This study was financed by national funds through FCT Fundação para a Ciência e Tecnologia, I.P., under the scope of the Cardiovascular R&D Center – UnIC (UIDB/00051/2020 and IDP/00051/2020) and RISE (LA/P/0053/2020).

# P17
# The significance of Assessing Proportional Hazard Assumption in Cox Regression to evaluate sex differences after Coronary Artery Bypass Graft

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Keywords: Coronary Artery Bypass, Women, Survival, Population Surveillance, Life Expectancy

**Background**: Data on sex differences after coronary artery bypass surgery (CABG) still scarce and conflicting. The log-rank test and Cox analysis are used in clinical research to evaluate survival. Testing their proportional hazard assumptions is crucial for achieving accurate results. The aims of our study were assess the impact of gender and age on long-term survival after CABG and to compare the survival of patients with the expected survival of the Portuguese population.

**Methods**: Single center, longitudinal retrospective study involving patients who underwent primary isolated CABG (2004-2014). Patients were categorized by age: ≤60, 60-70 and ≥70 years to evaluate a potential interaction sex*age. The primary outcome was all-cause mortality (02/2023), that was studied using Kaplan-Meier curves, Log-Rank tests and multivariable Cox Regression with split analysis. To compare observed vs expected mortality in the general population (matched for sex and age), survival tables from the National Institute of Statistics (INE) were consulted. Kaplan-Meier curves for the reference population were compared to the surgical cohort using one-sample Log-Rank test. Standardized mortality ratios (SMR) were estimated.

**Results**: From 3978 patients included patient's, 21% were women (W). W were older (mean age 67±9 vs. 63±10 years, p<0.001) and had a higher prevalence of cardiovascular risk factors and severe chronic kidney disease compared to men (M). Although three-vessels disease was similar between sexes (p=0.111), W were frequently implanted with less grafts than M (2.49±0.89 vs 2.67±0.89, p<0.001). The prevalence of complete revascularization and the use of cardiopulmonary bypass was similar between groups. The mean follow-up was 11 years and maximum of 19 years. Cumulative survival for M vs W, at 5, 10 and 15 years of follow-up, was 89%vs88%, 73%vs68%, and 57%vs46%, respectively (Log-Rank p<0.001). However, after stratification by age, no differences between groups were found. Multivariable adjustment did not identify gender as an independent predictor of long-term survival in any subgroup. However, Schoenfeld residuals analyses indicated non-proportionality in the sex variable within the subgroup ≥70 years (p=0.040). In this subgroup, a time-stratified analysis at 10 years of follow-up was conducted, revealing that W had a higher risk compared to M after 10 years (HR: 1.42 [1.11-2.00], p=0.03). Comparing with the survival of the Portuguese population, CABG allowed M to equalize the risk of mortality to what was expected (SMR =1.1;95%CI:0.9-1.1), but W showed a higher risk of mortality after CABG than W in the reference population (SMR =1.6,95%CI:1.3-1.8).

**Conclusions**: Women evidenced similar outcomes to men in early and mid-term follow-up but older women exhibit poorer survival outcomes after 10 years, as revealed by split analysis. Additionally, W demonstrate inferior survival outcomes compared to the women of general population.

**Ethics committee and informed consent**: Considering the retrospective nature of the study patient informed consent was waived. This work was approved by the local Ethics Committee.

# P18
# Simulating the appointment scheduling in Primary Care Services using Poisson distribution.

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Keywords: Discrete-event Simulation, Poisson Distribution.

**Objective**: To effectively provide health services, the institutions need to allocate their resources according to the faced demand. This has led to appointment fixing for the Primary Care Services when feasible so that medical staff can distribute the resources according to the expected demand of services. Patients enter to the appointment scheduling system following some probability function. The objective of this study is to explore patterns in the scheduling of appointments when patient entries into the system are modelled using Poisson distribution.

**Methods**: Using R code for generating random numbers, entries to the system of Primary Care are simulated from a Poisson distribution. Then, three constraints are considered to fulfil the scheduling of requested appointments: the number of demands received, the availability of physicians (provided by a health professional) and ensuring that the maximum operational response time for the service is lower than the maximum guaranteed response time outlined in Portuguese legislation (Diário da República). In Portugal, a maximum number of days for a health service to be covered is fixed making it a performance indicator of the service for Portuguese health institutions. With the entries simulated, the number of days the system takes to assign an appointment date from the day it was requested are explored and identified the existence of failure. Furthermore, the operational maximum response time and its' patterns are studied.

**Results**: For the simple Poisson model, the simulation results have demonstrated improvements in the scheduling of appointments for Primary Care Services through minor modifications in the allocation of medical staff resources.

**Conclusions**: Although it is a work in progress, our preliminary results have been showing that these types of simulations may indicate potential changes that lead to a better service while meeting the requirements of the types of appointments for patients and medical staff. By understanding and identifying the patterns, we expect to be able to use the simulation of the model, in the future, for identifying the parameters of the system that will optimize the used resources in the Primary Care Services and complies with the performance indicators.

**Conflicts of interest:** The authors declare no conflict of interests. **Acknowledgements:** This work was supported by CIDMA and is funded by the Fundação para a Ciência e a Tecnologia, I.P. (FCT, Funder ID = 50110000187) under Grants https://doi.org/10.54499/UIDB/04106/2020 and https://doi.org/10.54499/UIDP/04106/2020. Diana A. Vázquez-Limón has a Starting Research Grant position, BII-BIOMATH-1-2024, under the Thematic Line of Biomathematics at CIDMA.

# P19
# The Effects of Regular Physical Activity on Musculoskeletal Pain Improvement: A Cross-Sectional Study

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Keywords: Exercise, Pain, Public Health, Work

**Objective**: Our study aimed to understand whether the self-reported physical activity levels before injury is related to self-reported improvements after physiotherapy sessions, as well as analyse the variables associated with regular physical activity practice.

**Methods**: A cross-sectional study was conducted among 60 employees at a firm with pain due to musculoskeletal disorders, who went physiotherapy between January 2023 and June 2023, and complete all the sessions prescribed by the physiatrist. The main outcome measures were self-reported physical activity practice and self-reported reduction in pain following physiotherapy, obtained through interviews for assessment purposes. To handle missing data, multiple imputation was applied using the MICE package in RStudio. To estimate the association effect sizes, we utilized both simple and multiple logistic regression models. Additionally, we employed StepAIC for feature selection

**Results**: A total of 60 patients were included in the analysis, 16% showed significant improvement after physiotherapy, 33% showed minor improvements and 50% did not showed any improvement. An association was found between the number of treatment sessions (P=0.028) and type of pain (P=0.017) with the level of improvement perceived. However, we did not find an association between a regular physical activity practice and the level of improvement (P=0.730). Multiple logistic regression indicated a statistically significant association between increased perception of improvement and the number of physiotherapy sessions attended (OR=1.40, 95% CI 1.03 to 2.09). Additionally, physical activity practice is greater among younger individuals (P=0.007).

**Conclusions**: Our study failed to establish any correlation between the perception of pain and the level of physical activity prior to the injury. Nonetheless, we identified a positive association between the number of sessions and perceived improvement. Patterns of physical activity practice among employees were comparable to those observed in the Portuguese population. Further research is necessary to understand effective methods of pain management, as well as to develop appropriate public health policies aiming to reduce age disparities in physical activity practice.

**Ethics committee and informed consent:** The current research was approved by an independent ethics committee and subjects gave their informed consent before they were enrolled in the study.

**Supplementary material:** Available online

# P20
# Longitudinal Analysis of Red Blood Cells Omics Data from COVID-19 Vaccination

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# both coordinate this study.

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Keywords: COVID-19 vaccination, Immune response, Longitudinal data, Metabolomic analysis, Red blood cells.

**Background**: Red blood cells are emerging as important modulators of the immune system. Despite evidence that alterations in RBC functionality are associated with disease severity in COVID-19 patients, there is no information regarding the impact of RBC activity on the immune response to COVID-19 vaccination. This work aims to establish an adequate methodology for the statistical analysis of longitudinal RBC metabolomics data collected during COVID-19 vaccination (n=22, 5 time-points) to identify metabolites with significant changes throughout the immunization process.

**Methods**: Given the large number of zero values in the mass spectrometry raw data set, which could represent either absent metabolites or abundances below the detection limits, an imputation step was required for the pre-treatment of the database. Additionally, a normalization method was developed for each individual $i$ and metabolite $j$ based on the expression $(X_{ij} - baseline_{ij})/(\max_{ij} - min_{ij})$ in order to rescale the data as individual's variations of concentration relative to the baseline of the metabolites' natural abundance in RBCs. To investigate which imputation algorithm was more adequate, two of the most commonly used methods in metabolomics, the k-nearest neighbors and the quantile regression imputation of left-censored data, were compared. In the case of the kNN algorithm, cosine and Mahalanobis distance measures were used due to their invariance to scale. Furthermore, the order in which the imputation and normalization steps were performed was also evaluated. The performance of each pair of imputation and normalization procedures was assessed by randomly selecting five patients and ten metabolites for each time-point and replacing the corresponding metabolite concentration values with NA. Then, the different pre-treatment methods were applied, and the resulting imputed and normalized data was saved. For reproducibility, this procedure was conducted 1000 times. Finally, the obtained values were compared to the normalized original data using four error measures. The method with the best performance was employed. The metabolomics data were modeled through Generalized Estimating Equations considering the Gaussian family and an exchangeable correlation structure.

**Results**: Testing of different pre-treatment methodologies showed that normalization followed by kNN imputation using cosine distance performed the best. Following its application, the GEE models constructed from the normalized data revealed that 30 out of 85 metabolites had significant changes in concentration along the different time-points of COVID-19 vaccination.

**Conclusions**: Further investigations are in progress to determine the relevance of these metabolites to the immunological role of RBCs in the vaccine-induced immunization process.

**Conflicts of interest**: The authors declare no conflict of interests.

# P21
# Regression Trees for Analyzing Longitudinal Health Data Streams: A comparative Study.

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Keywords: CVFDT, Dynamic Predictions, Longitudinal Studies, Regression Trees and VFDT.

**Introduction**: Chronic kidney disease (CKD) is characterized by kidney damage or an estimated glomerular filtration rate (eGFR) of less than 60 ml/min per 1.73 square meters for three months or more [1]. This study evaluates the performance of six tree-based machine learning models - Decision Trees [2], Random Forests, Bagging, Boosting, Very Fast Decision Tree (VFDT) [3], and Concept-adapting Very Fast Decision Tree (CVFDT) [4] - on longitudinal health data. Longitudinal data, where individuals are measured repeatedly over time, provide an opportunity to predict future trajectories using dynamic predictions that incorporate the entire historical dataset [5]. These predictions are essential for real-time decision-making processes in healthcare.

**Methods**: The dataset comprised 406 kidney transplant patients from the University Hospital of the Catholic University of Leuven, Belgium, spanning from January 21, 1983, to August 16, 2000 [6]. The study captured 120 time points over the first 119 days post-transplant, including baseline glomerular filtration rates (GFR), along with three static variables: weight, age, and gender. Data preprocessing involved robust imputation techniques to handle missing data, ensuring consistency and trend accuracy. The models were trained to predict health outcomes starting from the eighth day post-transplant, progressively incorporating daily values to predict subsequent days up to day 119. Model performance was evaluated using Mean Squared Error (MSE) and Mean Absolute Error (MAE) through data partitioning and cross-validation techniques.

**Results**: Ensemble methods (Random Forests, Boosting, Bagging) consistently outperformed other models, showing lower MSE and MAE. Incremental models (VFDT, CVFDT) showed higher errors, indicating less suitability for this dataset. The Boosting Regressor demonstrated the most effective performance for predicting post-transplant renal health outcomes over 119 days, highlighting its effectiveness in handling the complexity and variability in longitudinal data.

**Conclusions**: The study highlights the superior performance of ensemble methods in analyzing longitudinal health data for kidney transplant patients. Future research should focus on developing incremental algorithms that combine speed and accuracy, and on exploring the real-time application of these models in clinical practice.

**Acknowledgements**: We thank the Fundação para a Ciência e a Tecnologia (FCT) for the financial support provided through the doctoral scholarship with reference UI/BD/154394/2023.

**Supplementary material:** Available online

# P22
# Precision of minimal clinically important improvement (MCII) estimates: comparison of procedures

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Keywords: Anchor, MCII, Precision, PROMs

**Introduction**: Patient reported outcomes measures (PROMs), where patients provide direct input about their condition, are increasingly used in clinical studies and the management of patients. A challenge with PROMs is how to interpret the clinical relevance of a given change in the PROM. The minimal clinically important improvement (MCII) is the smallest change in PROM scores that signifies an important improvement to the patient. The primary approaches for calculating MCII are distribution-based and anchor-based. Anchor-based approaches, where changes in PROM are compared with scores on a second, explicit measure of patient improvement (the anchor), are generally acknowledged as most appropriate and relevant. The present work aims to compare the precision of MCII estimates obtained for the most popular procedures of cut-point estimation, to support the procedure choice for MCII estimation for PROMs.

**Methods**: We performed a simulation study comparing several receiver operating characteristics (ROC) based and non-ROC-based approaches to estimate the MCII using an anchor question, in various settings concerning sample size, latent anchor response distribution, and latent anchor-PROM correlation. The simulation and the data analysis were performed in R software (version 4.2.2). Precision was assessed as the width of bootstrapped confidence intervals for MCII.

**Results**: There was substantial differences in precision between the methods. In general, the Youden Index is among the most variable methods, while, conversely, the -45º Tangent line method is among the most precise methods. In extreme cases, 80% Specificity and 80% Sensitivity break down, namely for skewed distributions and smaller sample sizes (200 and 500). With larger sample sizes and stronger correlations between the latent anchor and PROM changes, the precision increases. The estimated MCII values vary substantially between the various methods.

**Conclusions**: The findings indicate that both sample size and the correlation between the latent anchor and PROM changes are critical factors affecting the precision of MCII estimates. The methods used differed both in terms of CI widths and the value of MCII estimates. This study provides valuable insights that can help researchers and clinicians select appropriate methods for MCII estimation. .

**Ethics committee and informed consent**: The current research was approved by an independent ethics committee and subjects gave their informed consent before they were enrolled in the study. **Conflicts of interest**: The authors declare no conflict of interests.

# P23
# A method for improving the generation of viral consensus sequences using adaptive models

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Keywords: Bioinformatics, Computational Biology, Computational Virology, Genomics, Virology.

**Introduction**: The increasing availability of diverse human viral sequenced samples has intensified the demand for the precise reconstruction of viral genomes. This need is particularly pronounced in clinical and forensic contexts, where having a correct representation of the genome is of paramount importance, but where the sequenced samples are particularly challenging to reconstruct due to low-depth coverage and high mutation rates. To increase the quality of the reconstruction process, multiple genome sequences belonging to an organism can be combined into a single sequence through the consensus-generating process.

**Methods**: To improve the consensus-generating process of viral genomes we developed a novel method, Optimized Adaptive Weighted-K (OAWK). This method is capable of analysing the genomes contained in an aligned multi-FASTA file and generating a consensus sequence in the FASTA format. To generate accurate consensus sequences OAWK retrieves information from each iteration of the consensus-generating process and based on that information it attributes different performance weights to each of the sequences contained in the multi-FASTA file considered. The OAWK is publicly available at https://github.com/cobilab/OAWK.

**Results**: The performance of OAWK was tested using nearly-synthetic and real datasets. The nearly-synthetic datasets contained the viruses B19V, HPV68, MCPyV and VZV, as well as contamination and mitochondrial DNA. To the viral genomes, between 0% and 15% of SNPs were added and the sequencing process was simulated with a depth coverage ranging between 2x and 20x. Using these datasets it was possible to observe that the OAWK improved the consensus-generating process by, on average, 88.5% in terms of the average identity, 46.8% in terms of the Normalized Compression Semi-Distance, 55.9% in terms of the Normalized Relative Compression, and retrieved over 8.5 times more bases than a commonly used method, EMBOSS, when set to the default parameters. Using real datasets, it was observed that the OAWK retrieved considerably more nucleotide bases than the commonly used method considered, resulting in more complete genomes.

**Conclusions**: The improvements observed with the use of OAWK are very significant as the increase in the accuracy and the quantity of bases in the consensus sequences can make a substantial difference in diagnosis and in the search for personalised clinical treatments.

**Conflicts of interest**: The authors declare no conflict of interests. **Acknowledgements**: This work was partially funded by National Funds through the FCT (Foundation for Science and Technology), in the context of the project UIDB/00127/2020. M.S. has received funding from the FCT - reference UI/BD/154658/2023. D.P. is funded by national funds through FCT, I.P., under the Scientific Employment Stimulus - Institutional Call – reference CEECINST/00026/2018.

# P24
# Environmental Exposure Index for Early Life Exposure Assessment Tool (ELEAT)

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Keywords: Autism Spectrum Disorder, Clustofvar, Eleat, Exposure Index, Factor Analysis Of Mixed Data

**Introduction**: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by a highly heterogeneous clinical presentation [1,2]. Multiple genetic factors explain 40% of ASD etiology [3]. Recent studies indicate a substantial effect of environmental factors on the onset of ASD [4]. To further understand the role of the environment in ASD, the Early Life Exposures Assessment Tool (ELEAT) was designed to collect very detailed data on environmental exposure during early development. The ELEAT is being administered to a sample of 102 children with ASD and 23 typically developing controls, collected from Hospital Pediátrico de Coimbra and Hospital Garcia de Orta. This aims to create an exposure index algorithm, enabling the assessment of exposure levels and facilitating comparisons between datasets, as well as the analysis of gene-environment interactions.

**Methods**: The Exposure Index is systematically developed through a logical sequence of steps [5]. This process begins with the selection of variables for the basic dataset, achieved by categorizing the 276 questions into three subsets, based on specific criteria: subset A includes variables that are known to be important, subset B comprises variables of uncertain significance for the final index, and subset C encompasses variables unrelated to exposure. To manage the extensive variable set, the ClustOfVar method is applied to subsets A and B. Variables from subset C are excluded from the analysis. Subsequently, to address the multidimensional nature exposure, we conduct a Factor Analysis of Mixed Data (FAMD) on the variables selected as those that most discriminate children with ASD from typically developing children. In this step, a set of orthogonal factors, intending to represent the various exposure dimensions related to ASD, is extracted from these variables. These factors are then transformed back into weighted original variables to create an aggregated index, termed the exposure index. Finally, we proceed with the validation of the index scores and removal of redundant variables, using multiple regression analysis of the orthogonal factors from the FAMD.

**Results**: It is important to note that this work is still in progress, and as such, it is only possible to mention some preliminary results. Following the initial filtering, we reduced the number of variables from 276 to 209, of which only 8 are quantitative. The ClustOfVar method yielded 81 variables. By applying FAMD, we extracted 16 factors, which led to the creation of the exposure index with 42 variables.

**Ethics committee and informed consent**: The current research was approved by an independent ethics committee and subjects gave their informed consent before they were enrolled in the study. **Conflicts of interest**: The authors declare no conflict of interests.
**Acknowledgements**: This work is partially financed by FCT under the projects DOI: 10.54499/UIDB/00006/2020 (CEAUL) and DOI: 10.54499/UIDB/04046/2020 (BIOISI).

**Supplementary material:** Available online

# P25
# The impact of balance as a marker of health status in patients with left ventricular ejection fraction (LVEF)≤40 participating in a home-based cardiac rehabilitation programme

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Keywords: Cardiac rehabilitation; Balance; Reduce left ventricular ejection fraction (LVEF); Frailty; Cardiovascular disease.

**Introduction**: Hospitalized patients with reduced left ventricular ejection fraction (LVEF) face daily activity limitations and increased dependency. Mobility, including balance and walking, is significantly affected, hindering recovery, promoting frailty, and raising comorbidity risks. Exercise inertia, a known cardiovascular risk factor, exacerbates physical dependence, frailty, and disease responsiveness.

**Objective**: To assess the physical fitness of patients undergoing a home-based cardiac rehabilitation (CR) programme aimed at improving cardiac health and functional capacity in patients with LVEF.

**Methods**: A prospective experimental study was conducted on patients admitted with LVEF. After informed consent, socio-demographic data were collected, and exercise and education sessions were provided during hospitalization (Time 1 - T1). Upon discharge, patients were advised to follow a home exercise program. Over 12 weeks, regular monitoring contacts were made, and at the end, patients were reassessed (Time 2 - T2). Physical fitness was evaluated using dynamic balance and mobility (Fullerton test battery), handgrip strength test, and cardiorespiratory fitness. The STOP-Bang scale and IPAQ were also utilized. Using R version 4.3.2, we conducted descriptive and inferential analyses, including linear mixed models and residual analyses. Results were deemed significant at $p<0.05$. To mitigate the increased risk of Type I errors associated with multiple testing, we applied the Bonferroni correction, adjusting the significance thresholds accordingly.

**Results**: In evaluating 34 patients with LVEF <40, all outcomes show an improvement between T1 and T2. A statistically significant improvement ($p <0.001$) was noted between evaluations T1 and T2, in the Fullerton Battery Test: assessing functional physical fitness (limb strength, flexibility, agility/dynamic balance, aerobic endurance - 6MWT) and a significant improvement in the assessment of dynamic balance. LVEF, handgrip strength, IPAQ, and EQ-5D also showed significant improvements presented in the table below. (Table 1 - Supplementary material)

**Conclusions**: The authors do not exclude the possibility that other factors, such as measurement and improvement, control of cardiovascular risk factors, and recovery of hibernating muscle, may influence improvement in LVEF. Patients with LVEF ≤40% exhibit high cardiovascular risk. The results showed an improvement in functional capacity, balance, and quality of life, indicating that the efficacy of cardiac rehabilitation could be evaluated by balance. Disability and frailty reflect poor performance.

**Conflicts of interest:** The authors declare no conflict of interest.

**Supplementary material:** Available online

# P26
# Stratified Cox Regression vs. Cox regression with IPW weights: Comparing two approaches for the estimation of the effectiveness of COVID-19 seasonal vaccine in elderly Portuguese population

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Keywords: COVID-19 pandemic, Cox regression, Inverse Probability Weighting, Stratification, Vaccine Effectiveness

**Introduction**: As part of the COVID-19 vaccination programmes, monitoring real-world vaccine effectiveness (VE) is essential. The causal association between vaccination and the occurrence of COVID-19-related health outcomes is often altered by confounders, biasing the estimated effect. Thus, the importance of controlling for confounders. However, in scenarios characterised by low event frequencies and multiple confounders, classical regression methods often encounter convergence issues, as in the case of VE on hospitalisation. To estimate the effectiveness of the COVID-19 seasonal XBB 1.5 monovalent vaccine against COVID-19 hospitalisation, we used two methods to adjust for confounders: a stratified Cox regression and a Cox regression with Inverse Probability Weighting (IPW) weights.

**Methods**: A historical cohort study was conducted using national electronic health records, within the Vaccine Effectiveness, Burden and Impact Studies multicentre study. VE was estimated between 1st October and 25th November 2023 in the resident population in mainland Portugal, against COVID-19-related hospitalisations. Analysis was stratified according to age cohorts (65-79 and ≥80 years). Stratified Cox and Cox with IPW weights were used to estimate VE. The adjusted confounders were sex, age group, health administrative region of residence, European Index of Deprivation quintile, comorbidities and number of boosters received before the seasonal campaign. Confounders were included as strata in the stratified Cox. In the IPW model, a logistic regression was used to calculate weights by adding confounders as variables in the model. The weights were then added to the Cox model. Adjusted hazard ratios (aHR) were estimated by comparing vaccinated individuals with those eligible for the seasonal vaccine but have not yet received it. VE was defined as (1-aHR)*100.

**Results**: A total of 2,197,922 individuals were analysed, of whom 916,513 received the Comirnaty XBB.1.5 vaccine, representing a seasonal vaccine coverage of 41.7% by the end of November 2023. VE against COVID-19-related hospitalisation was 46% (95%CI: -74%−83%) for 65-79 years and 64% (95%CI: 29%−81%) for ≥80 years using stratified Cox model. Considering the Cox with IPW weights, VE was 60% (95%CI: -22%−87%) for 65-79 years and 78% (95%CI: 56%−89%) for individuals aged ≥80 years.

**Conclusions**: VE estimates using IPW to adjust for confounding were higher than those from the stratified Cox regression, with narrower 95%CI, showing greater precision. The use of IPW weights should be considered in the presence of a low number of events and high number of confounders. Further research would validate results, as a single study period was analysed. Analysing other study periods could strengthen the results.

**Ethics committee and informed consent**: The current research was approved by an independent ethics committee. **Conflicts of interest:** The authors declare no conflict of interests.

# P27
# A Poisson Distribution-Based Simulation Approach to Consultation Scheduling

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Keywords: Healthcare Scheduling, Operational Efficiency, Poisson Distribution, Simulation Modeling, User-Computer Interface

**Introduction**: The quality of healthcare depends not only on personalization but also on the operational efficiency of the healthcare system. Optimizing internal processes, from resource management to coordination among medical teams, helps patients receive timely care and reduces waiting times. Increased efficiency minimizes wasted resources, allows healthcare professionals to spend more time with patients, strengthens the doctor-patient relationship, and improves the overall quality of care. This study presents a Poisson distribution-based simulation model designed to optimize medical planning practices.

**Methods**: We applied a Single-Channel, Single-Phase queuing model (M/M/1) due to its simplicity and effectiveness in capturing real-world queuing systems. The model assumes that arrivals follow a Poisson process and was used to analyse patient flow in a healthcare centre, accounting for various consultation types, working days, weekly hours, and service schedules. The model was implemented using Python's Dash framework, an open-source library ideal for building data visualization apps with highly custom user interfaces.

**Results**: The primary focus of our application is its user interface, ensuring that the simulation is accessible and practical for healthcare administrators. Interactive dashboards allow users to intuitively enter planning parameters and visualize simulation results. Visual tools, such as histograms showing the distribution of required clinical hours over different periods, help users understand complex data at a glance. The Simulation Results Display Tab utilizes previously entered data to generate both table results and graphical visualizations, including the proportion of days with failures by type of consultation and graphical representations of excess hours on working days by consultation type. The model evaluates the percentage of days with planning errors, providing insights into potential bottlenecks in the planning process. Demonstrations show that the simulation outcomes are dynamically updated based on the data and parameters within the software application, allowing users to adjust inputs at any stage. Initial inputs can leverage statistical data from the previous year, while in the absence of specific data, regional population statistics can be incorporated for informed decision-making.

**Conclusions**: Emphasizing the importance of a user-friendly graphical interface bridges the gap between complex data analysis and practical application. This approach facilitates better decision-making and more efficient resource allocation, directly contributing to improved operational efficiency in healthcare facilities. This research contributes to ongoing efforts to improve the planning efficiency of healthcare delivery systems, ultimately enhancing patient access and satisfaction. Future directions include improving decision-making and achieving more efficient allocation contribute to enhancing operational efficiency and thereby optimizing resources for health gains.

**Conflicts of interest**: The authors declare no conflict of interests. **Acknowledgements**: This research was conducted at the University of Aveiro and the ULS of Aveiro Region. We are deeply grateful to our advisor, Dr. Bruno Gago, and our supervisor, Dr. Pedro Damião, for their guidance and support. Special thanks to the USF of Fenix of Aveiro for their involvement in the improvement cycles and software usage.

# P28
# GeneSEA Explorer: A Tool for Exploring the Depths of Gene Expression Data with Shannon Entropy Analysis

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Keywords: Differentially expressed genes, Normalization, RNA Sequencing Data, Shannon Entropy, Shiny Web App

**Background**: RNA sequencing (RNA-seq) has become the go-to method for differential gene expression analyses in transcriptome research. Despite the widespread use of R packages like Deseq2 and edgeR for RNA-seq data analysis, challenges remain in identifying differentially expressed genes (DEGs), particularly in selecting suitable normalization methods. The complexity of these packages often requires programming proficiency, leading researchers to default normalization methods or avoid comparative analyses of DEGs results across different techniques.

**Methods**: We introduce a novel web application, "GeneSEA Explorer", designed to perform differential gene expression analyses using various normalization methods. The application presents outputs through interactive plots and tables, and uses Shannon Entropy, a novel approach in the transcriptomics field, to aggregate DEGs results, providing statistically supported outcomes.

**Results**: The "GeneSEA Explorer" allows researchers to explore and compare diverse DEGs outcomes across various normalization methods, including less commonly used ones. The innovative use of Shannon Entropy to aggregate all DEGs outputs provides an informative selection of DEGs, enhancing researchers' understanding of their RNA-seq data results.

**Conclusions**: The "GeneSEA Explorer" is an innovative bioinformatics tool for conducting differential gene expression analyses. Its user-friendly interface enables users to effortlessly explore and analyse diverse DEGs outputs. The proposed aggregation method, Shannon Entropy analysis, aims to minimize challenges for researchers less confident in this domain or those seeking to optimize their time when exploring their data for the first time.

**Conflicts of interest**: The authors declare no conflict of interests. **Acknowledgements**: This work has been funded by National funds, through the Foundation for Science and Technology (FCT) - project UIDB/50026/2020 (https://doi.org/10.54499/UIDB/50026/2020), UIDP/50026/2020 (https://doi.org/10.54499/UIDP/50026/2020), LA/P/0050/2020 (https://doi.org/10.54499/LA/P/0050/2020) and 10.54499/CEECINST/00018/2021/CP2806/CT0011 (https://doi.org/10.54499/CEECINST/00018/2021/CP2806/CT0011). The authors acknowledge the support of FCT within projects UIDB/04106/2020 (https://doi.org/10.54499/UIDB/04106/2020) and UIDP/04106/2020 (https://doi.org/10.54499/UIDP/04106/2020).

Journal of Statistics on Health Decision



# P29
# Development of a Software for Metrics Analysis in Next Generation Sequencing

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Keywords: Average Read Depth, Bioinformatics, Coverage, Gene Panel, Next Generation Sequencing (NGS)

**Introduction**: This work describes the development of a software during a nine-month internship at Unilabs, as part of the Clinical Bioinformatics Master's program at the University of Aveiro. The software aims to provide essential metrics, such as Average Read Depth and Coverage, at different thresholds, for gene panels, individual genes, and exome. The motivation came from the need to complement the capabilities of a new analysis software in a transitional phase and ensure the obtainment of necessary metrics for specific analyses.

**Methods**: The development environment was set up using the Windows Subsystem for Linux (WSL), as most bioinformatics tools are only compatible with Linux. All necessary dependencies and tools were installed, and scripts were developed to calculate the desired metrics using Samtools. Additionally, Streamlit was incorporated as a Graphic User Interface (GUI) to facilitate interaction with the software. Docker was used for the deployment and distribution of the tool, ensuring portability and easy installation. To streamline the software usage, a step-by-step approach was adopted. In the first step, users are prompted to select the type of analysis (single gene, gene panel, or exome). In the second step, the choice of genome version (GRCh37/hg19 or GRCh38/hg38) is requested. The third step involves selecting the region of interest, and finally, in the fourth step, users are prompted to choose the .bam file for which the metrics are relevant.

**Results**: The outcome yielded a fully functional software capable of analysing Average Read Depth and Coverage across various analysis types. It presents the results in a user-friendly graphical interface, making the analysis accessible even to users with limited bioinformatics experience. Additionally, the software generates a comprehensive table containing the metrics for the specific study, with the flexibility to save the analysis results in .csv format for further analysis and documentation.

**Conclusions**: Following method validation, the next step is the integration of the software into Unilabs's routine NGS metrics analysis. Additionally, there are plans to enhance the software by introducing new features, including custom gene panel creation, visualization of additional metrics, incorporation of advanced filters, GUI enhancements for a smoother user experience, and performance optimization to effectively manage large datasets. This endeavour marks a significant advancement in improving the efficiency and precision of genomic analyses at Unilabs, thereby contributing to the progression of clinical bioinformatics.

**Conflicts of interest**: The authors declare no conflict of interests. **Acknowledgements**: Special appreciation to Beryl Royer-Bertrand, Senior Bioinformatics Expert from Unilabs Lausanne, for her consistent availability and assistance throughout this project.

# P30
# The effects of PROsyntax on children with DLD and ASD

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Keywords: autism spectrum disorder; developmental language disorder; preschool children; syntactic intervention

**Introduction**: Children with Autism Spectrum Disorder and children with Development Language Disorder experience syntactic difficulties. Early evidence-based intervention is crucial to minimize the impact of these difficulties. Internationally, there are several programs with scientific evidence. In Portugal, there are only two intervention programs, one of which is PROsyntax. However, studies need to be carried out into its effectiveness. This study aims to determine the effects of PROsyntax on preschool-aged children with syntactic deficits, diagnosed with DLD or ASD.

**Methods**: This study is a non-randomized controlled trial with a non-probabilistic convenience sample. Thirty-one children were recruited and divided into a control group (CG) (n=17) and an experimental group (EG) (n=14). A blind pre- and post-intervention assessment was conducted using two standardized instruments (Sin:TACS and ALO). Children in the EG received intervention with PROsyntax, comprising 24 biweekly sessions, lasting 1 hour each. The intervention was conducted within the school setting. Data was analyzed using SPSS v29.0 through descriptive and inferential statistical analysis (hypothesis testing and correlation analysis).

**Results**: The results of the language skills assessment, comparing pre and post, intervention show statistically significant differences between the two groups (CG vs. EG) in both outcome measures used (Sin:TACS: U=1; p-value<0.001 for $\alpha$=0.05; ALO: U=6; p-value<0.001 for $\alpha$=0.05). Additionally, effect size (ES) was calculated (Sin:TACS: ES=2.54; ALO: ES=2.93). A strong and statistically significant correlation was found between the two tests (r= 0.832, p-value<0.05).

**Conclusions**: The results obtained in the study suggest that PROsyntax improves syntactic skills, both in production and comprehension, in preschool-aged children with DLD and ASD. The high level of heterogeneity of the studied conditions is a limitation. Future research will continue to increase sample size and analyze the data, to better understand the differences in the use of PROsyntax in DLD and ASD.

**Ethics committee and informed consen**t: This study was approved by the Ethics Committee for Research of Faculty of Letters of University of Lisbon (number 10_CEI2022). Written informed consent was obtained from the participants before data collection. **Conflicts of interest**: The authors declare no conflict of interest. **Acknowledgments**: This work was supported by the national funds through FCT—Fundaçao para a Ciência e a Tecnologia, I.P., within CINTESIS, R&D Unit (UIDB/4255/2020 and UIDP/4255/2020) and within the scope of the project RISE (LA/P/0053/2020), CLUL (UIDB/00214/2020) and a Ph.D. Grant (2022.12007.BD) and through CIDMA - Center for Research and Development in Mathematics and Applications, within project UIDB/04106/2020 (https://doi.org/10.54499/UIDB/04106/2020) and UIDP/04106/2020 (https://doi.org/10.54499/UIDP/04106/2020). The authors would like to thank the children and their families who participated in the study and their kindergarten teachers.

# P31
# Mental Health, Emotion Regulation and Body-Investment in Adults with Different Weight-Profiles

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Keywords: Obesity; Overweight; Mental Health; Emotional Regulation; Body-image.

**Background**: There is still limited evidence on the underlying psychological mechanisms associated with obesity and overweight. With the current study we want to investigate emotion regulation and body investment difficulties in a sample of adults with different weight profiles.

**Methods**: A sample of 407 adults (> 18 years old; 89.7% females) recruited from general population was assessed for dimensions of emotion regulation, body investment, and symptoms of depression, anxiety, and stress, using the Difficulties in Emotion Regulation Scale (DERS-SF), Body-investment scale (BIS), and the Depression, Anxiety and Stress Scale (DASS-21), respectively.

**Results**: Semi-parametric MANOVA models suggested a significant multivariate effect of different weight profiles in relation to the four dimensions of BIS (WTS = 145.7, df = 8, $p < 0.001$; *p (paramBS resampling)* < 0.001), and a non-significant multivariate effect of weight profiles in relation to six dimensions of DERS-SF (WTS = 17.62, df = 12, $p = 0.13$; *p (paramBS resampling)* = 0.15). Multivariate post-hoc comparisons (Tuckey method) showed significant lower BIS scores for individuals with obesity in comparison with individuals with healthy weight ($\beta = -1.24$, $p < 0.001$) and with individuals with overweight ($\beta = -1.20$, $p = 0.003$). Univariate post-hoc pairwise comparisons (using Bonferroni correction) suggested significant lower scores on BIS-Care for individuals with obesity in comparison with individuals with healthy weight ($\beta = -0.37$, $p < 0.001$), and significant lower scores on BIS-Body-image for individuals with obesity in comparison with individuals with healthy weight ($\beta = -0.99$, $p < 0.001$), and in comparison with individuals with overweight ($\beta = -0.94$, $p < 0.001$). ANOVA models showed greater DASS-21 scores (for all subscales) in individuals with obesity compared with individuals with overweight (Depression: $\beta = 3.91$, $p = 0.008$; Anxiety: $\beta = 2.96$, $p = 0.02$; Stress: $\beta = 3.95$ $p = 0.005$).

**Conclusions**: Specific emotion regulation and body investment difficulties were identified to be potentially associated with overweight and obesity, which is key to understand the multifactorial nature of these conditions, and to inform interdisciplinary treatment approaches.

**Ethics committee and informed consent**: The current study received ethical approval from the Instituto Superior Miguel Torga ethical committee. All experiments were performed in accordance with relevant guidelines and regulations, and in accordance with the Declaration of Helsinki and Informed consent was obtained from all participants in this study. **Conflicts of interest**: The authors declare no conflict of interests.

# P32
# Pain and Functional capacity in Rheumatoid arthritis with Acupuncture in Complementary treatment

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Keywords: Acupuncture; Functional Capacity; Pain; Rheumatoid Arthritis

**Background**: Nowadays, Rheumatoid Arthritis (RA) is the target of a multiplicity of therapies intended to treat the disease and the patient. Significant advances in its treatment have enabled a better understanding of the imbalances that accompany it, both from the perspective of Western Medicine and Traditional Chinese Medicine. Pain, as a transversal and impacting condition in any disease, the functional status and ability to perform the activities of daily living of patients with RA, are essential metrics for a better understanding of the impact of the disease. The objective is to understand the influence of a complementary treatment with acupuncture (tcA) on pain management and functional capacity in RA patients.

**Methods**: Experimental, randomized, prospective and controlled study. The sample consists of 100 patients (50 Control Group and 50 Experimental Group) who underwent 8 consecutive weeks of acupuncture (20 minutes). Two evaluations were carried out: 1st evaluation before the first treatment session of acupuncture (tcA) and 2nd evaluation: one week after the last acupuncture treatment. Data collection: for 6 months. Research questions: Q1: What influence does acupuncture have on pain intensity? Q2: What is the effectiveness of a complementary treatment with acupuncture on functional capacity? Evaluation Instruments: questionnaire characterization sample; Health Assessment Questionnaire – Disability Index (HAQ-DI); Visual Analogue Pain Scale (VAS). Statistical analyses: Software Rstudio version 1.1.1003. Test hypotheses (significance level= 0.05).

**Results**: The average value of VAS for pain increased in the control group (CG) (5.28 to 6.52) and decreased substantially in the experimental group (EG) (5.64 to 3.66). When applying the hypothesis test, the p-value <0.01 for a confidence level of 0.05 allowed us to rule out equality between means, enabling us to state that after tcA, VAS is lower in the EG. After the tcA, the mean value of the HAQ-DI score fell (0.65 to 0.57) due to the decrease in the mean value in the SG (0.57 to 0.26), while in the CG there was an increase (0.74 to 0.88). For a significance level of 0.05, the hypothesis test applied allowed us to rule out the similarity between the mean HAQ-DI values in the groups, as the p-value (p <0.01) was significantly lower than 0.05.

**Conclusions**: Pain management showed statistically significant results, as pain decreased from Intense Pain ~6 to Moderate Pain ~4 in RA patients undergoing tcA. Patients in the EG showed a 50% decrease in the HAQ-DI score, with a score close to 0, classified as "No Difficulty" in performing activities of daily living. Acupuncture was shown to influence the relief of acute pain complaints and over time, as well as contributing to a significant reduction in functional disability in RA patients undergoing tcA, highlighting its effectiveness in managing and controlling the disease, which could produce prolonged effects and contribute to the benefits of sustained RA remission.

**Ethics committee and informed consent**: The research study was developed in accordance with the Helsinki Declaration 2013 and the Oviedo Convention 1997. Ethical approval was granted by the Department of Education, Training and Research: Hospital de Santo António (2019.143(114-DEFI/118- CE). **Conflicts of interest**: The authors declare no conflict of interest.

# P33
# Tomographic Image Reconstruction from Projections using Generative AI

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Keywords: Generative Adversarial Networks; Image Reconstruction; Tomography

**Introduction**: Computed Tomography (CT) is a key imaging technique, which use shows a global growing trend, heightening the concern about patient radiation exposure due to its link to malignant diseases. Despite iterative reconstruction methods can obtain images with diagnostic quality from lower-dose acquired data, the possibility of dose reduction is not as great as expected. Thus, reconstruction methods based on Deep Learning (DL) have been recently proposed to achieve greater dose reduction and higher image quality when compared to existing methods. In this field, newly Generative Adversarial Networks (GAN) can generate images from real references, showing potential in tomographic reconstruction.

**Methods**: In this work, a DL method for reconstructing tomographic images was developed using a Conditional GAN to generate images from low dose sinograms. Three models were trained for this method: one for physical phantoms, using a database herein developed, one for the abdomen and thorax, and another for neuro studies, using data from the Low Dose CT Image and Projection Data (LDCT-and-Projection-data) database.

**Results**: The influence of data quality and context of application for training crucially impacts the obtained results. Additionally, the cost-function and the number of training epochs influences the results of the generative model. The adjustment of these parameters allowed to generate CT images from low dose sinograms with superior quality metrics when compared with the gold standard algorithm for image reconstruction (Filtered-Back Projection – FBP), namely a Mean Square Error of 0.004 (GAN) vs 0.012 (FBP), Peak Signal to Noise Ratio of 36.611 (GAN) vs 0.012 (FBP) and a Structural Similarity Index of 0.978 (GAN) vs 0.838 (FBP). Moreover, the processing time using GAN was considerably lower, about ten times less.

**Conclusions**: The developed method with GANs proved to be capable of generating low-noise images from low-dose sinograms and presented the ability to reconstruct volumes, on average, ten times faster than filtered backprojection. In addition, it has shown potential in reducing the effect of artifacts due to the presence of metallic materials or to photon deficit.

**Conflicts of interest:** "The authors declare no conflict of interests." **Acknowledgements:**The costs resulting from the FCT (Fundação para a Ciência e a Tecnologia, I.P– Portuguese Foundation for Science and Technology) hiring, L.F.N.D. Carramate, were funded by national funds (OE) in the scope of the framework contract 2022.00387.CEECIND (https://doi.org/10.54499/2022.00387.CEECIND/CP1720/CT0022).

# P34
# Predicting hospitalization for non-complicated diverticulitis

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Keywords:Diverticulitis; Machine Learning; Models; Hospitalization; Recall.

**Introduction**: Diverticulitis is a condition characterized by an inflammation of small diverticular pockets formed in the colon. Treating non-complicated diverticulitis in an ambulatory setting, as suggested by the literature, provides safety and comfort to the patient, as well as logistics and costs optimization to the hospital. This work proposes and presents an optimization study for a machine learning model that predicts the need for hospitalization in non-complicated diverticulitis patients.

**Methods**: Our cohort study included 766 patients with diverticulitis from 2 Portuguese Hospitals. 89.8% (n=688) of which were diagnosed with non-complicated diverticulitis. Information was collected regarding demographic variables, past medical history, laboratory results and medication. The study focused on developing multiple models (Logistic Regression, Random Forest, Naïve-Bayes, XGBoost and Support Vector Machine), applied to the data in three different processing approaches: APP1 - hyperparameter tuning (HT), APP2 - feature engineering (FE) and hyperparameter tuning and APP3 - FE and HT applied to a modified database with imputation methods (KNN Inputter using 5 neighbors and iterative imputers). For each approach there were 3 different training scenarios (TS) tuned with 5-fold cross-validation: TS1 - joint data from the 2 hospitals split into training (80%) and test (20%); TS2 - training on Hospital 2 (n=465) and testing on Hospital 1 (n=216); TS3 - same as TS2 but switching the hospitals.

**Results**: In all three approaches, the training scenario that presented the best results was TS2. Here, the approach with the best performance was a logistic regression with FE and HT (APP2): Accuracy = 62%; Precision = 60%; Recall = 95%; F1-Score = 74%. The results with other approaches, presented lower performance, however, it is worth noticing that for APP3, the best performing model was a XGBoost (Accuracy = 65% Precision = 63% Recall = 91% F1-Score = 74%). Other training scenarios showed worse performance, namely, TS1 and TS3. The best F1-Score for TS3 is only 56%, having worse overall metrics. TS1 is on average slightly worse than TS2.

**Conclusions**: Within clinical application of machine learning systems, it is important not to miss positive cases, identifying them as a false negative. It is crucial that these decision support tools maximize recall during training. In our work, the best performing model (APP2, TS2 with a logistic regression) presented a 95% recall which allowed us to be confident that this model wouldn't miss many positive cases if it was to be applied in a clinical setting. TS2 was the best performing scenario in all approaches, even when training with less data (n=221), compared to TS1. APP2, which requires less pre-processing of the data (n=581), showed better performance than APP3, where the missing values were imputed by iterative methods (n=688). This might indicate that the imputation methods implemented might have not been the optimal ones. In summary, considering the importance of recall and the results obtained mainly by TS2, the models had the potential to successfully predict hospitalization for non-complicated diverticulitis. Future work will be developed regarding interpretability and explainability of the models. 56

**Ethics committee and informed consent**:The current research was approved by an independent ethics committee. **Conflicts of interest**: No conflicts of interest have been declared by the authors.

# P35
# Potential of Machine Learning as a predictor of PI-RADS™ v2.1 classification

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Keywords: Machine Learning, Multiparametric Magnetic Resonance Imaging, PI-RADS™, Radiomic Features

**Introduction**: Multiparametric Magnetic Resonance Imaging (mpMRI) allows for improved visualization and detection of prostate lesions compared to conventional imaging methods. The Prostate Imaging Reporting and Data System (PI-RADS™) v2.1 [1] proposes a classification system into five categories for prostate mpMRI, involving images interpretation by radiologists, which leads to inevitable variability. Machine Learning (ML) methods have been developed to enhance the differentiation between clinically significant prostate cancer (csPCa) and non-csPCa [2], complementing the PI-RADS™ classification. This study aims to explore computational ML methods to improve the performance of PI-RADS™ v2.1 classification for csPCa.

**Methods**: A sample of 50 prostate mpMRI studies presenting PI-RADS™ v2.1 categories from 2 to 5 was considered. Manual prostate segmentation was performed in MeVisLab and the radiomic features were extracted using LIFEx-7.2.0 software. The data were loaded into Matlab Classification Learner application, to train and test different classification models in the categorization of cases into four PI-RADS™ v2.1 classes (from 2 to 5), and into two classes: csPCa (includes PI-RADS™ v2.1 classes 4 and 5) and non-csPCa (considering PI-RADS™ v2.1 classes 2 and 3). The models training was performed using the k-fold cross-validation method.

**Results**: In general, the Bagged Tree classifier and the Diffusion Weighted Imaging (DWI) sequence showed higher levels of accuracy; however, the classification in the 4 PI-RADSTM v2.1 classes was unsuccessful (accuracy 48%), due to the small sample size. True positive rate (TPR) registered for class 2 was 69%, for class 3 was 42%, for class 4 was 22% and for class 5 was 46%. Better results were obtained classifying in 2 classes (accuracy 88%) to discriminate csPCa from non-csPCa cases. In this case, the TPR for non-csPCa was 96% and for csPCa was 77%.

**Conclusions**: The classification in four classes according to PI-RADS™ v2.1 did not achieve a good performance due to the small sample size. However, it was possible to discriminate csPCa from non-csPCa with a high level of accuracy (88%).

**Conflicts of interest**: "The authors declare no conflict of interests." **Acknowledgements**: The costs resulting from the FCT (Fundação para a Ciência e a Tecnologia, I.P– Portuguese Foundation for Science and Technology) hiring, L.F.N.D. Carramate, were funded by national funds (OE) in the scope of the framework contract 2022.00387.CEECIND (https://doi.org/10.54499/2022.00387.CEECIND/CP1720/CT0022).

**Supplementary material:** Available online

# P36
# The control of dyslipidemia in patients enrolled in a Functional Unit in Northern Portugal

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Keywords: Dyslipidemia; Lypoproteins, Ldl; Statistics

**Background**: Dyslipidemia is an important risk factor for cardiovascular disease. Despite diagnostic and therapeutic advances in recent decades, cardiovascular disease is still the leading cause of death worldwide, accounting for 30% of the total number of deaths. Despite lifestyle changes and statin therapy, many patients do not reach the recommended LDL cholesterol levels, since the discontinuation rates are high and almost a third of patients do so within the first year of starting. The aim of this study is to assess the dyslipidemia control of patients enrolled in a Functional Unit (FU) in northern Portugal.

**Methods**: Descriptive retrospective observational study with an analytical component, including patients registered at the FU in March 2024, aged 40 or over and presenting ICPC-2 code T93 in their list of problems. Sample size was calculated for each medical file, with a 95% confidence interval and a 5% margin of error, using the RAOSOFT® application. Patients were excluded if they had died or had a lipid profile performed more than 3 years ago. Data were extracted from SClínico ACes® and MIM@UF. Variables collected included age, gender, years of disease progression, cardiovascular risk, lipid-lowering drugs prescribed, lipid profile and other comorbidities (diabetes, hypertension, overweight and obesity). Statistical analysis was performed using Microsoft Excel and IBM SPSS® Statistics.

**Results**: The sample included 1002 users, after excluding 54 users who did not have an up-to-date lipid profile and 4 because they had died. They had an average age of 69.3 years and were mostly female (57.9% | n=580). They had an average disease progression of 10.3 years (SD=5.8). In addition to dyslipidemia, the majority (90.0% | n=902) had at least one of the comorbidities described above. The majority were medicated with just one drug (62.6%), with statins alone being the most frequently prescribed regimen. Of the patients assessed, the majority (76.5% | n=767) had LDL values higher than the individual recommended targets.

**Conclusions**: In view of the results obtained, projects of this nature need to be carried out, which could eventually form the basis of continuous quality improvement studies. In this case, the use of statistical methodology has led to the realization that only a small proportion of patients are within the therapeutic target and that the rest need to optimize the statin therapy. It can therefore be concluded that statistics plays a key role in clinical decision-making.

**Conflicts of interest**: The authors declare no conflict of interests.

# P37
# Psychosocial Factors Determining Mental Health Status in Factory Workers

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Keywords: Burnout; Job Satisfaction; Mental Health; Occupational Stress; Psychological Factors.

**Introduction/Objective**: The work is a process that defines a person's identity and one of the main sources of dignity and personal and social fulfilment. However, work can also be a source of suffering, stress, dissatisfaction, and exposure to psychosocial factors associated with the physical and emotional demands of the job, lack of social support, imbalance between effort and rewards, and the perception of injustices. In this context, the aim was to assess the impact of psychosocial factors on the mental health of workers in a manufacturing industry.

**Methods**: The type of study was Observational, Analytical (Cross-sectional). The target population focused on workers in the manufacturing industry of the Coimbra district. The sampling method was non-probabilistic by quotas. The sample included 92 workers. A questionnaire was administered to the workers to assess psychosocial factors, stress (Perceived Stress Scale – PSS10), and burnout (Oldenburg Burnout Inventory).

**Results**: The sample consisted of 54.4% men, where 60% of the workers were up to 40 years old inclusive. At the sector level, 79.3% of the workers who participated in the study were in the production sector and the remaining in packaging/shipping. The psychosocial factors that the workers indicated they were most exposed to were: "pace and intensity" (96.7%), "work relationships" (93.5%), "autonomy and initiative" (89.1%), and "working hours" (77.2%). Workers in the production sector showed higher levels of burnout in terms of distancing compared to workers in packaging/shipping. A similar pattern occurred both in terms of burnout in the exhaustion dimension and in terms of stress. Workers who showed higher levels of stress also exhibited higher levels of burnout (distancing: $r$=0.486; p<0.001; exhaustion: $r$=0.518; p<0.001). We also observed that workers who experienced higher exhaustion burnout also manifested higher levels of distancing burnout ($r$=0.703; p<0.001). Using the multiple linear regression model, predictors identified as psychosocial factors, such as *"job satisfaction"* ($B$=-0.289; t=-3.215; p=0.002), *"autonomy and initiative"* ($B$=-0.169; t=-1.920; p=0.058), and the burnout index in the *"exhaustion"* dimension ($B$=0.372; t=4.016; p<0.001), showed a significant effect on the levels of stress manifested by the workers.

**Conclusions**: At the workplace level, stress has a significant impact on the life of companies, ranging from absenteeism, illness, low job performance as well as increasing the risk of occupational accidents. We conclude that high levels of stress tend to be associated with job dissatisfaction, less autonomy and initiative in their activities, and higher levels of burnout (exhaustion) among the evaluated company's workers.

**Ethics committee and informed consent**: The current research was approved by an independent ethics committee (Advice n.º 16_CEIPC/2024) and subjects gave their informed consent before they were enrolled in the study. **Conflicts of interest**: the authors declare no conflict of interests.

# P38
# Machine Learning contribution to detection of Subarachnoid Hemorrhagic Stroke in Computed Tomography

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Keywords: Computed Tomography, Fine KNN, Machine Learning, Radiomics, Subarachnoid Hemorrhagic Stroke

**Introduction**: Stroke is a vascular disorder resulting in the damage of brain cells due to the lack of oxygen and nutrients supply, leading to the death of brain tissue. This clinical situation promotes changes in the characteristics of brain tissues, affecting their computerized tomographic (CT) appearance and sometimes brain anatomy. The study aimed to identify the contributions of Radiomics combined with Machine Learning (ML) methods in the detection and lateralization of Subarachnoid Hemorrhagic (SAH) stroke.

**Methods**: A public database of cranio-encephalic CT studies [1] was used. 30 studies of patients with SAH, and 35 studies of patients without any pathology were selected. In both cases, non-contrast CT scans, 5mm slice thickness, were used, and the database included information related to evaluation by 3 observers. In the CT series of the selected studies, 12 regions of interest (ROI) at ganglionic and supra-ganglionic levels were segmented (MCA1, MCA2, MCA3, MCA4, MCA5 and MCA6, both right and left), and radiomic features of first order (intensity and histogram based) and second order (textural) were extracted using LifeX software [2]. Using the database of radiomic features and the Matlab Classification Learner application, classifiers of KNN (K Nearest Neighbors), SVM (Support Vector Machine) and Naive Bayes families were trained for detection (2 classes: SAH, no SAH) and lateralization (5 classes: no SAH, SAH outside ROIs, SAH right side, SAH left side, SAH right and left side) of the stroke. The classifiers were trained, and validation was made using 5 cross validation folds.

**Results**: The results demonstrated a high accuracy rate in the detection and lateralization of SAH stroke using just radiomic features, with accuracies above 90%. Among the trained classifiers:Fine KNN classifier (K=3) achieved the best performance,96.9% accuracy , in stroke detection, and Fine KNN classifier (K=1) achieved the best performance, 94% accuracy, in stroke lateralization.

**Conclusions**: The results allowed to conclude that radiomic data extracted from the selected ROIs, combined with ML methods, allows to detect the presence of SAH stroke and its lateralization with a high degree of certainty. On the other hand, it has enabled us to envision the replication of the methodology adopted in the context of software development, which can contribute to a faster and more accurate diagnosis of SAH stroke.

**Conflicts of interest**: "The authors declare no conflict of interests."

**Supplementary material:** Available online

# P39
# Mental health in students of polytechnic higher education

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Keywords: Health Risk Behavior; Mental Health; Psychological Well-Being; Social Support.

**Introduction/Objective**: The mental health of college students has been gaining significant importance as they encounter new challenges and adversities at this stage of their lives, which can result in a decline in their mental well-being. The aim of this study was to characterize the mental health of students, perceived social support, and health and well-being behaviors.

**Methods**: The type of study was Observational, Analytical, and Cross-sectional. The target population of the study was students (Polytechnic Higher Education). The final sample consisted of 1182 students (sampling method - probabilistic and simple random). A questionnaire was administered in three parts: Biographical and academic information; Mental Health Inventory (MHI); Social Support Satisfaction Scale. The Student's t-test, One-way ANOVA, Brown-Forsythe test, Games-Howell multiple comparison test and Pearson's Linear Correlation Coefficient were used.

**Results**: Most students were female (66.7%), and the most prevalent age groups were [21-26[ years (41.5%) and [18-21[ years (38.4%). Academic level, 79.2% were enrolled in a bachelor's degree in one of the 6 Teaching Units. In terms of Mental Health, the male group showed, on average, lower MHI scores (M=57.31; SD=16.6) compared to the female group (M=61.06; SD=16.2) significantly ($p<0.001$). Significant differences in MHI were observed among students regarding age ($F_{(3;436.165)}=16.278$; $p<0.001$). Students aged >30 years (M=52.64; SD=15.03) exhibited poorer MHI compared to younger groups: [18-21[ years (M=59.85; SD=17.55; $p<0.001$), [21-26[ years (M=62.82; SD=15.02; $p<0.001$), and [26-30] years (M=58.76; SD=17.29; $p=0.05$). Differences in MHI were also observed based on the enrolment year ($F_{(3;1178)}=2.974$; $p=0.031$) of the student. First-year students exhibited lower MHI compared to students in the 3rd year ($p=0.017$) and those in the 4th year ($p=0.014$). At the level of Social Support, in this exploratory phase of our study, we can observe that students who showed poorer MHI were also those who felt less "satisfied with friends" ($r=-0.322$; $p<0.001$), less "intimacy" with others ($r=-0.496$; $p<0.001$), less "satisfaction with family" ($r=-0.387$; $p<0.001$), and less "satisfaction with social activities" ($r=-0.335$; $p<0.001$).

**Conclusions**: Having a socio-familial network is crucial for reducing stress in young university students. Several studies report that social support is a predictor of psychological well-being; students who have access to social support demonstrate lower levels of stress. In this sense, the results suggest that mental health is closely linked to social support, and in this case, the lack thereof was associated with situations of poorer mental health condition.

**Ethics committee and informed consent**: The current research was approved by an independent ethics committee (Advice n.º 2_CEIPC/2022) and subjects gave their informed consent before they were enrolled in the study. **Conflicts of interest**: the authors declare no conflict of interests.

# P40
# Spatial distribution and determinants of TB incidence among children under five-years-old in Mozambique.

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Keywords: Children; Incidence; Mozambique; Bayesian Modelling; Tuberculosis

**Introduction**: Tuberculosis (TB) is an ancient, preventable, and curable disease. However, it remains an enormous public health issue in low-income countries such as Mozambique. Tuberculosis in children has been overlooked in research. However, children are at higher risk of developing severe form of TB and, consequently a higher risk of death. Moreover, TB in children can rapidly progress from exposure to an active disease, and its diagnosis is linked to a recent infection. A higher TB incidence rate among children suggests ongoing disease transmission within the community. Although Mozambique is a high TB burden country, little is known about the spatial distribution of TB incidence among children at the subnational level. This information is crucial for targeting interventions and the efficient allocation of resources. Therefore, our study aimed to analyze the spatial distribution and determinants of tuberculosis incidence among children under five years old across Mozambique districts and to identify hotspot areas.

**Methods**: We ran an ecological disease mapping study with the district as the unit of analysis (n = 154). We included all cases of tuberculosis diagnosed in children between 0-59 months in Mozambique from 2016 to 2020. We obtained the data from the Mozambique Ministry of Health and other publicly available sources. The data was analyzed using hierarchical Bayesian multivariate regression models.

**Results**: A total of 29,002 children below five years old were diagnosed with tuberculosis in Mozambique during our study period. We observed a marked variation in the incidence of TB across the country. The highest incidence rates were mainly observed in the south and center regions, while the north region had lower incidence. Thirty-nine districts (25.3%) out of 154 were identified as hotspot areas. The incidence of TB was associated with the illiteracy rate (RR: 1.37; 95%CrI 1.15 to 1.60), number of health centers per 100 000 inhabitants (RR: 1.16; 95%CrI 1.00 to 1.34), annual average temperature (RR: 0.80, 95%CrI 0.65 to 0.96), and the proportion of people with a bank account (RR: 0.74; 95%CrI 0.57, 0.96).

**Conclusion**: The spatial distribution of TB incidence among children in Mozambique is not uniform, with higher incidence in the south and central regions, and 25.3% of districts are hotspot areas. Social determinants of health play a significant role. Targeting interventions in these hotspot districts and addressing the social determinants of health, with particular emphasis on improving healthcare access and socioeconomic conditions, are essential to ending tuberculosis in Mozambique.

**Conflicts of interest**: The authors declare that they have no conflict of interest. **Acknowledgements**: We thank the Portuguese Foundation for Science and Technology (Fundação para a Ciência e a Tecnologia) for granting the PhD Scholarship number PD/BD/1505331/2019 to Nelson Cuboia Fernando Cuboia. We also want to thank the National Program for Tuberculosis Control, Nutrition, HIV/AIDS, the National Directorate of Public Health of Mozambique, and the Mozambique National Institute of Statistics for providing data for this study.

# P41
# Modeling trajectories of peripheral muscle strength, functional capacity and disease impact in COPD

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Keywords: Cluster Analysis; Linear Models; Pulmonary Disease, Chronic Obstructive

**Introduction**: Chronic obstructive pulmonary disease (COPD) is characterized by persistent respiratory symptoms, skeletal muscle weakness, and reduced functional capacity. Its heterogeneous and unpredictable nature may lead to different disease trajectories. Identifying these trajectories can help tailor rehabilitation, potentially altering the course of the disease. This study aimed to assess the trajectories of peripheral muscle strength, functional capacity, and the disease's impact on people with COPD.

**Methods**: A prospective study, including individuals with COPD (FEV1/FVC<0.7) assessed monthly for six months, was conducted from November 2018 to August 2020. Data collection included demographic (sex, age), anthropometric (body mass index [BMI]), and clinical measurements, such as smoking status, lung function (FEV1%pred), dyspnoea (mMRC), previous year exacerbations, and comorbidities. Additionally, functional capacity, peripheral muscle strength, and disease impact were measured using the 1-minute sit-to-stand test (1minSTS), handgrip muscle strength (HMS), and the Chronic Airways Assessment Test (CAAT), respectively. Repeated measures correlations ($r_{rm}$) were conducted to determine the relationship between outcomes. A K-means algorithm with Euclidean distance, designed for longitudinal data, was used to identify clusters based on data from the 1minSTS, HMS, and CAAT. The solution was optimized by maximizing the Calinski-Harabasz criterion for 2 to 8 trajectories. Linear mixed-effects models with backward elimination were used to assess the effects of time, group, and their interaction, adjusted for age, sex, BMI, smoking status, and comorbidities. The Naïve Bayes classifier, using 5-fold cross-validation, was applied to predict cluster trajectory assignment.

**Results**: In total, 149 individuals with COPD (age 68 [62;73] years; 84% men; FEV1%pred 49 [38;70]) were included. Longitudinal correlations showed that the 1minSTS and HMS were positively correlated ($r_{rm}$=0.14, p<0.001), and CAAT scores were negatively correlated with both 1minSTS and HMS ($r_{rm}$=-0.21, p<0.001; $r_{rm}$=-0.10, p=0.014, respectively). Three trajectory clusters were identified: Cluster A had the highest 1minSTS and HMS scores and the lowest disease impact at baseline, while Cluster C had the worst scores. Significant time and group interactions were found only for 1minSTS; Cluster A increased repetitions, while Clusters B and C remained unchanged. The Naïve Bayes classifier, using sex, BMI, mMRC, and 1minSTS scores at baseline as predictors, achieved an average accuracy of 0.75.

**Conclusions**: This study showed that peripheral muscle strength and disease impact remained stable in COPD over six months. Nevertheless, those with better outcomes seemed to improve their functional capacity, possibly due to their ability to engage in physical activity. Pulmonary rehabilitation should prioritize individuals with worse baseline outcomes.

**Ethics committee and informed consent**: The study was conducted with approval from an independent ethics committee, and all participants provided informed consent prior to their enrolment. **Conflicts of interest**: The authors declare no conflict of interests. **Acknowledgements**: This research was funded by Fundação para a Ciência e Tecnologia (FCT) through the Center for Research and Development in Mathematics and Applications (CIDMA) and projects https://doi.org/10.54499/UIDB/04106/2020 and https://doi.org/10.54499/UIDP/04106/2020. This research was also supported by Programa Operacional de Competitividade e Internacionalização—POCI, through Fundo Europeu de Desenvolvimento Regional—FEDER (POCI01-0145-FEDER-028806), by Fundação para a Ciência e Tecnologia (PTDC/SAU-SER/28806/2017) and under the project UIDB/04501/2020.

# P42
# Unraveling the signature of lower airway infection associated with COPD exacerbation in the oral microbiota

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Keywords: COPD, Exacerbation, Haemophilus influenzae, Oral microbiota

**Introduction**: Chronic obstructive pulmonary disease (COPD), a chronic inflammatory disease of the lungs, affects 10% of the worldwide population and is considered the third leading cause of death. It is highly heterogeneous and difficult to manage. COPD is punctuated by periods of aggravated symptoms mostly caused by viral and bacterial infections of the lower airway, known as exacerbations (ECOPD). Most bacterial species able to cause respiratory infections are also part of the commensal microbiota, thus, it is difficult to pinpoint the origin of infection as endogenous or exogenous. This information might, however, inform preventive or therapeutic strategies. Given the topographic continuity between the oral cavity and the lower airways, we hypothesized that an ECOPD might yield an oral signature. Compared with sputum or bronchoalveolar lavage, the traditional clinical samples, saliva collection is less invasive, thus amenable to longitudinal monitoring, essential to disentangling the origin of infection.

**Methods**: During 6 months, 15 saliva samples were collected from a patient with COPD (77y, ♂, FEV1 43%predicted), monthly while stable and every two days during ECOPD. Shot-gun metagenomics sequencing was performed for all time points. Taxonomic classification was performed with kraken2 (v.2.1.2). Metagenomic assembly was carried out with Megahit (v.1.2.9). Multiple sequence alignments of the contigs were carried with BLASTN (v.2.7.1) against NCBI's RefSeq database and further analysis with Breseq (v.0.35.7) explored candidate strains. Clustering of the assembled contigs and candidate strains was performed with ape (v.5.8) library, comparing k-mers of length 7, with Euclidean distance.

**Results**: At days 5 and 7 a peak of *Haemophilus* genus was observed, representing 40% and 58% of the entire oral microbiota, respectively. Moreover, *H. influenzae* represented around 88% of its genus at days 5 and 7. Alignment of the assembled contigs against the Refseq database identified three top candidate strains. Strain M21384, present in both stability and exacerbation, and strains 86-028NP and KR271, exclusive to exacerbation. Cluster analysis showed that these three strains cluster with ECOPD timepoints.

**Conclusions**: A clear signature of a lower airway infection associated with an ECOPD was found in the oral microbiota, leading to the identification of the most probable infection agent, which is thought to be of exogenous origin. Despite the results supporting the use of saliva for the diagnosis of respiratory infections, further work is needed to validate its routine use. Particularly, comparing results obtained in matched samples from oral and lower airways and a larger number of patients is required. In addition, our results support the feasibility of using saliva for longitudinal sampling, allowing to understand how endogenous microbiota might progress to infection agents.

**Ethics committee and informed consen**t: Ethical approvals were obtained from Administração Regional de Saúde Centro (64/2016) And from Centro Hospitalar do Baixo Vouga (08-03-17). Written informed consent was obtained from the participant. **Conflicts of interest**: The authors declare no conflict of interests. **Acknowledgements**: This work is integrated in "GENIAL – Genetic and Clinical Markers of COPD trajectory", "PRIME – Pulmonary Rehabilitation and microbiota in exacerbations of COPD" And "MicroAgeing – The role of microbiota in Ageing", funded by Programa Operacional de Competitividade e Internacionalização – COMPETE, Through Fundo Europeu de Desenvolvimento Regional – FEDER (POCI-010145-FEDER-028806, POCI-01-0145-FEDER-007628), by Programa Operacional Regional do Centro – FEDER (CENTRO-01-0145-FEDER-030212), by Fundação para a Ciência e Tecnologia – FCT (PTDC/DTP-PIC/2284/2014, PTDC/SAU-SER/28806/2017 and PTDC/BIA-EVL/30212/2017) and under the project UIDB/04501/2020. S. Melo-Dias was supported by Grant SFRH/BD/140908/2018 from FCT. A. Sousa was funded From national funds through FCT, under the Scientific Employment Stimulus – Institutional Call – reference CEECINST/00026/2018

**Supplementary material:** Available online

# P43
# Preparing for parenthood during pregnancy – search for health literacy in an E-program at Aveiro municipality

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Keywords: E-Health Literacy; Health Care; Parenthood Transition; Pregnant Woman

**Introduction**: Health literacy is the ability to acquire and understand information that is fundamental to decision-making in health. The WHO recognizes health literacy as an important way of empowerment women/couples during pregnancy (1)(2). During this period, there is a demand for health information related to the changes/care to be taken during pregnancy, labor and birth and care for the newborn, particularly breast-feeding. Currently, this search takes place in the most diverse ways, including an increase in search on the Internet, namely in online events, digital platforms, websites (3). Recognizing this evidence, the objective of this exploratory study is to identify, from which health units, in the Aveiro municipality, come from the pregnant women/couples who participated in the weekly Barriguitas e-Colloquies, organized by the UaCuida Project, during the year 2023

**Methods**: The Barriguitas e-Colloquies are held weekly via the Zoom Platform, with a range of 12 topics to prepare for Parenthood. At each conference, participants are invited to provide information, anonymously: number of weeks of pregnancy (to date), pregnancy and parity, and the Health Unit(s) where pregnancy is monitored.

**Results**: A total of 304 new participants joined the E-program during 2023, with the maximum amount occurring in the first session in May with 17 new participants. It was possible to obtain information regarding the variables of interest for 203 (66.7%) participants. Of these, most lived in the Aveiro region (n=192, 94.6%), and the most represented municipality was Aveiro (n=182, 89.7%). Considering participants from the Aveiro municipality, the health units with the newest participants correspond to housing areas with more population (Aradas, S. Bernardo / Oliveirinha, Esgueira, Sta. Joana, and Aveiro). The average weeks of gestation to start the program for participants in this municipality was 24.8±4.9, with no differences being found for the origin of participants. Most of participants (n=173, 85.2%) were experiencing their first pregnancy.

**Conclusion**: Although we do not have official knowledge about the number of births in the municipality of Aveiro for the year 2023, it is possible to state that this E-program continues to have high adherence, projected to involve 1 in every 4 pregnancies in the main geographic area. Efforts will be made to engage participants in earlier stages of pregnancy, to improve health literacy levels in preparation for parenthood.

**Ethics committee and informed consent**: The project was submitted to the Ethics Council of the University of Aveiro, obtaining a favorable opinion, after meeting the requirements inherent to the RGPD. Before being enrolled in the study, subjects gave their informed consent. **Clinical study registration number**: This project was registered in CIDTFF. **Conflicts of interest**: "the authors declare no conflict of interests."

**Supplementary material:** Available online

# P44
# The Contribution of Artificial Intelligence in Wound Healing Monitoring: A Scoping Review

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**Keywords:** Assessment, Wound Healing, Deep Learning, Artificial Intelligence, Machine Learning and Monitoring

**Background**: The application of Artificial Intelligence (AI) in wound healing monitoring draws onadvances in areas such as Machine Learning (ML) and Deep Learning (DL) to provide valuable insights to healthcare professionals. This scoping review was based on the question "What is the contribution of AI in wound healing monitoring?" with the aim of understanding the role that AI represents in wound healing monitoring, the existing tools and the implications in clinical practice.

**Methods**: This scoping review followed the steps laid out by the Joanna Briggs Institute (JBI). The research question was developed using the following descriptors: “Wound Healing”, “Regeneration”, “Re-Epithelialization”, “Healing Progress”, “Wound Management”, “Artificial Intelligence”, "AI (Artificial Intelligence)", "Computational Intelligence", “Monitoring” e “Evaluation”. The articles’ review was made in PubMed and Scopus databases between November 20, 2023 and March 6, 2024. For a more effective choice of articles, inclusion criteria were defined, namely participants with acute or chronic wounds in the process of healing and the express use of AI, and exclusion criteria, such as the approach to wounds healing by primary intention.

**Results**: In the research 107 articles were found, 15 of which were duplicates. After applying Prisma-Scr, 14 articles were analysed. The results were divided into 2 dimensions. In dimension “AI tools and their functionalities”, the articles show that there are tools that evaluate wound components, such as length, width and depth, and other articles that share clinical data between the user and the healthcare professional. The second category concerns "AI's implications". The authors show that the effectiveness of human evaluation is mostly lower than that of AI. These technologies allow for a more accurate and quick wound assessment, helping to reduce the costs associated with healthcare. Through AI tools, it is possible to optimize wound imaging through new technologies such as optical coherence tomography and multiplexed sensors.

**Conclusion**: After this scoping review, it can be concluded that AI tools help in wound assessment by measuring their characteristics, which reduces the time and costs associated with wound care. It is necessary to awaken professionals to this subject, which has proven to be an asset in wound care, offering significant benefits for both patients and health professionals.

**Conflict of interest**: There are no conflict of interest.

# P45
# Using AI to support professional interventions in community pharmacies

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Keywords: Large language models (LLM), Summary of Product Characteristics (SMPC)

**Background**: In the professional intervention of community pharmacists, it is increasingly important to broaden the scope of intervention when it comes to promoting the safety and effective use of medicines. Therefore, the ability to respond quickly, objectively and robustly to questions posed by clients are crucial. Relevant knowledge sources, such as summaries of product characteristics (SMPCs) and databases of medicines, are available to assist community pharmacists in providing further value to the customer. However, searching through the national repositories is impossible in real-time. The emergence of Artificial Intelligence (AI), and particularly text generative models, allows the user to interact and make sense of substantial amounts knowledge by using plain text prompts, in the form of a dialogue. The purpose of this work is to make viable for pharmacy practitioners to search through the data from the Portuguese repository of SMPC documents in real-time, in the form of a dialogue with an AI tool that is specialized in this documentation.

**Methods**: Documents from the national repository of SMPCs were downloaded from the website of the Portuguese regulatory entity for medicines. Each file was parsed using simple string search based on the standard structure of this type of document, and a tabular structure with columnar information pertaining each section of each document was created. The file was then uploaded to create a GPT based on the selected information.

**Results**: Preliminary results have shown that the tool is able to accurately answer the questions based only on the files selected. The answers consist of the text contained in the section to which the question concerns, delivered in the form of a dialogue. Thus, questions that would require consulting at least a dozen files (e.g., "which medicines containing the INN Atorvastatin do not contain lactose in the excipients?") are answered in one prompt, provided that the information is in the file. However, questions requiring the tool to search through blocks of text contained in each section of the document are time consuming, and often unfruitful. This led to the addition of more structures to the tabular file, such as "medicine name", "ATC code" and "INN," to facilitate search and help direct the questions/prompts.

**Conclusions**: Using this AI in community pharmacies empowers the practitioner and enriches customer experience since dialogues can be engaged in a Q&A fashion in real-time. Nevertheless, strategies to download information from the repositories and structuring them remain the bottleneck for adoption of these types of approaches, thus requiring further development.

**Conflicts of interest**: The authors declare no conflict of interests.

# P46
# Flu surveillance in Portugal using over-the-counter sales from community pharmacies

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Keywords: Community Pharmacy, Over the Counter (OTC) drugs, Pharmacoepidemiology

**Background**: In large-scale community transmission, such as seasonal influenza, monitoring geographic trends and estimating the transmission intensity are critical to support public health decision-making. Detection and tracking of this infectious disease primarily rely on physician diagnoses, sentinel influenza-like-illness (ILI) surveillance and virologic confirmation. However, the availability and timing of this data pose a clear limitation to the early identification of the outbreak and peak of the epidemy, and to the estimation of its impact in the health care system in real-time. Previous studies have successfully used sales data from over-the-counter (OTC) products in community pharmacies to detect and monitor different epidemiological outbreaks, developing surveillance systems that are able to anticipate the load on primary care services and hospitals by up to 3 weeks [1].

**Methods**: The subset of OTC products sold in Portuguese community pharmacies was selected by correlating sales data to primary care attendance in previous flu seasons. This data pertained to daily coded episodes of influenza-like-illness (International Classification of Primary Care, 2nd Edition, code R80) in the Portuguese health cluster Oeste Sul. By fitting a moving epidemic method [2] to historical sales data and then applying it to daily collected sales data, the developed index was used to anticipate the relative load to the primary care system as well as the start and the peak of epidemic activity for the current flu season. Results were compared to the public health data available on respiratory infections in Portugal.

**Results**: The model pinpointed the onset of the 2023-2024 flu epidemic in week 47 and its peak in week 52. The index curve showed a high correlation with the data published by the Portuguese national health service, with no time lag. However, the availability of consolidated public data was delayed, on average, by approximately two weeks.

**Conclusions**: Data from community pharmacies significantly enhance the early detection of seasonal flu trends, while reflecting population distribution. This underscores their invaluable contribution to public health assessments and the potential for improving the timeliness and accuracy of seasonal flu surveillance.

**Conflicts of interest**: The authors declare no conflict of interests.

**Supplementary material:** Available online