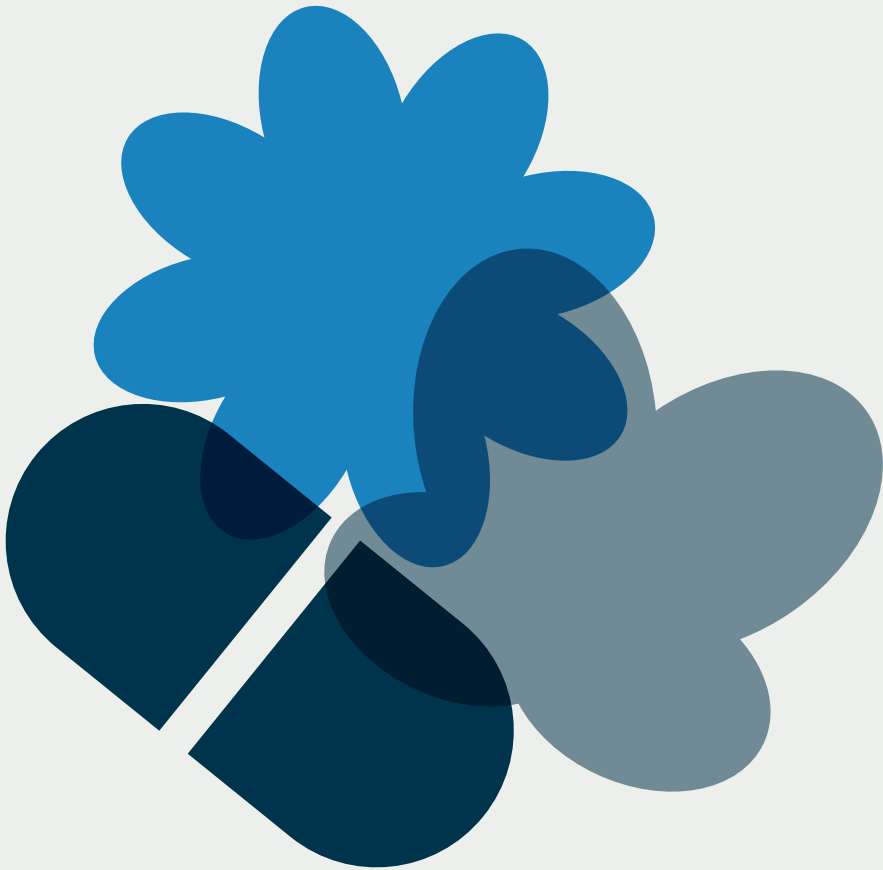


Mathematical Modelling Applied to Health



About



José A. Lozano
BCAM'S SCIENTIFIC
DIRECTOR



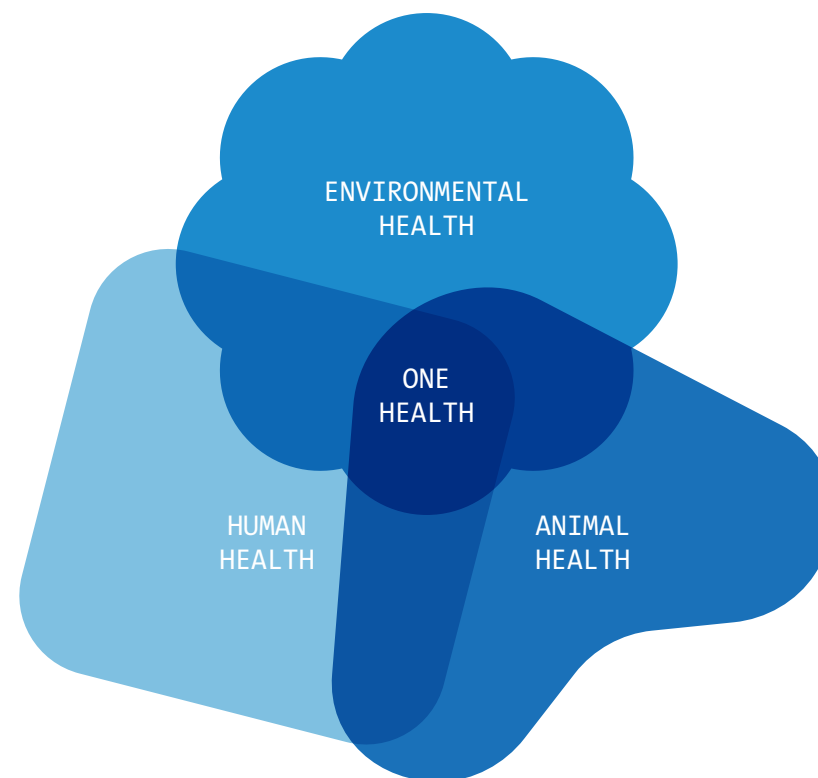
Over the past four years, the [Basque Center for Applied Mathematics \(BCAM\)](#), in close collaboration with Ikerbasque, UPV/EHU (University of the Basque Country), leading health and biosanitary institutes across the Basque Country and internationally renowned researchers in the field, has led a joint initiative titled [Mathematical Modelling Applied to Health](#). The project was funded by the Department of Science, Universities and Innovation of the Basque Country.

This ambitious interdisciplinary project was designed to bridge the gap between cutting-edge mathematical research and pressing biomedical and clinical challenges. Our objective was to demonstrate the transformative potential of mathematical modelling as a rigorous and versatile tool for understanding complex biological systems, improving diagnostic and prognostic methods, and supporting decision-making in healthcare.

The project brought together researchers from [applied mathematics](#), [statistics](#), [computational biology](#), [epidemiology](#), and [clinical sciences](#). Through collaborative work packages, we addressed a range of health-related problems—from modelling the progression of chronic diseases and analyzing biomedical data, to optimizing public health interventions. A strong emphasis was placed on data-driven modelling, methodological innovation, and translation to real-world clinical settings.

The outcomes of this initiative underscore the value of sustained, cross-sector collaboration. They also highlight the critical role that mathematics can play in supporting a more predictive, personalized, and efficient healthcare system. This report presents the main scientific contributions of the project and offers a perspective on future directions for research at the interface of mathematics and health.

One Health



Funded by ↓



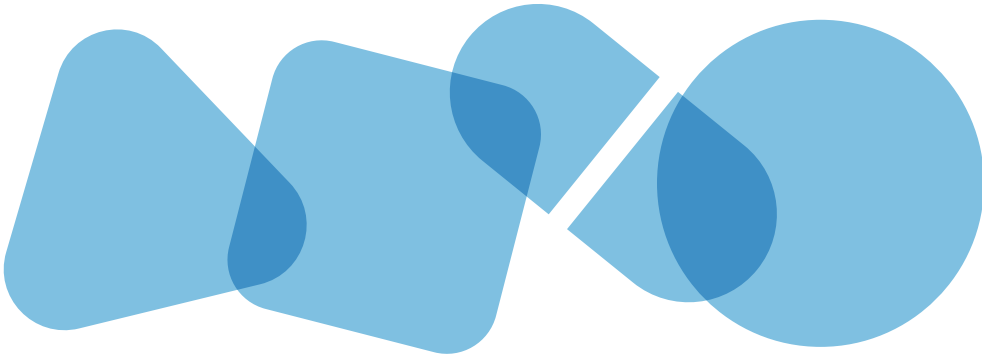
This is a collaborative project of the following entities ↓



Map of Collaborators



Human Health



01. Cancer

Multiplatform data integration and analysis for the identification of cancer biomarkers

The main objective has been to develop innovative mathematical approaches for the integration of clinical and “-omics” data in a Bayesian framework in order to identify key genes in resistance to hormone therapies in patients with breast cancer. A novel 6-gene signature discovered within this study demonstrates the superior predictive performance over previously known signatures of similar scope.

Given that breast cancer is the most prevalent cancer among women worldwide, the relevance and potential impact of this project is considerable, with applications that could significantly advance personalized medicine and improve patient outcomes.

This project has been carried out in collaboration with **CIC bioGUNE; University of Edinburgh, UK; University College London, UCL, UK.**

LIST OF PARTICIPANTS

BCAM Miguel Fernandez de Retana; Martin Parga Pazos

BCAM|Ikerbasque Elena Akhmatkaya

CICbioGUNE Maria Vivanco

University of Edinburgh Victor Elvira

PUBLICATIONS

M. Parga-Pazos, M., Cusimano, N., M. Rábano, M., Akhmatkaya, E., Vivanco, M. dM, A novel mathematical approach for the analysis of integrated cell-patient data uncovers a 6-gene signature linked to endocrine therapy resistance, *Laboratory Investigation*, 104 100286 (2024).

SOFTWARE

BLR-SA-TamResistance

<https://github.com/chanfanetas/BLR-SA-TamResistance>

More info ↓



VivancoLabSeq

<https://vivancolabseq.shinyapps.io/RNASeqSOX/>

More info ↓



A machine learning approach to predict healthcare cost of breast cancer patients

This work introduces a novel machine learning approach for early prediction of healthcare costs for breast cancer patients. The method involves two steps: (1) clustering patients based on similar clinical activities and healthcare costs, and (2) learning a Markov chain for each group to describe the sequences of clinical activities. The prediction phase consists of (1) estimating the healthcare cost of a new patient using the average cost of its k-nearest neighbors within the group, and (2) aggregating the costs from each group to determine the final predicted cost. Experiments show a mean absolute percentage error as low as 6%, even with partial clinical records, demonstrating the method’s early prediction capability. A comparative analysis also highlights its superiority over existing techniques.

This project has been carried out in collaboration with the economic-financial department of the **Hospital Universitario de Cruces**.

LIST OF PARTICIPANTS

BCAM |UPV/EHU Jose A. Lozano

BCAM Aritz Pérez; Patryusha Rakshit; Onintze Zaballa

Hospital Universitario Cruces Teresa Acaiturri Ayesta; Elisa Gómez Inhiesto

PUBLICATIONS

Zaballa, O., Pérez, A., Gómez Inhiesto, E., Acaiturri Ayesta T., Lozano JA., Pratyusha R.A., A machine learning approach to predict healthcare cost of breast cancer patients. *Sci Rep* 11, 12441 (2021).

Zaballa, O., Pérez, A., Gómez Inhiesto, E., Acaiturri Ayesta T., Lozano JA., Learning the progression patterns of treatments using a probabilistic generative model, *Journal of Biomedical Informatics*, Volume 137, (2023).

Zaballa, O., Pérez, A., Gómez Inhiesto, E., Acaiturri Ayesta T., Lozano JA., A probabilistic generative model for discovering coexisting disease treatments with missing data. *Computer Methods and Programs in Biomedicine*, 243, 107870. (2024).

SOFTWARE

Comorbidity Generative Model

<https://github.com/onintzezaballa/ComorbidityGenerativeModel>

More info ↓



02.Clinical Research

Reliable prediction of difficult airway for tracheal intubation from patient preoperative photographs by machine learning and deep learning methods

Deep neural networks were trained to automatically extract the location of orofacial landmarks (relevant anatomical points) [27 frontal + 13 lateral] from pre-operative photographs. Subsequently, we computed 59 morphological features: 3D distances, areas, angles and ratios; engineered with our anesthesiology team to describe each individual's airway anatomy. Along with 7 demographics, this information was fed to a machine learning algorithm developed to predict the risk of a difficult tracheal intubation. Overall, the system outperformed all baselines (both clinical assessment and state-of-the-art methods), yielding satisfactory discernment abilities, good calibration and fewer false negatives than the judgement by human experts.

This project has been carried out in collaboration with the **Hospital Universitario Galdakao-Usansolo: Servicio de Anestesiología & Research Unit**.

PUBLICATIONS

García-García, F., Lee, D.J., Mendoza-Garcés, F.J. and García-Gutiérrez, S., Reliable prediction of difficult airway for tracheal intubation from patient preoperative photographs by machine learning methods. *Computer Methods and Programs in Biomedicine*, 248, p.108118. (2024).

García-García, F., Lee, D.J., Mendoza-Garcés, F.J., Irigoyen-Mir, S., Legarreta-Olabarrieta, M.J., García-Gutiérrez, S., Arostegui, I., Automated location of orofacial landmarks to characterize airway morphology in anaesthesia via deep convolutional neural networks. *Computer Methods and Programs in Biomedicine*, 232, p.107428. (2023).

SOFTWARE

AirWay app

(September 2025) The software is still in a debugging stage. Pending registration of intellectual property.

<https://gitlab.bcamath.org/atahat/airway-app-debug.apk>

More info ↓



LIST OF PARTICIPANTS

BCAM Fernando García-García; Amani Tahat

BCAM|IE University Dae-Jin Lee

UPV/EHU Inmaculada Arostegui

Hospital Universitario Galdakao-Usansolo Susana García-Gutiérrez; Sofía Irigoyen-Miró; María José Legarreta-Olabarrieta; Francisco Mendoza-Garcés; Jonatan Vargas-Caño

Machine learning for predicting severity of ischemic stroke

The project investigated the application of machine learning techniques to predict the severity of ischemic stroke. A multi-objective optimization approach was introduced to produce models with varying levels of sensitivity and specificity, supporting physicians in their clinical decision-making. Two clinical calculators were developed—one for predicting mortality and another for assessing functional independence—using key stroke-related variables to ensure practical relevance in medical settings.

This project has been carried out in collaboration with the Hospital Universitario Donostia (HUD); Osakidetza.

LIST OF PARTICIPANTS

BCAM Mario Martínez García BCAM|UPV/EHU Jose A. Lozano Hospital Universitario Donostia/ HUD Juan Marta Enguita UPV/EHU Iñaki Inza

Study on PRO and mortality association in patients with COPD

The study analyzed the clinical evolution of Obstructive Pulmonary Disease (COPD) patients through Patient-Reported Outcomes (PROs), focusing on Health-Related Quality of Life (HRQoL). A joint statistical model for longitudinal and survival data was developed to assess associations between HRQoL and survival data. The study aimed to enhance COPD patient care by integrating PROs alongside clinical biomarkers.

This project has been carried out in collaboration with the Hospital Universitario Galdakao-Usansolo.

LIST OF PARTICIPANTS

BCAM Cristina Galán-Arcicollar; Josu Najera Zuloaga BCAM|IE University Dae-Jin Lee University of Cambridge Danilo Alvares

Other projects →

03.Epidemiology

Estimating the impact of COVID-19 vaccination in an elderly population using counterfactual modeling: evidence from the Basque Country

This project evaluates the impact of the COVID-19 vaccination campaign in Spain's Basque Country - one of the most aged populations globally - using counterfactual modeling. It estimates that vaccination efforts prevented between 46,000 and 75,000 hospitalizations, 6,000 to 11,000 ICU admissions, and 15,000 to 24,000 deaths, amounting to reductions of 73–86%. The most substantial effect occurred during the Delta variant wave in the third quarter of 2021, when vaccination coverage exceeded 60% [1]. These findings are supported and complemented by a second modeling study that reconstructs the evolving immunity profile of the Basque population from 2020 to 2022 [2]. This work used a multi-level immunity model to track the interplay of natural infection, vaccination, and waning immunity, providing a detailed picture of how immunity shaped outbreak severity over time. Both studies identify three distinct epidemic phases: an early wave suppressed by strong interventions; an intermediate period with variant-driven surges and rising immunity; and a late phase marked by Omicron's high transmissibility and immune escape. Across all phases, severe outcomes were largely associated with unvaccinated or immunologically naive individuals, highlighting the key role of sustained vaccination strategies.

Together, these studies underscore the importance of high vaccination coverage, continuous epidemiological monitoring, and adaptive public health policies in managing COVID-19's evolving impact.

This project has been carried out in collaboration with **Epidemiology and Public Health, Osakidetza; Biodonostia; Pasteur Institut Tunis, Tunisia.**

PUBLICATIONS

Estadilla, C.D., Mar, J., Ibarrondo, O. et al. Impact of high COVID-19 vaccination rate in an aging population: Estimating averted hospitalizations and deaths in the Basque Country, Spain using counterfactual modeling. *J Epidemiol Glob Health* 14, 1289–1299 (2024).

Naffeti, B., Ounissi, Z., Srivastav, A.K. et al. Modeling COVID-19 dynamics in the Basque Country: characterizing population immunity profile from 2020 to 2022. *BMC Infect Dis* 25, 9 (2025).

LIST OF PARTICIPANTS

BCAM Rubén Blasco; Carlo Estadilla; Nico Stollenwerk

BCAM|Ikerbasque Maira Aguiar

BCAM|Weill Cornell Medical College in Qatar, Doha
QA Bechir Naffeti

BCAM|Institut Pasteur de Tunis, Tunis, Tunisia
Zeineb Ounissi

Basque Government Public Health Department Joseba Bidaurreazaga

Biodonostia Oliver Ibarondo; Javier Mar

Predictive models to predict deterioration of patients hospitalized with COVID-19

The project aims to predict the deterioration of patients hospitalized with COVID-19 using data available at the time of admission. A novel predictive model is developed within the framework of learning with privileged information, which leverages additional patient data accessible during training but unavailable at prediction time. This approach enables the model to learn a more informative representation of patient risk, resulting in improved performance compared to existing models, despite relying only on admission data at inference.

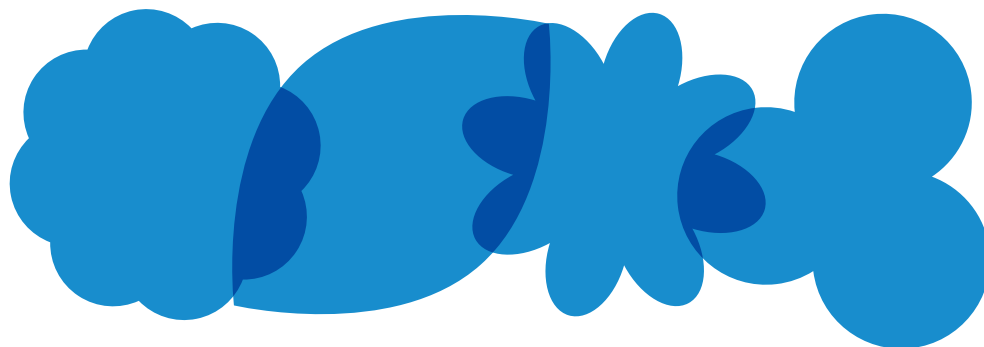
This project has been carried out in collaboration with Galdakao Usansolo

LIST OF PARTICIPANTS

BCAM Lasai Barreñada; Mario Martínez-García BCAM|UPV/EHU
Jose A. Lozano Hospital Galdakao-Usansolo /HUGU Susana García-Gutierrez UPV/EHU Iñaki Inza

Other projects →

Enviromental and Public Health



Modeling of public health emergency medical services

This project addresses the optimization of ambulance distribution in the Basque Country, seeking to balance response time between urban and rural areas. Since emergencies are concentrated in cities, while rural areas have less demand but more difficult access, a two-stage stochastic linear programming model is proposed. This model optimizes ambulance allocation by considering multi-interval response times and ensuring an equitable distribution of service. The results show that the proposal improves the success rate in rural areas by 23 percentage points, with a reduction of less than 9% in the overall rate.

This project has been carried out in collaboration with the **Emergency department of the Basque Public Health Service - Osakidetza**

LIST OF PARTICIPANTS

BCAM Imanol Gago Carro;
Alexis Le Merrer

BCAM|IE University Dae Jin Lee

BCAM|UPV/EHU Maria Merino
Maestre; Gloria Pérez Sainz
de Rozas

UPV/EHU Unai Aldasoro
Marcellan; Josu Ceberio

Université Laval, Canada
Angel Ruiz

PUBLICATIONS

Gago-Carro, I., Aldasoro, U., Ceberio, J., Merino, M., A stochastic programming model for ambulance (re)location-allocation under equitable coverage and multi-interval response time. *Expert Systems with Applications*, (2024).

Gago-Carro, I., Aldasoro, U., Lee, D.J., Merino, M., Stochastic optimization for Emergency Medical Services: a hierarchical compromise model and a matheuristic algorithm.

SOFTWARE

Equitable Multi-Interval (re) <http://dx.doi.org/10.5281/zenodo.10427658>

Location-Allocation (EMILA models:
codes and scalability analysis

More info ↓



Prognosis for the severity of COVID-19 pneumonia and assessment of the impact of outdoor air pollution on its severity and mortality

This cohort study included 1,548 patients hospitalized between February and May 2020 (first wave of the COVID-19 pandemic in Spain, 4 hospitals in 3 regions) due to SARS-CoV-2 pneumonia. On the one hand, the research team developed a machine learning strategy for the individualized prognosis of patients' clinical severity in the disease based on their admission status. There were 260 candidate algorithms compared, which exploited ordinal classification techniques, informed resampling and cost-sensitive learning to account for different implications in the diagnosis towards maximizing the quality of healthcare. On the other hand, researchers studied the relationship between levels of exposure to outdoor air pollution and the risk of short-term death for this SARS-CoV-2 pneumonia, as well as the relation with clinical indicators of gas exchange and systemic inflammation. Six environmental air pollutants were examined (PM10, PM2.5, O3, NO2, NO, NOX – aggregated exposure during the previous year), and adjustments were made to account for patients' sex, age, comorbidity, income group, and meteorological conditions. Using geospatial Bayesian models, the study found that exposures to PM10, NO2, NO, and NOX were significantly associated with increased risk of death, more inflammation and impaired gas exchange.

This project has been carried out in collaboration with the **Hospital Universitario Galdakao-Usansolo (HUGU): Servicio de Neumología & Research Unit.**

LIST OF PARTICIPANTS

BCAM Fernando García-García; Miren Hayet-Otero

BCAM|IE University Dae-Jin Lee

UP Valencia Joaquín Martínez-Minaya

HUGU Olaia Bronte; Pedro Pablo España Yandiola; Mónica Nieves Ermecheo; José María Quintana; Ane Uranga

PUBLICATIONS

García-García, F., Lee, D.J., Yandiola, P.P.E., Landa, I.U., Martínez-Minaya, J., Hayet-Otero, M., Ermecheo, M.N., Quintana, J.M., Menéndez, R., Torres, A. and Jorge, R.Z. Cost-sensitive ordinal classification methods to predict SARS-CoV-2 pneumonia severity. *IEEE Journal of Biomedical and Health Informatics*, 28(5), pp.2613-2623. (2024).

Bronte, O., García-García, F., Lee, D.J., Urrutia, I., Uranga, A., Nieves, M., Martínez-Minaya, J., Quintana, J.M., Arostegui, I., Zalacain, R. and Ruiz-Isturriaga, L.A., Impact of outdoor air pollution on severity and mortality in COVID-19 pneumonia. *Science of the Total Environment*, 894, p.164877 (2023).

SOFTWARE

FeatSel-COVID-19

More info ↓



Supporting code for: "Extracting relevant predictive variables for COVID-19 severity prognosis: An exhaustive comparison of feature selection techniques" (PLOS ONE)

<https://github.com/fegarcia-bcam/FeatSel-COVID-19-PLOS-ONE>

CostOrdinalPredict-COVID-19

More info ↓



<https://github.com/fegarcia-bcam/CostOrdinalPredict-COVID-19-IEEE-JBHI>

Other projects →

Application of big data for the assessment of the health status of the pediatric population in Alava-Vitoria

This project applied machine learning to analyze pediatric data in the Araba region, aiming to assess nutritional status, childhood obesity risks, and COVID-19's impact on child development. Using GAMLSS models, growth trends and increasing obesity were confirmed, with socioeconomic differences in obesity prevalence identified. The study highlights the value of the OSABIDE GLOBAL dataset for updating pediatric growth curves and informing public health policies.

This project has been carried out in collaboration with OSI Araba.

LIST OF PARTICIPANTS

BCAM Ioar Casado ; Aritz Pérez OSI Araba Ignacio Díez; Ainhoa Sarasua

Rheology of a Crowd: from faster-is-slower to shear thickening

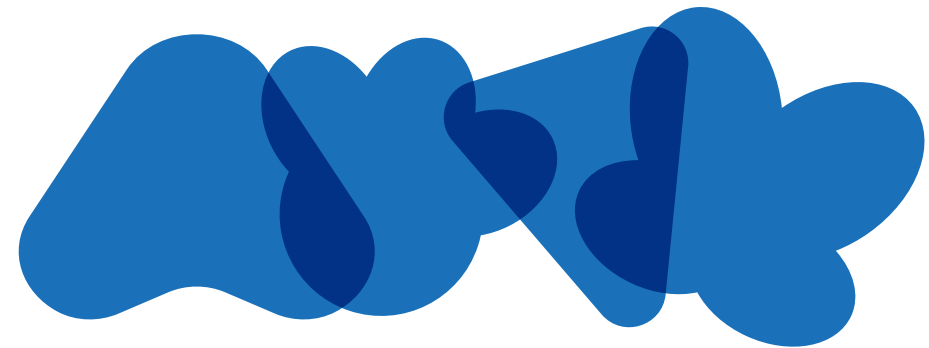
Development of a mathematical model that simulates infectious disease transmission in agent-based pedestrian simulations from discretised diffusion equations to capture the complexities of aerosol transmission.

This project has been carried out in collaboration with Galdakao Usansolo.

LIST OF PARTICIPANTS

BCAM|Ikerbasque Marco Ellero BCAM Ander García; Dariel Hernández-Delfin

Animal Health



Modeling spillover dynamics: understanding emerging pathogens of public health concern

The emergence of infectious diseases with pandemic potential is a significant global health threat, with around 60% of these diseases being zoonoses originating from spillover events. While the mechanisms behind spillover remain unclear, mathematical modeling offers insights into the interactions between pathogens, wildlife, humans, and their environment. This study proposes a continuous time stochastic modeling framework to simulate cross-species disease transmission. Numerical experiments exploring various spillover scenarios suggest that although most zoonotic outbreaks do not persist in human populations, the increasing frequency of spillover events can lead to large, unexpected outbreaks. Therefore, efforts to mitigate emerging diseases must focus not only on outbreak control but also on preventing pandemics before they take hold.

This project has been carried out in collaboration with *The Basque Health Department (Public Health)*

PUBLICATIONS

Saldaña, F., Stollenwerk, N., Van Dierdonck, J.B. et al. Modeling spillover dynamics: understanding emerging pathogens of public health concern. *Sci Rep* 14, 9823 (2024).

LIST OF PARTICIPANTS

BCAM Fernando Saldaña; Nico Stollenwerk

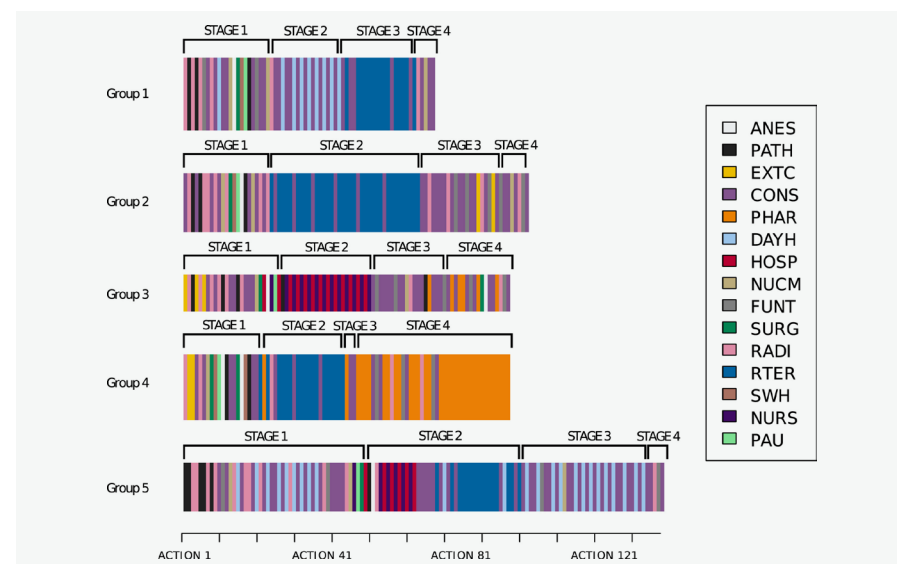
BCAM|Ikerbasque Maïra Aguiar

Public Health, Basque Health Department Joseba Bidaurrezaga Van Dierdonck

Illustrative Results



Cancer



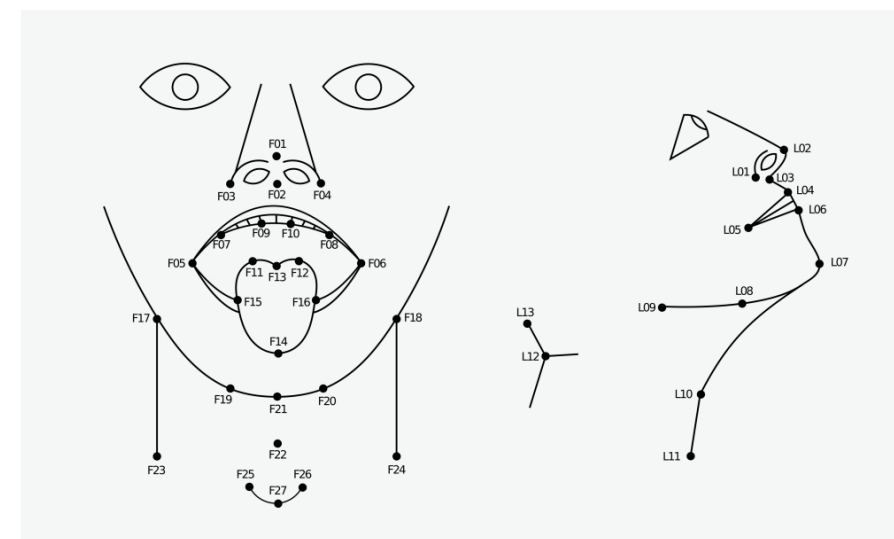
ABOUT THE FIGURE

Representative treatments of breast cancer segmented in the different phases of evolution. The medical actions of the legend are anesthesia (ANES), pathological anatomy (PATH), external consultation (EXTC), consultation (CONS), pharmacy (PHAR), day hospital (DAYH), hospitalization (HOSP), nuclear medicine (NUCM), functional testing (FUNT), surgery unit (SURG), radiology (RADI), radiotherapy (RTER), surgery without hospitalization unit (SWH), nursing unit (NURS), and post anesthesia care unit (PAU).

PUBLICATION INFO

Zaballa O, Pérez A, Gómez Inhiesto E, Acaiturri Ayesta T, Lozano JA. Learning the progression patterns of treatments using a probabilistic generative model, *Journal of Biomedical Informatics*, Volume 137, 2023.

Clinical Research



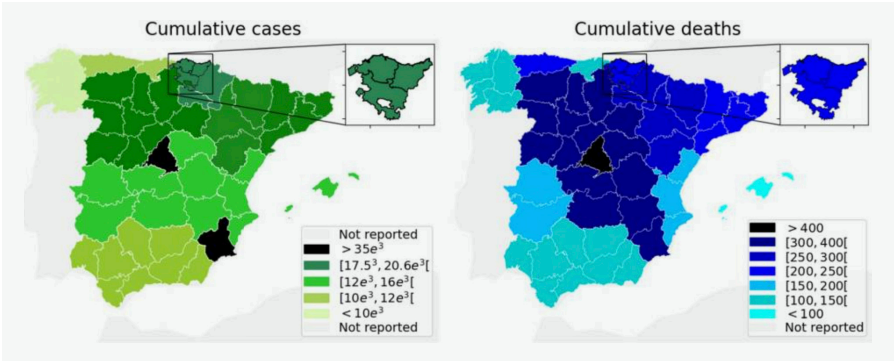
ABOUT THE FIGURE

Definition of orofacial landmarks to characterize airway morphology in the context of anaesthesia. Left panel – Frontal view: Landmarks F01–F27 (nose, lips, teeth, tongue, chin, mandible, neck, thyroid cartilage, sternal manubrium). Right panel – Lateral view: Landmarks L01–L13 (nose, lips, chin, mandible, thyroid cartilage, sternal manubrium, nape, occiput).

PUBLICATION INFO

García-García, F., Lee, D.J., Mendoza-Garcés, F.J., Irigoyen-Mir, S., Legarreta-Olabarrieta, M.J., García-Gutiérrez, S. and Arostegui, I., 2023. Automated location of orofacial landmarks to characterize airway morphology in anaesthesia via deep convolutional neural networks. *Computer Methods and Programs in Biomedicine*, 232, p.107428.

Epidemiology



ABOUT THE FIGURE

Spread of COVID-19 in Spain up to December 21, 2022. The Basque Country, located in the north of the country, is divided into three provinces, as highlighted in the figure.

PUBLICATION INFO

Naffeti, B., Ounissi, Z., Srivastav, A.K. et al. Modeling COVID-19 dynamics in the Basque Country: characterizing population immunity profile from 2020 to 2022. *BMC Infect Dis* 25, 9 (2025).

Environmental and Public Health

FIGURE 1 ↓

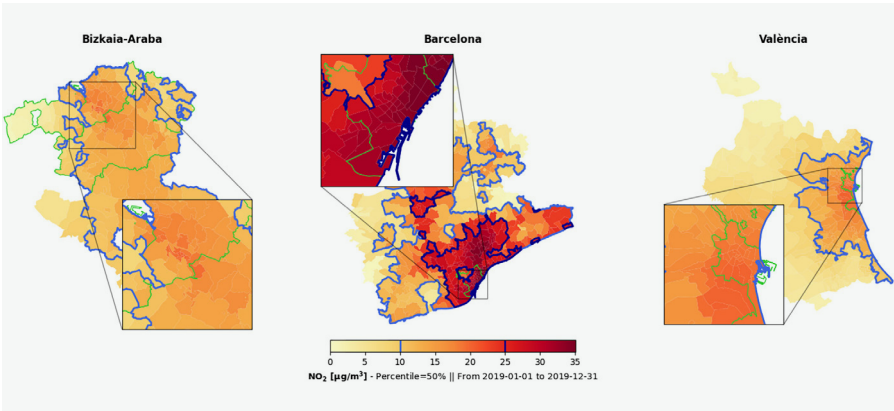
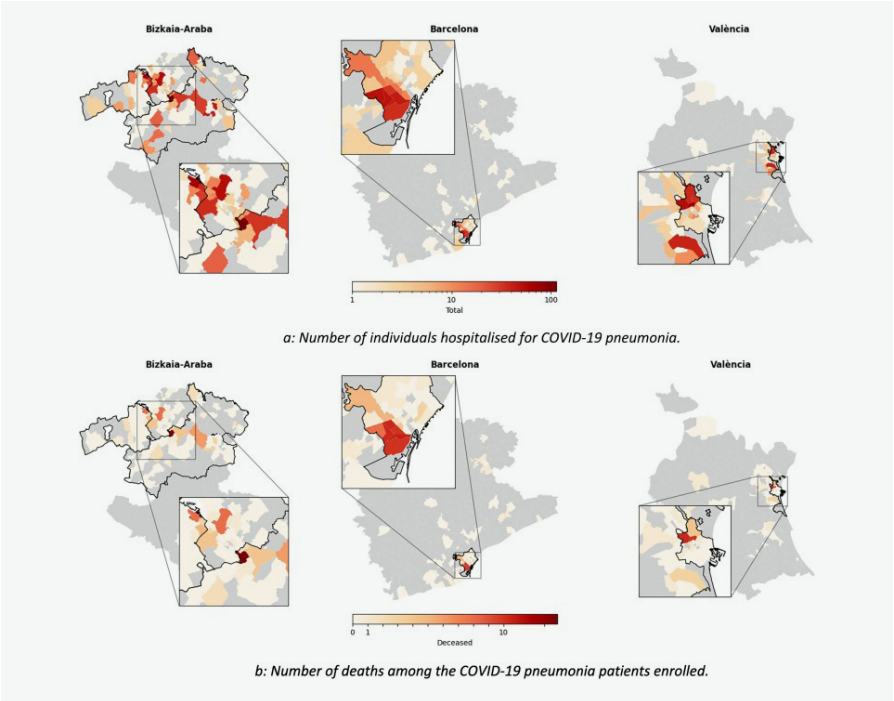


FIGURE 2 ↓



ABOUT THE FIGURES

- 1 This image depicts the distribution of the numbers of patients who were hospitalised (Fig. 3a) and who died (Fig. 3b) by postcode of residence.
- 2 Geographical distribution of the median daily NO2 concentration. Postcodes delimited with light blue lines experienced pollution levels above the annual air quality guideline [AQG] recommended by the World Health Organization (WHO, 2021) [i.e., 10 µg/m3 for NO2]; whereas postcodes outlined in dark blue experienced levels above the daily AQG [i.e., 25 µg/m3 for NO2]. In Bizkaia-Araba (left panel), the green lines delimit the catchment areas of Galdakao and Cruces hospitals; whereas, in the two other panels, green lines delimit the cities of Barcelona and Valencia.

PUBLICATION INFO

Bronte, O., García- García, F., Lee, D.J., Urrutia, I., Uranga, A., Nieves, M., Martínez-Minaya, J., Quintana, J.M., Arostegui, I., Zalacain, R. and Ruiz-Iturriaga, L.A., 2023. Impact of outdoor air pollution on severity and mortality in COVID-19 pneumonia. *Science of the Total Environment*, 894, p.164877.

Press Coverage Highlights



Report in Grupo Noticias on BCAM health projects (Deia, Diario de Noticias de Alava, Diario de Noticias de Gipuzkoa, Diario de Noticia de Navarra) December, 2024.

10 GARA KALEA

Deia - Domingo, 8 de diciembre de 2024

Deia - Lunes, 9 de diciembre de 2024

KALEA GARA 11



Las matemáticas y la medicina se unen para modernizar la sanidad y salvar vidas

Investigadores del BCAM utilizan algoritmos para personalizar tratamientos médicos y mejorar la gestión sanitaria

El BCAM, el Basque Center for Applied Mathematics, se encuentra en la vanguardia de la investigación matemática aplicada a la medicina. Los investigadores del BCAM están trabajando en proyectos que buscan mejorar la gestión sanitaria y personalizar los tratamientos médicos. Estos proyectos se centran en el uso de algoritmos y modelos matemáticos para analizar grandes cantidades de datos médicos y predecir el curso de las enfermedades. Los investigadores del BCAM están trabajando en proyectos que buscan mejorar la gestión sanitaria y personalizar los tratamientos médicos. Estos proyectos se centran en el uso de algoritmos y modelos matemáticos para analizar grandes cantidades de datos médicos y predecir el curso de las enfermedades.

Algoritmos matemáticos para predecir la evolución de la COVID-19

Los investigadores del BCAM están trabajando en proyectos que buscan mejorar la gestión sanitaria y personalizar los tratamientos médicos. Estos proyectos se centran en el uso de algoritmos y modelos matemáticos para analizar grandes cantidades de datos médicos y predecir el curso de las enfermedades. Los investigadores del BCAM están trabajando en proyectos que buscan mejorar la gestión sanitaria y personalizar los tratamientos médicos. Estos proyectos se centran en el uso de algoritmos y modelos matemáticos para analizar grandes cantidades de datos médicos y predecir el curso de las enfermedades.



Un modelo innovador para combatir el cáncer de mama

Una investigación del BCAM ayuda a afinar el diagnóstico de los tumores

Los investigadores del BCAM están trabajando en proyectos que buscan mejorar la gestión sanitaria y personalizar los tratamientos médicos. Estos proyectos se centran en el uso de algoritmos y modelos matemáticos para analizar grandes cantidades de datos médicos y predecir el curso de las enfermedades. Los investigadores del BCAM están trabajando en proyectos que buscan mejorar la gestión sanitaria y personalizar los tratamientos médicos. Estos proyectos se centran en el uso de algoritmos y modelos matemáticos para analizar grandes cantidades de datos médicos y predecir el curso de las enfermedades.

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Video Interview in El País. Onintze Zaballa



El País
April, 2024

<https://www.youtube.com/watch?v=csfSWWKogFI>

More info ↓



Interview in Gara

4 | CRISIS DEL CORONAVIRUS

2020/11/25 | LUNES DE GARA

GARA 2020/11/25 | LUNES DE GARA

ECT 15

MATEMÁTICA PARA PREDECIR LA EVOLUCIÓN DE LA COVID-19

Un grupo de matemáticos está trabajando para predecir, en base a los modelos, la evolución de la covid-19 y poder así dar un soporte a la toma de decisiones. Un trabajo complicado dada la poca evidencia científica y el desconocimiento de algunos datos.



PLAN DE GARA

Hay algunas formas que afectan la forma, como el de la evolución de la COVID-19. En este momento, la evolución de la COVID-19 es un tema muy relevante. Hay algunas formas que afectan la forma, como el de la evolución de la COVID-19. En este momento, la evolución de la COVID-19 es un tema muy relevante.

PREDICIONES

Se están haciendo predicciones sobre la evolución de la COVID-19. Se están haciendo predicciones sobre la evolución de la COVID-19. Se están haciendo predicciones sobre la evolución de la COVID-19. Se están haciendo predicciones sobre la evolución de la COVID-19.

ANTICIPARSE

Hay que anticiparse a la evolución de la COVID-19. Hay que anticiparse a la evolución de la COVID-19. Hay que anticiparse a la evolución de la COVID-19. Hay que anticiparse a la evolución de la COVID-19.

Grupo Noticias
Derech, 2024

<https://www.deia.eus/actualidad/sociedad/2024/12/08/matematicas-medicina-unen-modernizar-sanidad-9023935.html>

More info ↓

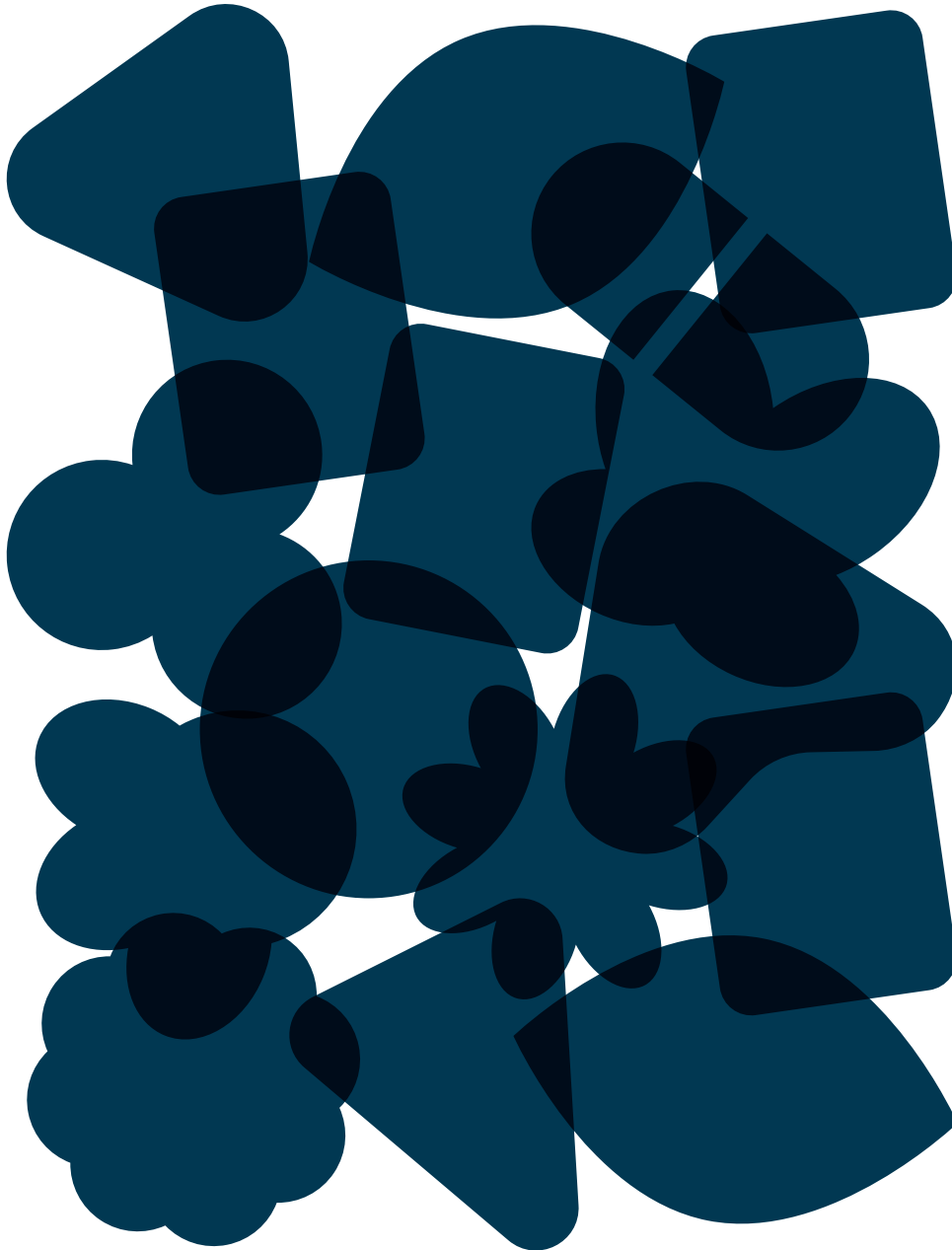


https://www.naiz.eus/es/hemeroteca/gara/editions/2020-05-25/hemeroteca_articles/matematica-para-predcir-la-evolucion-de-la-covid-19

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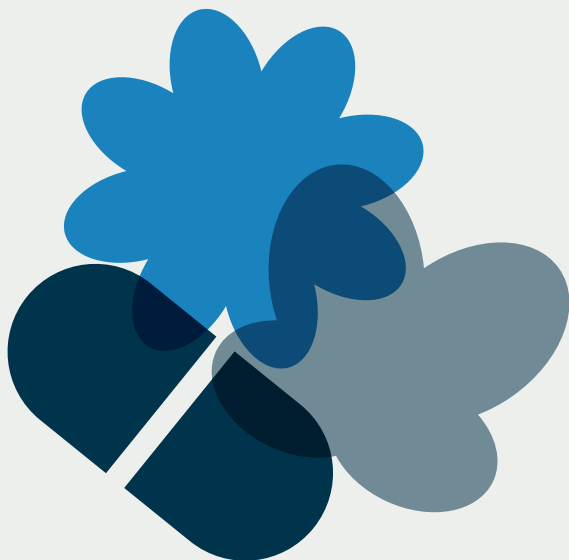
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Mathematical Modelling Applied to Health

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