

ISGlobal **Annual** **Report** **2016**

Total number of employees

385

From 31 different countries

Gender

70%
Women

30%
Men

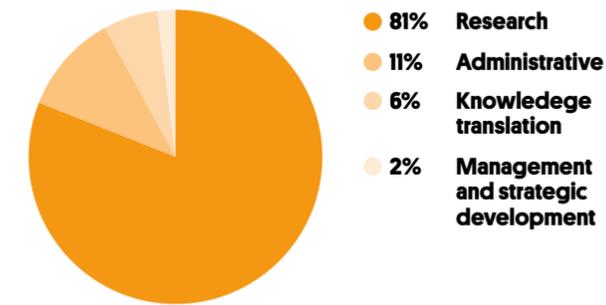
Average age

38.5

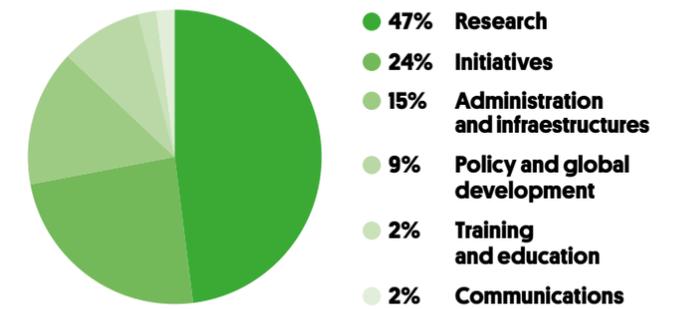
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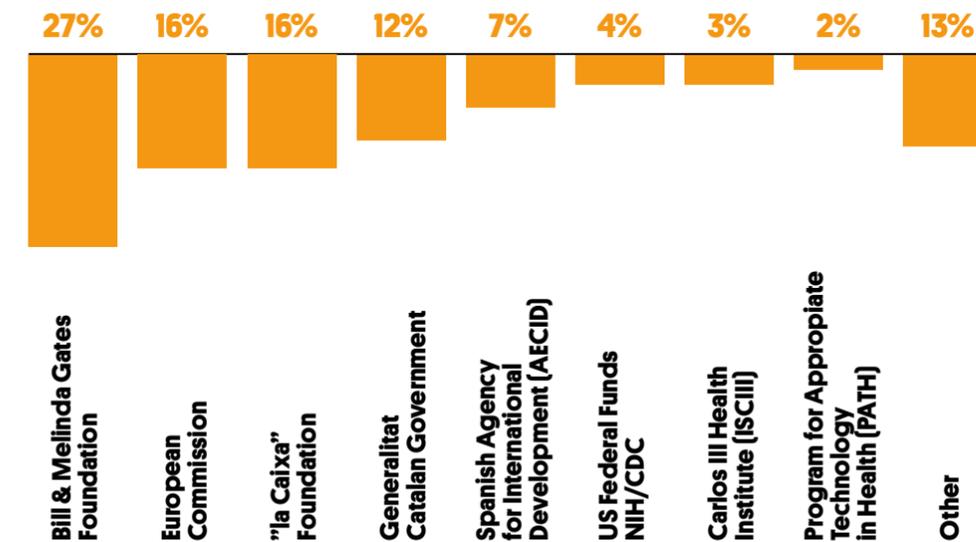
Staff by area



Budget breakdown



Main funders



Funding sources

53%
Private

47%
Public

Ongoing grants, fellowships and projects

187 of which 78 awarded in 2016

Total budget 2016

€22,397,801

Malaria Elimination Initiative

Chagas Initiative

Maternal, Child and Reproductive Health Initiative

Antimicrobial Resistance Initiative

Urban Planning, Environment and Health Initiative

RESEARCH

- Mozambican Alliance Towards the Elimination of Malaria (MALTEM): Generation of scientific evidence on how to best eliminate malaria, including the establishment of epidemiological and entomological surveillance systems
- Malaria Eradication Scientific Alliance (MESA): Finalisation of consultations to update the Malaria Eradication Research Agenda (malERA Refresh) and consolidation of MESA
- MESA Track database with research projects relevant to malaria elimination and eradication
- Development and assessment of new tools for malaria control and elimination
- Review of available evidence on the use of ivermectin as a malaria vector control tool, in support of a WHO Evidence Review Group

- Epidemiology of Chagas disease in non-endemic areas
- Biomarkers of therapeutic efficacy and for early diagnosis of cardiac damage in patients with Chagas disease
- Clinical trials of new drugs to treat Chagas disease
- Studies on the pharmacokinetics of benznidazole

- Operational research to improve delivery of intermittent preventive treatment of malaria in pregnancy
- Pharmacovigilance studies on antiretroviral and antimalarial drugs in pregnant women
- Operational research on the acceptability and viability of introducing HPV vaccination programmes in Africa
- Determination of causes of death in low-income countries
- Effects of the HIV/AIDS epidemic on maternal and child health
- Cervical cancer
- Maternal immunisation studies
- Surveillance of Zika virus infection in pregnant women
- Exploring arbovirus infection in Northern Colombia
- Determination of inequalities in access to reproductive and maternal health

- Molecular basis of antimicrobial resistance
- Relationship between virulence and antimicrobial resistance
- Discovery and assessment of new antibacterial drugs
- Search for diagnostic and prognostic biomarkers of bacterial and viral infections
- Pathogenesis and antimicrobial resistance of microorganisms that cause neonatal sepsis
- Epidemiology and clinical presentation of viral and bacterial infections

- Early life outdoor exposome and childhood diseases (HELIX Project)
- Air pollution and exposome and health (EXPOsOMICS Project)
- Promoting active transportation through sustainable transport (PASTA Project)
- Evaluating the relationship between blue space and health (BlueHealth Project)
- Cardiovascular effects of air pollution in India (CHAI Project)

TRAINING AND EDUCATION

- 5th edition of the course “Science of Eradication: Malaria”
- Training activities in the context of MALTEM

- 12th Workshop on Chagas Disease
- Capacity building in Bolivia’s Chagas Platform

- 2nd “Safe Mothers and Newborns” leadership workshop
- Master of Global Health short course: Maternal and Reproductive Health

- Workshop: “Biofilms: Past, Present and Future”

- Master of Global Health: Environmental Health short course
- Master in Public Health: Risk Assessment
- Environmental Health course for medical students at UPF and UAB
- ESPM: Health Impact Assessment Course
- Diputació de Barcelona: Health Impact Assessment Course

POLICY AND GLOBAL DEVELOPMENT

- Coordination of ISGlobal’s activities as a WHO Collaborating Centre for Malaria Control, Elimination and Eradication
- Support for international organisations and countries in the development of guidelines and strategic plans for malaria elimination
- Advocacy for malaria elimination

- Coordination of the Global Chagas Disease Coalition
- Report: *Breaking the Silence: An Opportunity for Patients with Chagas Disease*
- Online report: *Chagas: 5 Problems and a Series of Solutions*
- CEADES-ISGlobal-Probitas Foundation agreement to improve diagnosis and treatment of Chagas disease in Bolivia
- Expansion of the Chagas Platform healthcare model to the National Health System in Bolivia
- “Spread the Word to Fight Chagas Disease” campaign

- Roll Back Malaria working group on malaria in pregnancy
- Participation in Partnership for Maternal Newborn and Child Health (PMNCH)
- Participation in Women Deliver 2016
- Report: *Inequalities in Women’s and Girls’ Health Opportunities and Outcomes in Sub-Saharan Africa*
- Increased commitment to UN Global Strategy for Women’s, Children’s and Adolescents’ Health

- Report: *Biomedical Innovation and Access to Essential Medicines: Alternatives to a Broken Model*
- Report: *Hepatitis C: The New Battleground for Access to Essential Medicines*
- Online report: *The 4 Battlefronts in the War Against Antibiotic Resistance*

- Advocacy work for health in draft of New Urban Agenda
- Input into the WHO document *Health as the Pulse of the New Urban Agenda*
- Member of Planetary Health
- Contribution to the design of WHO HEAT Tool
- Input into WHO Transport and Health Tool
- Health Impact Assessment Tool for Urban Master Plans in Barcelona Province
- Participation in the pilot superblock in Barcelona’s Poblenou neighbourhood

A Decisive Year for Our Future

**Antoni
Plasència**
General
Director

In 2016, culminating over three years of strategic alliance, ISGlobal, the Barcelona Centre for International Health Research (CRESIB) and the Centre for Environmental Epidemiology (CREAL) completed the process that has brought them together in a single entity. This milestone marked the beginning of a new stage that saw ISGlobal, with a substantial increase in high quality scientific production, becoming an international centre of excellence in research, knowledge translation and training in both global and public health.

Broadening the scope of our scientific agenda with an ambitious portfolio of highly competitive research, including non-communicable diseases and the environmental factors that influence them in addition to infectious diseases, is consistent with the worldwide epidemiological shift and the growing importance of climate change. In addition, the incorporation, at the end of the year, of a new programme of cutting edge research on the health effects of climate reflects our firm belief in the need for scientific excellence to address the growing complexity and diversity of the key challenges facing global health.

Another facet of ISGlobal is our ambitious model of knowledge translation and innovation which—in addition to the four existing initiatives on Malaria Elimination, Chagas Disease, Maternal, Child and Reproductive Health, and Antimicrobial Resistance—has recently been expanded with the creation of a new initiative on Urban Planning, Environment and Health. The model has also been enhanced by associating our research programme and translation activities with the 2030 Development Agenda (the 17 Sustainable Development Goals) and by the recent emergence of the paradigm of planetary health, a concept linking human health with the health of the planet. Following the merger, our education department has become an outstanding hub for training in both public health and global health and has been strengthened through our affiliation as a university institute to two prestigious institutions: the University of Barcelona and Pompeu Fabra University.

In ISGlobal, we strongly believe in public-private collaboration as a way to achieve a high-level approach based on science and knowledge translation that would not otherwise be possible. ISGlobal could not have reached this point without the vision and backing of the "la Caixa" Banking Foundation and the Generalitat de Catalunya together with the contributions of all the other prestigious public and private institutions that support our project—Hospital Clínic de Barcelona, Mar Health Park, University of Barcelona, Pompeu Fabra University, the Government of Spain, Barcelona City Council, and the Ramón Areces Foundation. The structural support of the public institutions and the increase in private structural funding—to the point where it now equals our public funding—has given us institutional and financial stability during a period when economic recession has particularly affected the availability of public funding for R&D. Finally, we would also like to recognise the contribution of all the members and managers in our institutions, who during this transition period have worked tirelessly to make this project a reality. Thanks to all those involved, starting with three relatively small centres of excellence, we have created an international institute that is a leader in its field.

Several key challenges lie ahead, including the launch of a new strategic cycle for the period 2017-2020, which we are embarking on with the support of our partners and our external advisory bodies. In addition, a new headquarters is needed to resolve the current severe lack of space and the fragmentation of our operations across various sites. The new premises will facilitate the sustainable development of our institute's full potential and we will maintain our presence in Campus Clínic and Campus Mar. Nor can we afford to forget the ongoing search for new sources of funding, especially in view of the need to recruit and retain talent and to upgrade the infrastructures that are crucial to our competitive edge.

We look forward to this new phase with renewed optimism and a clear understanding of our mis-

sion: to improve global health and work towards greater equity throughout the world. In the search for effective and affordable solutions for the challenges currently facing health, we focus on geographical and social inequalities, infectious and chronic diseases in transition, the urbanisation of our planet, and the impact of climate and the environment on human health. Today, more than ever, our strategic vision leads us to support talented people who are committed to science and the most transformative translation of the knowledge generated. As a results-oriented organisation supported by prestigious public and private institutions, we work through long-term partnerships with leading international organisations, maintaining active collaborations on all five continents.

At a time when the world appears to be entering an era of protectionist and isolationist policies, it is important to remember that the complex and interdependent challenges in health and equity can only be tackled with a global and collective approach. Because, in the words of the African proverb that has guided our path since the foundation of ISGlobal: "If you want to go fast, walk alone, but if you want to go far, walk together."

**Josep M.
Antó**
Scientific
Director

International Global Health Partnership Board

The International Global Health Partnership Board is made up of individuals and institutions of recognised international prestige in the field of health and international cooperation. One of its functions is to advise the Board of Trustees and provide a global vision of the organisation's executive strategy.

Aga Khan Foundation

Bill & Melinda Gates Foundation

Carlos Slim Foundation

Graça Machel

Fred Newton Binka

Jaime Sepúlveda

Manhiça Foundation

Marcel Tanner

Nelson Mandela Children's Fund

Pedro L. Alonso

Silvia Gold

Virander S. Chauhan

Board of Trustees

The Barcelona Institute for Global Health is the result of a collaboration between institution from the public and private sectors. At the end of 2016, the membership of the ISGlobal Board of Trustees was as follows:

H.R.H. The Infanta Cristina de Borbón

Chair
Director of the International Programme at the "la Caixa" Foundation

Mr Javier Solana Madariaga

Vice-Chair
President of ESADEgeo and member of the Board of Trustees of the "la Caixa" Foundation

Ms Marta Casals Virosque

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Director of the Legal Department at the "la Caixa" Foundation

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Second Deputy Mayor, Barcelona City Council

Mr Jordi Baiget

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Autonomous Government of Catalonia

Dr Enric Banda Tarradellas

Dr Antoni Comín

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Mr Joan Puigdollers Fargas

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Member of the Board of Trustees of the "la Caixa" Foundation

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Rector of Pompeu Fabra University

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Rector of the University of Barcelona

Ms Maria Mercedes Vinuesa Sebastián

Director General for Public Health
Ministry of Health, Government of Spain

Scientific Advisory Committees

During 2016, the two pre-existing scientific advisory boards were maintained as described here, pending the formation of a new integrated scientific committee.

Scientific Technical Advisory Committee (STAC)

Prof Marcel Tanner

Chair
Professor and Director of the Swiss Tropical and Public Health Institute

Dr José Alcamí

Head of the AIDS Immunopathology Unit, National Microbiology Centre, Instituto de Salud Carlos III

Prof Mariano Esteban

Head of the Poxvirus and Vaccine Laboratory, National Biotechnology Centre, Consejo Superior de Investigaciones Científicas (CSIC)

Dr Maria C. Freire

President and Executive Director, Foundation for the National Institutes of Health

Prof Vicente Larraga

Head of the Vaccine and Gene Expression Group, Biological Research Centre, Consejo Superior de Investigaciones Científicas (CSIC)

Prof Myron M. Levine

Grollman Distinguished Professor and Director of the Center for Vaccine Development at the University of Maryland School of Medicine

Prof David Mabey

Professor of Communicable Diseases, Department of Clinical Research, London School of Hygiene & Tropical Medicine

Scientific Advisory Committee (SAC)

Prof David A. Savitz

President
Vice President for Research, Professor of Epidemiology, Professor of Obstetrics and Gynecology, Brown University

Prof Bert Brunekreef

Director of the Institute for Risk Assessment Sciences, Utrecht University

Prof Brenda Eskenazi

Director of the Center for Environmental Research and Children's Health (CERCH), School of Public Health, University of California

Prof Anne Marie Nybo Andersen

Department of Public Health, Faculty of Health Sciences, University of Copenhagen

Prof David Richardson

Department of Epidemiology, University of North Carolina

Prof Neil Pearce

Director of the Center for Global Non-communicable Disease, London School of Hygiene and Tropical Medicine

Prof Annette Peters

Director of the Institute of Epidemiology II, German Research Center for Environmental Health Helmholtz Zentrum München

Prof Dirkje S. Postma

Groningen Research Institute for Asthma and COPD (GRIAC), University of Groningen

Prof Christopher P. Wild

Director of the International Agency for Research on Cancer (IARC, WHO)

How We Work

ISGlobal's mission is to improve global health and promote health equity through excellence in research and the translation and application of knowledge. Our vision is to be a world-class global health research and knowledge-translation centre working towards a world in which all people can enjoy health.

Work Model

The aim of our work model is to make the most of the positive impact science can have as an instrument of change and to create a virtuous circle involving knowledge, action and impact on health.

Scientific research is the backbone of ISGlobal's work. This activity is carried out with a focus on translational research and in collaboration with many partners and associates. Since the merger with CREAL in June 2016, ISGlobal focuses its research efforts on two main research areas: on one hand, infectious diseases and on the other hand, non-communicable diseases and the environment. Its multidisciplinary approach allows it to encompass a wide range of fields and topics, ranging from molecular biology to clinical and epidemiological research.

Indeed, the purpose of the ISGlobal value chain is to use the knowledge generated by scientific research to create a virtuous circle. Therefore, the Policy & Global Development department uses the results of multidisciplinary evidence-based analysis to inform the global health agenda and to intervene directly on the ground through international development projects, while the Education department provides training for professionals from diverse fields to help them meet global health needs with innovative and sustainable solutions.

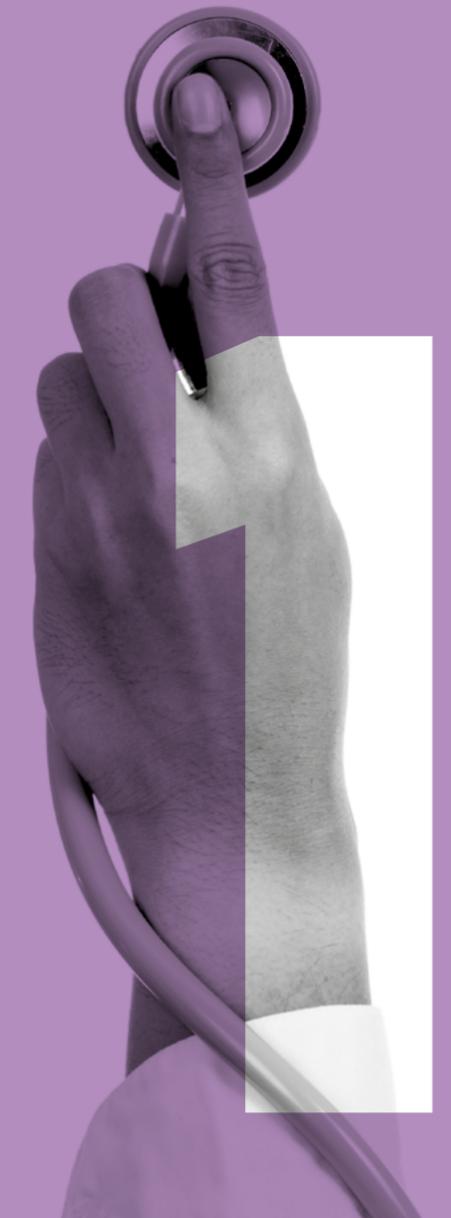
ISGlobal Initiatives

In the field of global health the transfer of knowledge is particularly important. Consequently, ISGlobal has a series of initiatives that focus on areas in which the institution is at the forefront of international research efforts in order to explore ways in which scientific knowledge can be applied and have an effective impact on global health. In 2016, following the merger with CREAL, a new Initiative on Urban Planning, Environment and Health was launched. Its aim is to apply rigorous scientific evidence, tools and indicators to promote sustainable and healthy urban development.

- **Malaria Elimination Initiative**
- **Chagas Initiative**
- **Maternal, Child and Reproductive Health Initiative**
- **Antimicrobial Resistance Initiative**
- **Urban Planning, Environment and Health Initiative**



RESEARCH



Facts & Figures

Number of articles & reviews

359

Articles published in high ranking journals

2 THE LANCET

1 nature

1 JAMA

4 nature genetics

1 THE LANCET Global Health

2 THE LANCET Infectious Diseases

5 PLOS | MEDICINE



WHO Collaborating Centre
for Malaria Control, Elimination
and Eradication

In first-decile journals

39%

Competitive contracts

2 ERC

2 ICREAs
1 awarded in 2016

3 Miguel Servet I
1 Miguel Servet I and 1 Miguel Servet II
awarded in 2016

3 Ramón y Cajal
2 awarded in 2016

5 MSCA
2 awarded in 2016



Institució
CERCA
Centres de Recerca
de Catalunya

In 2016, with the merger of ISGlobal and CREAL we have completed a process that started in 2012 and has resulted in a strengthened ISGlobal with a leading international profile and a more comprehensive scientific portfolio incorporating research on both communicable and noncommunicable diseases and their environmental determinants. Research on communicable diseases is organised into five programmes: Malaria; HIV/AIDS and Tuberculosis; Maternal, Child and Reproductive Health; Viral and Bacterial Infections; and Chagas and Imported Diseases. The work on noncommunicable diseases and the environment takes place in the following programmes: Respiratory Diseases; Cancer; Child Health; Air Pollution and the Urban Environment; Radiation; and Water Pollution. In addition, a new programme led by Xavier Rodó on Climate and Health with a strong focus on communicable diseases joined ISGlobal at the beginning of 2017. Altogether this has made us a stronger and more comprehensive Global Health research centre.

During the year, we completed the integration of the scientific structures and policies of the two institutions. This has resulted in a new integrated scientific career model with both tenure and non-tenure track paths, an internal scientific committee, and a project unit responsible for scientific coordination and pre-award and post-award services. We also started a new strategic cycle, covering the period 2017-2020, to strengthen the excellence of our research, reinforce synergies across programmes, and maximize our competitiveness and international leadership. Some of the most important aspects of this new strategic cycle include a restructured scientific organization with the research programmes as building blocks, the definition of standards of structural support for group leaders, the need to improve current services for robust data storage and intensive computation, and how to improve the access of the research groups to the scientific services of our partner institutions.

During the year, we have consolidated a large and competitive portfolio of research projects and fellowships, with about 85 proposals funded externally by national and international organisations. The ISCIII and the EU-H2020 contributed funding for the most projects. In 2016, ISGlobal researchers published 359 articles, our second largest annual production, with 39% of them in first decile journals. Some of these articles were published in leading international journals like Nature, Lancet, JAMA and PLoS Med.

ISGlobal's leadership in the area of malaria was recognised by the renewal of our WHO accreditation as collaborating centre for Malaria Control, Elimination and Eradication. Moreover, the institute's leadership in the development of minimally invasive autopsies as a tool for determining cause

of death in low-resource settings was reinforced with the funding of CaDMIA-plus, a project that establishes ISGlobal as a training and research centre for the evaluation of cause of death. That project was further strengthened by the publication of studies that validate the technique for use in adults and demonstrate its acceptability in different countries and cultural contexts.

Today, ISGlobal is a leading international centre in environmental epidemiology which continues to do ground-breaking birth cohort research. Examples include our research on the exposome, a new frontier for environmental research that will probably transform our current knowledge of how the external environment influences human health and disease. ISGlobal's contribution in this field, our leadership of the H2020 HELIX project and our participation in the EXPOsOMICS project deserve special mention, as reflected in the publication of papers in leading journals such as Environmental Health Perspectives and the Annual Review of Public Health. We also organised the 25th Epidemiology in Occupational Health Conference (EPICOH) in September 2016.

One of ISGlobal's defining characteristics is its commitment to maximising the impact of knowledge to reduce the health equity gap and tackle complex environmental health risks. In addition to the targeted work done in the ISGlobal initiatives, in 2016 we have also created horizontal working groups in two important and related areas: the sustainable development goals (SDGs) and planetary health. ISGlobal is currently member of the Sustainable Development Solutions (SDS) network and the Planetary Health Alliance, two partnerships that will help to reinforce the impact of our research.

The main strength of ISGlobal is its membership. In 2016, some of our scientists received important prizes and distinctions. Among others, Mònica Guxens received the HEI's Walter A. Rosenblith New Investigator Award, Elisabeth Cardis was honoured with the "Chernobyl-30 years" medal for her work on the health consequences of the nuclear accident, Judith Garcia-Aymerich was elected as a fellow of the European Respiratory Society, and Regina Rabinovich was elected future president of the American Society of Tropical Medicine and Hygiene.

Research Programmes

Air Pollution and the Urban Environment

Ambient air pollution, caused by traffic, agriculture, industries and households, is the world's largest single environmental health risk today, causing some 7 million deaths each year according to recent World Health Organisation (WHO) estimates. In 2014, 92% of the world's population was living in places where air quality guidelines were not met. Of all air pollutants, fine particulate matter—derived from fuel combustion—has the greatest effect on human health. It is estimated to cause about 25% of lung cancer deaths, 8% of chronic obstructive pulmonary disease (COPD) deaths, and about 15% of ischaemic heart disease and stroke deaths. Although particulate matter pollution affects people worldwide, low- and middle-income countries suffer disproportionately from this burden. Besides air pollution, noise in cities has been associated with many adverse health effects, including sleep disturbances, impaired cognitive function, and cardiovascular morbidity. Heat island effects—another consequence of built areas in cities—contribute to increasing cardiovascular morbidity and overall mortality during summer's hottest months.

Furthermore, cities lack green and blue spaces, which have been shown to have beneficial effects on health, including reductions in stress, mental health problems, and cardiovascular and overall mortality. In addition, a large proportion of the urban population does not get enough physical activity.

At ISGlobal, we conduct exposure assessment, epidemiological and health impact studies on a range of urban-related exposures, including air pollution, noise, temperature, natural environments (including green and blue spaces) and lifestyle (including active transportation and physical activity). The main aims are to get a better understanding of where and how exposure takes place in urban settings, the relationship between

these exposures and health, and the likely burden of disease. This will allow us to improve the evidence base and conduct health impact modelling to help guide policies in different scenarios.

Group Leaders

Mark Nieuwenhuijsen
Xavier Basagaña
Benedict Jacquemin
Cathryn Tonne
Payam Dadvand
Monica Guxens
Jordi Sunyer

Main Lines of Research

- Exposure, health effects, mechanisms and health impact assessment of air pollution, natural environment, noise, temperature and active transportation, with the aim of promoting healthy urban living.
- Active transportation and health, including physical activity and air pollution and their interaction.
- Novel exposure assessment/epidemiological/statistical methodology applied to air pollution, green space, temperature, noise, and active transportation research.

Main Results in 2016

A review of urban planning and health by Mark Nieuwenhuijsen, head of the programme, provides the overall framework of study for the research group. The study identifies new tools and methods that can provide better data on complex factors and their linkages. It concludes that making cities green and healthy goes beyond reducing CO₂ emissions, that interventions at the community level are more cost-effective, and that multi-sector approaches are needed to break existing silos and successfully tackle urban environmental problems.¹

¹ Nieuwenhuijsen MJ. Urban and transport planning, environmental exposures and health- new concepts, methods and tools to improve health in cities. *Environ Health*. 2016 Mar 8;15 Suppl 1:38. doi: 10.1186/s12940-016-0108-1.

● **Air pollution, fertility and birth weight.** A systematic review evaluated currently available evidence on the impact of air pollutants on human fertility. It concludes that air pollution is associated with lower live birth rates and higher rates of miscarriage, regardless of the mode of conception (spontaneous versus IVF).² Another study found that low birth weight was associated with an increase in sulphur and other elemental constituents of particulate matter, independently of particle mass.³

● **Air pollution and physical activity.** As part of the EXPOsOMICS European Project, a study performed in Barcelona followed 30 healthy adults in different pollution settings. The results show that exposure to high levels of air pollution reduces the respiratory gains associated with exercise.⁴

● **Air pollution exposure during pregnancy and autistic traits.** An analysis of four European population-based cohort studies (ESCAPE project) did not support an association between autistic traits in children and prenatal exposure to nitrogen dioxide and particulate matter.⁵

● **Air pollution and mortality.** A first-of-its-kind analysis of air pollution and mortality data throughout Spain found that an increase of 5µg/m³ in coarse particles (PM₁₀) was associated with a decrease in life expectancy of almost one year.⁶ Along the same lines, findings from a long-term epidemiological study with more than 600,000 participants suggest that long-term exposure to ambient ozone contributes to a higher risk of respiratory and circulatory mortality.⁷

● **Noise and mortality.** A study carried out in London showed no significant association between night-time road traffic noise and two major risk factors for stroke: hypertension and carotid intima-media thickness.⁸

² Checa Vizcaino MA, González-Comadran M, Jacquemin B. Outdoor air pollution and human infertility: a systematic review. *Fertil Steril*. 2016; 106:897-904.e1.

³ Pedersen M, Gehring U, Beelen R, Wang M, Giorgis-Allemand L, Andersen AM, et al. Elemental constituents of particulate matter and newborn's size in eight European cohorts. *Environ Health Perspect*. 2016; 124:141-50.

⁴ Matt F, Cole-Hunter T, Donaire-Gonzalez D, Kubesch N, Martínez D, Carrasco-Turigas G, Nieuwenhuijsen M. Acute respiratory response to traffic-related air pollution during physical activity performance. *Environ Int*. 2016; 97:45-55.

⁵ Guxens M, Ghassabian A, Gong T, Garcia-Esteban R, Porta D, Giorgis-Allemand L, et al. Air pollution exposure during pregnancy and childhood autistic traits in four European population-based cohort studies: The ESCAPE project. *Environ Health Perspect*. 2016; 124:133-40.

⁶ de Keijzer C, Agis D, Ambrós A, Arévalo G, Baldasano JM, Bande S, et al. MED-HISS Study group. The association of air pollution and greenness with mortality and life expectancy in Spain: A small-area study. *Environ Int*. 2017. 99:170-176. Epub 2016 Nov 18.

⁷ Turner MC, Jerrett M, Pope CA 3rd, Krewski D, Gapstur SM, Diver WR, et al. Long-term ozone exposure and mortality in a large prospective study. *Am J Respir Crit Care Med*. 2016;193:1134-42.

⁸ Halonen JI, Dehbi HM, Hansell AL, Gulliver J, Fecht D, Blangiardo M, Kelly FJ, Chaturvedi N, Kivimaki M, Tonne C. Associations of night-time road traffic noise with carotid intima-media thickness and blood pressure: The Whitehall II and SABRE study cohorts. *Environ Int* 2017; 98:54-61. Epub 2016 Oct 3.



● **Green spaces and health.** A population-based study of more than 3,000 adults residing in Barcelona revealed that proximity to green spaces was associated with better subjective general health (i.e. how people rate their health) and that this association was mediated in part by mental health status, enhanced social support, and physical activity.⁹ But green spaces do not only improve subjective well-being: a systematic review of a dozen studies conducted across the world supports the hypothesis that living in areas with higher amounts of green spaces reduces mortality, especially from cardiovascular disease.¹⁰

● **Car-free cities.** A review of the scientific literature found that an increasing number of cities are planning to reduce private car use. This would lead to significant reductions in traffic-related air pollution, noise and temperature in city centres and a decrease in premature mortality and morbidity.¹¹ In fact, better urban and transport planning could prevent 20% of premature deaths every year, according to an ISGlobal study. Compliance with international recommendations for performance of physical activity, exposure to air pollution, noise, heat and access to green spaces would increase the average life expectancy of Barcelona residents by 360 days and result in economic savings of €9.3 billion per year.¹²

Main Ongoing Projects

1. CHAI. Cardiovascular Health Effects of Air Pollution in Telangana, India. This project seeks to investigate the cardiovascular health effects of exposure to particulate air pollution from outdoor and household sources within the Andhra Pradesh Children and Parents Study (APCAPS) prospective cohort.

PI and coordinator: Cathryn Tonne
 Funding institutions: ERC-StG
 Funding: €1.2 M
 Calendar: 2015-2018

⁹ Dadvand P, Bartoll X, Basagaña X, Dalmau-Bueno A, Martínez D, Ambros A, Cirach M, Triguero-Mas M, Gascon M, Borrell C, Nieuwenhuijsen MJ. Green spaces and general health: Roles of mental health status, social support, and physical activity. *Environ Int.* 2016;91:161-7.

¹⁰ Gascon M, Triguero-Mas M, Martínez D, Dadvand P, Rojas-Rueda D, Plasencia A, Nieuwenhuijsen MJ. Residential green spaces and mortality: A systematic review. *Environ Int.* 2016; 86:60-7.

¹¹ Nieuwenhuijsen MJ, Khreis H. Car free cities: Pathway to healthy urban living. *Environ Int.* 2016; 94:251-62.

¹² Mueller N, Rojas-Rueda D, Basagaña X, Cirach, M, Cole-Hunter T, Dadvand P, et al. Urban and transport planning related exposures and mortality: a health impact assessment for cities. *Environmental Health Perspectives.* 2017;125:89-96.

2. BLUEHEALTH. Linking Up Environment, Health and Climate for Inter-sector Health Promotion and Disease Prevention in a Rapidly Changing Environment. This project's aim is to systematically explore the impact of urban waterways on health and wellbeing.

PI and WP leader: Mark Nieuwenhuijsen
 Funding institution: H2020
 Funding: €974,000
 Calendar: 2016-2020

3. PASTA. Physical Activity through Sustainable Transport Approaches. This project seeks to identify innovative measures and initiatives to promote active mobility as well as traffic safety interventions in cities, and to assess the health and economic impact of such measures.

PI: Mark Nieuwenhuijsen,
 Funding institutions: EU-FP7
 Funding: €585,839
 Calendar: 2013-2017

Cancer

Cancer is the second most common cause of death worldwide. In 2015, an estimated 8.8 million people died from cancer, more than half of them in low and middle-income countries. Lifestyle factors such as obesity, alcohol consumption, smoking and unhealthy diets account for a high proportion of cancers (tobacco alone is responsible for approximately 22% of cancer deaths). In addition, numerous environmental and occupational exposures have been shown to increase a person's risk of developing cancer. These include air pollution, water contaminants, numerous occupational chemical exposures, and other occupationally-related factors such as shift work and ionising radiation. The good news is that 30% to 50% of cancers can currently be prevented by avoiding risk factors and implementing prevention strategies, and its burden can be greatly reduced through early detection and adequate management of patients.

At ISGlobal, we have extensive experience in cancer research. Our main aim is to identify environmental and occupational causes of cancer. Among the main exposures examined are drinking water disinfection by-products, night shift work and circadian disruption, and ionising and non-ionising radiation. Among the main cancer types evaluated are bladder cancer, brain tumours, colon cancer and also lymphomas, childhood cancers, breast and prostate cancer. In addition, we are developing cutting-edge research in the application of biomarkers and genetics to evaluate mechanisms of disease and identify susceptible populations, as well as bioinformatics applications, including "omic" data integration.

Numerous environmental and occupational exposures have been shown to increase a person's risk of developing cancer

Group Leaders

Manolis Kogevinas
 Michelle Turner
 Cristina Villanueva
 Juan Ramón González
 Elisabeth Cardis
 Xavier Basagaña

Main Lines of Research

- Multi-case control study on common tumours in Spain
- Studies on night shift work and circadian disruption
- EXPOsOMICS: European study on exposome research, including water contaminants and cancer risk
- Studies in children focused on the use of biomarkers and potential genotoxic exposures during pregnancy and early childhood
- Bladder cancer
- Studies in low- and middle-income countries, including research on endemic Burkitt lymphoma
- Bioinformatics applied to studies of transcriptomics (including polymorphic inversions and copy-number variants) and disease, exposome data analysis, "omic" data integration, and mosaicism detection in cancer and other complex diseases

Main Results in 2016

● **New epidemiological data on Burkitt lymphoma in Mozambique.** The burden of endemic Burkitt lymphoma (eBL) in Mozambique was characterised in one of the first joint publications by Campus Mar and Campus Clínic researchers. The study provides estimates of incidence rates for different regions of the country and shows a larger number of cases in regions where the intensity of malaria transmission is higher. Although the reasons underlying the association between eBL and *Plasmodium falciparum* remain unclear, these results will contribute to better evaluation of changes in trends between and within countries, especially with the implementation of malaria control programmes.¹

● **Night shift work and cancer risk.** Night shift work has been classified as a probable human carcinogen by the International Agency for Research on Cancer, but evidence for different types of cancer is scarce. A case-control study in a Spanish population (MCC-Spain cohort) shows that having ever worked the night shift was associated with a small but significant increase in risk for breast cancer, especially among women with particular hormone-related characteristics.² In contrast, no evidence of an association between night shift work and stomach cancer risk was observed.³

● **Genetic associations with bladder cancer risk.** A large consortium including ISGlobal sought to identify new susceptibility variants for bladder cancer in European populations. They described a new susceptibility locus on chromosome 13 (13q34) and refined the association with a previously described susceptibility locus at chromosome 20 (20p12.2).⁴ Another study identified germline variants in the APOBEC gene family associated with bladder cancer risk, as well as a high rate of APOBEC mutations within bladder tumours.⁵ These studies pave the way to a better understanding of the interplay between genes and the environmental exposures that contribute to this and other cancer types.

¹ O'Callaghan-Gordo C, Casabonne D, Carrilho C, Ferro J, Lorenzoni C, Zaquetu C, et al. Incidence of endemic Burkitt lymphoma in three regions of Mozambique. *Am J Trop Med Hyg.* 2016 Dec 7;95(6):1459-1462.

² Papantoniou K, Castaño-Vinyals G, Espinosa A, Aragonés N, Pérez-Gómez B, Ardanaz E et al. Breast cancer risk and night shift work in a case-control study in a Spanish population. *Eur J Epidemiol.* 2016 Sep;31(9):867-78.

³ Gyarmati G, Turner MC, Castaño-Vinyals G, Espinosa A, Papantoniou K, Alguacil J, et al. Night shift work and stomach cancer risk in the MCC-Spain study. *Occup Environ Med.* 2016 Aug;73(8):520-7.

⁴ Jonine D, Figueroa, Candace D, Middlebrooks, A, Rouf Banday, Yuanqing Ye, Montserrat Garcia-Closas, Nilanjan Chatterjee, et al. Identification of a novel susceptibility locus at 13q34 and refinement of the 20p12.2 region as a multi-signal locus associated with bladder cancer risk in individuals of European ancestry. *Hum Mol Genet.* 2016 Mar 15; 25(6): 1203–1214.

⁵ Middlebrooks CD, Banday AR, Matsuda K, Idquim KI, Onabajo OO, Paquin A et al. Association of germline variants in the APOBEC3 region with cancer risk and enrichment with APOBEC-signature mutations in tumors. *Nature Genetics.* 2016. 48,1330–1338.

Main Ongoing Projects

1. MCC-Spain. Multicase-control Population-based Study on High Incidence Tumours in Spain – Colorectal, Breast, Prostate and Stomach Cancers and Chronic Lymphocytic Leukaemia. This project aims to evaluate the influence of environmental factors and their interaction with genetic factors in common cancers in Spain and will help promote cancer research and prevention.

PI: Manolis Kogevinas
Funding institution: CIBERESP and FIS-ISCIII
Funding: CIBER-ESP-Strategic Action (€850,000); FIS-ISCIII (€397,900)

2. HORMONIT. A molecular epidemiological study on hormonal changes associated with circadian disruption in night shift workers.

PI: Manolis Kogevinas,
Funding institution: FIS-ISCIII
Funding: €155,182
Calendar: 2015-2017

3. EXPOSOMICS. Enhanced Exposure Assessment and Omic Profiling for High Priority Environmental Exposures in Europe. This project aims to predict individual disease risk related to the environment by characterising the external and internal exposome for common exposures during critical periods of life, including *in utero*.

PI and WP leaders: Manolis Kogevinas and Mark Nieuwenhuijsen
Funding institution: FP7-Env
Funding: €1.2 M
Calendar: 2012-2016

Chagas and Imported Diseases

Around 25 million people live at risk of contracting Chagas disease and 6 million people are estimated to be currently infected with *Trypanosoma cruzi*. Between 30% and 40% of infected individuals will develop cardiac and digestive alterations that are irreversible and potentially lethal. The economic burden of Chagas disease worldwide is estimated at \$7.2 billion. Despite these figures, Chagas is a neglected tropical disease and only 1% of infected people receive treatment. The impact of Chagas disease is no longer confined to rural areas of Latin America, where vector-borne transmission occurs. Due to migratory flows, the disease has spread to non-endemic countries such as Spain, where transmission can occur from mother to child or through blood transfusions or transplantation of infected organs.

ISGlobal is working on three fronts: i) in Bolivia, the endemic country most affected by Chagas disease, we have established, in partnership with CEADES, national and local health authorities and universities, a platform for comprehensive care to improve prevention and the diagnosis and treatment of patients with chronic Chagas disease; ii) we are working on the development of new drugs and biomarkers to evaluate treatment response; and iii) we have generated scientific evidence to strengthen European legislation on the detection and control of Chagas disease.

As a result of intercontinental travel, imported infectious diseases pose an increasingly serious threat worldwide. Recent examples are the Ebola virus outbreak in West Africa and the Zika virus epidemic in Latin America. In addition, the introduction and/or presence of disease vectors may also lead to local transmission of imported pathogens. ISGlobal undertakes epidemiologic surveillance and works to improve tools for the diagnosis and treatment of these diseases.

Less than 1% of people infected with Chagas disease receive treatment

Group Leaders/Associated Researchers*

Jose Muñoz
María Jesús Pinazo
Ana Requena
Montserrat Gállego*
Albert Picado*
Antoni Trilla

Main Lines of Research

- Epidemiology of Chagas disease in non-endemic areas
- Biomarkers for therapeutic efficacy and for early diagnosis of cardiac damage in patients with Chagas disease
- Clinical trials for new drugs to treat Chagas disease
- Studies on the pharmacokinetics of benznidazole
- Helminth infections
- Travel medicine
- Factors determining health in migrant populations
- Leishmaniasis: vector control, diagnosis and treatment

Main Results in 2016

● **Biomarkers of therapeutic response.** An analysis of coagulation factors in the blood of chronically infected patients treated with benznidazole identified three markers that could be used as surrogate markers to evaluate short-term response to treatment. The use of markers such as those described in this study will facilitate the testing of new drugs to treat this neglected disease.¹

● **Trial highlighting the need for new drugs and formulations.** The international, multicentre, double-blind, placebo-controlled trial Benznidazole Evaluation for Interrupting Trypanosomiasis (BENEFIT) was initiated more than 10 years ago to determine whether patients living with chronic Chagas heart disease could benefit from treatment with benznidazole. The study results did not show incremental benefits in cardiac outcome, underlining the need to initiate treatment at earlier stages of the disease and to develop improved treatments for patients with chronic Chagas heart disease.²

● **Treating severe imported malaria.** A retrospective study of patients treated with intravenous artesunate for severe malaria at Hospital Clínic in Barcelona shows that red blood cell exchange does not provide added benefit in terms of parasite elimination.³

● **An international network to improve strongyloidiasis control.** Strongyloidiasis is a soil-transmitted helminth infection that affects between 30 million and 370 million people worldwide. The StrongNet working group created in 2015 reviews and summarises recent developments in the field and outlines recommendations and challenges for public health interventions.⁴

¹ Pinazo MJ, Posada Ede J, Izquierdo L et al. Altered hypercoagulability factors in patients with chronic Chagas disease: potential biomarkers of therapeutic response. *PLoS Negl Trop Dis.* 2016;10:e0004269.

² Pecoul B, Batista C, Stobbaerts E, Ribeiro I, Vilasanz R, Gascon J, et al. The BENEFIT trial: Where do we go from here? *Plos NTDs* 2016;10(2):e0004343.

³ Calvo-Cano A, Gómez-Junyent J, Lozano M, Castro P, Cid J, Nicolás JM, et al. The role of red blood cell exchange for severe imported malaria in the artesunate era: a retrospective cohort study in a referral centre. *2016. Malar J.* 2016;15:216.

⁴ Albonico M, Becker SL, Odermatt P, et al. StrongNet: An international network to improve diagnostics and access to treatment for strongyloidiasis control. *PLoS Negl Trop Dis.* 2016 Sep 8;10(9):e0004898

Main Ongoing Projects

1. BENDITA. This project seeks to determine the safety and efficacy of different regimes and combinations of benznidazole in reducing and eliminating *Trypanosoma cruzi* parasitemia in chronically infected adults.

PI: Joaquim Gascon
Funding institution: GIB-UPM-DNDi
Funding: \$1.1 M
Calendar: 2016-2018

2. Euroleish. A European training network for the control of leishmaniasis, from bench to bedside and community. This network aims to train a new generation of young researchers in leishmaniasis. It involves the selection and training of 15 PhD students in various projects, including drug development, vaccines, diagnostic tools and vector control.

PI and coordinator: Albert Picado
Funding institution: ITN-H2020
Funding: €3.8 M
Calendar: 2015-2018

3. ECOHEMA-WORMS. A cross-sectional study to evaluate the prevalence and distribution of schistosomiasis and infection with soil-transmitted helminths in the areas around Manhiça District Hospital. The impact of helminth infections on the development of immunity against *P. falciparum* malaria will be evaluated.

PI: Jose Muñoz
Funding institutions: FNI, Mundo Sano, ISGlobal
Funding: €120,000
Calendar: 2015-2016

Child Health

In 2015, 5.9 million children under five years of age died. Estimates indicate that roughly a quarter of childhood deaths and disease burden could be prevented through the reduction of environmental risks such as air pollution, unsafe water, poor sanitation and exposure to chemicals. Furthermore, preventing these exposures during childhood could make an important contribution to reducing disease (such as diabetes, cardiovascular diseases and cancer) and early death in adulthood. Therefore, interventions that reduce environmental risks can greatly contribute to achieving the Sustainable Development Goals, since they benefit not only health but also the environment, the climate and overall development.

Child health is now considered a priority at the international level. Children are especially vulnerable to environmental threats due to their smaller bodies and developing organs and immune systems, but harmful exposures can start as early as in utero. Proportionate to their size, children ingest more food, drink more water and breathe more air than adults. Additionally, behaviours such as putting hands and objects in the mouth and playing outdoors can increase exposure to environmental pollutants.

Pre- and postnatal life are critical periods in the origins of chronic diseases such as obesity, metabolic syndrome, cognitive development, asthma and allergy. However, our current understanding of how chronic diseases develop during foetal life and childhood is still very limited. Our main objective is to perform epidemiological studies on the early-life origins of neurodevelopment, obesity and metabolic syndrome, and allergy and asthma.

To do this, we use three main approaches: i) a focus on birth cohorts from the general population as a powerful platform of etiological research to unravel the complex multicausal origins of chronic diseases; ii) a better integra-

Children are especially vulnerable to environmental threats

tion of “omics” through the exposome approach, which consists in integrating external exposure assessments with a wide range of internal biomarkers; and iii) population neuroscience through the integration of imaging together with the “exposome” in epidemiological studies, with the aim of better understanding the environmental origins of the development and decline of cognition.

We are recognised leaders in birth cohort research within the European Union and have coordinated actions to develop a joint European strategy and network (e.g. CHICOS, ENRIECO) and consortia based on birth cohorts (e.g. MEDALL, HELIX).

Group Leaders

Jordi Sunyer
Martine Vrijheid
Mònica Guxens
Jordi Julvez
Maribel Casas
Mariona Bustamante
Payam Dadvand
Josep M. Antó
Xavier Basagaña
Elisabeth Cardis
Judith García-Aymerich
Juan Ramón González
Stefano Guerra
Manolis Kogevinas
Mark Nieuwenhuijsen
Cristina Villanueva

Main Lines of Research

- Effects of early-life environmental factors (i.e. traffic, indoor air pollution, fish intake) on brain function, lung function and asthma/allergy
- Role of environmental agents (i.e., DDE, BPA, PFCs, endocrine disruptors) on obesity and metabolic syndrome, as well as on asthma and the immune system
- Identification of early epigenetic markers of neurodevelopment, obesity and growth, and asthma, as well as gene-environmental interactions related to asthma and chronic obstructive pulmonary disease (COPD) progression
- Development of “omics” methods in child health studies and methods for the statistical analysis of these data

Main Results in 2016

- **Foetal growth.** The developing foetus is particularly sensitive to environmental factors.
- **Endocrine disruptors**, which alter hormone regulation, have been shown to have adverse health effects and are present in certain food and consumer products. A study showed that women working in jobs classified as being associated with exposure to one or more groups of endocrine disruptors had a 25% higher risk of giving birth to an underweight baby at full term, and this risk increased when the women were exposed to more than one endocrine disruptor group.¹ However, a study combining repeat exposure biomarker measurements and multiple growth measures during pregnancy found little evidence of associations of BPA or phthalate exposures with foetal growth.²
- **Exposure to air pollution** has also been linked to low birth weight, although the mechanisms remain unclear. A study using data from two independent European cohorts (INMA in Spain and ENVIRONAGE in Belgium) analysed exposure to nitrogen dioxide and the content of mitochondrial DNA in the placenta. The results suggest that decreases in placental mitochondrial content could potentially be one of the mediators

¹ Birks L, Casas M, Garcia AM, Alexander J, Barros H, Bergström A, et al. 2016. Occupational exposure to endocrine-disrupting chemicals and birth weight and length of gestation: a European meta-analysis. *Environ Health Perspect* 124:1785–1793.

² Casas M¹, Valvi D, Ballesteros-Gomez A, Gascon M, Fernández MF, Garcia-Esteban R, Iniguez C, et al. Exposure to Bisphenol A and Phthalates during Pregnancy and Ultrasound Measures of Fetal Growth in the INMA-Sabadell Cohort. *Environ Health Perspect*. 2016 Apr;124(4):521-8. doi: 10.1289/ehp.1409190. Epub 2015 Jul 21.

³ Clemente DB, Casas M, Vilahur N, Begiristain H, Bustamante M, Carsin AE, et al. Prenatal Ambient Air Pollution, Placental Mitochondrial DNA Content, and Birth Weight in the INMA (Spain) and ENVIRONAGE (Belgium) Birth Cohorts. *Environ Health Perspect*. 2016 May;124(5):659-65.

⁴ Eva Morales, Nadia Vilahur, Lucas A Salas, Valeria Motta, Mariana F Fernandez, Mario Murcia, Sabrina Llop, Adonisa Tardon, Guillermo Fernandez-Tardon, Loreto Santa-Marina, Mara Gallastegui, Valentina Bollati, Xavier Estivill, Nicolas Olea, Jordi Sunyer, Mariona Bustamante; Genome-wide DNA methylation study in human placenta identifies novel loci associated with maternal smoking during pregnancy. *Int J Epidemiol* 2016; 45 (5): 1644-1655.

⁵ Manzano-Salgado CB, Casas M, Lopez-Espinosa MJ, Ballester F, Martinez D, Ibarluzea J, et al. Variability of perfluoroalkyl substance concentrations in pregnant women by socio-demographic and dietary factors in a Spanish birth cohort. *Environ Int*. 2016;92-93:357-65.

⁶ Lea Maitre, Cristina M Villanueva, Mathew R Lewis, Jesus Ibarluzea, Loreto Santa Marta, Martine Vrijheid, et al. Maternal urinary metabolic signatures of fetal growth and associated clinical and environmental factors in the INMA study. *BMC Medicine* 2016. ISSN: 1741-7015.

of the association between prenatal air pollution exposure and birth weight.³

- **Maternal smoking**, a major risk factor for low birth weight, may also affect the placental environment. A study identified several genes that are differentially methylated (and therefore, differentially expressed) in the placenta of mothers who smoked during pregnancy as compared to non-smokers.⁴ These results provide a potential mechanism by which maternal smoking affects birth weight.
- **Perfluoroalkyl substances (PFAS)** are man-made chemical contaminants that are extensively used in industrial and commercial applications. These substances can cross the placental barrier, potentially leading to adverse foetal outcomes. A study performed in Spain revealed that levels of these substances varied by age, region, country of birth and previous breastfeeding. Fish and shellfish intake was the main dietary factor that contributed to maternal PFAS concentrations.⁵
- **Predicting foetal growth.** An analysis of urine samples and lifestyle questionnaire data from over 800 pregnant women aged 28–33 years from two locations in Spain revealed a urine metabolite signature that could be used to predict foetal growth and modify lifestyles accordingly.⁶
- **Neuropsychological development.** The developing central nervous system is particularly vulnerable to environmental exposures, which can have a positive or negative impact.
- **Maternal consumption of seafood.** A study performed in Spain showed that seafood consumption above the recommended levels during pregnancy has a beneficial effect on the cognitive development of children. Large fatty fishes provided the greatest benefits, likely due to the levels of omega-3 fatty acids.⁷
- **Breastfeeding duration.** Another multicentre study in Spain showed that longer breastfeeding duration was associated with better cognitive

function and could protect against the development of autistic traits.⁸

- **Prenatal exposure to paracetamol.** This study showed that paracetamol, which is used extensively during pregnancy, may increase hyperactivity and autism spectrum symptoms in children.⁹
- **Exposure to air pollution** has been suggested to increase the risk of autism spectrum disorder. However, a study performed with four European population-based child/birth cohorts did not reveal any association between prenatal exposure to nitrogen dioxide or particulate matter and autistic traits in children from 4 to 10 years of age.¹⁰

However, another study performed with schoolchildren in Barcelona showed that a higher concentration of air pollutants in the school environment was associated with impaired cognitive performance but not with changes in brain anatomy, structure or metabolites. The study results suggest that air pollution directly interferes with functional maturation of the brain during childhood.¹¹

In another study with schoolchildren from Barcelona, traffic-related air pollutants were found to be associated with increased behavioural problems in schoolchildren and noise exposure was associated with more symptoms of attention deficit and hyperactivity disorder (ADHD).¹²

Along the same lines, a study performed on two cohorts of German adolescents showed that exposure to traffic-related air pollution was associated with higher hyperactivity/inattention scores.¹³

⁷ Julvez J, Méndez M, Fernández-Barres S, Romaguera D, Vioque J, Llop S, et al. Maternal Consumption of seafood in pregnancy and child neuro-psychological development: A longitudinal study based on a population with high consumption levels. *Am J Epidemiol*. 2016 Feb 1;183(3):169-82.

⁸ Boucher O, Julvez J, Guxens M, Arranz E, Ibarluzea J, Sánchez de Miguel M, Fernández-Somoano A, Tardon A, Rebagliato M, Garcia-Esteban R, O'Connor G, Ballester F, Sunyer J. Association between breast-feeding duration and cognitive development, autistic traits and ADHD symptoms: a multicenter study in Spain. *Pediatr Res*. 2016 Nov 15.

⁹ Avella-García CB, Julvez J, Fortuny J, Rebordosa C, García-Esteban R, Galán IR, Tardón A, Rodríguez-Bernal CL, Iniguez C, Andiaarena A, Santa-Marina L, Sunyer J. Acetaminopen use in pregnancy and neuro-development: Attention function and autism spectrum symptoms. *Int J Epidemiol* 2016;45(6):1987-1996.

¹⁰ Guxens M, Ghassabian A, Gong T, Garcia-Esteban R, Porta D, Giorgis-Allemand L, et al. Air pollution exposure during pregnancy and childhood autistic traits in four European population-based cohort studies: The ESCAPE Project. *Environ Health Perspect*. 2016;124:133-40.

¹¹ Pujol J, Martínez-Vilavella G, Macía D, Fenoll R, Alvarez-Pedrerol M, Rivas I, Forns J, Blanco-Hinojo L, Capellades J, Querol X, Deus J, Sunyer J. Traffic pollution exposure is associated with altered brain connectivity in school children. *NeuroImage* 2016;129:175-184.

¹² Forns J, Dadvand P, Foraster M, Alvarez-Pedrerol M, Rivas I, López-Vicente M, et al. Traffic-related air pollution, noise at school, and behavioral problems in Barcelona schoolchildren: A cross-sectional study. *Environ Health Perspect*. 2016;124:529-35.

¹³ Fuertes E, Standl M, Forns J, Berdel D, Garcia-Aymerich J, Markevych et al. Traffic-related air pollution and hyperactivity/inattention, dyslexia and dyscalculia in adolescents of the German GINIplus and LISAPlus birth cohorts. *Environ Int* 2016; 97: 85-92



● **Source of fine particles.** A study in Barcelona found that the only source of fine particles associated with slower cognitive development in schoolchildren was traffic, indicating that reducing traffic-related air pollution in primary schools could have beneficial effects on cognition.¹⁴

● **Copper exposure.** Cognitive development is also affected by copper exposure. A study showed that children's genetic background influences their susceptibility to such exposure.¹⁵

● **Cognitive abilities and video games.** A study performed with children between 7 and 11 years of age showed that, while 2 hours per week of video gaming was beneficial, 9 hours or more was associated with conduct problems, peer conflicts and reduced social abilities.¹⁶

● **Infant weight and asthma.** Greater infant weight gain has been associated with lower lung function and increased risk of childhood asthma. A study confirms the association between faster height gain and body mass index with increased risk of wheezing.¹⁷

● **Environmental pollutants and child health.** ISGlobal researchers reviewed recent concerns and evidence on the effects of different environmental pollutants (including air pollutants, heavy metals, perfluoroalkyl substances, phthalates and bisphenol A) on child health outcomes (foetal growth and prematurity, neurodevelopment, respiratory and immune health, and childhood growth and obesity). They conclude that unborn and young children require more protection than is currently provided and that large, coordinated research efforts are needed to better understand the long-term effects of complex chemical mixtures.¹⁸

¹⁴ Basagaña X, Esnaola M, Rivas I, Amato F, Alvarez-Pedrerol M, Fornis J, López-Vicente M, Pujol J, Nieuwenhuijsen M, Querol X, Sunyer J. Neurodevelopmental deceleration by urban fine particles from different emission sources: A longitudinal observational study. *Environ Health Perspect.* 2016;124.

¹⁵ Alemany S, Vilor-Tejedor N, Bustamante M, Álvarez-Pedrerol M, Rivas I, Fornis J, Querol X, Pujol J, Sunyer J. Interaction between airborne copper exposure and ATP7B polymorphisms on inattentiveness in scholar children. *Int J Hyg Environ Health.* 2016 Oct 22.

¹⁶ Pujol J, Fenoll R, Fornis J, Harrison BJ, Martínez-Vilavella G, Macià D, et al. Video gaming in school children: How much is enough? *Ann Neurol.* 2016 Sep;80(3):424-33.

¹⁷ Casas M, den Dekker HT, Kruithof CJ, Reiss IK, Vrijheid M, de Jongste JC, et al. Early childhood growth patterns and school-age respiratory resistance, fractional exhaled nitric oxide and asthma. *Pediatr Allergy Immunol.* 2016 Dec;27(8):854-860.

¹⁸ Vrijheid M, Casas M, Gascon M, Valvi D, Nieuwenhuijsen M. Environmental pollutants and child health-A review of recent concerns. *Int J Hyg Environ Health.* 2016;219:331-42.

Main Ongoing Projects

1. BREATHE. BRain dEvelopment and Air pollution ultrafine particles in scHool childrEn. This project's aim is to study the impact of air pollution in cities on the cognitive development of children attending 40 primary schools in Barcelona with different pollution levels.

PI: Jordi Sunyer
Funding institution: ERC-AdG
Funding: €2.5 M
Calendar: 2011-201

2. HELIX. The Human Early-Life Exposome – novel tools for integrating early-life environmental exposures and child health across Europe. The project will integrate chemical, physical and molecular environment data and link this to the health, growth and development of children. The aim is to better understand how various types of exposures combine to influence our risk of disease.

PI: Martine Vrijheid
Funding institution: FP7-Env
Funding: €2.3 M
Calendar: 2013-2017

3. INMA-Infancia y Medio Ambiente. This project on childhood and the environment seeks to describe prenatal and postnatal exposure to common contaminants (air, water and xenobiotics), to measure their association with reproductive disorders and neural, immune system and endocrine development, and to identify protective factors such as diet and genetic polymorphisms.

PI: Martine Vrijheid
Funding institution: FP7-Env
Funding: €2.3 M

Climate and Health

The world has warmed by approximately 0.85°C over the last 130 years, mostly as a result of human activities such as burning of fossil fuels. Each of the last three decades has been successively warmer than any preceding decade since instrumental records began in 1850.

Climate change has an impact on social and environmental determinants of health, such as clean air, safe drinking water, sufficient food and secure shelter. Extremely high air temperatures contribute directly to deaths from cardiovascular and respiratory disease, particularly among elderly people. Rising sea levels and increasingly extreme weather events will destroy homes, medical facilities and other essential services. Increasingly variable rainfall patterns are likely to affect the supply of fresh water and decrease the production of staple foods in many of the poorest regions. Changes in climate are likely to alter and lengthen the transmission seasons of important vector-borne diseases, mainly in low- to middle-income countries.

Although precise estimations are difficult to make, climate change is at least expected to cause approximately 250,000 additional deaths per year between 2030 and 2050 from malnutrition, malaria, diarrhoea and heat stress. Indirect effects caused by changes in air quality and the effects of air pollution are enormous and difficult to quantify. All populations will be affected, but some are more vulnerable (e.g. people living on small islands, in coastal regions, in medium-sized cities in tropical countries, or in megacities). Children and elderly people, particularly those living in poor countries, will also be particularly affected.

Not surprisingly, climate change is becoming a major issue in public health and in political agendas worldwide.

In 2016 ISGlobal incorporated a new research programme to address the effects that environmental changes associated with climate change may have on human health

This year, ISGlobal has grown stronger through the incorporation of a new research programme on Climate and Health. The overall aim of this programme is to address the effects that environmental changes associated with climate change may have on human health and to develop predictive computational models to inform, anticipate and predict future impacts, and to help mitigate these impacts.

Group Leaders

Xavier Rodó
Joan Ballester

Main Lines of Research

- Models and prediction of climate-driven infectious diseases (cholera, malaria, dengue, chikungunya, Zika, leishmaniasis)
- Climate extremes and temperature-related mortality
- Climate dynamics and predictability: El Niño–Southern Oscillation (ENSO), the Mediterranean and the Indian monsoon
- Aerial biogeochemistry, microbiome and human health (Kawasaki disease, other vascular conditions and inflammatory diseases).

Main Ongoing Projects

1. Blue-Action. Arctic Impact on Weather and Climate. This project's goal is to improve how we describe, model and predict the weather and climate on seasonal to decadal time scales in the Arctic and throughout the northern hemisphere.

PI: Joan Ballester
Funding institution: H2020
Funding: €215,000
Calendar: 2016-2021

2. SECTEUR. Sector Engagement for the Copernicus Climate Change Service –Translating European User Requirements. This project engages directly with end users to analyse their requirements for climate information, identify gaps and deliver recommendations on future needs to support better informed decision-making.

PI: Xavier Rodó
Funding institution: Copernicus Programme EC
Calendar: 2016-2017

3. WINDBIOME. Aerial microbiome diversity and its role in Kawasaki disease.

PI: Xavier Rodó,
Funding institution: Fundació Privada Daniel Bravo
Funding: €234,000

An estimated
1.8 million
children are
living with
HIV according
to the WHO

HIV/AIDS and Tuberculosis (TB)

At the end of 2015, 35 million people worldwide were living with HIV, of which the majority were in sub-Saharan Africa. HIV was responsible for the deaths of 1.1 million people in 2015, 30% of whom were co-infected with tuberculosis (TB). TB on its own killed nearly 1.4 million people worldwide.

Combined efforts in HIV and TB prevention and treatment over the last decade have led to a 35% worldwide reduction in the number of new HIV infections since 2000 and to a worldwide halt and reversal of TB incidence. Both diseases are included in the Sustainable Development Goals and have sparked global initiatives. The UNAIDS 90-90-90 initiative aims to diagnose 90% of HIV cases, provide treatment to 90% of positive cases, and achieve viral suppression in 90% of treated patients by 2020. The Stop TB initiative aims for a 90% reduction in tuberculosis incidence and a 95% reduction in tuberculosis deaths by 2035.

To reach these goals, enormous challenges in diagnostics, treatment, retention in care and emerging drug resistances are being addressed through clinical, implementation and operational research.

Our activities in HIV/AIDS and TB focus on clinical and implementation research specifically related to the epidemic in sub-Saharan Africa.

Group Leaders

Denise Nanche
Clara Menéndez
Maria Roura
Jeffrey Lazarus

Main Lines of Research

- HIV and maternal and child health
- Pathogenesis of acute and early HIV infection
- Epidemiologic studies to determine the TB burden in the community
- Health systems, HIV/AIDS and viral hepatitis

- Community-based epidemiologic and operational studies to improve access to antiretroviral treatment
- Epidemiologic studies to determine the TB burden in the community
- Evaluation of new tools for the diagnosis, treatment and prevention of TB

Main Results in 2016

● **Biomarkers for individuals recently infected with HIV.** A study in collaboration with IrsiCaixa and the Manhiça Health Research Centre (CISM) identified 4 biomarkers that make it possible to determine whether a recently infected patient is in the pre- or post-seroconversion phase (i.e. before or after generating virus-specific antibodies). The immune response pattern will contribute to our understanding of early HIV pathogenic events and the identification of potential targets for immunotherapies during the early phases of infection.¹

● **Qualitative studies on HIV testing and treatment adherence.** In-depth interviews and discussion groups with Latin American migrants and health professionals revealed that provider-initiated HIV testing is a promising approach to identify new HIV cases among vulnerable populations most at risk.² Another study assessed the challenges related to long-term adherence to antiretroviral therapy in adolescents and adults in Uganda. The main challenge among adults was treatment access among economic migrants, and common themes included treatment side effects, supply of single tablets instead of combined drugs, and lack of counselling due to staff shortage.³

● **Post-mortem diagnosis of TB.** A collaboration with the Manhiça Health Research Centre (CISM) and Maputo Central Hospital in Mozambique validated the use of a rapid and easy-to-use DNA amplification assay for the post-mortem diagnosis of TB. The method represents a powerful tool for evaluating the real burden of disease and for helping to stop its transmission.⁴

¹ Pastor L, Parker E, Carrillo J, Urrea V, Fuente-Soro L, Respeito D, et al. A cytokine pattern that differentiates pre- from post- seroconversion phases of primary HIV infection. *J Acquir Immune Defic Syndr.* 2016 Dec 23.

² Navaza B, Abarca B, Bisoffi F, Pool R, Roura M. Provider-initiated HIV testing for migrants in Spain: A qualitative study with health care workers and foreign-born sexual minorities. *PLoS One.* 2016 Feb 25;11(2):e0150223.

³ Inzaule SC, Hamers RL, Kityo C, Rinke de Wit TF, Roura M. Long-term antiretroviral treatment adherence in HIV-Infected adolescents and adults in Uganda: A qualitative study. *PLoS One.* 2016 Nov 29;11(11):e0167492.

⁴ García-Basteiro AL, Ismail MR, Carrilho C, Ussene E, Castillo P, Chitsungo D, et al. The role of Xpert MTB/RIF in diagnosing pulmonary tuberculosis in post-mortem tissues. *Sci. Rep.* 2016; 6:20703.

⁵ Lazarus JV, Safreed-Harmon K, Barton SE, et al. Beyond viral suppression of HIV—the new quality-of-life frontier. *BMC Medicine.* June 2016 Jun 22;14(1):94.

● **Public health priorities in relation to HIV and viral hepatitis.** Key themes are community engagement in strengthening health systems and the development of more “people-centred” health systems. The Health Outcomes: Beyond Viral Suppression study of HIV and health systems reviews comorbidities among people living with HIV and develops health-system indicators to address the reality of long-term living with HIV.⁵

Main Ongoing Projects

1. GAMA: Development of novel biomarkers for use in determining HIV progression and HIV incidence in a sub-Saharan African setting. The project seeks to gain a better understanding of the dynamics of biomarkers of gastrointestinal inflammation during the first year of HIV infection as compared to chronic infection. These biomarkers could help distinguish early from long-standing HIV infection.

PI: Denise Nanche
Funding institutions: Bill & Melinda Gates
Funding: \$1 M
Calendar: 2012-2017

2. TESFAM: Scaling up HIV counselling and testing services within a health demographic surveillance system in Manhiça, Mozambique. The project's goal is to increase linkage to HIV care and treatment services after HIV testing in the community of Manhiça.

PI: Denise Nanche
Funding institutions: CDC-Pepfar
Funding: \$915,000
Calendar: 2011-2017

3. TB-ART: Diagnostic performance of Abbott RealTime MTB and MTB RIF/INH Resistance assay for detecting pulmonary tuberculosis and RIF/INH resistance among HIV infected adults.

PI: Alberto García-Basteiro
Funding: Abbot Molecular Diagnostics
Calendar: 2016-2017

Malaria

The last 15 years have seen unprecedented progress in the reduction of malaria cases and malaria-attributable mortality. Despite these achievements, there were more than 200 million new cases of malaria in 2015 and 429,000 deaths. Most of these deaths occurred in sub-Saharan African children. Much work remains to be done, but the progress made over the last few years has triggered the ambitious goal of transitioning from malaria control efforts to a more deliberate global malaria eradication strategy. In fact, a growing number of countries are moving towards malaria elimination. In 2015, 33 countries reported fewer than 1,000 cases of malaria and last year the WHO determined that 21 of these countries were capable of reaching zero cases by 2020. However, the emergence of artemisinin resistance among circulating parasites in Southeast Asia and the global increase in insecticide-resistant *Anopheles* mosquitoes underscore the importance of accelerating malaria elimination efforts.

At ISGlobal, we are convinced that the only sustainable long-term solution is the complete elimination of the parasite, first in a given region and eventually worldwide. In many settings, this will require the development of new tools and strategies aimed at completely clearing the parasite that causes the disease. Our Malaria programme is working on a series of projects that will help to create the knowledge base needed to achieve this goal and address key knowledge gaps in malaria research from the basic science to the field, with the ultimate goal of advancing science and eventually contributing to public health impact.

Group Leaders

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Clara Menéndez
Quique Bassat
Alfred Cortés
Carlota Dobaño

Xavier Fernández-Busquets
Alfredo Mayor
Azucena Bardají
Carmen Fernández-Becerra
Luis Izquierdo
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Elisa Sicuri

Main Lines of Research

- Enabling technologies for malaria research
- Parasite biology
- Pathophysiology
- Malaria immunology
- Diagnostics
- Evaluation of preventive and therapeutic tools
- Epidemiology and clinical presentation of *P. falciparum* and *P. vivax*
- Vector biology and control
- Novel approaches and strategies for malaria elimination

Main Results in 2016*

● **Vivax malaria.** *P. vivax* is not the most deadly malaria parasite but it can cause severe complications in pregnant women and their babies. A multicentre study detected immune responses to VIR proteins of *P. vivax* among women from five different countries. Some of these antibodies were associated with higher birth weights, and T cell responses to these proteins were also detected. These results could further efforts to develop a *P. vivax* vaccine.¹ ISGlobal also led a team that reviewed the key knowledge gaps regarding *P. vivax* elimination.²

● **Severe malaria.** The PfEMP1 protein is expressed at the surface of red blood cells infected with *P. falciparum*. A study identified a domain of this protein that could play a key role in the vascular pathology that leads to severe malaria. The results pave the way for therapeutic interventions based on antibodies that block the interaction between the parasite protein domain and its human receptor.³

¹ Pilar Requena, Edmilson Rui, Norma Padilla, et al. Naturally-acquired antibody and T Cell immune responses to malaria in pregnant women. *PLoS Negl Trop Dis* 2016;10:e0005009.

² Bassat Q, Velarde M, Mueller I, Lin J, Leslie T, Wongsrichanalai C, Baird JK. Key knowledge gaps for *Plasmodium vivax* control and elimination. *Am J Trop Med Hyg*. 2016 Dec 28;95 (6 Suppl):62-71. doi: 10.4269/ajtmh.16-0180.

³ Magallón-Tejada A, Machevo S, Cisteró P, et al. *Plasmodium falciparum* erythrocyte membrane protein 1 in severe malaria. *PLoS Pathog*. 2016;12:e1006011.

* Studies related to malaria in pregnancy are included in the section on Maternal, Child and Reproductive Health Research.

⁴ Moles E, Moll K, Ching JH, Parini P, Wahlgren M, Fernández-Busquets X. Development of drug-loaded immunoliposomes for the selective targeting and elimination of rosetting *Plasmodium falciparum*-infected red blood cells. *J Control Release*. 2016; 241:57-67.

⁵ Marques J, Vilanova E, Mourão PA, Fernández-Busquets X. Marine organism sulfated polysaccharides exhibiting significant antimalarial activity and inhibition of red blood cell invasion by *Plasmodium*. *Sci Rep*. 2016; 6:24368.

⁶ Galatas B, Guinovart C, Bassat Q, Aponte JJ, Nhamússua L, Macete E, Saúde F, Alonso P, Aide P. A prospective cohort study to assess the micro-epidemiology of *Plasmodium falciparum* clinical malaria in Ilha Josina Machel (Manhiça, Mozambique). *Malar J*. 2016;15:444.

● **New drug delivery approaches.** A joint IBEC-ISGlobal study showed that drug-loaded nanovesicles coated with antibodies that target the parasite protein PfEMP1 selectively eliminate red blood cells infected by *P. falciparum*, prevent their aggregation, and inhibit parasite growth.⁴ This combined strategy represents a promising alternative in the treatment of severe malaria since parasite resistance to two drugs with unrelated modes of action is very low.

● **New antimalarial drugs.** The same IBEC-ISGlobal group found that certain sugar molecules obtained from marine organisms inhibit the growth of *P. falciparum* by inhibiting the parasite's capacity to invade red blood cells.⁵ These results open new avenues for the development of anti-malarial drugs against which the parasite does not seem to develop resistance.

● **Resurgence of clinical malaria.** After the decrease in clinical cases observed in Mozambique up to 2009, a steady resurgence of cases per year has been reported. A study performed in a small area of the Manhiça district revealed a shift in the age distribution of clinical malaria, indicating changes in transmission intensity patterns and a slower acquisition of natural immunity to malaria.⁶ The results underscore the need to ensure the sustainability of malaria control interventions and target the most vulnerable populations, particularly infants and children under 5 years of age.

Main Ongoing Projects

1. MALTEM: Mozambican Alliance Towards Elimination of Malaria. The primary aim of MALTEM is to eliminate malaria in the southernmost areas of Mozambique by 2020 and to ultimately expand malaria elimination efforts to the rest of the country through the development of a national elimination strategy.

PI: Antoni Plasència
Funding institution: Obra Social "la Caixa", Bill & Melinda Gates Foundation

Partners: CISM, Ministry of Health, Mozambique
Funding: €16 M
Calendar: 2015-2020

2. RTS,S Vaccine Immunology Study: Immune correlates of protection against malaria after vaccination with RTS,S/AS01E –a comprehensive immunological arm of a Phase III double-blind, multicentre randomised, controlled trial. The project's aim is to investigate the immunological mechanisms underlying RTS,S vaccination and identify immune correlates of vaccine-induced protection.

PI and coordinator: Carlota Dobaño
Funding institution: NIH
Funding: \$3 M
Calendar: 2012-2017

3. MiPMon: Pregnant women as a sentinel group for malaria surveillance in an era of changing malaria transmission. The study seeks to provide epidemiological, molecular and immunological insights on the value of pregnant women attending health facilities to generate estimates of malaria burden and its consequences with varying levels of transmission. The aim is to develop new tools for the monitoring of malaria in endemic countries.

PIs: Alfredo Mayor and Eusebio Macete
Funding institution: NIH
Funding: \$700,000
Calendar: 2016-2020

4. Preventing infectious bites: Repulsing mosquito vectors with electric field pulsations. The purpose of this project is to develop functional prototypes of mosquito barriers that use high-power electric fields to repel mosquitoes of medical importance.

PI: Krijn Paaijmans
Funding institution: USAID
Funding: \$720,000
Calendar: 2016-2018

Maternal, Child and Reproductive Health

Between 1990 and 2015, maternal mortality worldwide dropped by about 44%. However, it remains unacceptably high: every day, approximately 830 women die as a result of pregnancy, childbirth or postpartum complications. Almost all of these deaths occur in developing countries and most could have been prevented. Greater progress has been achieved in reducing mortality in children under five years of age (the rate has dropped from 91 deaths per 1,000 live births in 1990 to 43 in 2015), but the likelihood of death in the first days of life remains extremely high (45% of child deaths occur in the first month of life). Furthermore, despite progress, the proportion of mothers who do not survive childbirth in developing regions is still 14 times higher than in developed ones.

The new Sustainable Development Goals have set a target to reduce global maternal mortality to less than 70 per 100,000 births by 2030 (SDG 3.1), with no country having a rate more than twice the global average. Closely related are the targets to reduce neonatal mortality to 12 or fewer deaths per 1,000 live births (SDG 3.2), to ensure universal access to sexual and reproductive health care services (SDG 3.7), and to achieve universal health coverage for all (SDG 3.8), as well as the target of ending all forms of malnutrition (SDG 2). Overall, this has led to a new “Global Strategy for Women’s, Children’s and Adolescent’s Health”, which calls for ending preventable maternal and child deaths and addressing women’s, children’s and adolescents’ health priorities.

In line with the targets set by the SDGs, ISGlobal is conducting research in order to i) develop tools that help identify the main causes of maternal and child mortality and that are reliable, acceptable and feasible in low-resource settings, where the lack of reliable data hinders the design of adequate health policies; ii) improve and scale up strategies for the prevention and control of

Most maternal and child deaths occur in developing countries and are preventable

malaria during pregnancy; iii) study the impact of HIV infection; iv) assess the efficacy of maternal immunisation against vaccine-preventable infections; v) determine the effectiveness of a human papillomavirus (HPV) immunisation programme with the aim of preventing cervical cancer; and vi) analyse levels and causes of inequalities in maternal and reproductive health. In addition, we have launched a project aimed at determining the short- and long-term effects of Zika virus transmission from mother to child in a cohort of exposed pregnant women and their babies.

Group Leaders

Clara Menéndez
Jaume Ordi
Quique Bassat
Alfredo Mayor
Azucena Bardají
Raquel González

Main Lines of Research

- Malaria in pregnancy
- Determination of causes of death in low-income countries
- Pharmacovigilance studies of antiretroviral and antimalarial drugs in pregnant women
- Operational research on the acceptability and viability of introducing the HPV vaccine in pre-adolescent African girls
- Effects of the HIV/AIDS epidemic on maternal and child health
- Cervical cancer
- Maternal immunisation
- Inequalities in maternal and reproductive health in low-income countries

Main Results in 2016

● **Malaria treatment during pregnancy.** A large-scale study evaluated the health of infants born to mothers who received intermittent preventive treatment with the antimalarial drug mefloquine during pregnancy. The results show that the drug has no impact on mortality, morbidity and development during the first year of the infant’s life.¹

● **Economic cost of malaria.** The economic impact of malaria during pregnancy in the Brazilian Amazon was estimated for the first time. The study concludes that, despite the low risk of transmission, *P. vivax* infections during pregnancy represent a considerable economic burden for the region, especially in the case of multiple infections and hospital admission.²

● **Knowing the causes of death in low-income countries.** Two studies confirm that a minimally invasive autopsy technique developed by ISGlobal researchers can reliably determine the cause of death in developing countries, where complete autopsies are difficult to perform.³ Furthermore, the method was shown to be acceptable to communities from five different countries and cultures.⁴ This technique will help guide more informed and effective health policies in low-income countries.

Main Ongoing Projects

1. CaDMIA-plus: Continued validation of the minimally invasive autopsy (MIA) for the investigation of the causes of death in infants and establishment of a research and training centre to study causes of death. Building on the CaDMIA study, the project aims to validate the MIA tool for surveillance of child mortality in developing countries and to create a training and research centre to support current and future initiatives on this topic.

PI: Jaume Ordi
Funding institution: Bill and Melinda Gates Foundation
Funding: \$4,883,451
Calendar: 2016-2018

¹ María Rupérez, Raquel González, Ghyslain Mombongo, et al. Mortality, morbidity, and developmental outcomes in infants born to women who received either mefloquine or sulfadoxine-pyrimethamine as intermittent preventive treatment of malaria in pregnancy: A cohort study. *PLOS Medicine* 2016; 13: e1001964.

² Bötto-Menezes C, Bardaji A, Dos Santos Campos G, et al. Costs associated with malaria in pregnancy in the Brazilian Amazon, a low endemic area where *Plasmodium vivax* predominates. *PLoS Negl Trop Dis.* 2016;10:e0004494.

³ Castillo P, Martínez MJ, Ussene E, Jordao D, Lovane L, Ismail MR, et al. (2016) Validity of a minimally invasive autopsy for cause of death determination in adults in Mozambique: An observational study. *PLoS Med* 13: e1002171.

⁴ Maixenchs M, Anselmo R, Zielinski-Gutiérrez E, Odhiambo FO, Akello C, Ondire M, et al. Willingness to know the cause of death and hypothetical acceptability of the minimally invasive autopsy in six diverse African and Asian settings: A mixed methods socio-behavioural study. *PLoS Med.* 2016;13:e1002172.

This project is closely linked to CHAMPS, the Child Health and Mortality Prevention Surveillance Network, which will be initially based at six sites, including the Manhiça Health Research Centre (CISM) and the Hospital of Maputo in Mozambique.

2. ZIKA-Preg: Surveillance of Zika virus infection in pregnant women travelling from affected areas. The study aims to generate new knowledge on the epidemiology and impact of Zika virus infection in pregnancy through hospital-based surveillance of pregnant women travelling from Zika-endemic areas.

PI: Azucena Bardaji
Funding institution: FIS-MINECO
Funding: €91,657
Calendar: 2016-2017

3. MIPPCOD: Evaluation of a new delivery approach to maximise the coverage of malaria prevention interventions in pregnancy.

PI: Clara Menéndez
Funding institution: Bill and Melinda Gates Foundation
Funding: \$508,784
Calendar: 2014-2016

Radiation

Radiation can be ionising or non-ionising, depending on whether or not it has sufficient energy to cause atomic changes in the matter through which it passes. Both kinds of radiation are naturally found in the environment (e.g. non-ionising infrared radiation and ionising ultraviolet radiation from the sun or radon gas from the ground) at low levels. Increased exposures to radiation may occur as a result of both natural and human-related processes.

Increases in the application of non-ionising radiation as a means of transmitting data— for example, in mobile communications—have raised concerns about potential risks to health. Similarly, new ionising radiation imaging and treatment modalities are increasingly used in both diagnostic and therapeutic procedures in many areas of medicine. Understanding the potential health risks to both patients and medical staff is paramount in maximising the efficacy of treatments while ensuring their safety. In addition, understanding potential risks associated with occupational and accidental exposures to ionising radiation related to the nuclear industry is crucial to radiation protection and public health.

While exposure to non-ionising radiation from a variety of sources has been potentially associated with a number of health outcomes—including some cancers— mechanisms explaining such associations are largely missing and require further epidemiological research. In contrast, exposure to ionising radiation has been conclusively linked to the risk of cancer and other health outcomes in a variety of studies. However, the nature of such risks at low doses is much less well understood.

The overall objective of the Radiation programme at ISGlobal is to better understand the potential risks associated with exposure to both ionising and non-ionising radiation. Ultimately, this aim serves the radiation protection of the general public, patients and those exposed in their work,

while also informing policy to achieve this goal. Another goal of the programme is to improve the surveillance and living conditions of populations affected by past and future nuclear accidents. Our research contributes to a better understanding of the processes by which radiation affects human physiology and human health. Many of our projects also address the estimation of radiation exposures and related uncertainties and the impact of radiation exposure on the health of workers, patients and the general population in Europe.

Group Leaders

Elisabeth Cardis
Mònica Guxens
Payam Dadvand
Michelle Turner

Main Lines of Research

- Health effects of ionising and non-ionising radiation (UV, electromagnetic frequencies [specifically radiofrequencies from mobile communication devices], intermediate frequencies and extremely low frequencies) resulting from occupational, environmental, medical, and radiation accident exposures
- Health impact assessment of such exposures
- Exposure assessment and uncertainties in exposure

Main Results in 2016

● **Ionising radiation and health risks for exposed medical staff.** ISGlobal researchers launched InterCardioRisk, a tool featuring an easy-to-use web interface that provides a general estimate of the cumulative absorbed doses experienced by medical staff exposed in the interventional cardiology setting and the estimated associated health risks.¹

● **Ionising radiation and health risks for nuclear workers.** The effects of low-level, chronic exposure remains a subject of ongoing debate. The International Nuclear Workers Study (INWORKS) consortium combines data from informative co-

¹ Morina D, Grellier J, Carnicer A, Pernot E, Ryckx N, Cardis E. InterCardioRisk: a novel online tool for estimating doses of ionizing radiation to occupationally-exposed medical staff and their associated health risks. *J Radiol Prot.* 2016;36:561-578.

horts of nuclear workers from France, the United Kingdom and the United States to study the association between cancer and non-cancer diseases and low, chronic radiation exposure. A number of papers highlight the key findings from INWORKS, particularly associations between low-dose radiation and risk of solid cancers and leukaemia.^{2,3}

Main Ongoing Projects

1. MOBI-KIDS: Risk of brain cancer from exposure to radiofrequency fields in childhood and adolescence.

PI: Elisabeth Cardis
Funding institution: EC/FP7
Funding: €3.5M
Calendar: 2009-2016

2. GERONIMO: Generalised electromagnetic field (EMF) research using novel methods. An integrated approach: from research to risk assessment and support to risk management. The main goal of the project is to close gaps in knowledge on electromagnetic frequencies and health by better understanding the mechanisms underlying possible health effects, to characterise current and future exposure levels in Europe, and to improve the assessment of health risks associated with EMF.

PI: Elisabeth Cardis
Funding institutions: EC, local and national funding sources
Funding: €5.9M
Calendar: 2014-2018

3. SHAMISEN: Nuclear emergency situations: improvement of preparedness and health surveillance of populations affected by a radiation accident. The project's goal is to draw on the lessons from past nuclear accidents, namely Chernobyl and Fukushima, in order to make recommendations for early and long-term responses to radiation accidents, with the aim of responding to the needs of affected populations while minimising unnecessary anxiety.

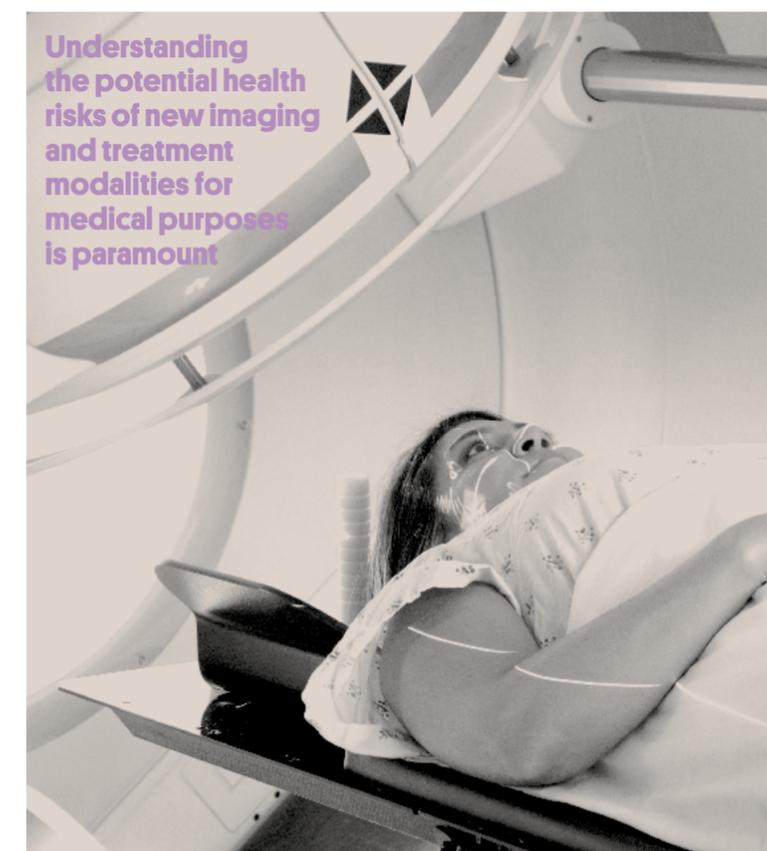
² Richardson DB, Cardis E, Daniels RD, Gillies M, O'Hagan JA, Hamra GB, Haylock R, Laurier D, Leuraud K, Moissonnier M, Schubauer-Berigan MK, Thierry-Chef I, Kesminiene A. Risk of cancer from occupational exposure to ionising radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS). *BMJ.* 2015 Oct 20;351:h5359. doi: 10.1136/bmj.h5359. Erratum in: *BMJ.* 2015;351:h6634

³ Leuraud K, Richardson DB, Cardis E, et al. Ionising radiation and risk of death from leukaemia and lymphoma in radiation-monitored workers (INWORKS): an international cohort study. *Lancet Haematol.* 2015 Jul;2(7):e276-81.

PI: Elisabeth Cardis
Funding institutions: EC-FP/OPERA
Funding: €181,500 to ISGlobal
Calendar: 2015-2017

4. EPI-CT: Epidemiological study to quantify risks for paediatric computerised tomography and to optimise doses. Comprising one of the largest paediatric cohorts in Europe, this project aims to evaluate radiation-related risk of cancer following computerised tomography examination and provide guidance on the optimisation of doses for paediatric computerised tomography scans.

PI: Elisabeth Cardis
Funding institution: EC
Funding: €393,884 to ISGlobal
Calendar: 2011-2016



Respiratory Diseases

In 2015, the leading causes of deaths from non-communicable diseases were cardiovascular disease (17.9 million), cancer (8.8 million), and chronic respiratory diseases (3.8 million).

Asthma and chronic obstructive pulmonary disease (COPD) are significant public health burdens and are among the leading causes of years lost to disability. Asthma is estimated to affect around 330 million people of all ages across the world and in 2015 it was among the top 30 diseases with the highest burden in terms of disability. COPD affects 65 million people worldwide and caused 3.1 million deaths in 2015. Total deaths from COPD are projected to rise in the coming years unless actions are taken to reduce the risk factors, particularly tobacco and indoor air pollution in low-income countries. The WHO estimates that, by 2030, COPD could become the third leading cause of death worldwide.

Much of the burden of respiratory disease could be prevented by reducing exposure to indoor and outdoor air pollution, eliminating tobacco use, limiting occupational exposures to contaminants and changing the urban environment to increase mobility and reduce pollution. Poverty is a salient determinant of respiratory diseases in both high and low-income countries.

ISGlobal's Respiratory Disease includes the study of environmental and occupational determinants of respiratory diseases in children and adults, including chronic obstructive pulmonary disease (COPD), asthma and other allergic diseases, in national and international projects. In addition, we contribute to generating relevant knowledge on the role of physical activity in COPD patients. The program also focuses on relevant disease characteristics and mechanisms through a systems approach.

Asthma and chronic obstructive pulmonary disease are among the leading causes of years lost to disability

Group Leaders

Josep M. Antó
Judith Garcia-Aymerich
Stefano Guerra
Jan-Paul Zock
Xavier Basagaña
Benedicte Jacquemin
Manolis Kogevinas
Jordi Sunyer

Main Lines of Research:

- Environmental, occupational and lifestyle determinants of the development and progression of respiratory and allergic phenotypes
- Phenotypic heterogeneity and comorbidities of respiratory and allergic diseases
- Genetic/molecular interactions with environmental and/or lifestyle factors that affect respiratory and allergic phenotypes
- New statistical approaches to integrate environmental, genetic, molecular and phenotypic data

Main Results in 2016

● **Passive smoking during pregnancy.** A study revealed that children of nonsmoking mothers who were exposed to tobacco smoke during their pregnancy were 11% more likely to develop wheeze than unexposed children. This risk increased by 29% if children continued to be exposed after birth. The risk was highest in infants of mothers who smoked during pregnancy and after birth and in children with an allergic family history.¹

● **Allergy development.** The European-funded MeDALL (Mechanisms of the Development of Allergy) project has developed an innovative approach to link epidemiological, clinical and basic research by combining data of children from 14 birth cohorts across Europe with systems biology (omics, IgE measurement using microarrays) and environmental data. A final report by the consortia explains how the results obtained reveal a high frequency of children

with multiple allergies, and suggest that allergic diseases share causal mechanisms irrespective of IgE sensitisation. This has led to a new classification framework of allergic diseases that could help develop early indicators for the prediction, diagnosis, prevention and therapeutic targets of the disease². Another MeDALL publication describes the prospective follow-up of 13,000 children with a new standardised Core questionnaire, as well as estimates of air exposure, microarray and omics data (gene-wide association studies, DNA methylation, targeted multiplex biomarker and transcriptomic studies) for a large number of these children. Results show the multimorbidity of eczema, rhinitis and asthma that is independent of IgE sensitisation. They propose a novel allergic phenotype characterised by polysensitisation and multimorbidity and associated with frequency, persistence and severity of allergic symptoms.³

● **COPD and asthma in patients living near farms.** An observational study using data from patients in rural areas in the Netherlands revealed that COPD and asthma patients living near livestock farms have an increased risk of disease exacerbation. The environmental exposure responsible for this risk remains to be determined.⁴

● **Physical activity and COPD.** A study designed urban trails of different intensity in different types of public spaces with the aim of validating such trails for urban training of COPD patients. Results show that physiological response and energy expenditure increased according to the trail's intensity, regardless of the different public spaces. This study shows that walkable public spaces allow the design of trails that can be used for the training of COPD patients in the community.⁵

● **Models to predict risk in COPD.** The validation of risk prediction models is limited by missing variables in otherwise suitable cohorts. In this study, the authors used individual patient data from 9 cohort studies from USA, Europe and Latin America that included almost 8,000 patients with COPD to test six methods for han-

¹ Vardavas CI, Hohmann C, Patelarou E, et al. The independent role of prenatal and postnatal exposure to active and passive smoking on the development of early wheeze in children. *Eur Respir J* 2016; 48:115-24

² Bousquet J, Anto JM, Akdis M, Auffray C, Keil T, Momas I et al. Paving the way of systems biology and precision medicine in allergic diseases: the MeDALL success story: Mechanisms of the Development of ALLergy; EU FP7-CP-IP; Project No: 261357; 2010-2015. *Allergy*. 2016;71:1513-1525.

³ Anto JM, Bousquet J, Akdis M, Mechanisms of the Development of Allergy (MeDALL): Introducing novel concepts in allergy phenotypes. *J Allergy Clin Immunol*. 2017 Feb;139(2):388-399.

⁴ van Dijk CE, Garcia-Aymerich J, Carsin AE, Smit LA, Borlée F, Heederik DJ, Donker GA, Yzermans CJ, Zock JP. Risk of exacerbations in COPD and asthma patients living in the neighbourhood of livestock farms: Observational study using longitudinal data. *Int J Hyg Environ Health*. 2016;219:278-87.

⁵ Arbilla-Etxarri A, Torrent-Pallicer J, Gimeno-Santos E et al. Validation of walking trails for the urban training of chronic obstructive pulmonary disease patients. *PLoS One*. 2016 Jan 14;11(1):e0146705

⁶ Held U, Kessels A, Garcia Aymerich J et al. Methods for handling missing variables in risk prediction models. *Am J Epidemiol*. 2016 Oct 1;184(7):545-551.

dling a simulated missing variable. They identify the best approach to impute the missing predictor, thus paving the way for widespread validation of prediction models even when one or more predictors of the model are missing.⁶

Main Ongoing Projects

1. PROACTIVE: Physical activity as a crucial patient-reported outcome in COPD.

PI and WP leader: Judith Garcia-Aymerich
Funding institution: IMI
Funding: €433,568
Calendar: 2009-2016

2. ALEC: Ageing Lungs in European Cohorts.

PI and WP leader: Judith Garcia-Aymerich
Funding institution: H2020
Funding: €496,026
Calendar: 2015-2019

Viral and Bacterial Infections

The mortality rate associated with infectious diseases has decreased worldwide, but viral and bacterial infections continue to disproportionately affect the world's poorest populations, particularly children: pneumonia and diarrhoea are still among the main causes of death in children living in low-income countries. In addition, hundreds of millions of patients across the world are affected by hospital-acquired infections, a large percentage of which are caused by multidrug-resistant bacteria. Drug-resistant bacteria and genes encoding for resistance determinants spread easily and are present in all regions of the world, posing an increasingly serious threat to global public health. According to recent estimates, antibiotic resistance causes 700,000 deaths worldwide per year. If no action is taken, this figure could rise to 10 million deaths by 2050, with an annual cost of \$100 trillion. The current antibiotic resistance crisis is mostly due to the overuse and misuse of these medications in health care and in the livestock industry, as well as a lack of new drug development by pharmaceutical industries.

At ISGlobal, we have deployed our expertise in this area in an effort to improve the diagnosis and treatment of infectious diseases, understand the causes of antibiotic resistance and find new treatments against infectious diseases.

Group Leaders/Associated Researchers*

Jordi Vila
Quique Bassat
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María Ángeles Marcos*
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Francesc Marco*

¹ Fàbrega A, Ballesté-Delpierre C, Vila J. Differential impact of ramRA mutations on both ramA transcription and decreased antimicrobial susceptibility in *Salmonella* Typhimurium. *J Antimicrob Chemother.* 2015; 71(3):617-24.

² Zboromyrska Y, Rubio E, Alejo I, et al. Development of a new protocol for rapid bacterial identification and susceptibility testing directly from urine samples. *Clin Microbiol Infect.* 2016; pii: S1198-743X(16)00105-1.

Main Lines of Research

- Design of new rapid tools for diagnosing infectious diseases
- Molecular basis of antimicrobial resistance
- Relationship between virulence and antimicrobial resistance
- Discovery and assessment of new antibacterial drugs
- Surveillance, phylogeny and clinical impact of the influenza virus and emergent viruses
- Search for diagnostic and prognostic biomarkers of viral and bacterial infection
- Pathogenesis and antimicrobial resistance of microorganisms causing neonatal sepsis
- Epidemiology and clinical presentation of viral and bacterial infections
- Treatment of yaws in Papua New Guinea

Main Results in 2016

● **Acquisition of drug resistance.** The analysis of a collection of *Salmonella* Typhimurium mutants selected in the laboratory revealed mutations in a regulatory gene (*ramA*) that led to the increased expression of several efflux pumps. These mutations are associated with decreased susceptibility to different antibiotics and seem to greatly contribute to multidrug resistance in *Salmonella*.¹

● **Speeding up the diagnosis of severe infections.** ISGlobal developed and validated a protocol that shortens the time needed for bacteriological identification and susceptibility tests in urinary tract infections. The technique, based on a mass spectrometry technique (MALDI-TOF-MS) to identify bacteria and a disc-diffusion test to determine antibiotic susceptibility, permits the direct testing of urine samples and shortens the sample processing time by 48 hours.²

● **A new potentially pathogenic bacterial species.** A series of three studies described a new *Acinetobacter* species (*Acinetobacter dijkshoorniae*) isolated from patient samples obtained in different countries. The new species carries several antibiotic-resistant genes and is highly likely to be

a human pathogen. It can be differentiated from other *Acinetobacter* species through the mass spectrometry method described above.³⁻⁵

● **An emerging cause of tropical ulcers.** A systematic review concluded that *Haemophilus ducreyi*, the causative agent of chancroid, has emerged as a frequent cause of chronic skin ulcers among children in developing countries. Hygiene and mass antibiotic treatment are key interventions to tackle this and other tropical skin diseases such as yaws.⁶

Main Ongoing Research Projects

1. NoMorFilm: Novel Marine Biomolecules against Biofilm. This project seeks to identify new biomolecules from microalgae with antibiotic and antibiofilm activity, which could be incorporated into prostheses or catheters to prevent post-implant infections.

PI and coordinator: Sara Soto
Funding institution: H2020
Funding: €7.7 M
Calendar: 2015-2019

2. COMBACTE-CARE: Combatting carbapenem resistance in Europe. This project aims to shed new light on carbapenem-resistant enterobacteriaceae (CRE) infections and their treatment (including clinical trials of a novel antibiotic combination product to tackle a sub-type of CRE infections with limited treatment options).

PI: Jordi Vila
Funding institution: Innovative Medicines Initiative
Funding: €291,950
Calendar: 2015-2020

³ Cosgaya C, Mari-Almirall M, Van Assche A, Fernández-Orth D, Mosqueda N, Telli M, Huys G et al. *Acinetobacter dijkshoorniae* sp. nov., a member of the *Acinetobacter calcoaceticus*-*Acinetobacter baumannii* complex mainly recovered from clinical samples in different countries. *Int J Syst Evol Microbiol.* 2016;66:4105-4111.

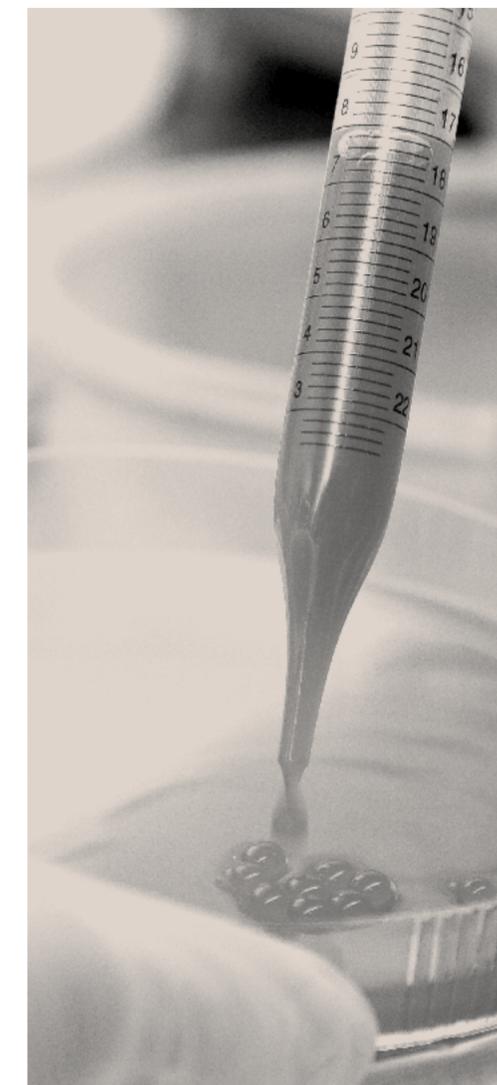
⁴ Mari-Almirall M, Cosgaya C, Higgins PG, Van Assche A, Telli M, Huys G et al. MALDI-TOF/MS identification of species from the *Acinetobacter baumannii* (Ab) group revisited: inclusion of the novel *A. seifertii* and *A. dijkshoorniae* species. *Clin Microbiol Infect.* 2016; 3:210.e1-210.e9.

⁵ Fernández-Orth D, Cosgaya C, Telli M, Mosqueda N, Mari-Almirall M, Roca I, Vila J. Draft Genome Sequence of JVAP01T, the Type Strain of the Novel Species *Acinetobacter dijkshoorniae*. *Genome Announc.* 2017;5:e01480-16.

⁶ González-Beiras C, Marks M, Chen CY, Roberts S, Mitjà O. Epidemiology of *Haemophilus ducreyi* Infections. *Emerg Infect Dis.* 2016;22:1-8.

3. Evaluation of Strategies for Yaws Eradication: The objective of this project is to evaluate the new World Health Organisation (WHO) strategy to stop yaws transmission, which involves mass treatment with single-dose oral azithromycin of the entire community.

PI: Oriol Mitjà
Funding institution: Newcrest Mining, International SOS
Funding: \$200.000
Calendar: 2013-2016



Water Pollution

Safe and clean drinking water is essential to human development and well-being. In 2015, 91% of the world's population had access to an improved drinking-water source, compared with 76% in 1990. However, at least 1.8 billion people in low- and middle-income countries still use a drinking-water source contaminated with faeces, resulting in infectious diseases such as cholera and diarrhoea.

Although microbiological contamination remains the leading cause of water-related morbidity and mortality globally, inadequate management of urban, industrial and agricultural wastewater means that the drinking water of hundreds of millions of people worldwide is often chemically polluted. This makes water an important exposure pathway for chemicals that may also cause disease, but evidence of the human health consequences is limited or lacking for many of them.

At ISGlobal, we seek to investigate the relationship between water contaminants, particularly disinfection by-products, and various adverse health outcomes including cancer and reproductive and respiratory disorders.

ISGlobal researchers have an international reputation in this field and are leading important international studies. Our work will help provide an important evidence base for policy-setting, particularly in the field of water disinfection, which is one of the pillars of public health.

Group Leaders

Cristina Villanueva
Manolis Kogevinas
Xavier Basagaña
Mark Nieuwenhuijsen
Jordi Sunyer

¹ Espejo-Herrera N et al. Ingested nitrate and breast cancer in the Spanish Multicase-Control Study on Cancer (MCC-Spain). *Environ Health Perspect* 2016; 124 (7): 1042–1049.

² Espejo-Herrera N et al. Colorectal cancer risk and nitrate exposure through drinking water and diet. *Int J Cancer* 2016;139:334–46.

³ Cristina M. Villanueva, Esther Gracia-Lavedan, Cristina Bosetti, Elena Righi, Antonio José Molina et al. Colorectal cancer and long-term exposure to trihalomethanes in drinking Water: A multicenter case-control study in Spain and Italy. *Environ Health Perspect*; DOI:10.1289/EHP155.

Main Lines of Research

- Evaluation of long-term exposure to water disinfection by-products and cancer risk
- Exposure to disinfection by-products during pregnancy and reproductive effects
- Exposure to disinfection by-products in swimming pools and adverse health effects, including biomarkers of early effect and “omic” signatures
- Evaluation of long-term exposure to water nitrate and cancer risk

Main Results in 2016

- **Drinking water and cancer.** Ingested nitrate leads to the synthesis of compounds that are carcinogenic in animals, although evidence in humans is limited. A multicase-control study on cancer found that waterborne ingestion of nitrate was associated with breast cancer in postmenopausal women with high red-meat consumption.¹ Along the same lines, a case-control study performed by the same group in Spain and Italy suggests that colorectal cancer is associated with long-term nitrate intake through drinking water² but not with exposure to trihalomethanes³, a water disinfection by-product that has demonstrated carcinogenic activity in laboratory animals.



- **Drinking water and birth outcomes.** Another independent study on trihalomethane exposure during pregnancy found no association with adverse birth outcomes in the total population or in potentially genetically susceptible subgroups.⁴

- **Exposure to disinfection by-products in swimming pools.** A study of 116 adult volunteers who swam for 40 minutes in a chlorinated pool showed increased levels of trihalomethanes in exhaled air, suggesting significant exposure through inhalation and dermal contact. Among the four trihalomethanes, the brominated components showed a correlation with several other disinfection by-products measured in water. These results suggest that brominated trihalomethanes in exhaled breath could be used as a non-invasive DBP exposure biomarker in swimming pools.⁵

Main Ongoing Projects

1. EXPOsOMICS: Enhanced Exposure Assessment and Omic Profiling for High Priority Environmental Exposures in Europe. This project aims to predict individual disease risk related to the environment by characterising the external and internal exposome for common exposures during critical periods of life, including *in utero*.

PI and WP leaders: Manolis Kogevinas and Mark Nieuwenhuijsen
Funding institution: FP7-Env
Funding: €1.2 M

⁴ Kogevinas M, Bustamante M, Gracia-Lavedán E, Ballester F, Cordier S, Costet N et al. Drinking water disinfection by-products, genetic polymorphisms, and birth outcomes in a European mother child cohort study. *Epidemiology*. 2016;27:903-11.

⁵ Font-Ribera L, Kogevinas M, Schmalz C, Zwiener C, Marco E, Grimalt JO, Liu J, Zhang X, Mitch W, Critelli R, Naccarati A, Heederik D, Spithoven J, Arjona L, de Bont J, Gracia-Lavedan E, Villanueva CM. Environmental and personal determinants of the uptake of disinfection by-products during swimming. *Environmental Research* 2016; 149: 206-215.

Water is an important exposure pathway for chemicals that may cause disease



Innovation

Research

Health Monitoring Mobile App for the 2016 Olympic Games in Brazil

In order to detect infectious diseases—particularly Zika virus infection—and collect data on the health status of Spanish athletes during their stay in Brazil for the 2016 Summer Olympics, ISGlobal, together with the Hospital Clínic and the Polytechnic University of Madrid (UPM), created a health-monitoring mobile app called Olymtrip. An agreement between the “la Caixa” Foundation and the Spanish Olympic Committee made it possible to develop the app further and make it available to the Spanish Olympic delegation.



Research-Industry Partnership to Develop New Antimalarial Therapies

ISGlobal, the Institute for Bioengineering of Catalonia (IBEC) and the biotech firm Bioiberica signed a partnership agreement to study the development of new compounds derived from heparin to combat malaria. This partnership brings together research by Dr Xavier Fernández Busquets, head of the ISGlobal and IBEC Nanomalaria Unit, on the development of specific anti-malarial therapies and the R&D project of Bioiberica, the world leader in heparin production, whose goal is to find new applications for this molecule.

Novel Research and Innovation Approaches

In 2016, ISGlobal was awarded two research and innovation projects. InSPIRES, a project funded by Horizon 2020, is a consortium composed of eight partners coordinated by ISGlobal in collaboration with the International Health Department of the Hospital Clínic. Its aim is to bring together practitioners and experts from across and beyond Europe to co-design, jointly pilot, implement and roll out innovative models for science shops, integrating responsible research and innovation, open science and impact evaluation to open the research process to civil society and other stakeholders. Co-Creating Innovative Solutions for Health (CRISH), a project funded by the European Institute of Innovation and Technology (EIT), is a consortium of nine partners coordinated jointly by Hospital Clínic and ISGlobal. Its main objective is to bring together key stakeholders in the health sectors—including patients—who will learn to co-create innovative processes, products and services that will promote the health of populations through the identification of unmet needs.

Knowledge Translation

One of ISGlobal’s objectives is to translate the results of basic research into practices and strategies that have an impact on health.

● **Clinical guidelines.** In 2016, we participated in the elaboration of five clinical guidelines on topics including case definition of neonatal infections by the Brighton Collaboration Neonatal Infections Working Group, as well as an update on traveller’s diarrhoea that includes recommendations on prevention and treatment.¹⁻⁴

● **Response to emerging pathogens.** Starting in November 2014, ISGlobal participated in the Catalan Scientific Committee on Ebola Virus Disease, which delivered its final report to the health minister in 2016. The report, entitled “The response to the Ebola epidemic in West Africa (2014-2015): lessons learned in our context”, provides a series of recommendations, including the establishment of an advisory committee to improve preparedness, strengthen surveillance and guide the response to future epidemics caused by emerging pathogens.⁵

● **Children’s rights and the environment: the need for a complete picture of the environment and healthy living.** ISGlobal’s HELIX team contributed to the UN’s general discussion on children’s rights and the environment. The overall objective of the 2016 Day of General Discussion was to promote understanding of the relationship between children’s rights and the environment, to identify what needs to be done for laws, policies and practices related to children’s rights to take into account environmental issues, and to make environment-related laws, policies and practices child-sensitive.

● **National Plan on SDGs.** We have participated in the working group convened by the Catalan Health Department to develop a National Plan on the Sustainable Development Goals.

● **Catalan regional and local committees for air pollution and air quality.** Several ISGlobal researchers are participating in committees on air pollution and air quality (Barcelona, Tarragona). These committees are made up of local and regional governments, social and political agents, NGOs and research centres. Their aim is to plan and implement a middle- and long-term strategy for reducing air pollution in the Barcelona area and in other municipalities.

● **Three ISGlobal researchers appointed members of the Advisory Council for Public Health.**

The Catalan health minister appointed three ISGlobal researchers to the Advisory Council for Public Health: Josep M. Antó, scientific director, Antoni Plasència, director general, and Antoni Trilla, epidemiologist at the Hospital Clínic and ISGlobal researcher. The Council’s role is to advise the health minister on technical and scientific aspects of public health.

¹ Torre-Cisneros J, Aguado JM, Caston JJ et al. Management of cytomegalovirus infection in solid organ transplant recipients: SET/GESITRA-SEIMC/REIPI recommendations. *Transplant Rev (Orlando)*. 2016 Jul;30(3):119-43. doi: 10.1016/j.trre.2016.04.001.

² Vergnano S, Buttery J, Cailles B et al. Neonatal infections: Case definition and guidelines for data collection, analysis, and presentation of immunisation safety data. *Vaccine*. 2016 Dec 1;34(49):6038-6046.

³ Virizuela JA, Carratala J, Aguado JM, Vicente D, Salavert M, Ruiz M, Ruiz I, Marco F, Lizasoain M, Jimenez-Fonseca P, Gudiol C, Cassinello J, Carmona-Bayonas A, Aguilar M, Cruz JJ. Management of infection and febrile neutropenia in patients with solid cancer. *Clin Transl Oncol*. 2016 Jun;18(6):557-70.

⁴ Vila J, Oliveira I, Zboromyrska Y, Gascon J. Diarrea del vijero [Traveller’s diarrhoea]. *Enferm Infecc Microbiol Clin*. 2016 Nov;34(9):579-584.

⁵ Resposta davant de l’epidèmia de malaltia pel virus Ebola a l’Àfrica Occidental (2014-2015): lliçons apreses en el nostre entorn. Informe del Comitè Científic Assessor de la Malaltia per Virus Ebola (CCAMVE), 8 February 2016.

Outreach

Research

Explaining Our Research

ISGlobal makes a great effort to ensure that the impact of our research goes beyond the academic community to reach other stakeholders and society in general. In 2016, we organised 34 workshops and 18 lectures in different venues, such as community centres, libraries, museums and schools, which were attended by more than 1,770 people interested in science.

Open Visits

One of our aims is to inform the public about our research and show them how our scientists work. As part of our outreach programme in 2016, we participated in the Barcelona Biomedical Research Park (PRBB) Open Day and hosted monthly visits by high school students as part of the Escolab initiative. We also collaborated with the Catalan Government's CERCA Institute and Department of Education by hosting a group of the year's top secondary school graduates for one week to introduce them to our research centre and our work.

Bringing Science Closer to Society

In 2016, we took part in numerous activities designed to bring science closer to society and to get young people interested in scientific research. At the 10th Barcelona Science Festival, scientists from ISGlobal led workshops and gave talks explaining the institute's research in malaria, antimicrobial resistance, and urban health. These activities, which addressed both adults and young children, were designed to be engaging and accessible. In November, ISGlobal's General Director opened the 21st edition of Science Week in Catalonia, during which the institute organised an activity that involved students in an exploration of the environmental determinants of health.

In 2016, we organised
34 workshops
and 18 lectures
in different venues



TRAINING AND EDUCATION



Facts & Figures

Programmes and courses

33

Capacity-building seminars

28

Doctoral theses defended

19

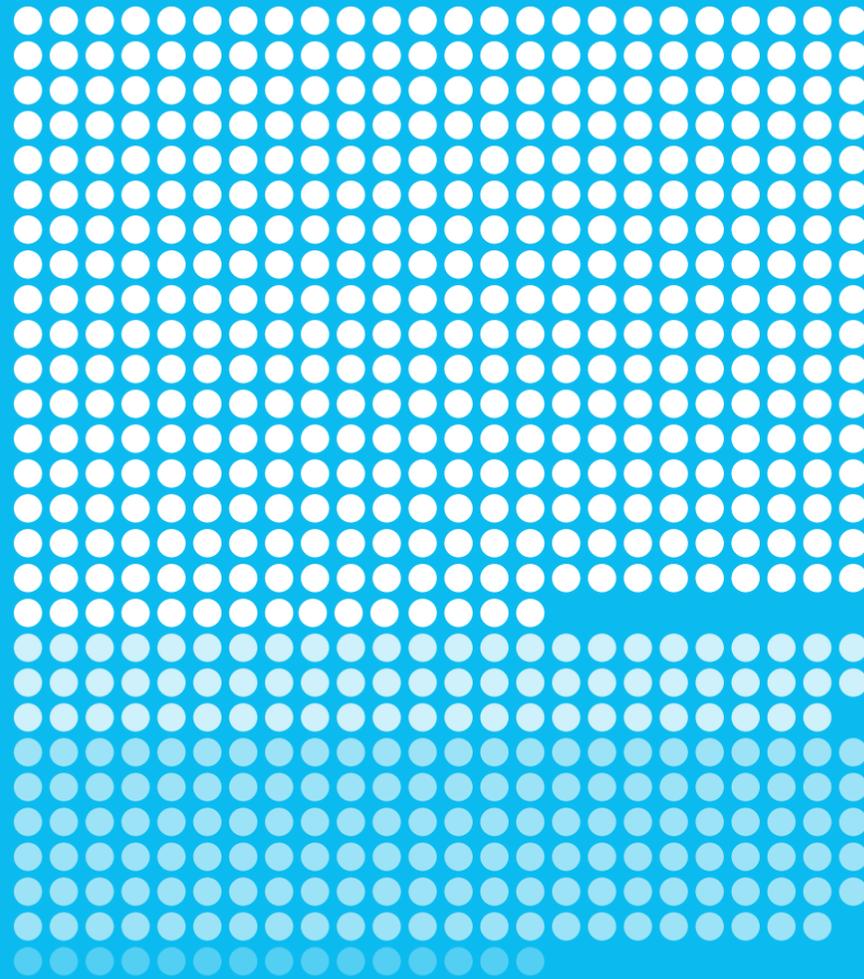
Number of students 652

Short courses 423

Doctorate 71

Master or diploma 143

Rotations 15



Núria Casamitjana
Training and Education Director

ISGlobal has established itself as a leading academic institution in the field of global health. In 2016, we completed our merger with the Centre for Research in Environmental Epidemiology (CREAL), opening up an array of new opportunities to expand our portfolio of training programmes. In the same year, ISGlobal was recognised as an affiliated research institute of the University of Barcelona and of Pompeu Fabra University.

The Master of Global Health course was taught entirely in English for the first time, and this year's class—24 students from Spain and around 30 visiting students from more than 25 countries— was especially diverse in terms of the nationalities and disciplines represented. ISGlobal also collaborated on two tracks of the University of Barcelona's Master of Clinical Research (International Health and Clinical Microbiology) and on the Master of Public Health given by Pompeu Fabra University and the Autonomous University of Barcelona.

We remain committed to collaborating with world-renowned academic institutions to offer international courses and workshops like Science of Eradication: Malaria, the Safe Mothers & Newborns workshops, and the Workshop on Chagas Disease. We will also continue to work with our partners in Mozambique, Bolivia, Morocco and Liberia on capacity-building programmes and to participate actively in international networks such as the Consortium of Universities for Global Health (CUGH), the Network for Education in International Health (tropEd) and the World Federation of Academic Institutions for Global Health (WFAIGH).

Training and Education

Graduate Courses

- Doctorate in Medicine and Translational Research (International Health track), UB
- Doctorate in Biomedicine, UPF
- Trans Global Health: joint doctorate in the framework of the Erasmus Mundus programme in collaboration with academic institutions in Belgium, France and the Netherlands
- ISGlobal-UB Master of Global Health
- ISGlobal-UB Master of Clinical Research (International Health and Clinical Microbiology tracks)
- Master in Internationalisation. Global Health course, Faculty of Economics, UB
- Master in Public Health, Global Health course, UPF-UAB
- Master of Translational Medicine, Translational Research in Public Health course, Faculty of Medicine and Health Sciences, UB
- ISGlobal-UB Diploma of Global Health Fundamentals
- Diploma of Public Health, UPF

Courses, Workshops and Rotations

- Against the Current: Migrants and Health in the Mediterranean
- Determinants of Global Health
- Development and Application of Vaccines in Global Health
- Environmental Epidemiology
- Epidemiology III
- European Course on Tropical Epidemiology
- Exposure and Risk Measurement
- Fundamentals of Qualitative Health Research
- Global Environmental Health
- Global Health Management
- Global Health Systems and Policies
- Health Economics
- Humanitarian Crises and Global Health
- Imported Diseases
- Lost & Found: Adolescent Health in the 21st Century. Barcelona Global Health Summer School 2016
- International Governance & Politics of Global Health
- Maternal and Reproductive Health
- Residential Summer Course in Epidemiology (EEPE)
- Safe Mothers and Newborns: A Leadership Workshop
- The Science of Eradication: Malaria
- Undernutrition & Food Security from the Global Health Perspective
- Workshop on Imported Chagas Disease
- Rotations of resident physicians and graduate doctors at the Chronic Diseases Clinic of Ifakara (Tanzania)
- Rotations of resident physicians and graduate doctors at the Manhica Health Research Centre (Mozambique)
- Student internships at the Manhica Health Research Centre (Mozambique)
- Data Management and Analysis
- Omic Data Analysis in Association Studies with R/Bioconductor

Doctoral Theses Defended

Clinical characterization, diagnosis and management of pediatric acute respiratory infections in developing countries

Miguel Lanaspá
15 January 2016, UB
Supervisor: Dr Quique Bassat

Marcadores moleculares de lesión cervical premaligna en mujeres con infección por el Virus del Papiloma Humano

Amaia Sagasta
27 January 2016, UB
Supervisors: Dr Jaume Ordi, Dr Marta del Pino

Inmunopatología de la malaria grave en niños

Ariel Magallón-Tejada
29 January 2016, UB
Supervisor: Dr Alfredo Mayor

Alteración de los factores de hipercoagulabilidad en pacientes con enfermedad de Chagas crónica: ¿pueden ser considerados marcadores de respuesta terapéutica?

María Jesús Pinazo
1 March 2016, UB
Supervisors: Dr Joaquim Gascon, Dr Joan Carles Reverter

Farmacocinética de rifampicina e isoniazida y su relación con la respuesta al tratamiento de la tuberculosis

Ana Requena
29 March 2016, UB
Supervisors: Dr Jose Muñoz, Dr David Moore

Ecología de bacterias gram negativas no fermentadoras multirresistentes (MDR): Contribución del entorno genético a la diseminación y expresión de genes de resistencia

Noraída del Carmen Mosqueda
7 April 2016, UB
Supervisor: Dr Jordi Vila

The merger of ISGlobal with CREAL brings with it a plethora of new opportunities and new courses



Training of experts is a key component of knowledge transfer in the field of global health

Epidemiología de la tuberculosis pediátrica en Manhiça, Mozambique

Elisa López

7 October 2016, UB

Supervisors: Dr Pedro Alonso, Dr Nenise Naniche

Determinants of infants' health and HIV drug resistance in sub-Saharan Africa

María Rupérez

21 October 2016, UB

Supervisor: Dr Clara Menéndez

Caracterización epidemiológico-molecular de Bartonella bacilliformis

Claudia Gomes

2 December 2016, UB

Supervisor: Dr Joaquim Ruiz

HIV, a global health perspective

Cesar Velasco

12 December 2016, UB

Supervisors: Dr Antoni Trilla, Dr Noe Garín

Characterization of patients admitted to hospital for the first COPD exacerbation

Eva Balcells

20 January 2016, UPF

Supervisor: Dr Judith Garcia-Aymerich

Indoor dampness and mould in primary schools and respiratory health in children

Alicia Borrás

2 February 2016, UPF

Supervisor: Dr Jan-Paul Zock

CT scans in children and young adults and cancer risk: the Spanish EPI-CT cohort

Magda Bosch

28 November 2016, UPF

Supervisor: Dr Elisabeth Cardis

Physical activity and neurodevelopment in children

Mónica López

14 December 2016, UPF

Supervisor: Dr Jordi Sunyer

Effectiveness of an intervention of urban training in patients with chronic obstructive pulmonary disease (COPD): a randomized controlled trial

Ane Arbillaga

20 December 2016, UPF

Supervisor: Dr Judith Garcia-Aymerich

INTEROCC: Occupational exposure assessment for electromagnetic fields and risk of brain tumours

Javier Vila

25 November 2016, UPF

Supervisor: Dr Elisabeth Cardis

Environmental influences on child health and development: the role of seafood, acetaminophen and maternal mental health

Claudia Avella

28 June 2016, UPF

Supervisor: Dr Jordi Julvez

Scale up of integrated care for chronic patients

Ivan Dueñas

13 October 2016, UPF

Supervisor: Dr Judith Garcia-Aymerich

Diet patterns and child health

Silvia Fernández

21 October 2016, URV

Supervisor: Dr Dora Romaguera

ISGlobal Becomes a UB/UPF-Affiliated University Research Institute

The Generalitat de Catalunya accepted ISGlobal's affiliation as a university research institute of the University of Barcelona. This status not only recognises ISGlobal's research activities but also its training programmes and knowledge-transfer activities in global policy and development. Following the merger between CREAL and ISGlobal, the status of 'Pompeu Fabra University affiliated university research institute' held by CREAL since 2012 was transferred to ISGlobal.

ISGlobal Becomes an Institutional Member of the CUGH

ISGlobal has become an institutional member of the Consortium of Universities for Global Health (CUGH). The Consortium views universities as a transforming force in global health and seeks to promote their capacities in training, research and service to better address the current challenges in the field. Being a member involves benefits such as networking with other leading academic global health programmes, access to a global health information hub, and having a stronger voice and presence in the global health community.

ISGlobal Organises its Third PhD Symposium

The third ISGlobal PhD symposium took place on 28 November at the Campus Mar. PhD students from both of ISGlobal's campuses had the opportunity to present preliminary results of their research projects and attend a training session led by Professor Lynn McAlpine of McGill University, on "the post-PhD dream job".

Fifth Edition of the "Science of Eradication: Malaria" Course in Barcelona

The fifth edition of the "Science of Eradication: Malaria" course started on 12 June. This was the second time that the course—organised by ISGlobal, the Harvard T.H. Chan School of Public Health and the Swiss Tropical and Public Health Institute—took place in Barcelona. The seven-day course brought together 53 participants from 31 countries across the world. A wide range of topics relevant to malaria elimination were discussed, including parasite and vector biology; new strategies in vaccination, diagnosis, treatment and vector control; and the economic and social determinants of the disease.

Safe Mothers and Newborns Workshop

The second edition of the Safe Mothers and Newborns workshop took place from 10 to 15 July in Boston, USA. The event brought together more than 60 international experts and leaders in the field of maternal, child and reproductive health from countries that still have a high burden of maternal and neonatal mortality. The aim of the workshop, first held in Barcelona in 2015, is to provide a forum to help participants improve their knowledge and skills in this important area.

We participate actively in international networks, such as CUGH, tropEd and WFAIGH

12th Workshop on Chagas Disease

The 12th Workshop on Imported Chagas Disease, organised by ISGlobal in collaboration with the Mundo Sano Foundation, brought together close to 150 experts from all over the world. The aim of the workshop, which has become an international point of reference in the field, was to present the latest research on diagnostic tools, treatment and access to care. In addition to the scientific sessions, the workshop featured a parallel work session organised by the Ibero-American network NHEPACHA. The aim of the network, which comprises 13 research groups from nine countries and is funded by the Drugs for Neglected Diseases initiative (DNDi), is to develop new tools and biomarkers for the diagnosis, treatment and management of Chagas disease.

The European Educational Programme in Epidemiology (EEPE)

ISGlobal contributed to the 28th edition of this 3-week residential summer course providing intensive training in a broad range of epidemiological topics, from basic to advanced methods in epidemiology and statistics. The course director in 2016 was Prof Manolis Kogevinas from ISGlobal. This edition took place in Florence (Italy) and around 100 participants from 20 countries attended the course.

We continue to work with our partners in Mozambique, Bolivia, Morocco, and Liberia on capacity-building programmes

Capacity Building in a Post-Ebola Context

SELeCT, an EDCTP/ WHO-TDR-funded project led by ISGlobal in collaboration with the Fundación Juan Ciudad, started in February 2016 to strengthen capacities in the St. Joseph's Catholic Hospital of Monrovia, Liberia, with a view to conducting biomedical research and clinical trials between and during infectious disease outbreaks. Throughout the 18-month project, hospital staff received training on Good Clinical and Laboratory Practice standards and the preparation of Standard Operating Procedures documents. Additionally, community engagement and communication activities were performed, including the constitution of a community advisory board.



Facts & Figures

Publications

4

Digital reports

2

Equity analysis of the

17 Sustainable Development Goals

Rafael Vilasanjuan
Policy and Global Development Director

Is it possible to think about people's health without at the same time thinking about the health of the planet? The 2030 development agenda—which sets out 17 Sustainable Development Goals—makes it clear that the problems of global health cannot be solved without addressing environmental factors and the consequences of climate change. Consequently, 2016 was a critical year in the development of this dual vision. This coincided with ISGlobal's expansion and consolidation as an organisation combining expertise in the field of infectious diseases with research on environmental epidemiology and the global consequences of climate change.

During the year, we launched our fifth global health initiative to promote actions intended to improve health in cities through the study of urban planning and mobility patterns. This project is the first step in one of the many areas of environmental health—from pollution to radiation—in which we are now working to ensure that scientific knowledge and innovation have a real impact on people's lives.

As part of this new approach, we have also been working on an ambitious new proposal to set up a Mediterranean Health Observatory in North Africa. In a year in which some countries in Latin America experienced a serious Zika virus epidemic, we have also strengthened our connections and collaborations with multilateral organisations in that region, including the United Nations Development Programme (UNDP). Through these efforts, we have stepped up our international presence in two regions that are central to our agenda: the Mediterranean and Latin America.



Policy and Global Development

ISGlobal Ranked Among Top Policy Think Tanks in Global Health

Just over five years after its founding, ISGlobal has carved out a place among the world's highest-ranked global health policy think tanks. The Institute's standing as a top think tank was confirmed by its inclusion in the Global Go To Think Tank Index, the leading tool for measuring the influence of policy think tanks, which is drawn up annually by the University of Pennsylvania's Lauder Institute. The 2015 index ranked ISGlobal fifteenth in the Global Health Policy category.

ISGlobal and the SDGs

The new development agenda comprises 17 Sustainable Development Goals (SDGs) underpinned by two guiding principles: equity and sustainability. The SDGs provide a unique and coherent framework for ISGlobal's activity, fully reflecting our vision of global health that combines research on infectious diseases, non-communicable diseases and environmental factors with the promotion of interventions that involve communities in developed and developing countries and efforts aimed at helping to inform and shape public policies at different levels. In 2016, several of our researchers collaborated on the epidemiological study *Measuring the health-related SDGs in 188 countries: a baseline analysis from the Global Burden of Disease Study 2015*. In Spain, we participated in a working group convened by the Catalan Health Department to develop a National Plan on the SDGs.

New Direction in Our Development Cooperation Strategy in Spain

With the election of a new Spanish legislature in 2016 and the current improvement in the country's economic outlook, it is now possible to envisage the reform and recovery of Spain's development cooperation policy. Following these changes, in 2016 we established a new direction in our advocacy strategy. Whereas we previously focused primarily on the government, we are now directing our efforts towards all the newly elected legislators, especially those who sit on committees related to science, health and development issues. With the support of the Bill & Melinda Gates Foundation, we have analysed successful European cooperation models and developed a new proposal for an international cooperation strategy that would place the emphasis on knowledge-sharing and return on investment.

Fifth ISGlobal Initiative

Collaboration between the planning, transport, environment and health sectors is urgently needed to address the challenges posed by urbanisation. It has become essential to put health and well being at the centre of the urban development agenda and to tackle problems such as air and noise pollution, heat island effects, lack of green space and sedentary behaviour. In 2016 we created the Urban Planning, Environment and Health Initiative, which will use rigorous scientific evidence, tools and indicators to promote sustainable and healthy urban development.

Policy

New Series of Reports on Innovation and Access to Medicines

In 2016, the department of Policy and Global Development launched a new series of reports on pharmaceutical innovation and access to medicines. The first report in the series, *Biomedical Innovation and Access to Essential Medicines: Alternatives to a Broken Model*, analyses the existing system of innovation and research to lay the groundwork for a debate among all the stakeholders to look for a balance between pharmaceutical innovation, the public interest and the need to ensure that all patients have access to the treatments they need. The second report in this series, *Hepatitis C: The New Battleground for Access to Essential Medicines*, analyses the debate on access to treatment for hepatitis C, an issue that has been in the international spotlight due to the controversy surrounding the high cost of Sovaldi (sofosbuvir), a drug approved in late 2013.

Report: *Breaking the Silence: An Opportunity for Patients with Chagas Disease*

On World Chagas Day, the Global Chagas Disease Coalition published a new report that provides a comprehensive analysis of the current situation regarding the disease caused by the parasite *Trypanosoma cruzi* and proposes a series of measures designed to remedy one of the major hurdles facing infected patients: the lack of access to diagnosis and treatment. In this report, the Global Chagas Disease Coalition, of which ISGlobal is a founding member, highlights the fact that, at the current rate, it would take 300 years to treat all those affected.

The SDGs provide a unique and coherent framework for ISGlobal's activity

Report: *Inequalities in Women's and Girls' Health Opportunities and Outcomes*

At a meeting of the board of the Partnership for Maternal, Newborn & Child Health (PMNCH) in Maputo (Mozambique) in October, ISGlobal and the World Bank presented the report *Inequalities in Women's and Girls' Health Opportunities and Outcomes: A Report from Sub-Saharan Africa*. The document presents the results and conclusions of a study of the most recent data from 29 sub-Saharan African countries. The analysis of the data for these countries, at national and regional levels, reveals that women of childbearing age (15 to 49 years) have very unequal access to the 15 health opportunities studied. The report concludes that achieving universal and equitable access to essential maternal and reproductive health services is a priority for achieving the Sustainable Development Goals.

Digital Reports

In 2016, we continued to publish online reports that combine a critical and rigorous view of global health issues with graphic material and interactive data visualisations. On the occasion of World Chagas Day, we published a special digital report on the main obstacles to care and a series of solutions aimed at breaking the silence on Chagas disease: *Chagas: 5 Problems and a Series of Solutions*. During World Antibiotic Awareness Week, in close collaboration with ISGlobal's Antimicrobial Resistance Initiative team, we published the online report *The 4 Battlefronts in the War Against Antibiotic Resistance* to raise awareness about what is being done in the fight against drug-resistant bacteria.

Global Development

Cooperation Agreement to Establish a Mediterranean Health Observatory

In May, ISGlobal and the Moroccan Ministry of Health signed a cooperation agreement with two aims: to undertake joint initiatives in public health and epidemiology, and to establish a Mediterranean Health Observatory based in Morocco. The purpose of the observatory will be to identify and work on global health issues that are in line with the SDGs and of particular interest to the Mediterranean region.

ISGlobal Gets Involved in the Zika Response

A multidisciplinary team of specialists at ISGlobal worked on the response to the Zika epidemic, which was declared a public health emergency of international concern by the World Health Organisation in February 2016. The working group monitored the global and local epidemiological situation and participated in several actions aimed at managing possible local cases and generating knowledge about the virus. In addition, ISGlobal advised the Spanish Olympic Committee on the risks related to the Zika virus for those attending the Olympic Games in Brazil.

Member of the CSO Steering Committee for Gavi, the Global Vaccine Alliance

ISGlobal has become a member of the Gavi Civil Society Organisation (CSO) Steering Committee, a group of 19 civil society organisations from 15 countries that guide the work of more than 3,000 CSOs that seek to ensure access to vaccines for children, even in the poorest countries. The profile of the CSOs engaged in Gavi is very diverse and includes large international organisations, local NGOs, professional associations and academic institutions.

ISGlobal has become a member of the Gavi Civil Society Organisation Steering Committee

ISGlobal and the Fundación Ayuda en Acción Join Forces

ISGlobal and the Fundación Ayuda en Acción signed a collaboration agreement to improve the impact of their interventions and the quality of life of populations living in the areas where they work. ISGlobal's contribution to the NGO's development interventions will be diverse: scientific evidence and knowhow; expertise in methodology, cost-effectiveness and impact analysis; and experience in mounting an effective response to poverty-related and vector-borne diseases.

Agreement to Improve Diagnosis and Treatment of Chagas Disease in Bolivia

The Foundation for Applied Science and Studies for Health and Environmental Development (CEADES), ISGlobal and the Probitas Foundation have joined forces in pursuit of a common objective: helping to remedy the current lack of resources for the diagnosis and treatment of Chagas disease. With this new agreement, signed in Barcelona, the three institutions have pledged to strengthen the capacities of four towns in the Bolivian region of Cochabamba—Punata, San Benito, Arani and Villa Rivero—in order to promote early diagnosis and appropriate treatment of Chagas and other neglected diseases, especially in children and pregnant women.

Extended Commitment to the “Every Woman, Every Child, Every Adolescent” Global Strategy

In September 2016, ISGlobal renewed and extended its commitment to the Global Strategy for Women's, Children's and Adolescents' Health (2016-2030) in several areas: promoting a coordinated R&D agenda together with other collaborators, prioritising research issues in maternal health that involve vulnerable populations such as pregnant women and their newborns in malaria-endemic areas, and training aimed at strengthening the capacity of health professionals, especially in low- and middle-income countries.



Communications

ISGlobal in the media

Media coverage is an important way of translating the knowledge generated in our institution for the good of society. In 2016, ISGlobal took part in:

39 TV Interviews

65 Radio Interviews

394 Written Media Appearances

2,394 Online Media Appearances

Producing our own content

Much of the work of the Communications Department is carried out on the Web, where throughout the year we published:

139 News Items

68 Posts

68 Social Media Klout Score

This number corresponds to December 31st, 2016.

The Klout score is an index that measures online social influence.

3 Ways to Stay Up to Date

1 Follow us on social media

 www.facebook.com/isglobal

 Twitter: @ISGLOBALorg

 Instagram: @ISGLOBALorg

2 Subscribe to our blog on global health issues

www.isglobal.org/healthisglobal

3 Subscribe to our monthly newsletter

With the support of

Agencia Española de Cooperación Internacional para el Desarrollo (AECID)

Agència Catalana de Cooperació al Desenvolupament (ACCD)

Agència de Gestió d'Ajuts Universitaris i Recerca (AGAUR)

Ajuntament de Barcelona

Agence Nationale de Sécurité Sanitaire de l'Alimentation, de l'environnement et du travail (ANSES)

Barcelona MAR Health Park Consortium

Bill & Melinda Gates Foundation

Centers for Disease Control and Prevention (CDC)

CEPHEID

CIBER - Epidemiología y Salud Pública

Comité Olímpico Español

Consejo Nuclear de Seguridad (CNS)

Drugs for Neglected Disease initiative (DNDI)

Education, Audiovisual and Culture Executive Agency (EACEA)

European & Developing Countries Clinical Trial Partnership (EDCTP)

European Commission (FP7, H2020)

European Liver Patients Association (ELPA)

European Respiratory Society (ERS)

European Society of Clinical Microbiology and Infectious Diseases (ESCMID)

Ferrer Internacional, S.A.

Fundación Manhiça

Fundación Mundo Sano

Fundación Ramón Areces

Fundación Infant

Fundación Prevent

Fundación Probitas

Fundación Anesvad

Generalitat de Catalunya

GlaxoSmithKline Biologicals

Hospital Clínic de Barcelona

Health Effects Institute (HEI) Innovative Medicines Initiative

Instituto de Medicina Molecular
Institut de Radioprotection et de Sûreté Nucléaire (IRSN)

Instituto de Salud Carlos III

Institut Investigacions Biomèdiques de Barcelona (IIBB-CSIC)

ISDIN

"la Caixa" Foundation

Medicines for Malaria Venture

Ministerio de Economía y Competitividad

Ministerio de Educación, Cultura y Deporte

Ministerio de Sanidad, Servicios Sociales e Igualdad

National Institutes of Health

PATH Malaria Vaccine Initiative

SEM-TSI
Sociedad Española de Medicina Tropical y Salud Internacional

SPOO - Stichting Pathologie, Onderzoek en Ontwikkeling

Swiss Federal Institute of Technology (Branco Swiss)

USAID

United Nations Development Programme (UNDP)

University of Barcelona

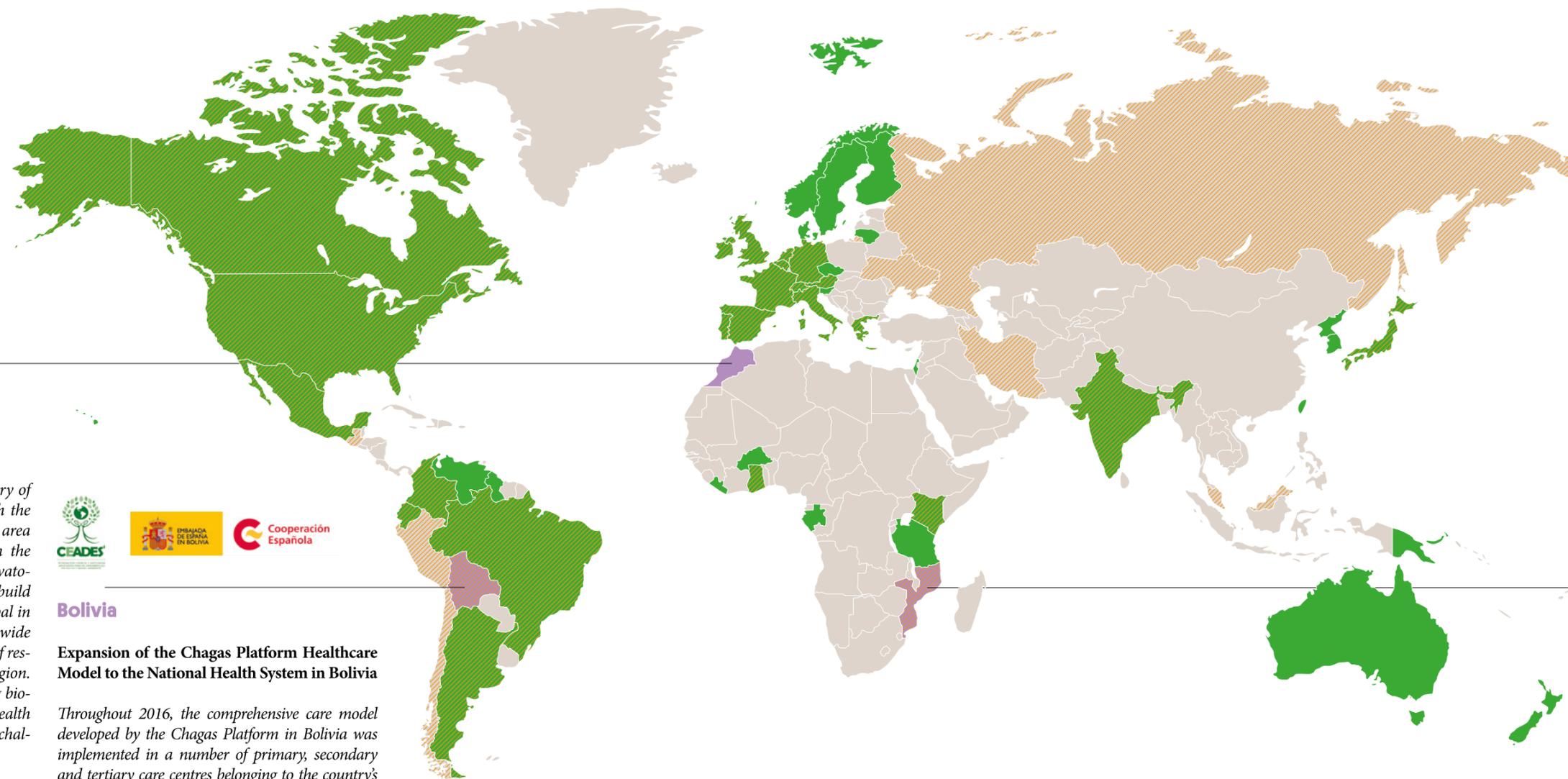
University Pompeu Fabra

Wellcome Trust

World Health Organisation (WHO)

A Global Presence

- Countries where ISGlobal coordinates projects and networks
- ▨ Countries of origin of ISGlobal professionals
- Long-term strategic alliances



Morocco

Strengthening Links with Moroccan Stakeholders

In 2016, ISGlobal and the Moroccan Ministry of Health signed a cooperation agreement with the aim of undertaking joint initiatives in the area of public health and epidemiology through the creation of a Mediterranean Health Observatory based in Morocco. The Observatory will build on the scientific experience gained by ISGlobal in Morocco and will allow for the creation of a wide network of experts and institutions capable of responding to global health challenges in the region. It will also serve as a platform for translating biomedical and epidemiologic research into health policies related to the monitoring of health challenges affecting the region.



Bolivia

Expansion of the Chagas Platform Healthcare Model to the National Health System in Bolivia

Throughout 2016, the comprehensive care model developed by the Chagas Platform in Bolivia was implemented in a number of primary, secondary and tertiary care centres belonging to the country's National Health Service. Thanks to this expansion of care for patients with Chagas disease, 18,336 patients—7% of the at-risk population in the Platform's area of influence—have been tested for the disease over the past year. *T. cruzi* infection was found in 4,898 patients and 43% of these (1,134 women and 814 men) began treatment. The National Health Service centres achieved a similar rate of adherence to treatment as the Platform's own centres, an indication that the expanded programme has been able to maintain the same standards of care.



Mozambique

Joint Scientific Meeting of ISGlobal and CISM in Mozambique

ISGlobal's long-term strategic alliance with the Manhiça Health Research Centre (CISM) guarantees knowledge transfer and capacity building while also supporting a research portfolio focused on some of the main threats to health in Mozambique. In March 2016, researchers and managers from ISGlobal and CISM met to share and discuss their scientific agendas and challenges and to identify possible synergies. The areas of research discussed included malaria, HIV, tuberculosis, antibiotic resistance, maternal and perinatal health, and exposure to chemicals and air pollution.

A partnership of:

