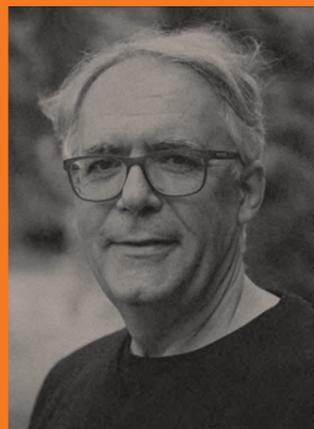


**Annual
Report
ISGlobal
2017**



Antoni Plasència
General Director



Josep M. Antó
Scientific Director

Foreword

After the merger of our foundational centres in June 2016, ISGlobal went on to have an important year in 2017. Thanks to the many institutions, bodies and individuals who support our work and have put their trust in our organisation, we have continued to grow and develop our strengths as a solid scientific organisation based on a model designed to bridge the gap between science and society at large. During the same period, we consolidated our long-term international alliances to improve global health and to work towards greater equity in all parts of the world.

During 2017, a year that marked the beginning of a new strategic cycle (2017-2020), we restructured our scientific organisation using our research programmes as building blocks and strengthening the synergies between them. We continued to increase our scientific output and of the 443 articles published throughout the year, 43% appeared in first-decile journals. ISGlobal was involved in 67 ongoing international research projects, acting as the leading institution in 24 cases. We were awarded major new projects, including the Unitaid-funded TIPTOP project, which aims to increase intermittent preventive treatment in pregnancy for malaria in four African countries, and FRONTIER, a new European Research Council Advanced Grant focusing on the impact of air pollution on children's brains.

One of the defining characteristics of our organisation is our commitment to maximising the impact of the knowledge we generate by promoting evidence-based action. This is the responsibility of our five Initiatives: Antimicrobial Resistance; Chagas Disease; Malaria Elimination; Maternal, Child and Reproductive Health; and Urban Planning, Environment and Health.

In the framework of the 2030 Agenda for Sustainable Development, ISGlobal is aligning its work with the Sustainable Development Goals, which are inextricably linked to our institutional mission. Indeed, we have become a leading actor in activities related to SDG implementation in several international initiatives, including the Sustainable Development Solutions Network. Equally important is our commitment to developing the scientific basis for better health-related environmental and climate policies and our role in the Planetary Health Alliance.

We have continued to strengthen our knowledge-translation activities. ISGlobal was again ranked by the University of Pennsylvania as a leading global health think tank (16th in the world and 4th in Europe). We also continued to develop the Mediterranean Health Observatory. The year saw the launch of a major project to involve the scientific community in the debate on pharmaceutical innovation and access to medicines. Our training and education programmes enrolled a record number of students, with an increasingly diverse profile in terms of backgrounds and nationalities.

In recognition of the institute's achievements, the Agency for the Research Centres of Catalonia (CERCA) awarded ISGlobal the highest qualification for its performance during the period 2013-2016. The CERCA award recognised ISGlobal for its "outstanding performance", situating our centre "among the top international institutions in its field". Moreover, our External Advisory Committee issued a series of highly valuable recommendations on how to further develop ISGlobal's role as a key player in global public health.

External factors will continue to influence national and international policies and funding in 2018, although it is not yet clear to what extent. Meanwhile, a number of international and national events do not bode well for health policies and funding: the new US administration has pulled out of important international agreements such as the Paris Climate Agreement and announced budget cuts for health and environment agencies and programmes, the European Union has started negotiating a Brexit deal, and Spain and Catalonia are immersed in a political crisis.

With these challenges in mind, ISGlobal will continue to build on its strengths through the deployment of its Strategic Plan, which has been updated with recommendations from the External Advisory Committee and the CERCA reviews.

Today, more than ever, we must continue to address the current global health challenges -social and geographical inequalities, the unfinished agenda of infectious diseases and malnutrition, the rise of chronic diseases, rapid urbanisation, and environmental and climate-related health threats- by generating high-quality science and translating it into evidence-based policies.

Thank you to all for making it possible. ●

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Highlights

1. Health and the City

The health impact of living in a city like Barcelona was assessed using a model called UTOPHIA. Every year, nearly 20% of premature deaths could be prevented if recommendations on air pollution levels, noise, green spaces, etc., were followed.

By 2050, almost 70% of the world's population will be living in urban areas. Cities can provide access to goods and services, innovation, and facilitate social interactions. But some aspects of urban life such as exposure to air pollution and noise, sedentary lifestyles, and extreme heat can have negative effects on our health and increase premature mortality.

Measuring the Health Impact of Urban Life

The car-centred design of cities in the preceding decades has led to high levels of traffic-related air pollution and noise, a lack of green spaces, and high levels of physical inactivity. The combination of ambient air pollution and physical inactivity are estimated to cause over 5 million premature deaths every year.

In order to better understand the health impact of city life, Mark Nieuwenhuijsen and his team have developed a model called UTOPHIA that can estimate the mortality burden associated with current urban and transport planning. In their first study, they estimated that 20% of premature deaths could be avoided (and €9.3 billion saved) in the city of Barcelona if international recommendations for physical activity levels, air pollution exposure, traffic noise, heat and access to green spaces were followed. Lack of physical activity accounted for the biggest share of preventable deaths. A second study using the UTOPHIA tool showed that the city of Barcelona could also reduce its total burden of disease by 13% every year by complying with these international recommendations and that road traffic noise is the factor that causes the most disease, followed by air pollution. “Evidence shows that nighttime noise exposure is particularly harmful because it affects the regenerative processes

that occur in the body during sleep. Traffic noise is also associated with hypertension, cardiovascular disease and stroke,” explains Natalie Mueller, lead author of the study.

In the case of physical activity, 70% of Barcelona residents fall short of the minimum level recommended by the World Health Organisation (150 minutes of moderate activity or 75 minutes of vigorous activity per week). Regarding heat, summer temperatures in Barcelona exceed levels considered to be healthy. Finally, a third of the city's population does not live near any green spaces.

Cities for People, Not for Cars

Nieuwenhuijsen is emphatic: “There are two steps that could be taken to dramatically decrease Barcelona's burden of disease: reduce the volume of motor traffic by promoting active modes of transport, and increase the amount of green space in the city. This would not only increase levels of physical activity but also reduce air pollution, noise and heat.”

The team is currently working to apply the UTOPHIA tool in various cities and provide evidence to improve decision-making in urban planning and transport policies around the world. ●

By 2050, 70% of the world's population will live in cities

70%

“Our health – and that of our planet – will largely depend on how cities are designed”

Mueller N, Rojas-Rueda D, Basagaña X, et al. *Urban and transport planning related exposures and mortality: a health impact assessment for cities.* Environmental Health Perspectives.

Mueller N, Rojas-Rueda D, Basagaña X, et al. *Health impacts related to urban and transport planning: A burden of disease assessment.* Environment International, 2017 Oct; 107:243-257.

2. Turning Up the Volume of a Silent Disease

The Bolivian Platform for the Comprehensive Care of Adults with Chagas Disease shows the way.

Chagas Disease in Numbers



“The transnational nature of our alliance allows the follow-up of patients and relatives who move between Barcelona and their places of origin in Bolivia”

Chagas: A Silent Disease

In 1909, the Brazilian epidemiologist Carlos Chagas described the disease that would later bear his name and discovered that it was caused by a parasite (*Trypanosoma cruzi*) transmitted by the so-called kissing bug. Of the estimated 6 million people currently infected by *T. cruzi* worldwide, Bolivia—home to more than 600,000 infected people—has the highest prevalence. Chagas disease can remain “silent” for years but can be lethal in patients who develop severe cardiac complications. The good news is that it can be treated. The bad news is that less than 1% of Chagas patients have access to treatment. Needless to say, this figure can and should be increased, and this is what Joaquim Gascon and his team have been working on over the last years.

Bolivian Platform for Chagas Disease

As a result of a collaboration between ISGlobal and the CEADES Foundation, the Bolivian Platform for the Comprehensive Care of Adults with Chagas Disease was created in 2009 to help control the disease. The Platform has six centres in highly endemic areas of Bolivia and is supported by the Spanish cooperation agency as well as the Bolivian authorities. Its work model is based on four pillars: i) providing healthcare, ii) acquiring expertise and building disease research capacity, iii) training health profes-

sionals in the management of Chagas disease, and iv) organising educational activities in the community.

Encouraging Figures

Between 2010 and 2015, a total of 26,227 people received care through the Platform, 69% of whom were diagnosed with the infection. Of the 8,567 patients who began treatment, 80% completed it. The Platform provides care to more than 75% of the adults in Bolivia who are being treated for Chagas disease. Over 1,600 healthcare professionals have been trained in the management of the disease and an exchange programme has been established with the University of San Simon (Bolivia).

Time to Learn Lessons and Identify Challenges

Despite these encouraging results, much remains to be done. Gascon and his team describe how the programme is now being implemented at primary healthcare facilities in Bolivia and identify the lessons learned as well as the challenges that remain. “The scaling-up efforts of the last two years show that the limitations have been solved locally through collaboration with the health authorities,” explains Gascon. ●

Pinazo MJ, Pinto J, Ortiz L, et al. A strategy for scaling up access to comprehensive care in adults with Chagas disease in endemic countries: The Bolivian Chagas Platform. *PLoS Negl Trop Dis*. 2017 Aug 18; 11(8):e0005770.

3. Through the Crystal Ball of Climate Services

A model that incorporates seasonal forecasts of rain, temperature and El Niño events can help predict dengue outbreaks several months in advance.

“This advanced warning on the magnitude and peak of the incidence can help public health authorities better manage resources, especially if they are scarce”

The Growing Burden of Mosquito-Borne Diseases

The global burden of dengue fever has increased considerably over the last few decades (2013 saw nearly 60 million cases, according to the World Health Organisation). As with many other mosquito-borne diseases (Zika, chikungunya, yellow fever, etc.), dengue is particularly sensitive to climate conditions (for example, temperature affects the development and activity of the *Aedes* mosquito as well as the rate of viral replication in the mosquito). However, collaboration between meteorological and health services is still very limited. In addition, most predictions regarding dengue and climate have been made retrospectively, using data that would not have been available before the dengue season.

Predicting the Entire Dengue Season at the Start of the Year

Xavier Rodó and his team have used seasonal climate and El Niño forecasts to make the first long-term predictions of dengue incidence in the city of Machala, Ecuador, where the disease is highly endemic. They used real-time temperature, precipitation and El Niño index forecasts to predict, with a mathematical model, the monthly number of cases of dengue in 2016. They also used active surveillance data to adjust for misreporting (i.e. cases reported as dengue that

were actually caused by chikungunya, a virus introduced in the region in 2014 whose clinical symptoms are similar to those of dengue). Their model correctly predicted an increase in dengue incidence in the first half of 2016 and a peak that occurred three months earlier than expected. “The main advantage of this model is that it allows a prediction to be made at the start of the year for the entire dengue season,” explains Rachel Lowe, lead author of the study.

“Advance warning of the magnitude and peak of incidence can help public health authorities more effectively manage resources, especially when these are scarce,” adds Rodó. A comment published in the same journal notes that the study “shows the way forward for the discipline of climate services” and highlights the need to generalise and translate these tools to help public health policies reduce the burden of dengue and other climate-sensitive diseases.

Rodó and his colleagues warn, however, that climate forecasts are more accurate during El Niño and La Niña events, and that factors such as human mobility, vector-control campaigns and population immunity status may also be important factors in other years. ●

Half of the world’s population is at risk of contracting dengue



4. A Brand New Agenda for an Old Disease

malERA Refresh is an updated research agenda to accelerate malaria elimination and eradication. It is the result of a consultation process involving more than 180 scientists, programme leaders and policymakers from all over the world.

From Worms to Mosquitoes

Ivermectin is an anti-parasitic medicine that has been successfully used to treat worm infections such as onchocerciasis and lymphatic filariasis. But worms are not the only target of this Nobel-prize-winning drug. It also kills arthropods feeding on a treated individual, including the *Anopheles* mosquitoes that transmit malaria. This has led scientists to consider ivermectin as a potential game changer in the fight against malaria. In an evidence-based review, Carlos Chaccour and Regina Rabinovich propose how the drug could be used as a complement to vector-control tools for malaria elimination. “Mass administration of ivermectin constitutes a new paradigm for vector control,” says Rabinovich. The drug offers indirect human protection by reducing local transmission. It also acts against multiple mosquito species and could work in the context of insecticide resistance.

Chaccour C, *Malar J*, 2017 Apr 24;16(1):161, 162, 166.

“The value of malERA Refresh is that it focuses on the problems that need to be solved and not just the technologies that could be developed”

Eliminating Malaria Is No Easy Task

Achieving a world without malaria would present enormous benefits in terms of health, equity and economics. The World Health Organisation has set ambitious goals for reducing the burden of malaria worldwide, and 21 countries have been identified as having the potential to eliminate local transmission of malaria by 2020. However, there is no easy path to achieving a malaria-free world and there is a real need for innovation. And this is where malERA Refresh comes in: it sets out the research agenda needed to meet the challenges, achieve these goals and, in the long term, eradicate malaria globally.

Eradication Will Require Tailored Approaches and Innovation

The Malaria Eradication Scientific Alliance (MESA), with headquarters at ISGlobal, organised a collaborative process to address the progress made and the main challenges in the following areas: basic science and technologies; insecticide and drug resistance; reservoir and measurement of transmission; diagnostics, drugs, vaccines and vector control; combination interventions and modelling; and health systems and policy research.

The outcome is a series of seven papers that have been published as a special collection in *PLOS Medicine*.

“The value of malERA Refresh is that it focuses on the problems that need to be solved and not just the technologies that could be developed,” states Regina Rabinovich, Chair of MESA and Director of ISGlobal’s Malaria Elimination Initiative.

Key messages highlighted in the malERA Refresh collection include the following:

- Significant progress has been made since 2011, including support for large-scale testing of the first approved vaccine (RTS,S) and new genetic technologies to block parasite transmission by mosquitoes.
- This progress, however, has been matched with significant challenges, such as the expansion of resistance to both insecticides and drugs. Tools to tackle *Plasmodium vivax* malaria, the most common malaria outside Africa, are still lacking. In addition, the continuous evolution of malaria parasites and vectors brings new challenges.
- Solutions to these problems require innovation and integrated approaches tailored to local contexts and variations in disease transmission dynamics. ●

Rabinovich RN, Drakely C, Djimde AA, et al. malERA: An updated research agenda for malaria elimination and eradication. *PLoS Med* 2017 Nov 30;14(11):e1002456.

Visit: collections.plos.org/malera-refresh

5. A Tricky Vaccine

The malaria vaccine RTS,S protects some children but not others, particularly infants, and this difference could be related to a certain type of immune response.

Developing an effective vaccine against malaria is not for the faint-hearted: the structure of the malaria parasite is much more complex than that of a virus or bacterium and it has multiple life stages.

RTS,S is the first licensed malaria vaccine, but its efficacy in protecting children against clinical malaria is moderate (ranging from 30% to 50%) and age-dependent. The reasons for this are not yet clear, but may be due to differences in the magnitude or type of immune response induced by the vaccine. Carlota Dobaño and her group have been working hard over the last few years to understand this issue.

One Vaccine, Different Responses

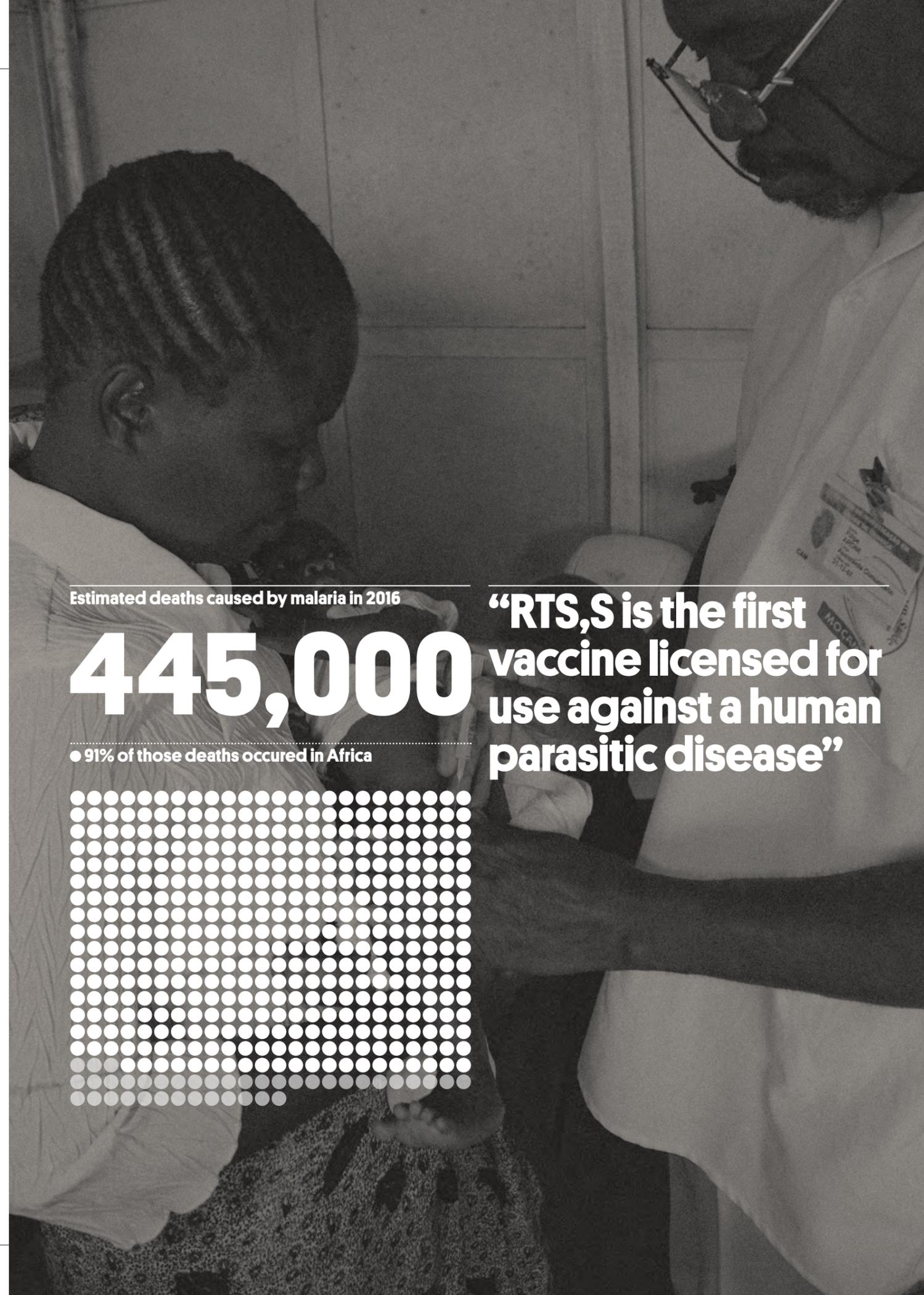
Within the multicentre Phase 3 clinical trial for RTS,S, Dobaño's team performed a study with at least 200 vaccinated and unvaccinated infants and children from Bagamoyo (Tanzania), Lambaréné (Gabon) and Manhica (Mozambique), some of whom subsequently developed clinical malaria. They used an assay that permits the simultaneous analysis of multiple cytokines (proteins secreted by immune cells) from blood samples obtained one month after the last RTS,S shot.

The researchers found that IL-5 (a cytokine characteristic of an anti-inflammatory Th2-type response) was associated with a risk of developing malaria despite vaccination, while a pro-inflammatory Th1-type response (characterised by an increase in IFN- γ , IL-15 and GM-CSF cytokines) was associated with protection against subse-

quent malaria. They also found that, while the vaccine induced high levels of Th1 cytokines in children, this increase was not observed in infants.

"It is thought that the immune response in newborns is biased towards a Th2-like profile," explains Gemma Moncunill, lead author of the study, "which could explain the lower efficacy of the vaccine in younger babies." Carlota Dobaño, the coordinator of the study adds, "These results indicate that we need to find adjuvants (substances included with the vaccine) that boost Th1-type responses during the first months of life." These results have implications for the development of other paediatric vaccines. ●

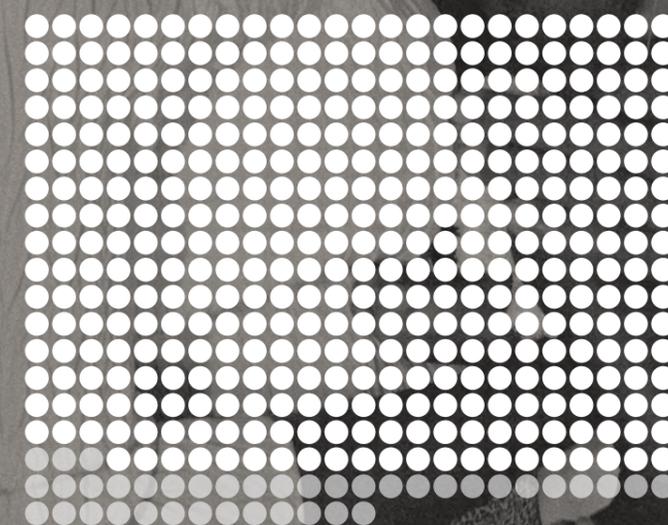
Moncunill G, Mpina M, Nhabomba AJ, et al. Distinct helper T cell type 1 and 2 responses associated with malaria protection and risk in RTS,S/AS01E vaccinees. *Clinical Infect Dis.* 2017 Jun 19;11(6):e0005684



Estimated deaths caused by malaria in 2016

445,000

● 91% of those deaths occurred in Africa



“RTS,S is the first vaccine licensed for use against a human parasitic disease”

6. When Patients Do Not Fit in the Box

A study challenges the validity of classifying patients with chronic obstructive pulmonary disease into defined subgroups.

COPD Deaths in 2015

3.17 million

90% of COPD deaths occur in low and middle income countries



COPD is an under-diagnosed, life-threatening lung disease. The main causes are smoking, indoor and outdoor pollution, and occupational exposure to dusts and fumes. The WHO predicts that it will become the third leading cause of death worldwide by 2030.

A Common but Heterogeneous Disease

Chronic obstructive pulmonary disease (COPD) makes it difficult to breathe. About 65 million people worldwide have moderate to severe forms of this chronic disease, which is expected to become a leading cause of death by 2030. One major problem in the diagnosis and treatment of COPD is that it is a very heterogeneous disease and there is little consensus on the existence and definition of different COPD subtypes.

Individual Traits Rather than Defined Subgroups

Some groups have attempted to use algorithms based on clinical parameters to cluster patients into homogenous groups, but this classification does not appear to be reproducible. Indeed, Judith Garcia-Aymerich and her team analysed 1,700 patients with COPD using the same algorithm and the same COPD-related characteristics across cohorts. The reproducibility of COPD classification into subtypes (e.g. very severe phenotype or cardiovascular phenotype) was moderate to low. In contrast, relationships between individual clinical manifestations (such as lung function or cardiovascular comorbidity) were more consistent. These manifestations respond to a continuous spectrum of disease severity and can coexist to varying degrees within the same patient.

Implications for Clinical Management

“This means that COPD phenotypical heterogeneity is better explained if one considers the individual traits rather than trying to classify the patients into well-defined groups,” explains Garcia-Aymerich. “Our results challenge the idea that individual studies that classify the disease into defined subtypes can immediately be extrapolated to different causes and treatments for each subgroup,” she adds. ●

Castaldi PJ, Benet M, Petersen H, et al. [Do COPD subtypes really exist? COPD heterogeneity and clustering in 10 independent cohorts.](#) *Thorax*. 2017 Jun 21. doi: 10.1136/thoraxjnl-2016-209846.

7. Reducing Mortality by Understanding the Causes

A minimally invasive technique will help to determine cause of death in mothers, children and neonates in low- and middle-income countries and inform public health strategies.

This technique will help guide public health strategies to improve child survival in low-resource countries.

Cause of Death: Unknown

As Professor Prabhat Jha correctly pointed out during one of our Global Health Lectures, “Counting the dead and describing the causes is the ‘GPS’ for global health.” It may be difficult to believe, but the cause of most deaths that occur in our world is not certified. This is because, in most low- and middle-income countries, people die at home and the cause of death is rarely established. However, without this information it is impossible to design effective strategies for reducing mortality.

A New Tool That Is Accurate, Easy to Use and Acceptable...

Since 2013, a multidisciplinary team led by Jaume Ordí, Clara Menéndez and Quique Bassat has been developing a minimally invasive technique for determining cause of death in developing countries. The method is based on the histologic and microbiological analysis of blood, cerebrospinal fluid and tissue samples obtained using thin biopsy needles. Unlike a complete autopsy, it does not require specially trained personnel and can be performed in low-resource settings. The project—CADMIA in the initial phase and subsequently CADMIA-plus—has demonstrated that in adults the technique yields comparable results to those obtained with complete diagnostic autopsy and that it is acceptable across different countries and cultures.

Menendez C, Castillo P, Martinez MJ, et al. [Validity of a minimally invasive autopsy for cause-of-death determination in stillborn babies and neonates in Mozambique: An observational study.](#) *Plos Med* 2017, Jun 20;14(6):e1002318.

Bassat Q, Castillo P, Martinez MJ, et al. [Validity of a minimally invasive autopsy tool for cause of death determination in pediatric deaths in Mozambique: An observational study.](#) *Plos Med*. 2017, Jun 20;14(6):e1002317

...And Will Help Reduce Maternal and Child Deaths, One of the Global Targets for 2030

More recently, the researchers validated the technique for determining cause of death in children, neonates and stillbirths, and for maternal deaths. The concordance between the results obtained by the minimally invasive technique and those obtained with the complete autopsy is high, particularly for deaths caused by infectious agents.

According to the project leaders Ordí, Menéndez and Bassat, “Reliable data on the causes of death in neonates, stillbirths and children will help guide better and more evidence-based public health strategies to improve child survival in countries with high disease burden and low resources.”

The journal *Plos Medicine* has dedicated a complete collection to this innovative technique, which is the cornerstone of CHAMPS, a global child health surveillance network funded by the Bill & Melinda Gates Foundation. ●

In 2010, less than 3% of deaths among children under 5 were assigned an official cause of death

8. A Small but Valuable Protein

A chemokine in blood called IP-10 could facilitate HIV diagnosis and treatment follow-up in low- and middle-income countries, helping health systems save hundreds of thousands of dollars.

Million people living with HIV

36.7

Million people living on antiretroviral therapy

20.9

“This blood test could lead to a 75% reduction in the number of viral load tests”

The Need to Detect Treatment Failure and Acute Infections

The HIV target set by UNAIDS for the year 2020 is 90/90/90: diagnose 90% of people living with HIV, treat 90% of them, and achieve viral suppression in 90% of treated patients. Viral suppression can only be achieved through close monitoring of antiretroviral drug efficacy. Treatment failure is currently detected using a costly test that measures the amount of virus in the blood (viral load test). For patients living in rural areas of Africa, it can take up to six months to get the test results. The viral load test is also used to diagnose patients in the acute phase of infection. Traditional diagnostic tests based on the measurement of HIV-specific antibodies are not useful during this initial phase because it takes the body around four weeks to produce the antibodies. The problem is that people in the acute stage are highly infectious because they carry millions of virus copies in every millilitre of blood. Therefore, early diagnosis and treatment of these patients would be highly beneficial.

Pastor I, Casellas A, Carrillo J, et al. IP-10 levels as an accurate screening tool to detect acute HIV infection in resource-limited settings. *Sci Rep*, 2017, Aug 14;7(1):8104.

Pastor I, Casellas A, Rupérez M, et al. IP-10 as a screening tool to optimize HIV viral load monitoring in resource-limited settings. *Clin Inf Dis*, 2017, Oct 30;65(10):1670-1675.

A Blood Test That Could Save Time and Money

For many years, the team led by Denise Nanche has been working on specific problems related to the HIV/AIDS epidemic in sub-Saharan Africa. They found a simple blood test that measures levels of a small protein called

IP-10 to be highly predictive of acute HIV infection. “This method does not replace the viral load test, but in an area with high HIV incidence, it can identify seronegative individuals who should be tested by viral load,” explains Nanche. “This would lead to a 75% reduction in the number of viral load tests, which are costly and complex,” adds Julià Blanco, a researcher at the Germans Trias i Pujol Research Institute at IrsiCaixa and senior co-author of the study. In effect, a cost-benefit analysis indicates that a rapid diagnosis test based on IP-10 could save between \$176,609 and \$533,467 per 1,000 patients tested.

In light of these results, the researchers wanted to determine whether IP-10 levels in blood could also be used as an indicator of detectable viral load in patients receiving antiretroviral treatment (ART). If a patient on ART has a detectable viral load in the blood, this could indicate that the drugs are not working well. The researchers showed that IP-10 levels were significantly higher in 92% of patients with detectable viral load, which means that IP-10 is an easy and affordable tool that can help doctors to detect treatment failure and possible drug resistance. “This rapid test could save time and resources in low-income countries and help make treatment follow-up in accordance with UNAIDS targets universally available,” explains Lucia Pastor, lead author of these studies. ●

9. Looking Beyond the Lung

Air pollution is associated not only with lung cancer but also with kidney, bladder and colorectal cancer deaths.

98% of cities in low- and middle-income countries (and 56% in high-income countries) do not meet the air-quality standards established by the WHO.

An Invisible Killer

Outdoor air pollution, although rarely visible, is the cause of many common diseases, including respiratory disorders and stroke, and is responsible for an estimated 3.7 million premature deaths every year. Given their association with lung cancer, both air pollution and suspended particulate matter have been classified as carcinogenic. But what about the impact of air pollution on other types of cancer?

Deaths from Lung and Non-Lung Cancers

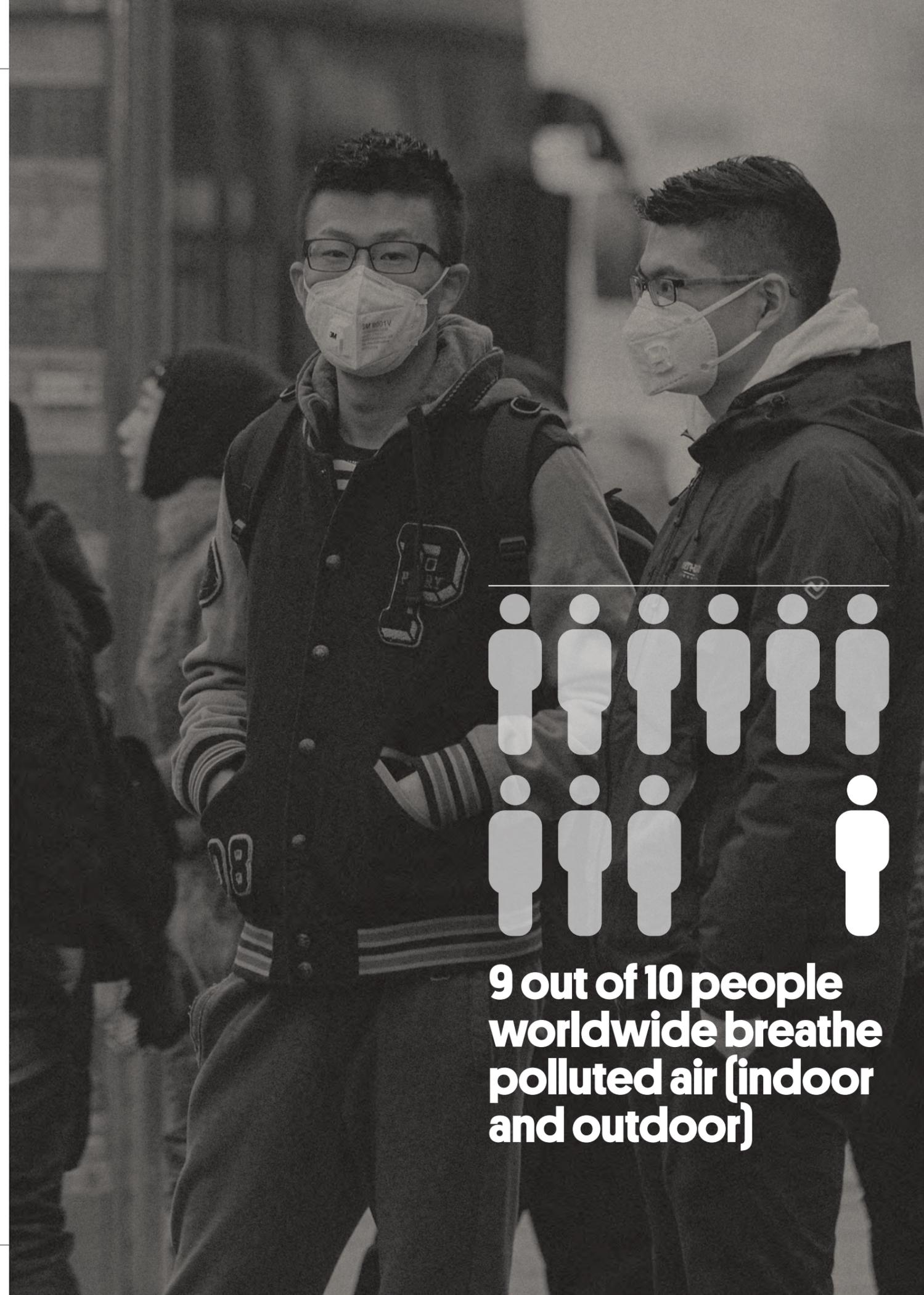
This is the question that Michelle Turner and her colleagues attempted to answer through a large-scale epidemiological study. The study included more than 600,000 adults in the United States who were followed for 22 years (from 1982 to 2004). The research team examined associations between residential exposure to three ambient pollutants—particulate matter with a diameter of under 2.5 μm (PM2.5), nitrogen dioxide (NO2) and ozone (O3)—and death from 29 different types of cancer (i.e. at different body sites).

Over 43,000 non-lung cancer deaths were recorded among the participants. Higher levels of PM2.5 were associated with a higher risk of dying from kidney or bladder cancer, while exposure to NO2 was associated with colorectal cancer death. No significant

associations were observed with cancer at other sites.

According to Turner, this research suggests that outdoor air pollution is not associated with most non-lung cancers. However, the associations observed with kidney, bladder and colorectal cancer deserve further investigation. ●

Turner MC, Krewski D, Diver WR, et al. Ambient air pollution and cancer mortality in the cancer prevention study II. *Environ Health Perspect.* 2017 Aug 21;125(8):087013.



9 out of 10 people worldwide breathe polluted air (indoor and outdoor)

10. Of Seagulls and Superbugs

More than half of seagulls analysed in Barcelona carry *E. coli* bacteria resistant to several antibiotics.

By 2050, antimicrobial resistance could cause more deaths than cancer unless serious action is taken.

The estimated annual cost of resistant infections in the EU is €1.6 billion

The number of bacteria presenting resistance to multiple antibacterial drugs has increased dramatically over the past few decades, in large part due to the abuse and misuse of antibiotics in humans and animals. Antibiotic resistance is currently considered to be one of the most serious threats to global public health.

Vergara A, Pitart C, Montalvo T, et al. Prevalence of extended-spectrum-β-lactamase- and/or carbapenemase-producing *Escherichia coli* isolated from yellow-legged gulls from Barcelona, Spain. *Antimicrob Agents Chemother.* 2017 Jan 24;61(2).

Multiresistant Bacteria Are Spreading Rapidly

Once drug-resistant bacteria emerge, they can spread quite quickly across the planet by hitchhiking on people (international travel), food (globalisation of commercial food) and even birds (migratory birds such as seagulls). In fact, faecal samples from gulls contain high levels of *Escherichia coli* bacteria and Spain is the European country with the highest number of gull *E. coli* isolates resistant to more than one antibiotic.

Migratory Birds May Play an Important Role

Jordi Vila and his team—researchers with extensive experience in the field of antimicrobial resistance—investigated the prevalence of genes that confer resistance to beta-lactams (broad-spectrum antibiotics) among *E. coli* isolates obtained from seagulls. Together with the Public Health Agency of Barcelona, they analysed 132 faecal samples obtained from gull chicks from various nests throughout the city of Barcelona. They found that more than half of the isolates (54.5%) were positive for antibiotic resistance genes, with a predominance of extended-spectrum beta-lactamases (enzymes produced by the bacteria and that neutralize the effect of most beta-lactam antibiotics). Furthermore, they identified for the first time the presence of

carbapenemases (which confer resistance to multiple antibiotics, including last-resort carbapenems) in two gull isolates.

“Our data show that the prevalence of drug-resistant *E. coli* in gull faecal samples is higher than we thought,” explains Vila. “The two carbapenem-resistant isolates share sequences with strains recovered from human samples in different parts of the world. This highlights the role played by these birds in the dissemination of antibiotic resistance genes.” ●

11. Linking Non-Stick Pots with Metabolic Disorders

A study of more than 1,200 pregnant women suggests that exposure to PFAS may interfere with lipid metabolism and glucose tolerance.

“This is the largest study to date on associations between PFAS exposure and multiple metabolic outcomes in pregnant women”

PFAS: A Public Health Concern?

Perfluoroalkyl substances (PFAS) have been used in many applications since the 1950s, including industrial appliances and consumer products such as water- and stain-resistant fabrics and coatings for paper products used to wrap food. The routes of human exposure to PFAS include consumption of packaged foods, drinking water and inhalation of indoor dust. These substances accumulate in the food chain and in animal and human tissues, persisting for years in the environment and living organisms. But what is the impact of these human-made chemicals that are ever-present in our daily life?

Evidence, mainly from animal studies, suggests that exposure to PFAS may play a role in the current epidemics of obesity and diabetes, among other health impacts, but conclusive epidemiological evidence is still lacking.

Pregnancy: A Particularly Vulnerable Period

The health impact of PFAS and other chemicals is a particularly relevant issue during pregnancy, which represents a window of enhanced susceptibility to environmental exposures, for both the foetus and the mother. To help address this question, Martine Vrijheid led a team that analysed 1,240 pregnant women from the INMA

(Environment & Childhood Project) birth cohorts in Sabadell, Valencia and Guipuzkoa. Concentrations of four PFAS (PFOS, PFOA and the emerging PFHxS and PFNA compounds) and various metabolic markers were measured in blood samples collected during pregnancy. The results showed that PFHxS and, particularly, PFOS were positively associated with impaired glucose tolerance and gestational diabetes. PFOA was also positively associated with total cholesterol levels.

“This is the largest study to date on associations between PFAS exposure and multiple metabolic outcomes in pregnant women,” says Vrijheid. “Gestational diabetes is associated with a range of short- and long-term health conditions for both the mother and the baby. For that reason, we believe it is critical to confirm our results with further studies in other populations,” states lead author Nuria Matilla-Santander. ●

Matilla-Santander N, Valvi D, Lopez-Espinosa MJ, et al. *Exposure to perfluoroalkyl substances and metabolic outcomes in pregnant women: evidence from the Spanish INMA birth cohorts. Environ Health Perspect*; 2017 Nov 13;125(11):117004

Around
84,000
human-made
chemicals are
in the market
today

12. What to Do -and Not to Do- in the Event of a Radiation Accident

Researchers from 11 countries provide new recommendations on dealing with nuclear accidents.

Recommendations to Improve Health Surveillance and Living Conditions of Populations in Case of a Nuclear Accident

GENERAL PRINCIPLES

- 1** Consider the overall well-being of the population
- 2** Engage the general public and other stakeholders
- 3** Respect the autonomy and dignity of affected populations

BEFORE → DURING → AFTER

BEFORE	DURING	AFTER
<ul style="list-style-type: none"> Train medical personnel and other professionals Establish / Improve disease registries Plan early response and communication protocols Establish sheltering and evacuation protocols 	<ul style="list-style-type: none"> Provide timely and reliable communication on the accident and the risks Provide sheltering advice and support Balance radiation exposure risk with other health risks before evacuating Collect and store the minimum information from affected populations to facilitate follow-up 	<ul style="list-style-type: none"> Offer health screening to the population, with adequate information and counseling Launch public health studies only if informative and sustainable over time Support and engage the affected populations: Listen to their needs and worries Support them in making their own dose measurements Help them make informed decisions

“The recommendations are aimed at improving the health of affected populations under the overarching principle of doing more good than harm”

Drawing Lessons from Chernobyl and Fukushima

In the unlikely but not impossible event of a nuclear accident, what should be done to improve the health surveillance and living conditions of affected populations without generating collateral damage or unnecessary anxiety? This was the question addressed by the EU-funded project SHAMISEN, coordinated by Elisabeth Cardis. Partners from 19 European and Japanese institutions -with the help of experts from Belarus, the Russian Federation, Ukraine and the USA- made a critical analysis of lessons learned from previous accidents, in particular Chernobyl and Fukushima, and organised a consultation process with national and international stakeholders. “The final document is a roadmap to help professionals as well as national and regional authorities to avoid repeating past mistakes,” explains Cardis.

Beyond Direct Radiation Effects

One of the main lessons drawn is that the impact of a nuclear accident goes well beyond direct radiation effects and includes considerable psychological, social and economic consequences. Another major lesson is that some decisions taken to protect populations can in fact cause collateral damage. In Fukushima, for example, no deaths related to radiation exposure were reported, but

the evacuation caused more than 600 premature deaths, particularly among elderly people and critically ill patients evacuated under inadequate conditions. Moreover, systematic thyroid screening in children generated needless anxiety among parents and in some cases led to unnecessary surgeries.

28 New Recommendations

SHAMISEN developed 28 recommendations to better prepare and respond to a radiation accident. Each recommendation includes a *why*, a *how* and a *who*.

The document highlights the importance of planning the response “in times of peace” for example by establishing disease registries to find out whether the incidence of certain diseases increases after the accident, as well as evacuation protocols and routes if necessary. Recommendations for the early response include providing timely and reliable information on the accident and associated risks, and ensuring collection of radiation dose data. For the recovery phase, it is important to establish a dialogue between experts and affected communities with the help of local facilitators, and provide support to people who wish to carry out their own dose measurements so they can make informed decisions. Ethical aspects were considered throughout, including the principle of “doing more good than harm”. ●

The SHAMISEN consortium. Recommendations and procedures for preparedness and health surveillance of populations affected by a radiation accident. A EU-OPERRA project.

13. Diversity in Training & Education: More than Just a Word

In 2017, we trained over 800 students from five continents.

No organisation can make a positive difference today unless it is consistent in implementing the values it stands for externally and internally. These values must be embedded at the heart of any action it undertakes, whether affecting its beneficiaries or the people who work in the entity.

In the Training & Education Department, we firmly believe that when we design our programmes, create our courses, select students and engage teachers, we need to make sure that the future professionals we train will not only acquire the essential knowledge, transferable skills and core competencies they need, but that they also share and apply the key values (respect, transparency, inclusion and diversity) that we believe are essential to making the world a better place for all.

2017: A Year of Diversity

Diversity means supporting equality of opportunity for people from disadvantaged backgrounds. This is why in 2017 we granted three full tuition-waiver scholarships to students from Kenya, the Gambia and Sierra Leone for the Master of Global Health.

Diversity means facilitating mutual learning in a classroom that in 2017 welcomed over 800 students from five continents, where the considerable mix of languages, cultures and viewpoints was not seen as a barrier but rather as an opportunity to grow individually and as a group.

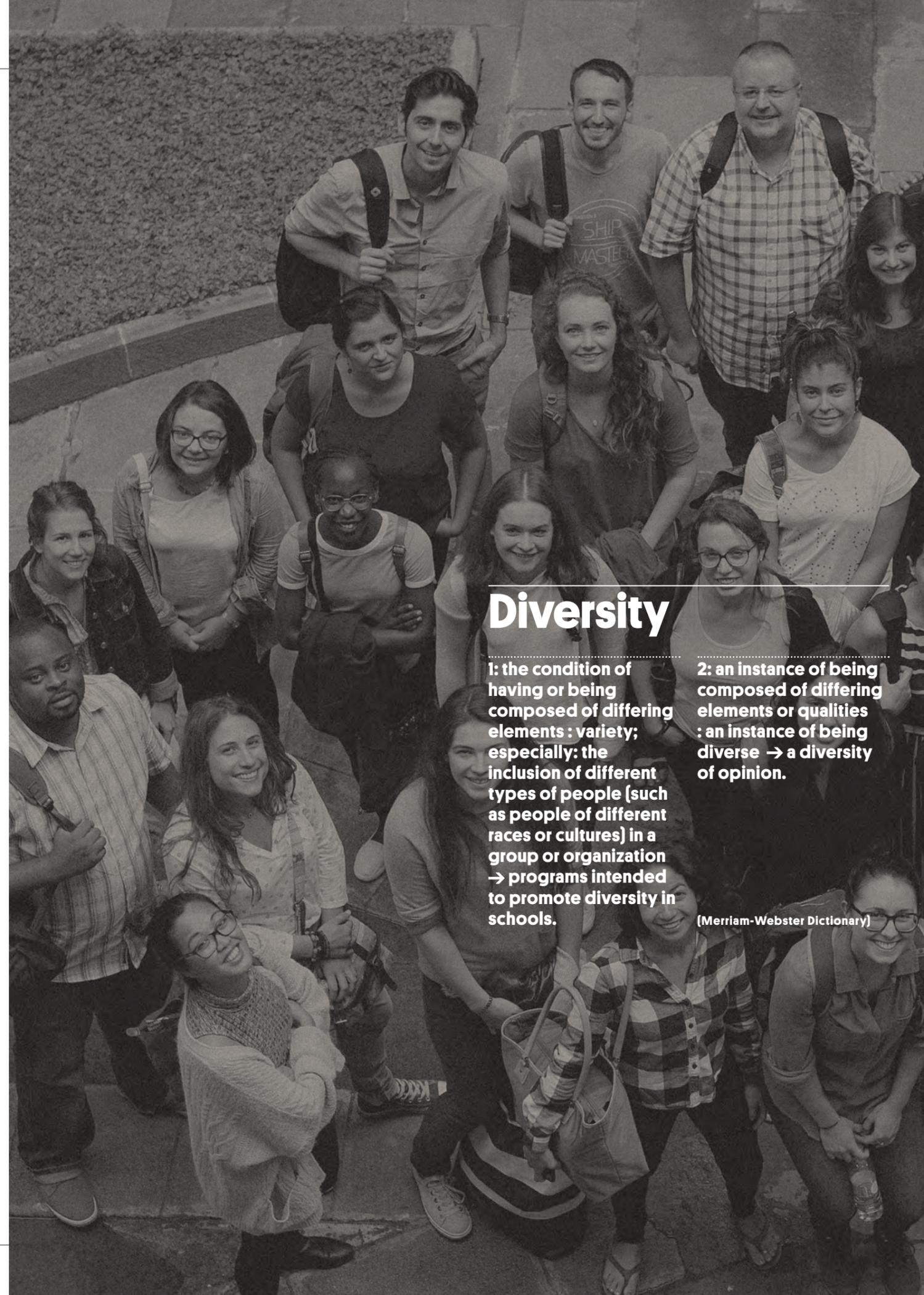
Diversity means having a growing number of sociologists, economists, lawyers, logisticians, nutritionists, nurses, doctors, psychologists, pharmacists and experts in business management or communications—both

students and teachers—critically analysing data and information; exchanging strong, divergent opinions; intensively negotiating common ground; and proposing fresh and innovative solutions for small and larger global health challenges.

Diversity means encouraging and supervising near 100 doctoral candidates covering a wide range of topics, categories and populations in the fields of infectious diseases and environmental health.

Diversity means running training and capacity-building programmes in Barcelona, Nairobi, Monrovia, Manhiça, Ifakara, Florence, Boston and Basel, in partnership with an ever-growing number of local and international partners.

In the Training & Education Department, recognising, celebrating and being inspired by people's diversity is our commitment and our daily practice; it is how we define ourselves and our relationship with others. Diversity is, ultimately, the way we see ourselves and the planet where we live – and this is the philosophy we transmit to all of our students. ●



Diversity

1: the condition of having or being composed of differing elements : variety; especially: the inclusion of different types of people (such as people of different races or cultures) in a group or organization → programs intended to promote diversity in schools.

2: an instance of being composed of differing elements or qualities : an instance of being diverse → a diversity of opinion.

(Merriam-Webster Dictionary)

SDG 3: “Ensure healthy lives and promote wellbeing for all at all ages”

The 2030 Agenda:

17 SDGs **169** targets

14. A Compass for the Future

The Sustainable Development Goals are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. ISGlobal has launched a series of initiatives to ensure its contribution to this ambitious and challenging agenda.

The 2030 Agenda represents a unique opportunity to promote the role of the international community in the pursuit of global health aspirations such as ending preventable diseases and achieving universal health coverage.

An Ambitious Agenda

In September 2015, the UN General Assembly launched the 2030 Agenda, a roadmap of 17 Sustainable Development Goals (SDGs) of unprecedented vision and ambition. Health has a central position in the agenda through SDG 3—“Ensure healthy lives and promote wellbeing for all at all ages”—but it is also present in at least 13 other goals that include targets related to non-communicable diseases, urban health, equal access to treatments, and sustainability.

The broad range of themes covered by the goals is extremely challenging. In the sphere of health, Europe has made great progress in many of the SDG targets over the last century, but much remains to be done in three key areas: non-communicable diseases; mental health; and health risk factors including child obesity and overweight (related to SDGs 2 and 3), tobacco use and the environment (SDG 11).

..that Requires Innovative Approaches

ISGlobal has understood the historic importance of this agenda, which is inextricably linked to our institutional mission because of the challenges and opportunities it represents for all global health actors. For this reason, in 2017 we undertook several actions.

Internally, our team identified dozens of re-

search and translational projects at ISGlobal that are completely aligned with -and contribute to- the 2030 Agenda. This has helped us to understand ISGlobal’s role from the SDG perspective.

We also joined the Sustainable Development Solutions Network, a multinational initiative led by Professor Jeffrey Sachs in coordination with the United Nations. Through this network (and its national counterparts, such as REDS in Spain), research institutions across the world come together to generate ideas and mechanisms for SDG implementation and to advise and inform governments and international organisations.

The Policy and Global Development Department also participates in “Think SDGs”, an international initiative comprising leading think tanks from all over the world. This platform—in which we lead the group of European organisations—seeks to promote dialogue with government and parliamentary representatives, support applied research on SDGs and disseminate good practices for their implementation.

Finally, we actively participated in the national dialogue for implementing the SDGs in Spain and supported the creation of an observatory that strengthens the role of private companies in the fulfilment of the SDGs. ●

Our Institution in 2017

RESEARCH PROGRAMMES

In 2017, we restructured our scientific organisation with the aim of strengthening our research programmes on communicable and non-communicable diseases and their environmental determinants and increasing the synergies between them.

1. Air Pollution and Urban Environment

Our programme studies the health impact of urban exposures, including air pollution, noise, temperature, natural environments (green and blue spaces) and traffic incidents, as well as urban lifestyle (including transport and physical activity). In 2017, we contributed data that will help improve our understanding of where and how these exposures take place, their impact on our health, and the estimated burden of disease. We participated in a systematic review of behavioural, environmental, occupational and metabolic risk factors for disease. That study found that at least 21,000 deaths per year in Spain are caused by exposure to environmental pollutants.¹ We also showed that air pollution increases smoking-related deaths¹ and that a low socioeconomic level is not necessarily associated with greater exposure to air pollution.² The findings of several of our studies highlight the key role of public and active transport in decreasing urban air pollution,³ disease burden related to traffic noise,⁴ and stress,⁵ and we have assigned potential health impacts to 64 urban transport policy measures.⁶ Finally, our researchers have provided new evidence on the positive impact of green and blue spaces: a study performed in three European cities indicates that living close to green spaces may benefit cognitive function in adults,⁷ and a systematic review concluded that blue spaces have a positive impact on mental health and well-being.⁸

1. Forouzanfar MH, *The Lancet* **2.** Temam S, *Environ Int* **3.** Basagaña X, *Sci Total Environ* **4.** Mueller N, *Environ Int* **5.** Avila-Palencia I, *BMJ Open* **6.** Khreis H, *J Transport and Health* **7.** Zijlema WL, *Environ Res* **8.** Gascon M, *Int J Hyg Environ Health*

2. Chagas and Imported Diseases

Major progress was achieved in 2017 in the fight against Chagas disease. We analysed, for the first time, the cost-effectiveness of routine screening of all adult Latin American migrants at primary healthcare centres and showed that systematic screening (and treatment when necessary) is more cost-effective than diagnosing and treating only symptomatic patients.¹ A study we carried out in Bolivia showed that the use of a combination of rapid diagnostic tests (RDTs) could replace more laborious conventional tests,² facilitating prompt treatment even in rural areas. Importantly, we published the results for the Bolivian Platform for the Comprehensive Care of Adults with Chagas Disease,³ an initiative that could serve as a case model for scaling up access to diagnosis and care in endemic countries. Finally, a Phase 2 clinical trial funded by the Drugs for Neglected Diseases Initiative (DNDi) and led by ISGlobal was launched in 2017 to evaluate the safety and efficacy of fexinidazole, a new drug for treating chronically infected adult patients with Chagas disease.

In an initiative focused on imported diseases, including helminthic, viral and mycobacterial infections, we launched a screening programme for migrants in collaboration with the primary health care service in Catalonia.

With respect to international health, we launched the Trip Doctor telemedicine service in September. Trip Doctor is a smartphone application designed to monitor the health of international travellers and, when needed, to provide medical advice and care through a telemedicine platform.

1. Requena-Méndez, *Lancet Glob Health* 2. Egúez KE. *PLoS Negl Trop Dis*
3. Pinazo MJ. *PLoS Negl Trop Dis*

4. Childhood and Environment

In 2017, this programme contributed five major discoveries on exposure to traffic-related air pollution and its effects on children's brains. Studies showed that attentional function at school age is affected by i) pre-natal, home-related exposure,¹ ii) acute exposure at school,² and iii) exposure during the home-to-school commute.³ In other studies, we identified structural changes in children's brains (e.g. basal ganglia volume) linked to air pollution exposure⁴ and identified airborne iron as one of the toxic elements involved.⁵ These findings were complemented by the discovery that living near green areas reduced attention deficit symptoms,⁶ underscoring the need to protect schools from traffic-related pollution and to promote "clean" school routes.

Regarding other exposures, physical exercise was shown to benefit the development of working memory in children,⁷ maternal mobile phone use was associated with behavioural problems in children,⁸ and maternal pre-pregnancy obesity was associated with a reduction in offspring verbal scores at pre-school age.⁹ In another study, exposure to water contamination had no impact on neurodevelopment.¹⁰ Finally, we found that exposure to perfluoroalkyl substances (PFAS) is related to metabolic syndrome and glucose intolerance in pregnant mothers,¹¹ but not to birth weight or obesity in their children,^{12,13} and that ultraviolet radiation is involved in the origins of eczema.¹⁴

1. Sentis A. *Environ Int* 2. Sunyer J. *Epidemiology* 3. Alvarez-Pedrerol M. *Environ Pollut* 4. Mortamais M. *Environ Int* 5. Lubczyńska MI. *Environ Int*
6. Dadvand P. *Environ Health Perspect* 7. Santa-Marina L. *Environ Int* 8. Birks L. *Environ Int* 9. Casas M. *Pediatr Res* 10. Villanueva CM. *Environ Int* 11. Matilla-Santander N. *Environ Health Perspect* 12. Manzano-Salgado C. *Environ Int*
13. Manzano-Salgado C. *Environ Health Perspect* 14. Fuentes E. *J Invest Dermatol*

3. Climate and Health

The aim of the Climate and Health Programme is to enhance our knowledge about the population dynamics of climate-driven infectious diseases and to develop top-notch climate information as well as products designed to improve our ability to predict the activity of climate-driven diseases. Over the past few years, we have developed computational models that predict the epidemiological dynamics of diseases such as cholera and dengue by analysing interactions between intrinsic and extrinsic factors. For instance, to explain why seasonal patterns in cholera exhibit pronounced variability across geographical regions, we developed a rainfall-temperature-driven epidemiological model which we used to analyse the historical dataset of cholera mortality in Bangladesh. Results indicate that the hydrological regime is a major driver of the seasonal dynamics of cholera: rainfall tends to buffer the propagation of the disease in wet regions, whereas it enhances cholera resurgence in dry regions.¹ We also implemented a new mathematical model for predicting cholera outbreaks in the region, making use of sea surface temperatures (SST) in the tropical Pacific and integrating local meteorological drivers. The results have implications for the dynamics and prediction of cholera outbreaks in tropical cities.²

In the case of mosquito-borne diseases, we developed a model that confirms the value of climate information for predicting the magnitude and peak of dengue incidence several months in advance.³

1. Baracchini T. *Adv Wat Res* 2. Martinez P. *PLoS One*
3. Lowe R. *Lancet Planet Health*

5. Malaria, HIV and Tuberculosis

In 2017, this programme generated knowledge that could help to develop new public health tools and policies. This included key findings on basic parasite biology (such as how parasites adapt to different environments¹); vaccines (understanding the type of immune response linked to the protection afforded by the RTS,S vaccine²); and treatments (new drugs and formulations for children,^{2,3} finding more efficient ways to deliver drugs,⁵ and using older drugs such as chloroquine as complementary elimination tools⁶). Our teams secured two large grants in 2017 for multi-centre projects, one on intermittent preventive treatment in pregnancy at the community level and another on repurposing ivermectin for malaria control. At the same time, we have consolidated internationally recognised groups in entomology, glycobiology, drug delivery, epigenetics, pathophysiology, immunology and molecular epidemiology. Recognising the importance of *Plasmodium vivax*, we maintain a strong line of research on this species. Many of the programme's activities are clearly aligned with the long-term Global Malaria Elimination Plan.

With respect to HIV/AIDS and tuberculosis, our activities focus on clinical and implementation research related to the epidemic in sub-Saharan Africa. We demonstrated the potential value of a protein in blood called IP-10 for facilitating HIV diagnosis⁸ and treatment follow-up,⁹ as well as for monitoring tuberculosis treatment responses in HIV-positive patients¹⁰ in low-resource settings. These studies were carried out in southern Mozambique, where the incidence of tuberculosis is worryingly high and appears to be on the rise.¹¹

1. Mira-Martinez S. *J Infect Dis* 2. Gargano N. *Antimicrob Agents Chemother*
3. Varo R. *Malaria J* 4. Moles E. *Biomaterials* 5. Moncunill G. *Clinical Infect Dis*
6. Galatas B. *Scientific Reports* 7. Baro B. *PLoS Negl Trop Dis* 8. Pastor L. *Sci Rep*
9. Pastor L. *Clin Inf Dis* 10. García Basteiro A. *Sci Rep* 11. García Basteiro A. *Eur Respir J*

6. Maternal, Child and Reproductive Health

The five-year “Transforming IPT for Optimal Pregnancy (TIPTOP)” project was launched in May. Funded by Unitaid and implemented by Jhpiego (coordinator) and ISGlobal (research partner) in collaboration with the World Health Organisation and the Medicines for Malaria Venture, TIPTOP aims to increase the coverage of intermittent preventive treatment in pregnancy (IPTp) for malaria and expand antenatal care attendance in four sub-Saharan African countries: the Democratic Republic of the Congo, Mozambique, Madagascar and Nigeria. The project is expected to generate sufficient evidence to guide WHO policy recommendations and future actions for each country, and is well aligned with the Sustainable Development Goal 3 health targets of accelerating the reduction in maternal and newborn mortality in the region.

Other relevant research outcomes in 2017 include: i) the publication of the results of a multi-centre study that evaluated the burden and impact of *Plasmodium vivax* malaria in pregnant women,¹ which will help inform malaria elimination strategies in endemic countries; and ii) the validation of the minimally invasive autopsy as a key tool for determining cause of death and reducing maternal² and child^{3,4} mortality in low-income countries, one of the greatest challenges of the 2030 agenda.

1. Bardaji A, *PLoS Negl Trop Dis* 2. Castillo P, *Plos Med* 3. Menendez C, *Plos Med* 4. Bassat Q, *Plos Med*

7. NCDs and Environment

In 2017, this programme provided new information on risk factors for non-communicable diseases (NCDs), including the identification of night-shift work as a risk factor for colorectal cancer,¹ interactions between cigarette smoking and particles measuring less than 2.5 µm in diameter (PM2.5) for cardiovascular mortality,² and evidence of associations between air pollution and cancer mortality beyond lung cancer.³ We contributed evidence to support the hypothesis that some adult diseases, including chronic obstructive pulmonary disease (COPD), may have origins in early childhood⁴ and for the first time identified a role for social characteristics as determinants of physical activity in COPD patients.⁵ We reported on the worryingly poor reproducibility of COPD subtypes⁶ and proposed a new view of the multimorbidity associated with allergic diseases, independent of IgE sensitisation.⁷ We also provided insight into the mechanisms of NCDs, including the identification of gene expression changes after exposure to water contaminants (for example, swimming in chlorinated pools⁸).

The use of new methods is a central aspect of our research. In 2017, we developed and applied new bioinformatic tools for detecting methylation changes in large genomic regions⁹ and “exposome” approaches (using omics technologies) to assess air and water pollution.⁸ Furthermore, we pioneered the use of web-based surveillance tools for allergic diseases.¹⁰ Although most of our research was in high-income countries, we also established collaborations in low- and middle-income countries, such as Mozambique and Peru. For example, we confirmed the role of the Epstein–Barr virus as a risk factor for endemic Burkitt lymphoma in Africa and identified antibodies against *Plasmodium falciparum* and Epstein–Barr virus associated with this increased risk.¹¹

1. Papantoniou K, *Scand J Work Environ Health* 2. Turner MC, *Environ Res* 3. Turner MC, *Environ Health Perspect* 4. Bui DS, *Am J Resp Crit Care Med* 5. Arbillaga-Etxarri A, *Thorax* 6. Castaldi PJ, *Thorax* 7. Anto JM, *J Allergy Clin Immunol* 8. van Veldhoven K, *Environ Int* 9. Ruiz-Arenas C, *BMC Bioinformatics* 10. Bousquet J, *J Allergy Clin Immunol* 11. Aguilar R, *Front Immunol*

8. Radiation

Through its participation in the DoReMi Network of Excellence, the MELODI platform, the OPERRA project and the recent CONCERT European Joint Programming Action, this programme has continued to collaborate in efforts to foster the integration of radiation protection research in Europe and to develop strategic research agendas. In 2017, the EU-funded SHAMISEN project produced its final results¹ (28 recommendations for preparedness and health surveillance of populations affected by a radiation accident), which gave rise to SHAMISEN-SINGS, a CONCERT-funded project launched in November that seeks to enhance citizen participation in preparing for and recovering from a radiation accident. With respect to low-level doses of ionising radiation, we showed that internal exposure to alpha particles emitted by plutonium and uranium is associated with an increased risk of lung cancer mortality among nuclear workers.²

The initial results of the GERoNIMO project’s study of the health effects of electromagnetic fields (EMF) were published. In an analysis of 83,884 mother-child pairs in five cohorts, maternal cell phone use during pregnancy appeared to be associated with increased risk of behavioural problems, particularly hyperactivity/inattention, in the offspring.³ Another study found that the pattern of cell phone use among young people varies considerably between and within countries according to age, sex and socioeconomic status.⁴

1. Recommendations and procedures for preparedness and health surveillance of populations affected by a radiation accident 2. Grellier J, *Epidemiology* 3. Birks L, *Environ Int* 4. Langer CE, *Environ Int*

9. Viral and Bacterial Infections

One of our key research lines is antibiotic resistance, which poses a major threat to public health worldwide. In 2017, we reported a worryingly high incidence of pandrug-resistant (i.e. resistant to all known antibiotics) *Acinetobacter baumannii* isolates collected from patients with ventilator-associated pneumonia in several Mediterranean countries¹ (Spain, Italy and Greece). The results of a study that analysed faecal samples from seagull chicks in Barcelona underscored the potential role of migratory birds in the spread of antibiotic resistance genes.² Our researchers also contributed to generating the first global estimates of the worldwide burden of infection with Group B *Streptococcus*, which causes 150,000 stillbirth and infant deaths every year.³

Another key research line focuses on yaws, a tropical skin disease that our research showed can be cured with a single dose of azithromycin. Results published in 2017 indicate that azithromycin is also effective for curing people with latent yaws⁴ (i.e. infected with the bacterium but presenting no ulcers), lending support to the World Health Organisation’s ongoing yaws eradication strategy based on mass azithromycin administration campaigns irrespective of clinical status.

1. Nowak J, *J Antimicrob Chemother* 2. Vergara A, *Antimicrob Agents Chemother* 3. The Burden of GBS worldwide. *Clin Infect Dis* 4. Mitjà O, *Lancet Glob Health*

TRAINING AND EDUCATION

In 2017, most of our master programmes enrolled the maximum number of students and the geographical and background diversity increased. Three full tuition-waiver scholarships were granted to sub-Saharan African students in the Master of Global Health. Overall, 819 students took part in master and diploma programmes, short courses and rotations in 2017, up from 652 in 2016.

In 2017, for the first time, PhD students from the Erasmus Mundus Joint PhD Programme Trans Global Health defended their theses under ISGlobal's supervision. This was also the first year in which extended seminars (1.5 days each) were organised on two emerging topics: Health Impact Assessment and Global Mental Health. The "Science of Eradication: Malaria" workshop was renewed for three more years. Capacity-building projects in Liberia (SELeCT) and Mozambique (EDCTP) also received renewed funding, and a new partnership with Equatorial Guinea was set up. A grant proposal for a three-day workshop on grant writing for Portuguese-speaking African researchers was approved by the EDCTP.

POLICY AND GLOBAL DEVELOPMENT

Policy and Global Development, the department responsible for the institute's knowledge translation activities, had a successful year in 2017: it was ranked among the leading global health think tanks (16th in the world and 4th in Europe) in a report from the University of Pennsylvania.

In Spain, our team launched a major project to involve the scientific community in the debate on pharmaceutical innovation and access to medicines. We also strengthened our position as a key player in discussions on the future of Spain's aid and development model. This year, we became a leading actor in activities related to the Sustainable Development Goals (SDGs): as co-leaders of the health section of the Sustainable Development Solutions Network (SDSN), an initiative created to mobilise global scientific and technological knowledge in support of SDG implementation; as advisors for the SDG observatory in the Spanish private sector, led by "la Caixa"; and through our senior advisory role to the Spanish Parliament and membership of a high-level governmental commission on the SDGs.

The Global Health Observatory in Morocco, set up jointly with the Moroccan Ministry of Health, organised its first seminar in Rabat on migration and health. Finally, one of the highlights of the year was a long-expected plan to expand access to the diagnosis and treatment of Chagas disease. Through its programmes in Bolivia, ISGlobal, together with the International Chagas Coalition, has played a major role in developing the plan, which will start to be implemented in 2018.

INITIATIVES

The aim of our initiatives is to enhance the impact of ISGlobal's work beyond the sphere of science. Building on existing areas of excellence in research and using a multidisciplinary approach, we generate synergies between departments and areas to ensure a broader and more integrated response to key challenges of global health.

1. Antimicrobial Resistance

The Antimicrobial Resistance initiative, in collaboration with ISGlobal's policy department, published a report entitled "Antibiotic Resistance: Not Just a Problem of Patents", which reviews the current situation in pharmaceutical innovation, particularly the failure to develop new antibiotics, and proposes some solutions. We also designed and developed a card game on antimicrobial resistance, for which we received an award from the European Health Forum Gastein (Austria). In collaboration with the "la Caixa" Foundation, we developed two educational resources on antimicrobial resistance: an interactive tool called "A pathogenic journey: how are diseases transmitted?" and an interactive comic entitled "Superheroes Against Superbugs: Antimicrobial Resistance". We also organised two workshops at primary schools and one activity at the Barcelona Biomedical Research Park Open Day to raise awareness among children about the problem of antibiotic resistance.

2. Chagas

As every year since 2005, this initiative organised the Chagas Workshop in Barcelona, in collaboration with the Mundo Sano Foundation. The 13th edition of the workshop brought together some 150 experts on Chagas disease to discuss the latest advances in the care and treatment of Chagas patients. Importantly, the initiative supported the Catalan Health Department in a revision of the screening protocols used to detect Chagas disease in pregnant women (Catalonia is one of the only regions of Spain to have introduced such a screening programme). We also published a policy document on Spain's contribution to the fight against Chagas disease, which highlights the need to ensure future work on disease control (especially congenital transmission), innovations in diagnostic and therapeutic tools, knowledge exchange, and cooperation with endemic countries. The initiative has advocated maintaining Spain's leadership in the fight against Chagas disease in the coming years.

3. Malaria Elimination

The Malaria Eradication Research Agenda (malERA) Refresh collection¹ was published in the framework of the Malaria Eradication Scientific Alliance (MESA), led by the Malaria Elimination Initiative. MESA, with headquarters at ISGlobal, received renewed funding from the Bill & Melinda Gates Foundation. The WHO also renewed ISGlobal's designation as a Collaborating Centre for Malaria Control, Elimination and Eradication (2017-2021), extending our commitment to providing high-quality evidence and advice for policymaking. The Ivermectin Platform at ISGlobal was launched, as well as the design of the Ivermectin Roadmap (to be published in 2018) with a wide range of stakeholders from academia, industry and regulatory authorities. Together with Unitaid and the WHO, we organised a meeting in Madrid on innovation for vector control, which generated knowledge and subsequent funding for Unitaid. We also obtained funds from JCFlores to support a collaborative working group on "border malaria" with the WHO, which led to the creation of a WHO Evidence Review Group on this issue. As every year, together with the training department, we co-organised the "Science of Eradication: Malaria" course, another example of successful actions developed by ISGlobal in collaboration with malaria experts worldwide.

¹ Rabinovich R, *PLOS Med Collection*

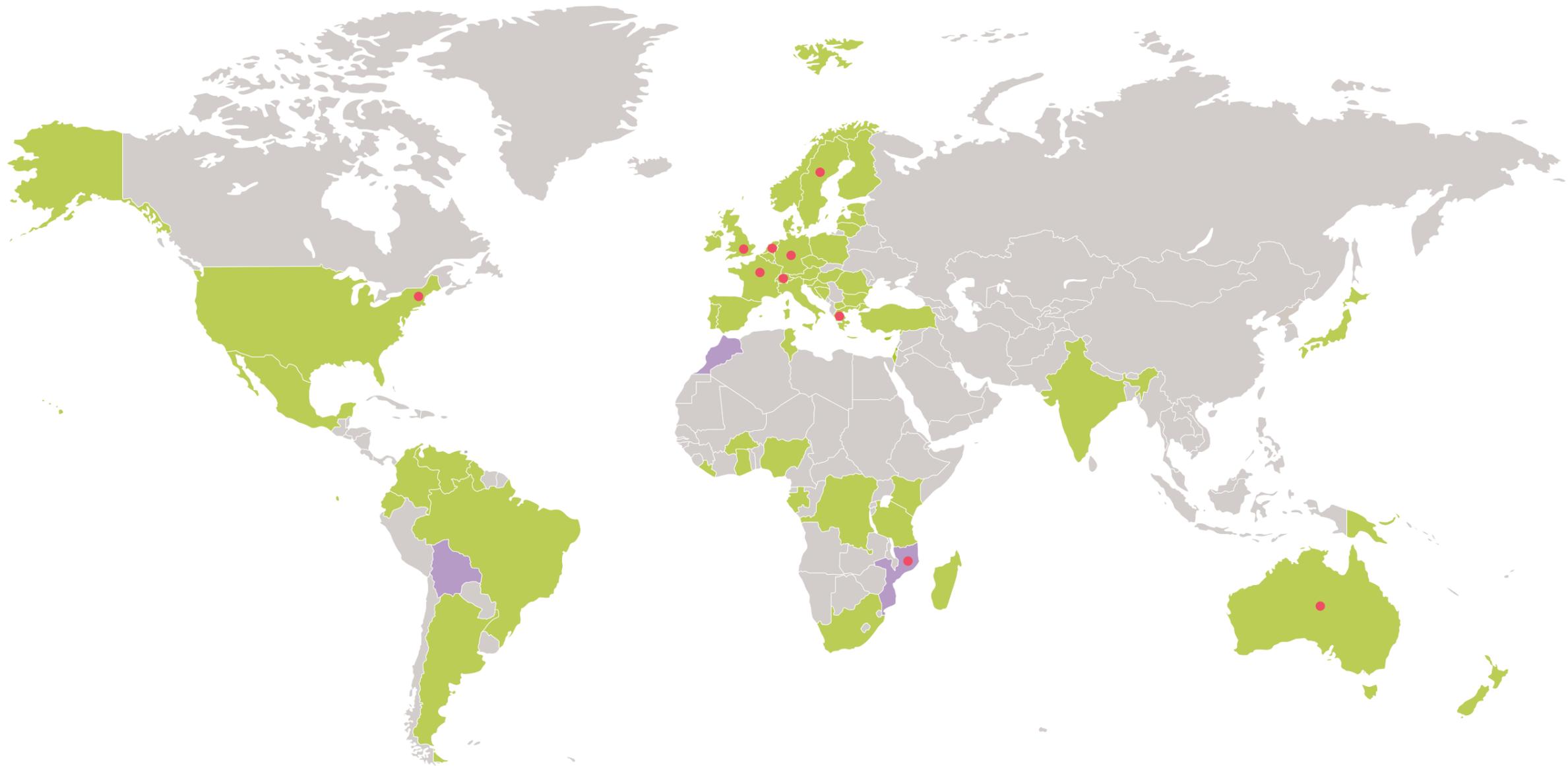
4. Maternal, Child and Reproductive Health

In January, this initiative, together with the World Bank Group, published a report entitled "Inequalities in Women's and Girl's Health Opportunities and Outcomes: A Report from Sub-Saharan Africa". An analysis of data from 29 countries revealed that women of child-bearing age (15 to 49 years old) have very unequal access to the 15 maternal and reproductive health opportunities studied. TIPTOP, a project in which ISGlobal leads the research component, kicked off in May. The project will bring intermittent preventive treatment for malaria in pregnancy (IPTp) to 400,000 women in four African countries and will help inform the World Health Organisation's policy on IPTp. In June, the third edition of the "Safe Mothers and Newborns Leadership Workshop" took place in Africa for the first time. The workshop in Nairobi, Kenya, was coordinated by ISGlobal in collaboration with the Maternal Health Task Force at the Harvard T.H. Chan School of Public Health and the Centre of Excellence in Women and Child Health at Aga Khan University East Africa.

5. Urban Planning, Environment and Health

This year, we focused on consolidating this initiative and positioning ISGlobal as a leading centre on the urban environment in health at the local, regional and international level. We developed a number of translational materials and responded to over 25 calls for proposals. We finalised the book "Integrating Human Health in Urban and Transport Planning" (to be published June 2018). In June, ISGlobal hosted the International Conference on Transport in Health, which was attended by over 120 participants from different countries as well as WHO, UN-Habitat and local government agencies. We continued to strengthen our ties with local and regional governments, responding to proposal requests, presentations and training, and are developing an institutional agreement with the Barcelona Provincial Council. We developed the Transport Planning Health Impact Assessment (UTOPHIA) tool, which can be applied to different cities, and provided input into tools such as HEAT (WHO) and the C40 Climate Action Framework. We also participated as expert advisors on several bodies and panels, including the Barcelona Air Quality Commission and the Catalan Advisory Committee for Sustainable Development (CADS).

ISGlobal has two campuses in Barcelona -Mar and Clínic- and offices in Madrid, but the scope of our work is global.



A Global Presence

Countries where ISGlobal coordinates projects and networks

Long-term strategic alliances

Bolivia



Mozambique



Marruecos



Main international institutions with whom ISGlobal has published scientific articles (last Scimago period, 2011-2015)

- UK** Imperial College London / MRC
- Switzerland** SwissTPH
- France** INSERM
- Germany** Helmholtz Gemeinschaft
- Mozambique** CISM
- Australia** WEHI
- Sweden** Karolinska Institute
- Greece** University of Crete
- USA** Harvard University
- The Netherlands** University of Amsterdam / Utrecht University

OUR ORGANISATION



HR EXCELLENCE IN RESEARCH

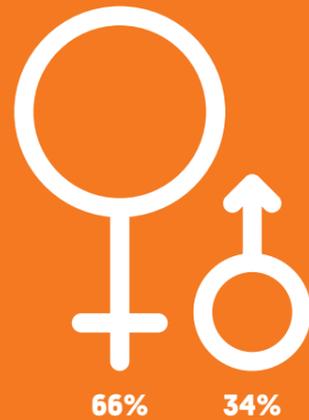
Total number of staff

409

Nationalities

36

Gender



Average age

36

Facts & Figures

Total budget

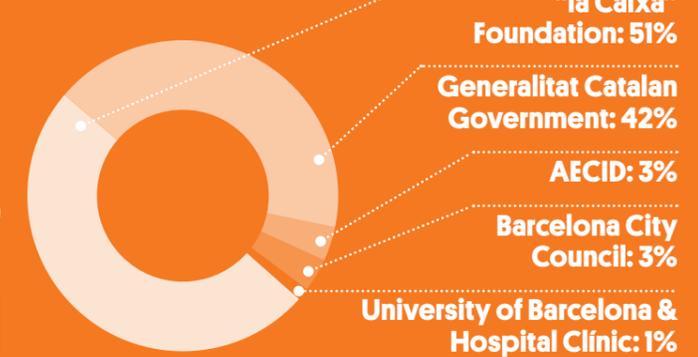
€27,385,589.18

29% core

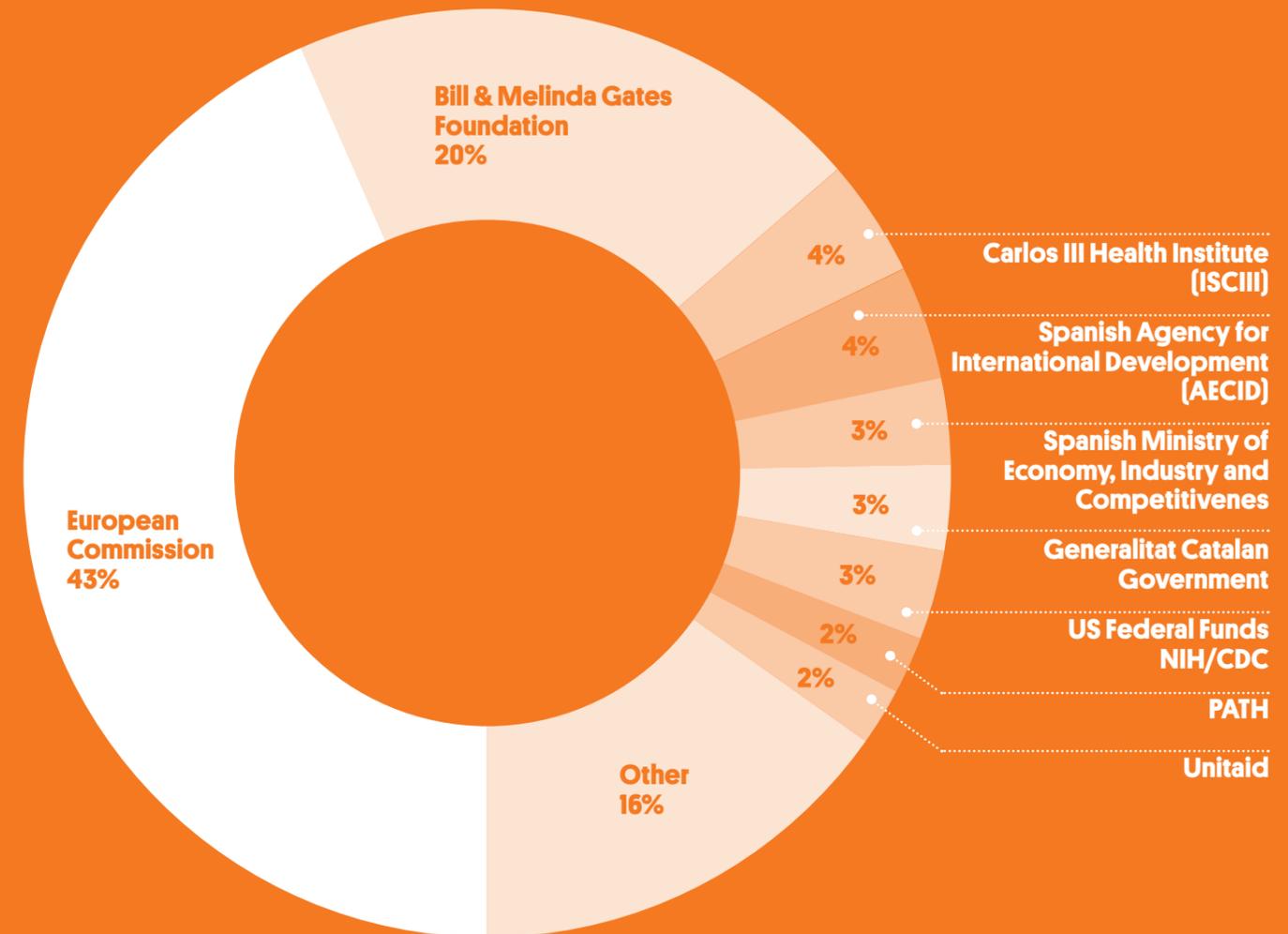
71% competitive



Core funding 2017:



Main sources of competitive funds 2017:



KNOWLEDGE CREATION



Research Staff

Research Professors

13

Women 23%

Associate Research Professors

15

Women 40%

Assistant Research Professors

24

Women 58%

ICREAs



Postdocs

40

Women 77%

Predocs

87

Women 72%

ERC



Total number of publications:

443



Q1: 75%

D1: 43%

Total ongoing research projects

131

Total coordinated research projects

26

INNOVATION

Market launch

1

Patent portfolio

9

(2 submitted in 2017)

Innovative projects with transfer potential

8

Agreements signed with companies

3

Number of scientific seminars

75

Invited speakers 70%

KNOWLEDGE TRANSFER



Students trained

8119

Women 66%



PhD theses defended

16

Women 75%



Training programmes and courses given

35

Capacity building workshops / seminars

32

KNOWLEDGE APPLICATION AND DISSEMINATION



WHO Collaborating Centre for Malaria Control, Elimination and Eradication

Ranked 16th Global Health Think Tank

(index Univ. Pennsylvania 2016)

Policy publications

7

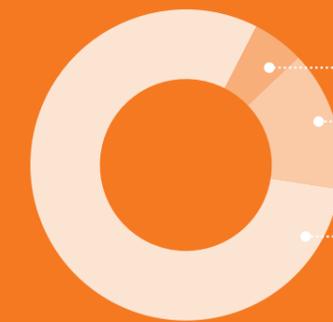
Digital report

1

143 news items and 77 blog posts published in ISGlobal's website

Media impacts

3,453



TV & Radio: 4%
Written media: 16%
Online media: 80%

Number of twitter followers (Jan 2018)

6,817

Total number of outreach activities

43

Target audience reached

1,500

With the support of

Agencia Española de Cooperación Internacional para el Desarrollo (AECID)	European & Developing Countries Clinical Trial Partnership (EDCTP)	L'Oréal España Medicines for Malaria Venture
Agència de Gestió d'Ajuts Universitaris i Recerca (AGAUR)	European Comission (FP7, H2020)	Ministerio de Economía, Industria y Competitividad
Ajuntament de Barcelona	European Institute for Biomedical Imaging Research (EIBIR)	Ministerio de Educación, Cultura y Deporte
Agence Nationale de Sécurité Sanitaire de l'Alimentation, de l'environnement et du travail (ANSES)	European Respiratory Society (ERS)	National Institutes of Health (NIH)
Bill & Melinda Gates Foundation (BMGF)	Foundation in Innovative New Diagnostics (FIND)	Parc de Salut Mar Barcelona
Centers for Disease Control and Prevention (CDC)	Fundación Bancaria "la Caixa"	PATH
Consejo Nuclear de Seguridad (CNS)	Fundación Mundo Sano	Swiss Federal Institute of Technology (Branco Swiss)
Drugs for Neglected Disease initiative (DNDI)	Fundació Privada Daniel Bravo Andreu	USAID
Education, Audiovisual and Culture Executive Agency (EACEA)	Fundación Probitas	Unitaid
	Generalitat de Catalunya	Universitat de Barcelona
	Hospital Clínic de Barcelona	Universitat Pompeu Fabra
	Innovative Medicines Initiative	University Health Network
	Instituto de Medicina Molecular	World Health Organisation (WHO)
	Instituto de Salud Carlos III	

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