



WORLD  
HEALTH  
SUMMIT

SCIENCE - INNOVATION - POLICIES



## YEARBOOK 2016

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MIGRATION AND  
REFUGEE HEALTH  
From Care to Policy

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INFECTIOUS  
DISEASES  
Lessons Learned from  
Ebola to Zika

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TECHNOLOGICAL  
INNOVATION  
Improving Healthcare  
Delivery

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TRANSLATIONAL  
RESEARCH  
Advancing Innovative  
Treatment

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# EXCELLENCE IN MEDICINE



The Charité - Universitätsmedizin Berlin is one of the largest university hospitals in Europe. Indeed, with over 16,800 employees the Charité is one of the largest employers in Berlin, generating more than one billion euros each year. Day after day our highly-committed staff dedicate themselves to the motto: "Research, Teaching, Healing, Helping". Within this remit, the Charité achieves excellent results both in terms of pre-clinical research and in the clinical development of drugs and medicinal products. In addition, the Charité is an innovative force within the health-care system. It successfully brings together scientific rigour, compassionate medical care and a creative, entrepreneurial approach to university medicine and healthcare delivery.

## Editorial



This year's World Health Summit found us face-to-face with a challenge of unprecedented scale: For the first time ever, more than 60 million people are fleeing war, terror and persecution. The effects have been profound. Europe, seen for decades as a model of cooperation and friendship, is diverging from its blueprint. Social norms and contracts are dissolving under the weight of mistrust and short-term interests. In many countries, health systems are struggling hard with the duty of providing care for those in need.

Experience shows that there is only one way to confront these paramount issues: We have to build up trust again and intensify international cooperation. Last year's G7 summit emphasized these issues and the German government ties its G20 Presidency at the end of 2016 to sharpening this focus and working on reforming the global healthcare structure, as Chancellor Angela Merkel expresses in her Welcome Message. This strong political will is in alignment with the internationally endorsed Sustainable Development Goals (SDG) and highly promising developments in translational research that cross the boundaries between science and medicine, as well as the increasing accessibility of data and powerful new tools.

This spirit of cooperation permeated the WHS Geneva Meeting in April 2016, held on the occasion of the Geneva Health Forum's (GHF) sixth edition and 10 year anniversary. It emphasized the continuous commitment of the Swiss government and the GHF organizers to global health and peace, thus providing a sterling example of partnership and friendship while sounding a clear call for collaboration across all health-related sectors.

To continue this call, the World Health Summit 2016 drew more international experts from academia, politics, the private sector and civil society than ever before. Their deliberations focused on topics including:

- Migration and Refugee Health:  
From Care to Policy
- Technological Innovation for Health:  
Improving Healthcare Delivery
- Women, Empowerment and Health:  
Equality and Agency
- Translational Research:  
Advancing Innovative Treatment
- Infectious Diseases:  
Lessons Learned from Ebola to Zika
- Sustainable Development Goals:  
Transforming the Health Agenda

Supported by the M8 Alliance of Academic Health Centers, Universities, and National Academies, this meeting demonstrates how trust and cooperation can improve lives worldwide.

What better goal could we collectively target than the objective of longer, healthier lives that can be lived out in peace? Please join us as we work toward this goal.

**PROF. DR. ANTOINE FLAHAULT**  
WHS President

**PROF. DR. DETLEV GANTEN**  
WHS President



# Contents

## OPENING

- 3 **Editorial**  
*Antoine Flahault, Detlev Ganten*
- 7–8 **Welcome Messages**  
*Angela Merkel, François Hollande, Jean-Claude Juncker*
- 10–13 **World Health Summit – Mission and Goals**
- 14–17 **M8 Alliance: A Global Partnership**



## 1 MIGRATION AND REFUGEE HEALTH

- 18–19 **Introduction**
- 20–21 **Migration and Refugee Health**  
*A. David Napier*
- 22–23 **Better Health Systems Strengthen our Common Security**  
*Wolfgang Ischinger*
- 24–25 **Refugee Mental Health**  
*Luciano Saso, Maurizio Marceca, Paolo Villari*
- 26–27 **Migration, Cultures and Health**  
*Günther Stock, Reinhard Schäfers, Jean-Yves K. Tano*
- 28–29 **“It’s a megatrend of the century”**  
*Interview with William Lacy Swing*
- 30–31 **Health in Numbers**



## ANNUAL DISCUSSION

- 32–39 **“There is a whole universe of fantastic, unexpected new findings out there”**  
*Matshidiso Rebecca Moeti, Pascale Ehrenfreund, Yukiya Amano, Manuel Delgado*

## 2 INFECTIOUS DISEASES

- 40–41 **Introduction**
- 42–43 **Lessons Learned from Ebola to Zika**  
*Stefan H.E. Kaufmann*
- 44–45 **Flipping the Access Model to Innovation**  
*Suresh Kumar*
- 46–47 **Ebola to Zika: Areas of Action**  
*Christian Bréchet*
- 48–49 **Lesson Learned: from Syria to Ebola**  
*Yves Daccord*
- 50–51 **“We simply don’t know enough”**  
*Interview with Rolf Zinkernagel*
- 52–53 **Health in Numbers**

## WORLD HEALTH SUMMIT – BERLIN 2016

- 54–55 **Need for Progress**
- 56–62 **WHS 2016 | Day1 – Day3**
- 58 **Faces and Voices in the Crowd**
- 60–61 **WHS Startup Track: Tech Takes the Stage**
- 65–66 **The M8 Alliance Declaration**

## 3 TECHNOLOGICAL INNOVATION

- 68–69 **Introduction**
- 70–71 **Improving Healthcare Delivery**  
*Frans van Houten*
- 72–73 **Innovations in Healthcare Delivery**  
*Norbert Hauser*
- 74–75 **Precision Health: Seizing the Moment**  
*Lloyd B. Minor*
- 76–77 **Transforming Care: Consumer Applications**  
*Steve Singh*
- 78–79 **“People indicate that they would like to change”**  
*Interview with Jutta Allmendinger*
- 80–81 **Health in Numbers**



## WHS GENEVA MEETING 2016

- 82–83 **Combined Conferences Break Records**



## 4 TRANSLATIONAL RESEARCH

- 84–85 **Introduction**
- 86–87 **Translational Medicine: Value for Patients**  
*Erwin Paul Böttinger*
- 88–89 **Novel Targets for Therapy**  
*João Pedrosa de Lima, Miguel Castelo Branco*
- 90–91 **Asia-Pacific Beacon of Medical Research**  
*K. Arnold Chan, Wei-Hsun Hsu*
- 92–93 **The Power of Translation**  
*Tarik Möröy*
- 94–95 **“You make the biggest impact by doing basic research”**  
*Interview with Elizabeth Blackburn*
- 96–97 **Health in Numbers**

## 98 PREVIEW 2017 / IMPRINT

# BETTER RESEARCH, BETTER THERAPIES

## Maintaining Quality of Life, Creating Value: BIH Strategy 2026

At BIH, we focus on translational research and precision medicine. Our scientists are dedicated to improving prediction in progressive diseases and developing new medicinal products for advanced therapies in order to improve patients' quality of life. The key is our 10-year strategy. It will guide our actions, decisions and priorities in the coming years.

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INSTITUTE  
OF HEALTH**

Charité & Max Delbrück Center

## Welcome Messages



The individual desire for health and well-being is something we all share. With this in mind, one of the aims of the 2030 Agenda for Sustainable Development is to encourage people across the globe to live lives that are as healthy as possible at every stage of their existence. We committed ourselves to this goal last year within the framework of the United Nations. Now we have to implement this ambitious objective. That involves fighting epidemics and poverty-related diseases and also extends to improving prevention and treatment of complaints of modern civilization such as diabetes and cardiovascular disorders.

Germany plays a very active role in global health policy. To bring about further progress, we must strengthen healthcare systems worldwide and reform the global healthcare structure. We sharpened the focus on both these issues during Germany's G7 Presidency. We intend to build on this when our country assumes the G20 Presidency at the end of this year.

Whether we are talking about institutional factors or other global health issues such as a joint approach to tackling antimicrobial resistance, we can only be effective in overcoming the challenges they present if scientists, policymakers and society work together side by side. This is why dialogue forums such as the World Health Summit are particularly important. As the patron of the Summit, I would like to welcome all participants to Berlin. This message comes with my hope that you will enjoy a fruitful exchange of new insights. I would like to thank you most sincerely for your remarkable commitment to advancing healthcare throughout the world.

**DR. ANGELA MERKEL**  
Chancellor of the Federal Republic of Germany



The themes discussed during this eighth World Health Summit are both ambitious and strategic. They also reflect the deep changes we are seeing in the world. The terms of globality and universality are now, more than ever, associated with health: quality care for all, accessible to all; international preventive measures; renewed support for health as a driver of development, growth and stability; and an ambitious research policy, which is a source of progress. These are principles to which France is committed, and which it supports in international bodies. France thus obtained, during the last G7, that reflection will take place at the international level on access to expensive medicines. This Summit is a forum for discussion and dialogue, bringing together men and women of "good will." That means it is a place of peace.

I wish you all excellent meetings.

**FRANÇOIS HOLLANDE**  
President of the French Republic





It is impossible to talk about health issues in the past year in Europe without reflecting on the refugee crisis, and the challenges and opportunities that it has presented for Europe. Over one million children, women and men arrived at our shores and borders last year.

The European Union had a common responsibility to ensure that these persons, many of them physically and mentally exhausted, were offered care and support, including through the provision of healthcare when required. Their journeys were punishing, and we cannot imagine the impossible choice they had to make between staying in their countries in extreme danger and the unenviable alternative of risking their lives at the hands of people smugglers. Europe's number one task was to offer these people a humane reception in Europe, which the Commission helped to achieve by the setting up of hotspots in Greece and Italy, and through financial and practical assistance to our Member States under our emergency asylum funding and through the EU's Civil Protection Mechanism.

Our next priority is to ensure the effective integration of those that are granted international protection. For some, that will mean gaining access to our health services. At the same time, the people who arrive in Europe must be given the opportunity to pay their way, through access to the labor market. And there is an obvious counterbalance to the demands they make of our healthcare system with the contributions that they can make to it. I hear of many medical professionals coming to Europe seeking to rebuild their lives; doctors and nurses, pharmacists and researchers, carers and therapists. In the next year I hope to hear heartwarming stories of their integration into our national health services, care homes, research institutes and universities, and the valuable contribution they are making.

And one reason to welcome these new arrivals is the reason I gave you in my message for last year's World Health Summit – Europe's population is getting older, which makes it increasingly difficult to provide for our healthcare needs. I know that you will again address the

healthcare challenges of an aging population at this year's Summit. Setting strategic research priorities will be of fundamental importance, and I am pleased that the European Commission continues to make an important contribution through our Horizon 2020 funding program.

Another area where we are making an important contribution is eHealth. More and more people are taking steps to monitor their own health and lifestyles through wearable devices and smartphones. These form an excellent contribution to preventing and monitoring diseases. Through the Connecting Europe Facility, we are contributing to building Europe's digital health infrastructure. So far, 20 of our Member States have applied for funding to connect their systems and exchange health data and patient information or to offer e-prescriptions and reduce the administrative burden on our care systems.

Let me conclude by mentioning the healthcare industry, which is one of the major drivers of jobs, growth and innovation in Europe. We need a successful economy to sustain our European social model, and you are an intrinsic part of this with the many thousands of jobs you create and sustain. The world is getting older, and the world is in need of health technology to sustain us as we go through a major demographic change. Europe must lead the way in looking after its own citizens, and it must generate a competitive advantage in the global market for healthcare services and products.

I wish you a fruitful Summit, and another year of success.



**JEAN-CLAUDE JUNCKER**  
President of the European Commission



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# World Health Summit

## An International Forum for Networking, Exchange and Policy-Shaping Debate

The World Health Summit (WHS) is one of the world's most prominent strategic forums for global health. The interdisciplinary, international event takes place within an atmosphere of academic freedom.

Every October, internationally renowned leaders and representatives from the sciences, politics, business, and civil society travel to Berlin for the WHS to discuss the latest challenges facing medical research and healthcare. Under the high patronage of German Chancellor Angela Merkel, French President François Hollande and European Commission President Jean-Claude Juncker, the World Health Summit is the premiere international platform for exploring strategic developments and decisions in the area of healthcare.

The World Health Summit's academic think tank is provided by the "M8 Alliance," a unique collaborative net-

work made up of leading international medical universities, research institutions and the InterAcademy Partnership (IAP) for Health – representing science academies worldwide. The M8 Alliance selects the World Health Summit's rotating annual president and also organizes the associated Regional Meeting that takes place each April.

Under the leadership of Charité – Universitätsmedizin Berlin, the medical alliance was set up in 2009 along the lines of the G8 political forum. Today, it is made up of 24 members from 17 countries.

### THE THREE PILLARS OF THE WORLD HEALTH SUMMIT

- **Global challenges:** At the WHS, participants discuss and debate topics such as chronic disease, the application of modern technologies in the healthcare sector, vaccination and immunization, the promotion of innovation and interdisciplinary cooperation in healthcare research.
- **Global responsibilities:** Advances in medicine have to reach people faster and more effectively. Sustainable approaches must play a central role in this process, and the means for doing so are a major focus at the Summit.
- **Global networking:** International figures and bodies from the fields of science, politics, business and civil society come together to promote and strengthen cooperative efforts.



**PROF. DR. SHUNICHI FUKUHARA**  
WHS President 2015 | Japan

*“The recognition that academic health science centers needed to be engaged in the global health debate was a central lesson. Good debates addressed the promise of precision medicine requiring even closer collaboration between academic institutions, healthcare providers and social and community care, as well as the need to use developments in digital health and data analytics to provide real-time healthcare choices at both the personal and public health levels.”*



**PROF. DR. JOSÉ OTÁVIO COSTA AULER JÚNIOR**  
WHS President 2014 | Brazil

*“The WHS 2014 contributed to improving health on a global scale by providing approaches which combined classic public health rules with new strategies, some setting explicit goals to integrate public health with general welfare policy. Health for all, health promotion, and population health contribute to this reorientation in thinking and strategy.”*



**PROF. DR. JOHN EU LI WONG**  
WHS President 2013 | Singapore

*“The WHS 2013 showed that there is a need for leading academics, policymakers, and shapers of civil society to collectively develop strategies to address important health issues which affect our society. Following our Regional Meeting in Singapore, we were able to make significant progress in helping the region with issues ranging from universal health coverage implementation to medical education and research collaboration.”*



**PROF. DR. MICHAEL J. KLAG**  
WHS President 2012 | USA

*“We wanted to grow the number and breadth of stakeholders attending that meeting – which definitely happened. At the same time, we aimed at increasing the number of universities that are members of the M8 Alliance, which happened with great success as well. It includes now universities from around the world and still more will be joining in the future. Personally, I made great connections with colleagues and investigators from around the world through this network. Some even grew into lasting friendships.”*

# Past WHS Presidents reflect on a legacy of engagement



**PROF. DR. AXEL KAHN**  
WHS President 2009 | France

*“The highlight of the WHS’s first edition was the concept of evolutionary health and how it linked global health and the Darwinian principles of evolution. One of my most cherished memories until today is the live discussion we had with the crew of the international space station.”*



**PROF. DR. STEVE WESSELINGH**  
WHS President 2011 | Australia

*“It was a great honor to jointly preside over the 2011 event, as it demonstrated for the first time the truly global reach of the WHS, with significant involvement from the Asia-Pacific region. There was clear evidence of the potential of the Summit to facilitate positive change on a genuinely worldwide scale. It highlighted new approaches in research and innovation dealing with a complex mix of escalating rates of non-communicable diseases, climate change and worldwide political instability.”*



**PROF. DR. STEPHEN K. SMITH**  
WHS President 2010 | United Kingdom

*“The recognition that academic health science centers needed to be engaged in the global health debate was a central lesson. Good debates addressed the promise of precision medicine requiring even closer collaboration between academic institutions, healthcare providers and social and community care, as well as the need to use developments in digital health and data analytics to provide real-time healthcare choices at both the personal and public health levels.”*



# M8 Alliance: A Global Partnership

*The M8 Alliance of Academic Health Centers, Universities and National Academies is a collaborative network of academic institutions known for its educational and research excellence. The network was founded in 2009 at the inaugural World Health Summit, and has provided an outstanding academic foundation to every WHS event since.*

The M8 Alliance currently has 24 members based in 17 different countries, each of which are committed to improving global health and working with political and economic decision-makers to develop science-based solutions to health challenges worldwide.

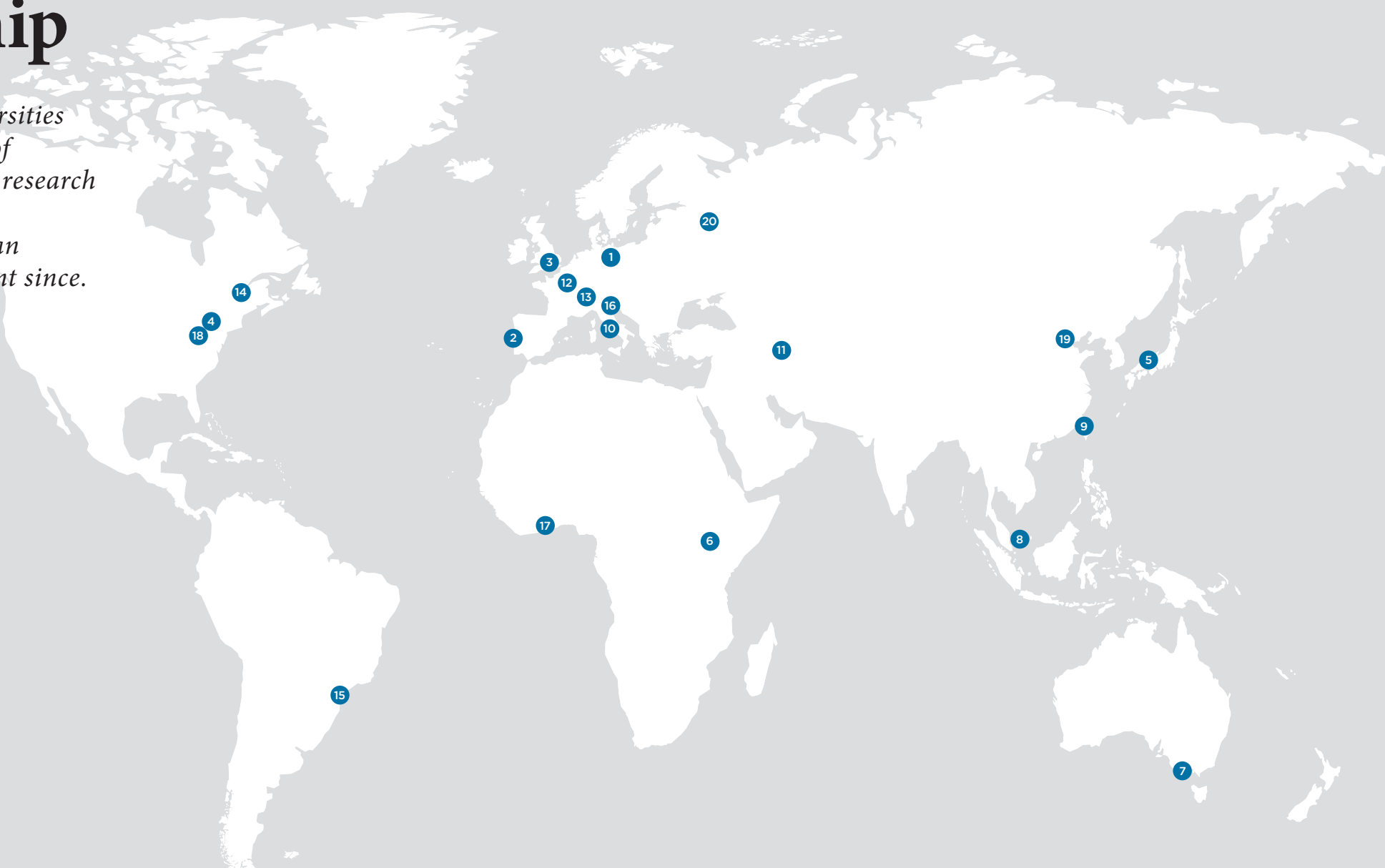
The M8 Alliance promotes the bench-to-bedside-to-population health translation of research, as well as the transformation of current medical care approaches to treating the ill by creating health-care systems aimed at the effective prevention of disease. The organization also works to adapt health-related solutions to rapidly changing living conditions through research in priority areas, in particular shifting demographics, urbanization and climate change.

The M8 Alliance is improving global health through the pursuit of five strategic goals:

- developing a worldwide network of academic health science centers and bringing together universities and healthcare providers;
- facilitating dialogue through the World Health Summit across a global network of stakeholders who are engaged with academic

health science centers – these stakeholders include individuals and institutions active in government, industry and commerce, inter-governmental agencies, healthcare providers, academies of medicine and science, professional associations, and the media;

- setting an agenda for global health improvement by addressing issues of interest to academic health science centers and conveying findings and recommendations based on scientific evidence through the generation of key statements;
- positioning the M8 Alliance as an authoritative influence when it comes to decision-making in global health;
- creating a knowledge base amongst M8 Alliance members, which directly involves the promotion of mutual learning, research collaboration, the enrichment of educational capabilities and enhanced clinical outcomes.



- 1

Charité – Universitätsmedizin Berlin, Germany
- 2

Coimbra Health, Portugal
- 3

Imperial College London, United Kingdom
- 4

Johns Hopkins Bloomberg School of Public Health, USA
- 5

Kyoto University Graduate School of Medicine, Japan
- 6

Makerere University, Uganda
- 7

Monash University, Australia
- 8

National University of Singapore
- 9

National Taiwan University, Taiwan
- 10

Sapienza University of Rome, Italy
- 11

Tehran University of Medical Sciences, Iran
- 12

University Sorbonne Paris Cité, France
- 13

University of Geneva, Switzerland
- 14

University of Montreal, Canada
- 15

University of São Paulo, Brazil
- 16

InterAcademy Partnership (IAP) for Health
- 17

World Federation of Academic Institutions for Global Health (WFAIGH)
- 18

Association of Academic Health Centers International (AAHCI)
- 19

Chinese Academy of Medical Sciences
- 20

Russian Academy of Medical Sciences, Russian Federation



# M8Alliance

Academic Health Centers, Universities and National Academies



## Charité – Universitätsmedizin Berlin, Germany

Europe's largest university clinic – and its oldest and most prominent hospital – is located in the German capital. Eleven Nobel Prize laureates have worked at the Charité.



## Makerere University, Uganda

One of the oldest and most prestigious centers of learning in Africa, Makerere University is home to a staff of over 4,000 and more than 40,000 students.



## Coimbra Health, Portugal

Over 700 years old, the University of Coimbra is a keystone of European and global scientific culture, as well as a UNESCO World Heritage Site. Together with the Coimbra Hospital and University Center, it forms Coimbra Health.



## Monash University, Australia

As Australia's largest university – with approximately 60,000 students from over 170 countries – Monash has seven campuses: five in Victoria, one in Malaysia and another in South Africa.



## Imperial College London, UK

The Imperial College of Science and Technology was created as a constituent college of the University of London. Fully independent since 2007, the Imperial College London attracts students from more than 100 countries.



## National University of Singapore

Founded in 1905, the National University of Singapore today consists of 16 different faculties and schools. Around 37,000 students can be found on its three campuses in Singapore and seven overseas locations.



## London School of Hygiene & Tropical Medicine, UK

Founded in 1899, the London School of Hygiene & Tropical Medicine is one of the leading research-focused graduate schools in the world.



## National Taiwan University, Taiwan

Known for its diverse and international curriculum, National Taiwan University is made up of 11 colleges, 54 departments and 105 graduate institutes. It has a student body of around 30,000.



## Johns Hopkins Bloomberg School of Public Health, USA

A fully accredited private institution, the JHSPH was the first public health facility in the world, and it remains the largest school in the field.



## Sapienza University of Rome, Italy

Established in 1303 by Pope Boniface VIII, Sapienza is one of the oldest universities in the world. With about 115,000 students, it's one of the largest in Europe as well.



## Kyoto University Graduate School of Medicine, Japan

The first institution of its kind in Japan, the Kyoto Imperial University College of Medicine was founded in 1899. Its successor, the Kyoto University School of Public Health, was established in 2000.



## Tehran University of Medical Sciences, Iran

The university is the oldest, largest and most highly ranked comprehensive higher education institute in the field of medicine and public health in Iran, offering a wide range of courses and receiving applications from students from around the globe.



## University Sorbonne Paris Cité, France

The University Sorbonne Paris Cité is a recently established consortium of prestigious institutions that brings together higher education and research institutions in the city of Paris.



## University of Geneva, Switzerland

Founded in 1559 as a theological and humanist seminary, the University of Geneva is renowned for emphasizing the unity of teaching and research. It's the only tertiary-level educational institution of its kind in the region.



## Geneva University Hospitals, Switzerland

The Geneva University Hospitals are heirs to a centuries-long tradition of excellence in medicine and science. The HUG represents a merger all public hospitals in Geneva.



## Graduate Institute Geneva, Switzerland

A semi-private post-graduate institution, the Graduate Institute Geneva was the first university in the world to be dedicated solely to the study of international affairs.



## University of Montreal, Canada

A public research university that started with less than 100 students in 1878, the University of Montreal has more than 60,000 today. Comprised of 13 faculties and more than 60 departments, it has the highest sponsored research income in Quebec.



## Montreal Clinical Research Institute, Canada

The IRCM was the first independent academic research center in Quebec to bring basic and clinical researchers together under a single roof.



## University of São Paulo, Brazil

Founded in 1934, the University of São Paulo arose from a combination of institutions, including a medical school. Today, the largest university in Brazil is seen as the country's most prestigious educational institution.



## IAP for Health

The IAP for Health combines the expertise and impact of the global network of science academies to advance sound policies, promote excellence in science education and improve public and global health.



## World Federation of Academic Institutions for Global Health (WFAIGH)

A global network of academic health institutions, the WFAIGH was set up to help provide evidence to inform policies on global health issues.



## Association of Academic Health Centers International (AAHCI)

The AAHCI is a global non-profit organization that aligns efforts among health professionals in education, research and patient care.



## Chinese Academy of Medical Sciences & Peking Union Medical College, China

The college is among the most selective medical institutions in the People's Republic of China and one of its top two universities.



## Russian Academy of Medical Sciences, Russian Federation

Set up in 1944, the USSR Academy of Medical Sciences was considered the most prestigious scientific and medical organization in the Soviet Union. Its successor – the Russian Academy of Medical Sciences – was founded in 1992.





# Migration and Refugee Health

According to the United Nations, there are an estimated 65 million forcibly displaced people worldwide, including 21 million refugees. The statistics can be overwhelming – and numbing.

“The numbers hide one thing,” International Committee of the Red Cross Director Yves Daccord said in a speech at the WHS. “Behind every number there is a person. When it comes to migration and health, you need to understand the person.”

Caring for the many people displaced by war, famine or natural disaster is a challenge that requires medical professionals to think outside the box. To be effective requires an understanding of different cultural backgrounds, the political and social roots of conflict, and the isolation and despair that threaten refugees’ mental health.



## OVERVIEW

# MIGRATION AND REFUGEE HEALTH

**Caring for the health of migrants and refugees is not only about available resources or even about cultural competency. It is also about political wisdom and social trust.**

## I. FEARING THE FOREIGN

Across the globe, migration and its impact on individual, family, and population health have emerged as a societal challenge. Whether concerns around migration and refugees are anchored in the perception of migrants bringing with them communicable diseases or migrants taking away limited resources from local populations, they share in common undifferentiated scapegoat narratives that should have no place in the multicultural societies of our time.

Although a “fear of the foreign” is, perhaps, as ancient as the concept of “self and other,” today our moral and ethical obligation to assist those who come to us (both in existential need as in the spirit of improving their lives) is accompanied by an unprecedented experience of global citizenship. If we are indeed one world, we need better ways of addressing how and why others become vulnerable. Otherwise, the flowing wave of human migration will increasingly become a storm.

But while policymakers in receiving countries focus on quotas and points-based systems, on procedures for accepting or refusing migrant and refugee claims, and on migration’s impact on economic growth, individual views and community responses to migrant and refugee needs are complex. In the end, the ability of any person to thrive in a new home will also depend on the willingness of communities in receiving states to accommodate others whose lifestyles may diverge from local ways of living.

Crucially, this ability rests on understanding and successfully addressing the needs that stem from the unsettling of individuals and communities in the first place. And it rests in the longer term on how migrants and their families adjust and develop the social networks that are central to living lives fully realized. This last contingency is why it is important to distinguish between migrant health and the health of forced migrants, including refugees.

## II. MIGRATION AND FORCED MIGRATION

Migrants are people who move from their places of origin and settle elsewhere. That in itself can be challenging and complex. Many of the world’s megacities are already made up mostly of such people. But refugees are stateless people whose civil liberties can remain unacknowledged or openly denied, leaving them both vulnerable to changing national sentiment and deeply dependent on humanitarian goodwill.

To address refugee health requires, then, a careful assessment of their specific vulnerabilities and a sustained commitment to ameliorate what has made them vulnerable. However, given the real tragedies that make people seek refuge, that commitment must be honest and enduring.

This is why refugee health is so profoundly dependent on social trust and on the reliability and wisdom of political leaders. As important as is individual conviction, if governments fail to act in openly humanitarian ways, citizens are asked to be generous without the assurance that their generosity will be either acknowledged or supported.

This fact has been known for a long time. Indeed, John Maynard Keynes long ago referred to that failure of governments to express generosity in moments of social stress as the “paradox of thrift.” The “paradox” for Keynes rested in the destabilization created when leaders, citing resource limitations, cut back on social welfare exactly at the time when citizens needed to believe that their governments will be there for them no matter what. According to Keynes, the corrosive effects on public trust under such conditions are immeasurable.

## III. POLITICAL WISDOM

But wisdom is a precious commodity. And when it is absent, addressing migrant and refugee health and well-being can become problematic; for so many people are

unsure whether to look right or left in an effort to build a healthier and more vibrant society. We hear from the political right that the house is filling quickly and must be ring-fenced from those who may exhaust its resources if we are to care responsibly for citizen health and welfare. From the left we hear that the house itself may need rebuilding, and that the only morally acceptable way of replenishing those cupboards is by opening the front door.

But the truth is that public sentiment is never so clear-cut. Were the choice that simple, receiving countries would with one voice either accept or reject outsiders; and that is not at all what we now witness. Rather, a straightforward political divide is mediated by a deeper and much broader public mistrust of government. When leaders retreat from the frontline of the policies that they once supported and openly fought for, public trust collapses and with it the health of migrants and refugees is jeopardized.

When public anxiety is present, it is little wonder that anti-migration sentiment becomes a primary way in which people both voice mistrust in political processes and claim that society can hardly be expected to care for others. Migrant and refugee needs, in other words, tell us a great deal more about citizen trust than we often acknowledge. So immigrant health has to be placed against the background of wide-scale public anxiety, if we are to understand the long-term impact of our political decisions.

This is why those who already feel disenfranchised and disillusioned by political processes are often most vocally against that nation being generous, even to the point of supporting policies that may not be in the best interest of citizens themselves. One merely has to follow the irresponsible chaos created across Europe by Brexit, or the radical political shifts on migration in the United States, Australia and elsewhere to understand how migrant health and migrant well-being are entangled with politics.

## IV. THE NEW CONVERSATION

Migration has forced new conversations about human-kind and its values, and the health outcomes of all of us will be determined by how we adjust globally to the reality of a world in which actions in one country will have significant impacts in other places.

But it is here, also, where we have a real opportunity. Like climate change, migration demands new forms of cooperation – at the individual level, in communities, within nations, and across national borders. This truth means that migration is not a thing to be resolved by any one country’s attempt to close itself off to the realities of global disorder and the dire human needs of so many stateless peoples worldwide.

In other words, we all need to ask ourselves why someone would migrate in the first place, and to commit collectively to addressing this much bigger question. That means understanding the root causes of migration, for no walls or fences will stop the flow of people around the globe when migration is driven by an urgent desire to find the social security we all so much hope for.



Author  
**PROF. DR. A. DAVID NAPIER**  
Director | Science, Medicine and  
Society Network | University College  
London | United Kingdom



## ESSAY

# BETTER HEALTH SYSTEMS STRENGTHEN OUR COMMON SECURITY

**Health, security and stability are inextricably linked. As global instability and interconnectedness increase, so does the risk of a catastrophic outbreak.**

What keeps you up at night?" is a popular question directed at security leaders and decision-makers. Often, their responses refer to weapons of mass destruction (WMD), the use of which could kill people on a massive scale. Answers usually have an atomic component, ranging from the risk of nuclear terrorism to a catastrophic escalation of conflict between nuclear weapons powers. Bioterrorism, especially after the 2001 anthrax scare in the United States, is also near the top of the list – although it is not certain we are actually prepared for such an attack. But, many will admit, an epidemic stemming from natural causes has long not received the attention it deserves. Yet an epidemic could also bring about mass destruction – but there would be no enemy to blame but ourselves for not being prepared.

"Freedom is indivisible, and when one man is enslaved, all are not free," US President John F. Kennedy famously said in his "Ich bin ein Berliner" speech. Paraphrasing him, one might also say: When one human is sick, all of us may be threatened. Unfortunately, it did take a major outbreak of a deadly disease, the Ebola crisis, to highlight that danger again: The health systems in place in one country can have a great impact on global health as

well as on international security and stability. Without a doubt, "the unprecedented extent of the Ebola outbreak in Africa constitute[d] a threat to international peace and security," as the UN Security Council found in September 2014.

On the one hand, none of this is new. Since the plague killed almost 1 in 3 Europeans in the 14th century, states have recognized that diseases can pose a disastrous danger and have tried to take necessary precautions. And in the 20th century, in particular, there have been important health success stories, including the advent of antibiotics and the eradication of small pox.

## KEY GLOBAL TRENDS INCREASE THE RISK OF PANDEMICS

On the other hand, key global trends and characteristics of today's international system create a higher risk of a catastrophic global pandemic.

First, the progression of globalization, urbanization and population growth keeps decreasing the time between the outbreak of a disease and its spread. These trends are not

entirely new, but they are accelerating – and make it more difficult to get a pandemic under control again. In other words, the 2002-2003 severe acute respiratory syndrome (SARS) pandemic may only be a light blueprint of how a much deadlier global spread might occur. For example, Africa's population is projected to more than double by 2050, and most of that growth will be in cities. Population density in megacities can speed up the spread of diseases – and make widespread unrest and chaos more likely in case of an outbreak.

Second, the proliferation of state failure throughout key parts of Africa and the Middle East is also accelerating, which exacerbates health security challenges in those countries. After all, preventing or responding to disease outbreaks is extremely difficult in areas with limited governance or in areas of civil strife and war.

And consider this: We all know that if Ebola had been an airborne pathogen of a similar lethality, the outbreak could have caused millions of deaths. But, under different circumstances, Ebola could have been just as catastrophic: What would have happened if, for instance, populous Nigeria had been in complete turmoil in 2014 – or did not have relatively good health infrastructure in place from the fight against polio? If Ebola had spread to the megacity of Lagos under conditions of a civil war in Nigeria, the world would be very, very different today.

Moreover, the proliferation of state failure and civil conflict in today's world has also led to the biggest refugee crisis in history, leaving many millions of migrants vulnerable and without adequate healthcare. And these state failures, by the way, also increase the risk of terrorist groups having safe spaces to flourish and possibly even plot attacks with weapons of mass destruction, including biological weapons.

Conversely, of course, health security crises feed and foster instability as well; the Western African states most afflicted by Ebola will need years and years to fully recover. In some countries, HIV/AIDS has decimated entire generations. Beyond the millions of personal tragedies, the societal, economic and political consequences of such a massive health challenge can hardly be exaggerated.

Add to this challenge antimicrobial resistance, which experts say will skyrocket in the next decades and thus make treatment of common infections and bioterrorism more difficult, and you get a worrisome picture.

These are a few critical issues at the intersection of health, security and stability – and I have not even mentioned the protection of healthcare workers in conflict zones or the role of militaries in fighting outbreaks yet.

These are also some of the key reasons why I have been committed to promoting discussions between health offi-

cials, NGOs, security strategists, the private sector and decision-makers at Munich Security Conference events in order to deepen the conversation between professionals from different sectors.

To be sure, none of this is to suggest that security officials should only care about health questions if and when they have an impact on security policy in the traditional sense. It is true that health policy and security policy are two different policy areas, with sometimes competing priorities. Mixing them all together and "securitizing" health as a matter of principle is not sensible. But it would also be negligent to downplay the critical intersection of the two. A comprehensive understanding of security today must include health security.

In addition, in terms of communication, it might be useful to frame global health emergency preparedness in security terms. This could help sharpen the awareness among publics around the world that this is not just a problem of and for certain regions, and certainly not just for less developed countries, but that this problem affects everyone. It could help find the funds necessary for research and development, for disease surveillance, and for health and response systems. The launch and first operation of the European Medical Corps in the Congo, for example, has been a good step.

Moreover, it would be useful to routinely and prominently include health in security strategies, risk assessments and early warning mechanisms. Health systems are, after all, a line of defense. They help prevent both health and security crises, and thus strengthen our common security.

Speaking at a panel discussion on the intersection of health and security policy at this year's Munich Security Conference, Ghana's Minister of Foreign Affairs and Regional Integration, Hanna Serwaah Tetteh, observed: "Even though the discussion [of health security] is now more prevalent within our region and within our continent, [...] I'm really wondering whether the lessons have been learned as well globally as they have within the place where we suffered the crisis."

Global health and global security may well depend on learning those lessons without further delay.



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## ESSAY

# REFUGEE MENTAL HEALTH

**Welcoming refugees and organizing their integration into European Union society depends on preserving their mental health by reducing stressors before, during and after migration. It is a serious challenge, but European values make it an ethical imperative.**

Our species, *Homo sapiens*, originated in Africa. Between 60,000 and 70,000 years ago, we started to migrate to other continents, probably due to a major climate change which almost caused the species' extinction. To date, we continue to migrate and mix. The result is that, after centuries of racism and discrimination, scientists – and many others, though unfortunately not everyone – realize that human “races” do not exist. In other words, there are no exclusive genetic characteristics corresponding to black people, white people, etc.

The phenomenon of migration is also part of the European Union's DNA. In the aftermath of World War II, the fathers of the EU proposed the creation of the European Coal and Steel Community (ECSC). One of its motivations was to make another “war not merely unthinkable, but materially impossible.” The ECSC made possible the migration of workers – including around 140,000 Italians who moved to Belgium between 1947 and 1957 – who accepted very hard working conditions to try to improve their socioeconomic status.

## MIGRATION STRESSORS AND MENTAL HEALTH OF REFUGEES

According to the United Nations High Commissioner for Refugees (UNHCR), there are currently about 65 million forcibly displaced people worldwide, including about 21 million refugees (over half of whom are under the age of 18) and 10 million stateless people. The vast majority of these forced migrations are towards low and middle-income countries and “only” about 1.2 million towards the EU. But the impact has nonetheless been dramatic.

Several studies indicate that refugees have higher morbidity from several mental health disorders such as post-traumatic stress disorder, anxiety and depression compared to

the native population or family reunification immigrants. That could be due to different type of stressors:

### Pre-migration stressors

Many of the refugees reaching the EU from Middle Eastern and sub-Saharan countries have fled due to wars, persecution and extreme violence, such as torture, loss or murder of family members and friends, and rape.

High-income countries should make a stronger commitment to prevent any type of conflict in the world and induce non-democratic countries to respect human rights. This may, at first, appear to be a naïve and idealistic statement but instead it is a very concrete one. Besides the obvious ethical reasons, prevention of wars, poverty, hunger, etc. would drastically reduce forced migrations and ultimately be less expensive to deal with than the consequences of these tragedies. Higher investments in cooperation for development to stabilize areas at risk would save hundreds of thousands of lives and reduce the suffering of millions of human beings. Just as in medical practice, prevention is much cheaper and effective than therapy.

### During migration stressors

Refugees reaching the EU have often traveled for weeks, months or even years. Most of them crossed the Mediterranean Sea, sometimes losing family members and friends along the way (3,771 people drowned or went missing in 2015 alone). Many of them went through countries such as Libya, in which violence is usually inflicted on the vulnerable. For women and minors (often unaccompanied), these experiences are particularly traumatic. That is not ethically acceptable.

The various initiatives taken at the national and international level (Mare Nostrum in Italy, Triton and, very recently, the European Border and Coast Guard Agency)

are certainly positive steps towards saving human lives in extreme risk conditions, but much more needs to be done.

### Post-migration stressors

Many studies indicate that long periods of detention for asylum seekers, lengthy and complex asylum processes, unemployment, perceived discrimination and changes in socioeconomic roles (including changes of gender roles) have a dramatic impact on refugees' mental health. Thus, all possible efforts should be made to improve the quality of the asylum seeker centers and accelerate asylum procedures.

## HOW UNIVERSITIES CAN HELP IN REDUCING POST-MIGRATION STRESSORS

Universities and other higher education institutions can play an important role in improving the integration of refugees, thus reducing the post-migration living difficulties and possible mental disorders, by providing:

1. Training of experts to help refugee centers and hospitals offer high-quality and culturally acceptable medical services. Fast tracks for the recognition of academic and professional titles should be implemented, as Sweden has recently done.
2. Education opportunities for young people, facilitating access through full recognition of previous studies, skills and titles, creating preparatory and bridging courses, providing more scholarships, etc.
3. Research opportunities for all qualified refugees also in collaboration with the initiative Science-4Refugees by the European Commission.
4. Cultural and sport programs, very useful to facilitate integration of young people.
5. Advice to political authorities.

Universities, in cooperation with other civil society organizations, can prepare projects which can be funded under different European schemes:

- The Erasmus+ program is already funding more than 70 projects addressing migration issues
- A call on “Migrants' health: Best practices in care provision for vulnerable migrants and refugees” was recently published within the 3rd EU Health Programme
- The Asylum, Migration and Integration Fund (AMIF) (€3.137 billion for the period 2014-20) promotes the efficient management of migration flows and the implementation, strengthening and development of a common EU approach to asylum and immigration

## OTHER POSSIBLE EU ACTIONS

Another European tool which could be strengthened is the European Voluntary Service, a tool to organize training for young Europeans and provide short placements in refugee facilities inside and outside the EU under the supervision of expert staff members. For instance, Sapienza University of Rome, together with the Jesuit Refugee Service/Italia, has recently started to promote volunteer placements for medical students, which are getting very positive feedback. This measure would be very useful in improving the quality of the refugee centers and, in this moment of crisis for the EU, could help to reinforce the European values of peace, reconciliation, democracy and human rights for which the EU was deservedly awarded the Nobel Peace Prize in 2012.

## CONCLUSIONS

Facing the recent “refugee crisis” and enabling refugees' integration into the EU in good mental condition is a serious challenge. It is also an opportunity to remember our history and behave according to our values.



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## ESSAY

# MIGRATION, CULTURES AND HEALTH

**The arrival of migrants from different cultures is a challenge our healthcare systems must acknowledge and overcome. If they are to play their proper role, doctors and other healthcare providers in receiving countries have to take into account the complexity different cultural practices bring to the system and adapt accordingly.**

Migration, mobility and globalization processes in the 21st century have contributed to the rapprochement of populations, transfer of cultural practices and values throughout the world. Questions of belonging, similarities and differences of one's own cultural practices become increasingly relevant in a world of comprehensive globalization. These phenomena require nations and individuals to understand each other not only at an economic and political level but also to grasp the complexities of each other's histories, cultural inheritances and narratives.

We witness processes of diversification and homogenization at the same time. As a result, some anthropologists have even challenged the concept of culture, shifting their focus instead to "dynamic processes" being influenced by and influencing cultural practices. The current refugee crisis in Syria, Iraq, Lebanon, Turkey and Europe has put the spotlight on this new and complex dimension of cultural interaction.

Migrant populations include temporary migrants, refugees, asylum seekers and "illegal" or "undocumented" migrants. According to the International Office of Migration, they assisted about 58 million migrants from 2011 to 2014 (IOM 2015) and 2015 saw the displacement of

over 4 million people from Syria due to civil war. In addition, according to a release from the United Nations High Commissioner for Refugees, 65.3 million worldwide are currently forcibly displaced and 34,000 people are forcibly displaced daily due to conflict or persecution. Europe and particularly Germany are the destination a large share of migrants from the wider Middle East and Africa aspire to reach. Most migrants and all refugees brave extremely perilous conditions to travel to countries with cultures, values as well as healthcare systems very different from their countries of origin. For refugees, who are fleeing war, political upheaval and desperation, the situation is particularly precarious. Most of them arrive in Europe with multiple traumatic experiences.

But in the end, practically all migrants have health issues that need to be addressed. Many of them, for instance, faced violence and physical threats (women are at higher risk) during their journey. Furthermore, migrants frequently have to grapple with new health-related issues following their settlement in their host country. Hostility and lack of cultural awareness from the local inhabitants can lead, for example, to a worsening of migrants' mental health following social isolation, poverty, loss of status and insurmountable challenges. Under such circumstances, any traumatization tends to become a long-term

health issue. Such specific problems come in addition to communicable diseases like tuberculosis and hepatitis that can be developed due to the perilous journey and the change in environment.

Many migrants also suffer from non-communicable diseases like high-blood pressure or diabetes. Additionally, migrants often live in poor conditions since they are more likely to be offered employment in jobs that are "dirty, difficult and dangerous" (IPPR 2006) with minimal basic occupational safeguards and workers' rights (EC 2007). This situation that is new in its sheer dimension for most of the host countries raises important questions about the relevance of different cultural backgrounds in health prevention, delivery, care and health policies.

In order to continue to play their role properly in the interest of public health in general healthcare systems, receiving countries must take this complexity into account and – in part – adapt accordingly. Healthcare providers must be assisted by services that facilitate culturally sensitive healthcare as recently stated by the Regional Committee of the World Health Organization (WHO) European Region. At the same time, in order to boost the cultural competency of healthcare providers, curricula will have to be amended accordingly.

Our ambition should be to optimize existing healthcare systems through new, culturally sensitive capacities of communication. To achieve this important goal, a workshop entitled "Migration, Cultures and Health" was held on this topic at the World Health Summit 2016. The objective of this workshop was to attract attention to the need for cultural awareness and tolerance in the provision of healthcare to refugees and migrants. There is still a big gap between the understanding of cultural diversity by healthcare providers, including medical staff, politicians and NGOs, and the results achieved in the field. Overcoming the existing shortcomings would not only mean an objective optimization of existing healthcare systems in the interest of all but will also contribute to a reasonable policy of integration of those migrants who have a long-term perspective to stay.

The call for better cultural competency at all levels in the healthcare sector resounded throughout the workshop. Clinics and health organizations need to examine their cultures, a process which has already started in various places. For example, the German Commissioner for Immigration, Refugees and Integration published a much requested brochure on dementia-related illnesses, and the Charité – Universitätsmedizin Berlin initiated the "Woman to Woman" program, aiming at reducing cultural misunderstandings by holding seminars in the homes of migrant patients. Such programs exist, but in small numbers. They need to be increased and need to encompass the whole healthcare spectrum to achieve sustainable improvements and mutual understanding. ●



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## INTERVIEW

# “It’s a megatrend of the century”

Ambassador William Lacy Swing is the Director-General of the International Organization for Migration, a post he has held since 2008. He came to the IOM after serving as UN Special Representative of the Secretary-General for the Democratic Republic of the Congo, where he oversaw the largest UN peacekeeping operation in history. Ambassador Swing has been a diplomat for over 40 years, and was the US ambassador to Nigeria, Liberia, South Africa, the Democratic Republic of Congo, Haiti and the Republic of Congo.

*In a lot of discussions, the words “migrant” and “refugee” overlap. Part of the discussion about the recent arrival of refugees to Germany concerns the economic benefits, which obscures the right of people to be refugees, regardless of their economic utility. How do you make the case for that pure right of movement in the current situation?*

**Swing** — The International Organization for Migration has its own view on this – and I think it’s a widely shared view – which is that every refugee is a migrant, but not every migrant is a refugee. In other words, refugees are a category of migrants even though they are forced migrants. So, of the 244 million people the UN says are international migrants, you have 23 million refugees, which means that refugees are about 9% of all migrants.

Now, I’m sure some of our colleagues in the UN system might not like that definition. Part of the tendency here in Europe, given the large number of persons coming in from Africa and the Middle East, has been to say that everybody who doesn’t qualify as a refugee under the 1951 Refugee Convention is an economic migrant.

Well, that’s too simplistic. Migration is quite complex. You have in that group, for example, tens of thousands of unaccompanied minors. Germany alone has apparently about 55,000. You have victims of trafficking, you have pregnant women on the move, you have the sick and the elderly and you have, for example, Syrians who are simply going north to Scandinavia to join their families. They are not really refugees as such. But they still have rights.

*The international community is planning to meet in New York in 2018 to establish a global compact for safe, orderly and regular migration. That doesn’t leave a lot of time to sway the public discourse in favor of migration’s benefits. What are some of the strategies you think people can use to change the nature of discourse?*

First, all of us in positions of leadership, whether it be in government, or in NGOs, or in an international organization such as IOM, we have an enormous responsibility to begin to stand up and say what we all know: namely, that migration is a natural, necessary and potentially enriching phenomenon; that migrants are human beings deserving of respect, humane treatment and deserving of our thanks for their skills, their innovation, and their social and cultural enrichment, whatever their status may be. Yet, many migrants lack equitable access to health services, and many are exposed to poor living and working conditions and occupational health hazards that make them vulnerable to ill health. Health professionals who know well that ensuring migrants access to health services is a sound public health policy have a role to play in that.

Secondly, persons in the media who are spreading the word should offer people another approach, another angle, humanizing migration. We are engaging with social media and have, for example, an “I am a migrant” social media campaign that’s designed to showcase migrants who are doing interesting things. We are trying to do more to talk about migrant contributions to society, both in the host country and the country of origin, to show that historically migrants have always been overwhelmingly positive. They are the original agents of development. To quote the economist John Kenneth Galbraith, “migration is the oldest action against poverty.”

*Does that poverty reduction strategy work?*

It does. Global remittances amount to US \$500 billion, and last year the total foreign direct investment was something like US \$654 billion globally. So it’s almost as much as all foreign direct investment – and twice as much as foreign aid. For countries like El Salvador, for example, probably 30% of its GDP comes from remittances.



**“It’s a myth to think that migrants are coming to take your jobs.”**

**WILLIAM LACY SWING**  
Director-General | International  
Organization for Migration | Switzerland

*It might be a poverty reduction strategy for the migrant and their country of origin, but some politicians seem to focus on the possibility that migration may be impoverishing the host country.*

No, because migrants very often begin by taking jobs that locals don’t want. I mean, how many Germans do you have who are willing to work in the kitchen or to mop floors or take care of the sick and the elderly? It’s a myth to think that migrants are coming to take your jobs. They will fill in the areas where you don’t have enough workers.

*Have you found it an uphill battle to make the case that granting access to health coverage to migrants as soon as they arrive is a good idea?*

It’s an ongoing challenge. Thailand is a good example. Thailand has 3 million migrants from Myanmar and others from Laos and Cambodia. But they have given healthcare access to all migrants and in many ways I think they have benefited from it. They have a healthy workforce now, a productive workforce – they depend on these migrants. The

sooner these people get jobs, the sooner they are going to pay taxes. In the end they pay back more in taxes than they’ll ever get from the public services. The healthier they are, the better they contribute to the prosperity of their countries of origin and destination. It is a win-win situation.

*So the economic case is the most effective argument?*

It is an argument amongst others. Migrants’ health bridges rights, public health, and development, plus the contribution of diversity. Diversity does so much in terms of entrepreneurial skills, in terms of dynamism, languages, culture, all sorts of impulses that enter a society. Diversity has made so many countries very dynamic societies. I mean, my own country continues to benefit from inflows every year of migrants. In fact, we would be in the same situation as Europe – with more people dying than being born – if it weren’t for migration. The same thing goes for Canada.

*Are the historical examples applicable? In the German case, there were 12 million migrants right after WWII, but all of them spoke German. You have a different integration challenge today.*

There is a psychological adjustment that countries like European countries are having to undergo, and it’s not just a question of getting over refugee amnesia.

European countries have peopled the world for three centuries – colonies, investment, trade, academic exchanges. And now we are becoming a continent of destination rather than just a continent of origin, which means rather than you sending your people out, people are coming to you. That’s always a little disconcerting.

This is where the media and governments have such a big role to play. We try to explain why these people are coming, who they are, and how one can prepare to receive them. Both communities – the host communities and the migrants – have a responsibility to make integration work.

*Do you have any particular examples in mind that are really best-case scenarios or models?*

I hesitate to use Canada, because when you say Canada Europeans say, “look, they’ve only got one neighbor and they’ve got two big oceans on either side.” But if you want to take an example of who has done it and done it well, when the new Prime Minister, Justin Trudeau, was campaigning, he said, “If I am elected, we will bring in 25,000 Syrian refugees.” Then he went on to say, “We will bring them in not as refugees, but as future Canadian citizens.” That already sets a different tone for people. He sent his minister John McCallum out to provincial governments and talked to the mayors. That was, I think, done in a well-prepared way. It’s a bit different from the European situation, but it has elements that could be adapted.

*Sometimes people see this as a temporary crisis, but I’m hearing you say migration isn’t going away.*

No. It’s a megatrend of the century.

# Migration and Refugee Health: From Care to Policy

*The current influx of migration – the biggest since the end of World War II – is putting migrant health issues at the top of government agendas. Basic care is no longer enough. We need new concepts for adapting health policy strategies that take into account transformative processes, both in migrant countries of origin and in the nations to which they emigrate.*

## STRESS & TRAUMA



### 10 x higher:

Refugees and asylum seekers suffer post-traumatic stress disorder (PTSD) 10 times more often than non-refugees.

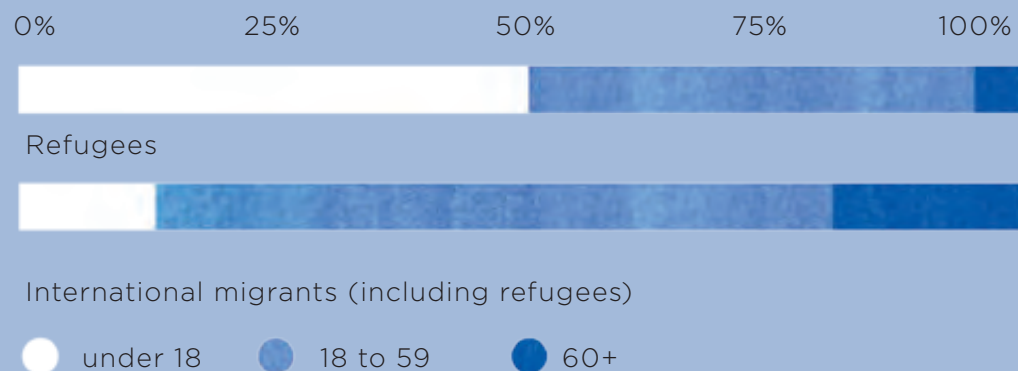
*(The German Association for Psychiatry, Psychotherapy and Psychosomatics, 2016)*

# 89%

**of all refugees are hosted by developing countries. As a result, their health problems stress the entire health system in these countries.**

*(The World Bank, 2016)*

## AVERAGE AGE



More than **50%** of the refugee population is under **18 years of age**, making the world's refugee population much younger than the overall migrant population.

*(Unicef, 2016)*

## STATEMENT

**What is good for migrants would also be good for patients with a non-migration background.**

Prof. Dr. Jalid Sehoul (Director, Clinic For Gynaecology, Charité - Universitätsmedizin Berlin) at WHS 2016

## ON THE MOVE

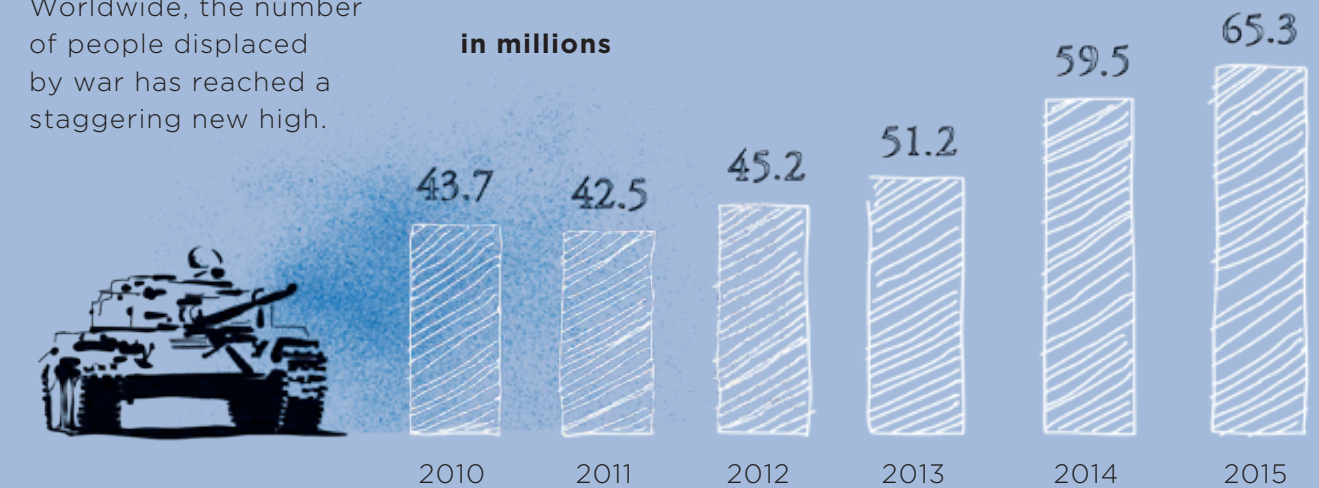
**One out of every 122** people on Earth is now either a refugee, internally displaced, or seeking asylum.



*(UNHCR, 2015)*

## INFLUX OF REFUGEES

Worldwide, the number of people displaced by war has reached a staggering new high.



*(UNHCR, 2016)*

## ORIGINS

**In 2015, 54% of refugees** worldwide came from three different countries:

*(UNHCR, 2016)*





“There is a whole universe of fantastic, unexpected new findings out there”

*From smartphones to delivery drones, technology is changing the way we think about public health. But are its benefits – and risks – evenly distributed? And what can be done to improve care for all the people of the world? At the World Health Summit, four leading figures from different health-related areas gathered to discuss the way technology can best be applied to pressing problems of public health and other challenges facing today and the future.*



**DR. YUKIYA AMANO**  
Director-General | International Atomic Energy Agency | Austria

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Chair of the Board | German Aerospace Center | Germany

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*Let's start by talking about the uneven distribution of technology, and what the needs are in developing and developed countries. Does the international community have its priorities straight when it comes to funding, or is too much being spent on solutions to first-world problems?*

**Moeti** — In the African region it's recognized that many people are taking advantage of technology, IT in particular. They still have a long way to go for technology to be a regular feature at the household or public health system levels.

Electronic health and mobile health, starting with information collection, surveillance and data gathering are important in our region. It's critical to have data systems that enable rapid awareness that a strange pattern of illness and death is occurring somewhere, understand what this means, and trigger an investigation and response, for example. We see this as a huge opportunity waiting to be better exploited in the African region.

**Amano** — Yes, distribution of resources is uneven. But we are doing a lot to change that. Just take, for example, cancer. On the African continent, 28 countries do not have any cancer diagnostic equipment or radiotherapy equipment. Cancer patients come to the clinic too late, so we cannot provide life-saving treatment. So this is unfair, this is uneven, and this must be corrected.

What can we do as an international organization? I think the different organizations need a different mandate and we need to cooperate. International organizations cannot do everything, so we need to cooperate with government, NGOs and private companies. We can provide basic equipment, but not much. What we are better at is providing training. We can receive trainees and what we can do is use our network to place trainees into other countries.

Are these devices cost-effective? Are they expensive? Yes, they are. The basic diagnostic machine can cost from US \$1 million to US \$2 million. More sophisticated machines can be around US \$10 million. But if you have one machine, you can diagnose 3,000 people a year.

We were involved in the diagnosis of Ebola, and that is much cheaper. One kit to detect the Ebola virus was around €50,000, and that is a lot. With one kit, though, we can detect the Ebola virus in 3,000 people. If you consider the economic loss from Ebola, from cancer, this is a very good investment, I think.

**Delgado** — We have to put resources in perspective. I'm coming from a country where frequently there are two experiences. In Portugal, all the Portuguese have access to technology. But we are linked to former colonies in Africa, and we see people coming to Portugal looking for help to treat problems they can't in their countries.

In a small country like Portugal, we have some problems with the distribution of these kind of treatments and technologies. The more treatments we make available, the more people will use them. So we are always trying to be diplomatic around the doctors. If we politicians say "no, this equipment cannot be used in these circumstances," they say, "But I am the doctor, not you." That may be true, but we need to promote the creation of criteria that are independent of stakeholders to promote the correct use of these kinds of treatments.

*Can you give an example?*

**Delgado** — Take intestinal cancer. We decided in Portugal to promote colonoscopies for people over 50. What happened was that the number of examinations increased more than 600%, with marginal benefits in terms of decreased mortality. Of course, the government spent a lot of money on these examinations.

Now we are in a very difficult situation, because if we introduce stricter criteria to promote the better use of colonoscopies, people will be unhappy.

**Amano** — I have personal experience on this: I became the director of the International Atomic Energy Agency in 2009 and attended the first conference as director in 2010. I chose to address breast cancer. People thought this new director is a strange guy – he doesn't talk about nuclear power generation, but will talk about breast cancer. They were talking about which age women need to go to screening, and there was a heated discussion. It's a serious issue.

But I said, "you are talking about which age women have to start going to screenings, but in African countries, which I have visited, people do not have any access to mammograms." Some people cannot tell their husbands that they have breast cancer – they leave the home and just die.

So there are two realities. On one hand, you could say people are suffering from an overdose of access to cancer diagnosis. On the other hand, there are those who have no access and are just dying without being treated and diag-



—  
*“The more treatments we make available, the more people will use them.”*  
 —

**DR. MANUEL DELGADO**  
 Secretary of State of Health |  
 Ministry of Health | Portugal

nosed. We need to address the contradiction: In developing countries, they don't have this luxury. They often cannot afford any access. So we need to support them.

*Help them establish expertise, or help them acquire the technology?*

**Moeti** — I think you need to guide how they invest. Countries have asked WHO to advise them on how to navigate the many different offers from private companies that are approaching the ministries, the different decision-makers within the system, offering deals. “I have got this for you, I have got that for you.” I think they run the risk of purchasing and contracting for technology or equipment which is not the most cost-effective for their needs.

**Amano** — This is exactly what we are doing together with the WHO. Before these countries buy expensive equipment, they have to establish their first dedicated cancer center, then they have to be able to train their own trainees. Otherwise they cannot be sustainable.

**Ehrenfreund** — I just have to talk a little bit from a different angle, since we are not really providing instrumentation. But we have a lot of cooperation with the United Nations and other organizations. When there are major disasters, like the recent Hurricane Matthew in Haiti, we deliver data immediately for an immediate response – within hours, we actually deliver data that helps provide humanitarian aid in those crisis regions. So from space we can really help when there is a need.

In the long term, when you have detailed satellite data on agriculture and climate you can also understand why people have to leave home in the first place. If we could use those 30 years of data in order to look at trends, perhaps we could stop the migration by improving the situation locally.

Telecommunication satellites can also promote healthcare solutions for remote locations. I think space can really contribute a lot to solving global challenges, including healthcare. The United Nations Office for Outer Space Affairs has, for instance, a network called the Basic Space Technology Initiative. They are actually teaching developing countries how to interpret satellite data, for instance, and how to build small satellites. We and NASA and many other organizations help people in developing countries look at their future and their health environment from space.





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*“Space can really contribute a lot to solving global challenges, including healthcare.”*  
 —

**PROF. DR. PASCALE EHRENFREUND**  
 Chair of the Board | German Aerospace Center | Germany

*Hurricane Matthew is a great example and I'm glad you brought it up. Who do you deliver assistance to? Everybody here, whether you're representing an international organization or government, has to have partners you work with. Is that collaboration good enough in the healthcare arena?*

**Ehrenfreund** — We are working with the United Nations in that case. We have a satellite crisis management team close to Munich. And they deliver immediate data to the UN when it's requested.

**Moeti** — We could probably use the data better if we understood where within the UN this data could be available. For example, I'm interested in data that would help predict disease outbreaks that might occur because of climate trends, weather pattern changes and the like. We could use something like that in a forward-looking way, in order to help countries prepare for and plan for shifts in the patterns of diseases.

I'm sure that more data on urban areas could also help. Let me be frank – we were caught by surprise by the outbreak of yellow fever that very soon spread to urban areas in Angola and the Democratic Republic of Congo. Everybody was petrified when we realized that the thinking about yellow fever and the strategy for prevention, at least in the African region, was based on how people were living 20 years ago.

We did not take into account the type of ecology that has evolved over the years with the rapid urbanization in African countries combined with the trends in the climate, which together have combined to really create a good environment for unusual patterns and unusually severe outbreaks of diseases like yellow fever and dengue. I think that having a better understanding of where such predictive data might be available, which you might have and could help with use in the UN and also, then, in the countries, would be helpful.

*So maybe I can ask a politician: How can technology be better applied to healthcare problems?*

**Delgado** — It's not an obvious thing but the health information system is technology, perhaps not applied to treatment but applied to knowledge. In Portugal, we are very, very focused on this because we think that the more access patients have to treatment and to their medical records the better.

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*“Quite often, people love to have the most advanced device, but we tell them it's not always a good idea.”*  
 —

**DR. YUKIYA AMANO**  
 Director-General | International Atomic Energy Agency | Austria



Our idea is to develop a national health service application. If you have a medical emergency you need to go to an emergency room, for instance: In Lisbon we have four. You can use your phone to see which one has the shortest waiting time. You can check waiting lists for surgery, waiting times for a patient consultation, all on your phone or computer.

Another idea we implemented recently is the prescription of drugs without paper. The doctor inputs the data directly into a computer and the patient receives an identification number. With this identification number he can go to any pharmacy and collect the drugs he needs. So it's more safe and eliminates corruption.

*Dr. Ehrenfreund, are scientists listened to in the political realm? How can researchers make more of a contribution to the public debate?*

**Ehrenfreund** — I think that scientists are always trying to find new ways of defining new research avenues, but what they need is, of course, support for grants. You can trigger research in a particular direction when you have special funding nationally but also from the EU or other organizations.

*And where does that funding need to be? What are the main crises that need to be addressed right now by the public health community?*

**Amano** — I would say that there is too little attention to cancer. There is this perception that this is a disease that just affects people in developed countries. This must be corrected. We want to promote more training and cooperation, perhaps using satellites and IT to get doctors in African countries connected to their colleagues or Canada, or Sweden in the form of virtual universities or educational programs from the IAEA.

**Ehrenfreund** — At the DLR [German Aerospace Center], we are not directly involved in healthcare as such, but I want to make a real call for basic research. You need this kind of research in order to have radical innovations. We can only achieve real breakthroughs when we are not too program-oriented.

I know this, from having previously led a research funding organization: In medicine, you need to fund the whole innovation chain in order to be successful.



**Delgado** — It's true that in developing countries they have no antibiotics, but in Portugal right now it's the excessive use of those that is a big problem. At the moment, some hospitals present mortality rates from infections that are higher than 10 years ago. The situation is so bad it's become a political issue. The challenge for industry is to develop new antibiotics. But the companies say "well, it's important, but there's not enough profit there – we need public investment to develop new antibiotics."

**Moeti** — I think antibiotic resistance is even more dangerous for low-income countries. As these antibiotics become ineffective in the wealthier countries, the market reasons for continued production disappear, which means that developing countries no longer will have access to effective antibiotics. Some of the most common antibiotics are simply not available.

Policy-makers are starting to think about some sort of global partnership, to create the incentives for pharmaceutical companies to invest in the research and development of new antibiotics.

Then there's the issue of counterfeit or low-quality drugs, which are frequently on sale in low-income countries all over the world. So again, there is demand for research and development to find solutions to this counterfeit drugs problem.

*And then investment in a time of austerity and pressure on funding, you're asking for basic science funding, you're asking for a very applied use. Is that going to come from taxpayers and governments?*

**Delgado** — It's very difficult to have a solution for this. The question for the industry is very easy to understand: If we use drugs and technologies without any kind of control, at a certain moment, the system goes broke. But if we use these technologies with control, with health technology assessment, all sides benefit – the governments, the patients, and the industry too. It's much more sustainable to manage care. It's a compromise.

*That kind of rationing can be politically unpopular. Patients want unlimited access to whatever care they might want or need.*

**Delgado** — It is not a good idea to have free access to health providers. We prefer a national service, free for everybody, but with some limits. If you have a disease our



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*“Developing countries no longer will have access to effective antibiotics.”*  
 —

**DR. MATSHIDISO REBECCA MOETI**  
 Regional Director for Africa | World  
 Health Organization | Botswana

system treats you, independent of the level of complexity or gravity of this disease. But we cannot use all kinds of new technologies before an agency assesses their effectiveness.

*So restriction and control should be based on efficacy, not cost? What if there were a fantastic new technology that was very expensive but better than the old technology?*

**Delgado** — Last year, a new drug for the hepatitis C virus was approved. For each treatment, the initial proposal of the industry was a significant amount per patient to cure hepatitis C. Not to manage, but to cure. The government negotiated directly with the company in order to bring down the price.

**Moeti** — So you have to go off the record.

**Delgado** — I can tell you we decided to negotiate, for the first time in Portugal, risk-sharing between the government and the company. We pay for the treatment, but only if the patient is really cured. And we have a simultaneous control made by the government and the company in order to define that with laboratory tests. If it works, and we pay for 98% of the patients, the company stands to earn so much.

**Moeti** — That's interesting.

*Dr. Amano, when you're proposing a country buy a very expensive radiotherapy device, what are your cost-benefit analyses?*

**Amano** — We are not proposing very expensive equipment. Quite often people love to have the most advanced device, but we tell them it's not always a good idea. For example, for linear accelerators, if their electricity is not stable it doesn't make sense to buy very advanced ones.

But we do not recommend starting from zero. Nowadays, medical treatment is very advanced and nuclear medicine is advanced, so why not start using the experience of other countries? All people should be entitled to the best possible care. What is important is suitable, quality and effective care, including cost-effectiveness. So the technology must be reasonably advanced, but there is no need to aim at the most advanced, most expensive thing. For example, in Japan,

heavy particle treatment is very effective for brain tumors, but the equipment costs €300 million. There are very few countries who can afford this. However, a €1.5 million machine can provide effective treatment for thousands of patients over many years. But in the end, it's the country that decides.

**Moeti** — I was very interested in the question that Secretary Delgado raised about negotiating with pharmaceutical companies and the need to keep that information confidential. There is a strong drive from our region for transparency and information sharing about pharmaceutical prices. Joint negotiation with the pharmaceutical companies – so that you don't find this one here paying a price very different from South Africa right next door to each other – seems like a good idea. What could be the role of inter-country joint approaches? The more countries that can join in at affordable prices, the more the market is growing. I think it's a very interesting possibility.

*Dr. Ehrenfreund, what about basic research? In light of the problems the world faces, is it worth spending money on discovery-based science?*

**Ehrenfreund** — There is huge value in space and also basic research. When we conduct experiments on the international space station, we have some main questions which we want to answer, and sometimes the results are very new and unexpected. We have new findings on osteoporosis because of bone loss in microgravity and weightlessness. We have new insights into cardiovascular diseases and the orientation of the eye. And you have certainly also heard that there are microbes which get very virulent in space.

On the International Space Station, there are a lot of radiation studies. And you can extrapolate from those results for cancer therapy on Earth. That also applies to technology, too – robots which we use in space can actually then be used for medicine here on Earth. But we also looked at the spatial orientation of astronauts in zero gravity with a 3D eye-tracking device that is now used in laser surgery for eyes.

What I'm saying is there are a lot of spinoffs and unexpected results from basic research. So you should not forget that there is a whole universe of fantastic, unexpected new findings out there which can be linked to research on Earth and help healthcare on our planet too. ■





# Infectious Diseases

From age-old nemeses like malaria and tuberculosis to modern adversaries like Zika and Ebola, communicable diseases are one of the greatest challenges the public health sector has to face. The consequences of failure are tremendous: 2014's Ebola outbreak cost an estimated US \$1 billion to bring under control.

The solutions, experts say, are within our grasp: Funding is needed for new vaccines, education programs to emphasize the importance of hygiene, and international coordination to deal with disease outbreaks promptly.

A broader perspective is needed: "When we think about infectious disease, we have to get out of the biomedical model and talk to economists, geologists and sociologists," said Peter J. Hotez, President of the Sabin Vaccine Institute. "It's not easy for us to do so because in the medical world we're quite siloed."



## OVERVIEW

# LESSONS LEARNED FROM EBOLA TO ZIKA

**Infectious diseases remain a challenge. The Ebola crisis was a wake-up call for better preparedness. Improved prevention measures will be costly, but are a bargain compared with projected annual losses on the order of US \$30 – \$50 billion.**

The Ebola crisis was not only a humanitarian tragedy, but also the straw that broke the camel's back and led politicians and economists to refocus not only on humanitarian issues, but also on financial impacts. Expert groups were gathered to develop new ideas targeted at nullifying or at least reducing the risk of pandemics. It was generally agreed upon that increasing urbanization and globalization significantly enhanced the risk that a local outbreak progresses into an endemic with risk of a pandemic if countermeasures are not taken immediately. In these calculations, not only were direct costs for diagnostics, drugs, vaccines and medical care considered, but also indirect losses due to leave of absence, illness or disability and even losses in trade, transportation and tourism. A common theme was active prevention, which was identified as the most cost-efficient option. Different reports calculated an average annual loss of US \$30 to \$50 billion due to new pandemics. The rather short pandemic caused by the severe acute respiratory syndrome (SARS) virus in 2003 alone accounted for some US \$54 billion in losses. Today, a pandemic of the size of the Spanish flu of 1918, with some 50 million deaths when the global population was less than 2 billion people, would amount to an estimated US \$3 trillion and a 5% decline in the worldwide gross domestic product (GDP). Over time, the idea of infectious diseases as being of both human and animal origin has also gained increasing awareness. In the past, some 70% of all newly emerging pathogens have jumped from animals to humans.

## THE "NEW" CULPRITS

The Ebola endemic was virtually restricted to three West African countries – Guinea, Sierra Leone and Liberia. The few cases that had occurred up to the end of 2013 were more or less ignored. After all, small Ebola outbreaks had come and gone before. However, this time things were different. Towards the end of 2014 more than 20,000 people had fallen ill and nearly 8,000 had died. The incredible engagement of non-governmental organizations, notably Médecins Sans Frontières (MSF), together with local health workers, prevented the worst. As late as August 2014, the World Health Organization (WHO) declared a global health emergency – too late for rapid termination of the crisis. In January 2016, when almost 30,000 people had fallen ill and almost 12,000 people had died, the WHO finally claimed the region Ebola-free. Financial losses for the area amounted to more than €1 billion and a 12% decline in GDP. Despite the inherent fear that the endemic could turn into a pandemic, this worst-case scenario was prevented. Of course a vaccine would have been a game-changer, and indeed some candidates had been developed in the aftermath of 9/11 under the umbrella of the US biodefense program. Yet, these vaccine candidates could not be pushed through the clinical pipeline because of the absence of disease. Only towards the end of the Ebola outbreak in 2015 did a clinical efficacy study which showed promising results become possible.

Soon a new disaster emerged. The Zika virus had entered Latin America. This virus is transmitted by Aedes mosquitoes. In contrast to the Anopheles mosquitoes responsible for transmission of malaria, the Aedes mosquitoes have adapted to urbanized areas. Because they are quite resistant to pollution and cold temperatures, they have spread from tropical and sub-tropical areas to the Middle East, India, the southern parts of the US and Europe. Although the Zika virus was identified in Uganda in 1947 and appeared in sporadic outbreaks in subsequent decades, it was more or less ignored because in most cases infection produced only mild symptoms. During its 2015 and 2016 spread throughout Brazil and some other 30 Latin American countries, it soon became clear that the Zika virus can cause neonatal microcephaly when it infects a woman during pregnancy. This time, the WHO reacted promptly, calling a global health emergency at the end of January 2016. By March 2016, around 1.5 million suspected or real cases of Zika disease and some 4,000 cases of microcephaly had been recorded in Latin America, with the majority in Brazil.

In parallel and more or less unrecognized, another viral pathogen, which is also spread by the Aedes vector, emerged. The dengue virus is responsible for at least 100 million cases of illness and 20,000 cases of deaths annually. A dengue vaccine has been licensed in Mexico, the Philippines and Brazil very recently which, although not perfect, provides some hope that this disease can be brought under control. Although a Zika vaccine is not yet on the horizon, the Zika virus belongs to the group of Flaviviruses. Together with dengue, these viruses also cause yellow fever, FSME and Japanese encephalitis. For all these diseases, vaccines have been developed. So a blueprint for the development of a vaccine against the Zika virus is already available. The fact that the availability of a vaccine does not prevent outbreaks as long as it is not widely used has been re-emphasized by the recent outbreak of yellow fever in Luanda, Angola's capital. There, yellow fever has rampaged since December 2015 with some 500 confirmed cases and 200 deaths so far. By now, some 6 million people have been vaccinated against yellow fever in the Luanda area with the hope that further spread can be prevented. However, the vaccine stockpiles are almost empty, emphasizing the need for international vaccine stockpiling.

## THE "OLD" CULPRITS

The dengue pandemic reminds us that in parallel to newly emerging diseases, existing pandemics are equally threatening and cannot be ignored just because they have been around a long time. Notably, the three major killers – tuberculosis (TB), Acquired Immunodeficiency Syndrome (AIDS) and malaria – are responsible for millions of infections and deaths. With a morbidity rate of 9.5 million and a mortality of 1.5 million in 2014, TB remains a global threat which is further exacerbated by increasing

occurrence of multidrug resistance. In 2014, the human immunodeficiency virus (HIV) infected some 2 million individuals, causing 1.2 million deaths. In 2015, there were roughly 214 million malaria cases, leading to nearly 450,000 deaths. It has been estimated that the increasing incidences of drug-resistant TB, malaria and AIDS will cause financial losses in the order of US \$100 trillion over the next 35 years. An efficient vaccine is neither available for AIDS nor TB, and the recently licensed vaccine against malaria is far from satisfactory.

## WHAT NEEDS TO BE DONE?

The world needs to be better prepared for infectious diseases. Newly emerging diseases need to be recognized and countered immediately and existing infectious threats need to be combatted more rigorously. One study proposed investing some US \$4.5 billion per year, split into US \$2–\$3 billion for early surveillance and counteraction; US \$1 billion for research and development and US \$150 million for establishing and sustaining these activities. Compared with estimated losses of US \$30–\$50 billion annually due to infectious disease outbreaks and pandemics, that sum looks like a bargain. The major activities to be put immediately into effect include:

- Functional clinics and basic medical care, including better vaccination and hygiene programs
- Global organization and stockpiling of intervention measures
- Global surveillance to rapidly identify emerging hotspots, ideally before the epidemic starts
- International centers for global health security measures
- Strengthening of research and development for novel medicines and interventions

Only if we learn our lesson from the Ebola crisis will we be better prepared for the next outbreak. ●



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## ESSAY

# FLIPPING THE ACCESS MODEL TO INNOVATION

**Recent epidemics have shown that infectious diseases know no barriers and cross international borders with impunity. Immunization programs are critical to improve our response system to these outbreaks, but the vaccine access model to innovation needs to be flipped to reach those in greatest need. We must work together to develop more equitable access models to innovation.**

The 2014 Ebola epidemic in West Africa and the recent Zika epidemic are painful reminders of the dreadful toll infectious diseases can take on populations and economies. They have shown that countries are not well prepared to respond to global epidemics caused by emerging pathogens. Though a global collaborative effort has allowed us to move from having no vaccines against Ebola to several candidate vaccines, the Ebola crisis should serve as a wake-up call that we need to change the access model to innovation.

Immunization programs are not only critical to improve our response system, but are also one of the “best buys” when it comes to public health and socioeconomic development. Vaccination is the most cost-effective healthcare intervention after the provision of safe drinking water and sanitation. In order to secure the highest public health and economic impact, vaccination programs should reach those in greatest need through broad programs implemented in the shortest time possible. This requires challenging the conventional vaccine introduction model.

In this model, innovation is steered by the medical needs of wealthier countries which can afford the launch prices necessary to finance and incentivize both innovation and production scale-up. As a consequence, new vaccines are

launched first in developed markets in small volumes and at a competitive price, and made available in low- and middle-income countries (LMICs) significantly later (i.e., 8 to 10 years) at a lower price once the innovation cost has been recouped. Access in poorer countries thus tends to be delayed, and diseases which affect these countries only – such as Ebola, Chikungunya, dengue or Zika – are often neglected.

## DENGUE

Dengue fever – for which half the world is at risk, mainly in LMICs – propelled Sanofi to adopt a new access model to innovation. Dengue is a serious and complex disease which mainly affects sub-tropical and tropical regions, and which is associated with a substantial socioeconomic burden at both individual and societal levels. The incidence of dengue has surged 30-fold over the last 50 years, amplified by globalization, urbanization and climate change, but the true scale of the disease burden is likely underestimated. According to some estimates, the dengue burden can be twice as high when considering the broader impact of dengue on productivity loss, decrease in foreign investment and losses in revenues from tourism.

The Sanofi dengue vaccine – a live, attenuated, tetravalent vaccine – is the only vaccine that has demonstrated

evidence of clinical efficacy against dengue in clinical studies (40,000 individuals enrolled in 15 countries). It has been licensed in five countries as of July 2016 (Mexico, the Philippines, Brazil, El Salvador and Costa Rica) and has been recommended for use by the Strategic Advisory Group of Experts (SAGE) on Immunization of the World Health Organization (WHO).

## POPULATIONS AT GREATEST RISK FIRST

The dengue vaccine, already launched in the Philippines, is having its initial introduction in LMICs where the need is the greatest and where it can have the greatest impact on global dengue burden. Sanofi is introducing the vaccine in both the public and the private sectors so as to ensure broad access and highest impact from registration on. To achieve this, the company is valuing the vaccine in a way that balances the cost of innovation against affordability in these LMICs.

## A BOLD AND EARLY ENGAGEMENT

Twenty years ago, long before the results of phase III clinical trials and the vaccine launch, Sanofi committed to the fight against dengue through an unprecedented investment of resources in scientific, technical and industrial capabilities. The company acknowledged the magnitude of the dengue challenge at its early stages and made a bold and uncommon decision: It took the risk to develop the vaccine, invest in industrial capacity and prepare market launch all at the same time, rather than as a sequence as is usually the case.

Sanofi committed substantial financial resources to dengue, including a €350 million investment in a dedicated state-of-the-art production plan in Neuville, France. This major investment allows the company to produce around 100 million doses per year, and to supply one billion doses over 10 years. Thanks to this early – and risky – engagement, Sanofi already has doses available at the time of licenses, thus avoiding a time lag between licensing and implementation.

## PAVING THE WAY FOR THE INTRODUCTION OF FUTURE VACCINES

A successful introduction of the dengue vaccine would demonstrate to other private sector companies that the dengue business model is attractive, and encourage sustained investment in healthcare innovations for LMICs, while improving the response system to dengue outbreaks. Dengue could serve as a model for the introduction of new vaccines which will be implemented through broad vaccination programs.

The dengue access approach has also created social value at local level through the strengthening of in-country skills and capacity and the building of public-health col-

laborations. In endemic countries where the clinical trials were conducted, Sanofi has developed strong cross-sector collaborations, empowered local healthcare providers with disease and vaccine knowledge, trained communities at risk on dengue prevention and upgraded healthcare facilities. This should facilitate future vaccine introductions.

Today, Sanofi is building on its successful history in developing vaccines against dengue and other similar flaviviruses (yellow fever, Japanese encephalitis), to answer the global call to action to fight Zika. Sanofi's expertise and established R&D and industrial infrastructure for the dengue vaccine is being leveraged to better understand the spread of the Zika virus and to expedite the identification of a vaccine candidate. It is, however, critical to underline that Sanofi cannot solve this alone; we need governments, international organizations, academia and industry partners to collaboratively work on a Zika vaccine development project.

## MOVING FORWARD TOGETHER

Because infectious diseases such as Zika know no barriers, common protocols and approaches are needed to promote investment and to prevent and cure diseases. When there is an immediate and guaranteed market, companies have an incentive to invest fast, but when the opportunity is longer-term and more uncertain, society flounders when struggling to come up with solutions. Populations, however, cannot wait 20 years for an essential cure. Diseases do not pause for us to get the access model to innovation right: not addressing this fundamental challenge fast enough is putting entire populations at risk. We thus need to develop more equitable access models to innovation that do not forgo long-term societal value for short-term returns. Let's think of it as life insurance: Paying a premium today will allow protect ing populations who need it most in the long term.

More innovative access models such as the one introduced by Sanofi for dengue are needed to allow LMICs timely and sustainable access to innovative vaccines and to improve the response system to outbreaks. Close international and cross-sector cooperation is vital to support an integrated approach to infectious diseases and to fight the global threat they represent. To go far, we must go together. ●



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## ESSAY

# EBOLA TO ZIKA: AREAS OF ACTION

**Recent outbreaks of Ebola, Zika and yellow fever have highlighted vulnerabilities and weaknesses in the way the global health community responds to these threats. The Institut Pasteur International Network is working, with other international partners, toward improving preparedness and response to infectious disease outbreaks and proposes the following actions to address these issues.**

Here, I outline three major areas of action that will help prepare for infectious disease outbreaks and what the Institut Pasteur International Network (IPIN), composed of 33 research institutes in 26 countries and five continents, is doing to address these issues.

## **ACTION NEEDED – BETTER PREPAREDNESS AND COORDINATION DURING PUBLIC HEALTH EMERGENCIES**

Changes in ecosystems, due to changes in human behavior and encroachment on the natural habitat of animals, changes in land use and food and agriculture systems, and the impact of climate change on animal and vector environments have given rise to an apparent increase in the number of outbreaks of emerging and re-emerging infectious diseases, often in somewhat new and unexpected geographic locations – H1N1pdm09 influenza virus in North America, Ebola in West Africa, and the Zika virus in Latin America and the Caribbean.

The reality is that infectious disease outbreaks will continue to occur and we are currently unable to accurately predict when and where they will occur. The challenge therefore lies in improving preparedness and responses to infectious disease outbreaks in order to minimize their impact. That is, improving surveillance and monitoring of not only human populations, but also animal populations and the surrounding ecosystem, in order to be able to quickly detect, monitor and characterize emerging threats. This needs to be accompanied by rapid evaluations of the potential impact of an outbreak and of

the effectiveness of possible control strategies. It is also urgent to further develop, improve and/or render accessible relevant and diagnostic tools, including rapid tests, point-of-care tests and tests enabling us to discriminate easily among different pathogens often giving rise to similar syndromes.

The IPIN institutes have proven their technical capacities in preparing for and responding to infectious disease outbreaks with a One Health approach. As I write this, scientists of IPIN in Dakar, French Guiana, Brazil, Guadeloupe and Paris are actively working in the affected countries with WHO and others on Zika to develop accurate and rapid molecular and serologic diagnostic tests and vaccines, evaluate vector competence and control options, develop and implement standardized epidemiologic studies to better understand the diseases Zika causes in adults and fetuses of infected mothers as well as the transmission dynamics. Similarly, colleagues from Cambodia, Cameroon and Paris are actively investigating outbreaks of H5N1 in poultry, while others from Dakar and Paris are on the front lines of the yellow fever outbreaks in Africa.

On the preparedness side, IPIN is active in 30 African countries to improve laboratory detection and effective surveillance, with training of African scientists and public health workers as a major component. International collaborative projects have provided support to train African scientists for the detection of hemorrhagic fever viruses in eight countries, as well as to set up surveillance systems for respiratory viruses.

Building on the expertise of IPIN and on the Laboratory for Urgent Response to Biological Threats, as well as on dozens of reference centers (national-, regional-, WHO-collaborating-, OIE-reference-, hosted in IPIN Institutes), the Center for Global Health has established the Institut Pasteur Outbreak Investigation Task Force (OITF). Upon request from a Ministry of Health or WHO, the OITF calls upon experienced interdisciplinary teams of IPIN scientists to be rapidly deployed to support investigations of outbreaks. Our aim is to better understand emergence and transmission patterns, to limit further spread in human populations, to improve emergency response management, to enhance preparedness, to contribute to the development or improvement of efficient diagnostics and to advance global understanding of emerging and re-emerging infectious diseases.

## **ACTION NEEDED – BUILDING AND MAINTAINING CAREERS OF SCIENTISTS, MEDICAL PRACTITIONERS AND PUBLIC HEALTH PROFESSIONALS**

The Ebola outbreak in West Africa highlighted not only the dramatic consequences of poor preparedness and weak health systems, but also the shortage of trained personnel and laboratory-based capacity in areas such as surveillance, diagnostics and medical care. We strongly believe that education and training are critical to strengthening capacity in a way that improves local responses to detecting, monitoring and managing public health threats.

The IPIN has long-running experience in educating and training scientists, medical practitioners and public health professionals throughout the world through undergraduate, Master's and doctoral programs that are strongly anchored in national educational systems. This is complemented by specific fellowship, post doc and early career placements within the IPIN institutes designed to further professional scientific development in the countries which need this most.

The Institut Pasteur is launching a new educational initiative: the Pan-African Coalition for Training (PACT) in Research and Public Health. This multi-country, multi-partner initiative builds on the existing educational and training activities of the IPIN. The long-term establishment of IPIN institutes in Africa will provide stability and opportunities for lifetime careers for local scientists and practitioners, but we have also developed strategic partnerships with key African players.

## **ACTION NEEDED – ENTERING THE DIGITAL SCIENCE AND MEDICINE ERA**

The genomics revolution has allowed enormous progress in gene sequencing and molecular detection capacity, as well as possibilities for personalizing medicine. While this puts scientists at the forefront of the “omics” revolu-

tion, it has also highlighted the need for enhanced big data capacity and analysis.

The Institut Pasteur Global Health Genomics Center (GHGC) is currently developing a specialized, cloud-based platform dedicated to data storage, sharing and analysis, while samples are collected, referenced and kept in local biobanks under well-standardized procedures. Local resource hubs throughout the IPIN will enable remote access to data and the translation of data-intensive biomedical research to clinical practice across the IPIN, enhancing capacities to respond to infectious disease threats. The GHGC also offers a training and education framework with a particular focus on bioinformatics, biostatistics, computational and modeling skills (also part of the PACT initiative).

## **MOVING FORWARD AND WORKING TOGETHER**

We have learned that we have to invest in the younger generation of scientists by providing not only robust education but opportunities for post-graduate research and employment. We have also learned that it is essential to organize surveillance systems with ministries of health and veterinary services, as well as to help laboratory networks to communicate more efficiently on i) actions in the field, ii) training actions, and iii) establishing an easy, fair and transparent way of sharing samples and data during outbreaks.

We know that infectious disease outbreaks are inevitable and recognize there are many obstacles to effective management and response when they occur. We believe that improving actions across these four areas is essential to being better prepared for and able to respond more effectively, and that it takes a global community to do so. The IPIN is committed to working in partnership with multi-sectorial partners, including the WHO, OIE, the Food and Agricultural Organization, academic, research, public health and industry partners to achieve these major challenges of our era.



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## ESSAY

# LESSON LEARNED: FROM SYRIA TO EBOLA

**Improving access to healthcare in fragile environments of conflict, displacement and disaster is an urgent global challenge that goes far beyond the simple humanitarian imperative and demands concerted action on numerous levels.**

Health care – in all its many aspects – is a major casualty of war and other situations of violence in many parts of the world today. Constrained access to emergency and basic healthcare services just when they are needed the most is one of the main problems facing many millions of conflict-affected people, and one of the main concerns of humanitarian organizations such as the International Committee of the Red Cross (ICRC).

Direct attacks on healthcare facilities and ambulances, which kill or wound staff and patients, are one part of the problem. The airstrike on the ICRC and MSF-supported Al Quds hospital in Aleppo, Syria, in April 2016 is just one example. It killed at least 49 civilians and six staff members, including one of the last paediatricians in the city, and destroyed vital equipment and drugs – an immeasurable loss to the many people for whom the hospital was a lifeline. In Syria alone, 63 MSF-supported hospitals and clinics were bombed or shelled on 94 separate occasions in 2015, destroying 12 facilities. And Syria is by no means singular: the ICRC documented almost 2,400 attacks against healthcare (personnel, facilities, transport and patients), by a range of perpetrators, in 11 countries over three years up to December 2014.

Beyond the impact of specific incidents, the general insecurity and disruption created by armed conflict or violence, while hard to measure, undoubtedly has a massive impact on the provision of, and access to, impartial healthcare. Even where healthcare facilities are functioning, albeit barely, reaching them may be fraught with dangers – and fear. Obstacles and threats directed by

states and by non-state armed groups at health workers and humanitarian organizations that are seen to help “the other side” impede access for entire communities in need of vital medical care. Furthermore, the crippling loss of health professionals has compounded the humanitarian crises in countries like Syria, Iraq, Yemen and many others. More than half of Syria’s doctors are reported to have fled or been killed (in opposition-held parts of Aleppo the toll is as high as 95%).

Moreover, the generally protracted nature of armed conflict and armed violence, which is increasingly concentrated in urban areas, is in many cases causing the collapse of healthcare systems, together with other vital infrastructure and public services, reversing development gains previously made. The inability of such weakened systems to absorb new shocks – even years after conflicts have ended – was made painfully clear during the Ebola pandemic, chiefly in Liberia, Sierra Leone and Guinea. With healthcare systems largely incapacitated and coping mechanisms overstretched, millions of already vulnerable people were at potential risk.

In armed conflicts, as in pandemics such as Ebola, vast numbers of people suffer and die not only from the direct effects but also because they are unable to access medical care for diseases or illnesses that could otherwise be treated or prevented altogether.

Women and children are impacted the most. More than half of preventable maternal deaths and deaths among children under five occur in fragile settings of conflict,

displacement and natural disasters. Worldwide, women and children are up to 14 times more likely than men to die in a disaster. And in an alarming number of cases, women and girls are deliberately targeted as a tactic of warfare, subjected to horrific sexual violence and other injury, with grave consequences for their psychological and physical health.

In Syria, as in many other countries suffering armed conflict, women lack access to appropriate healthcare services during pregnancy and childbirth, either because they are unavailable or because it is too dangerous or difficult to reach them. As a result, many women are giving birth without any medical assistance – presenting huge health risks to mothers and babies.

Infants who survive the early days after birth are in many cases exposed to further health risks because of the disruption of routine immunization programs. In Syria, polio has made a comeback after being eradicated in the 1990s, as well as deadly diseases like measles and meningitis.

Women and children were also disproportionately impacted by the Ebola crisis. Barriers to access and weakness of health systems – exacerbated by years of armed conflict and insecurity in the three worst affected countries – meant that maternal and reproductive health services were fragile even before the outbreak, making maternal mortality rates among the highest in the world. Pregnancy was shown to make women even more vulnerable to the disease, yet in many cases health workers afraid of becoming infected refused to deliver post-natal and delivery care. Furthermore, as healthcare resources became ever scarcer, diseases such as malaria, HIV/AIDS and tuberculosis were in many cases left untreated, claiming yet more lives.

Meeting the massive and complex challenge of constrained access to healthcare in armed conflicts or other emergencies requires action on multiple levels by a range of stakeholders. One of the main problems in armed conflicts is a widespread lack of respect for the rules of international humanitarian law (IHL) by states and non-state armed groups, specifically the rules related to the protected status of the medical mission, and those governing humanitarian access to populations in need. Violence against healthcare facilities and personnel is clearly illegal under international law, while the wounded and sick – combatants and civilians alike – must be spared further suffering during armed conflict and receive timely assistance. In situations of violence other than armed conflict, international human rights law stipulates that states must refrain from deliberately withholding or delaying healthcare to the wounded and sick in life-threatening circumstances, and that everyone has the right to access essential healthcare facilities and services on a non-discriminatory basis.

The real challenge is preventing violations from happening in the first place. While primary responsibility for this issue lies with states and with combatants, national legislators and courts must also fulfil their responsibilities of ensuring that domestic legislation recognizes the criminal responsibility of those who violate IHL, and of actually enforcing such legislation. Perpetrators of violations must be held accountable. The performance and behavior of humanitarian organizations and healthcare workers themselves is also critical. Securing acceptance for their work from all communities and political and military groups is essential to being able to work in sensitive and volatile contexts. This requires a clear demonstration of impartiality: the provision of healthcare based exclusively on humanitarian needs.

In countries where health systems are already fragile and access to healthcare is constrained under normal circumstances, sudden crises – such as the Ebola pandemic – can be devastating. The need for long-term investment at national and international levels to reinforce basic public health systems before disaster strikes is imperative. The most vulnerable should be prioritized, with maternal and infant health at the top of the list.

The Ebola outbreak also put into sharp relief the need to better boost the resilience of communities affected by multiple crises, as well as the need for humanitarian organizations – including the ICRC – to better anticipate and prepare for such crises.

Universal access to healthcare is a fundamental prerequisite to ensuring health and well-being for all, as aspired to by the Sustainable Development Goals. Achieving this will require innovative thinking, bold new approaches, and a major concerted effort across sectors. For the ICRC, this means better collaborating and co-creating innovative solutions with increasingly diverse stakeholders – including certain states, the private sector, civil society organizations, academic and policy centers and many more. Partnerships, as well as principles and preparedness, are absolutely vital. ●



Author  
**DR. YVES DACCORD**  
Director General | International  
Committee of the Red Cross (ICRC) |  
Switzerland



## INTERVIEW

# “We simply don’t know enough”

Rolf Zinkernagel is Professor Emeritus of Immunology at the University of Zurich. In 1996, he was awarded the Nobel Prize in Medicine for his research into the way the body’s immune system recognizes cells infected with viruses. The discovery advanced clinical efforts to strengthen the immune response against invading microbes and certain cancers. It also aided in research on autoimmune reactions that cause diseases like multiple sclerosis and diabetes.

*What has the international community learned about infection from Zika, and what are the differences in terms of detection and the potential for a vaccine compared to Ebola?*

**Zinkernagel** — The difference is very simple – Ebola kills you in five to seven days. One is the acute, lethal type. Lots of classical infections belong to that category – measles, polio, smallpox, bacterial tetanus, diphtheria, and so on. If you don’t survive these infections you are out of the evolutionary circuit: All these diseases hit you before puberty. If you don’t have a good immune response against these acutely lethal types, you’re dead.

There are many more infections that do not harm the cells in which they grow. If a cell is infected with a virus that doesn’t destroy the cell, there is no clinical sign. In effect, it isn’t there as far as the immune system is concerned. Examples of that type are hepatitis B, hepatitis C and HIV.

Many of these viruses are transferred from the mother to the newborn at a time when the immune system doesn’t work. There’s no immune response, and the offspring doesn’t die: It survives at least 30 or 40 years. The infected person will eventually develop liver cancer because of the infection, but that doesn’t interfere with reproduction. And in biology, that’s all that counts.

We don’t quite know whether the Zika belongs to that second category. After all, it hangs around for a long time, it doesn’t kill the mother, it doesn’t kill the offspring, and it seems to jump from mother to the offspring.

*What about before birth? Because the changes from Zika affect fetal development in the womb.*

We just don’t know enough at the moment. There are very, very few viruses that interfere with developmental processes. It’s actually a field that is almost unexplored.



*Do we know enough for you to be able to say something about the vaccine potential for Zika?*

No. We simply don’t know enough. What is important is if it is neutralizing antibodies. There are some indications that this might be the case, and then it should be reasonably possible. What we don’t know yet is how variable Zika virus is. Take influenza – the influenza virus changes the key protective surface deterrents every year or two. Other viruses – and all parasites, not just HIV or malaria – change these key protective deterrents every few weeks. So

even if you make a neutralizing antibody response, three weeks later or three months later this is not worth anything because the virus or parasite has shifted its shape. We don’t know these things about Zika. So far, from the viruses to which that virus seems to compare, it would be a surprise if the virus were so variable. It’s a reasonable guess a vaccine is possible, but the evidence isn’t there.

*Turn the clock back two or three years to the virus of the moment. Back then it was Ebola. What’s the status of the science there?*

Very easy. You know, if it’s not a serious health problem then nobody cares. This was certainly the case with Ebola. Ebola had been known for quite some time, but never recognized as a big problem. And once an infection like this starts, there are always two types of measurements to deal with it. One is the purely hygiene prevention-type of measurements, which was the big problem with Ebola. Then come all the rest like looking for protective drugs and vaccines.

*What’s the evolutionary strategy of a virus like Ebola that kills everybody in five days?*

A virus that did that would be too successful. It would kill itself. But that never happens. Both sides have to find a balance, which we call co-evolution.

**“Viruses depend on our unreasonable behavior to spread, and we are only too happy to provide that to them.”**

**PROF. DR. ROLF ZINKERNAGEL**  
Emeritus | Institute of Experimental  
Immunology | University of Zurich |  
Switzerland

*Does that happen in the case of Ebola, for example? That’s something that springs from another species, potentially, and hasn’t had time to co-evolve.*

In the 14th century, smallpox came from the east to continental Europe. Smallpox is about as lethal as Ebola. In some cities, 90% of the population was killed in the first round. The reason for that is the virus is very cytopathic: It kills many cells of the host and the host dies. But even smallpox never killed all Europeans, and the reason is very simple – the infection needs a certain population density to spread. Therefore it’s no wonder that smallpox, and also Ebola, really got off the ground in urban areas.

Even in the 14th century, smallpox hit areas where the population density was very low and very few people actually got infected. So there are many aspects that regulate the aggressiveness of the infection, like the population density and culture.

*So there’s sort of a perfect match between them?*

Eventually. The same Ebola in a rural, spread out area wouldn’t have impacted people as heavily as it did in the urban areas. However – and now comes the but – hygiene, education or social structure can play a role too. That was the case or is the case in these parts of the world where family members and friends hug the dying person, which is an ideal occasion for Ebola to transfer.

*So what would you say we can learn from these two cases?*

I think that ultimately there is nothing new. Acute lethal infections, which we by experience called childhood infections, need to be controlled, and the most efficient way to do that is by vaccines and hygienic measures. It’s very simple.

Then there are all the infections that don’t kill you in seven days but kill you in 20 years. Those basically are very difficult to control because the immune system cannot normally deal with them. Once you’re infected and you’re a carrier of the virus, you cannot make a post-infection vaccine to get rid of the virus. Zika is a little different: So far we haven’t had to deal with an infectious agent that has a direct impact on fetus or embryo development, so that is new.

*Is Zika comparable to herpes? In other words, you could be infected and get over it, but still be a carrier and always compromised in terms of whether you might pass it on to your offspring.*

With all the herpes viruses, you usually get infected when you’re young. You control the infection but you never get completely rid of the virus. There’s a very low-grade infection somewhere. Herpes viruses are always persistent in nerve cells and don’t seem to interfere with functioning of the cells, which we just don’t know yet with Zika.

*Are we paying enough attention to Zika? Is it too much? How big of a problem is this really, and are we responding appropriately?*

I think that’s too difficult a question for me. We need simple epidemiology of the classical type: When does it happen? Where does it happen? How is it transmitted? When is transmitted? Where does the virus hide? When does an infected mother transfer to the offspring? Is it during a certain phase of the mother’s infection or can it happen once and then she’s infected all the time? These are all simple questions, but so far we don’t know the answers.

*So what do we do until then?*

Whenever they have the opportunity, humans like to behave stupidly. Viruses depend on our unreasonable behavior to spread, and we are only too happy to provide that to them. Most infectious diseases basically depend on unreasonable behavior of humans, including Ebola. Zika would not be a problem if, you know, people practiced safe sex and mosquito control – things that we have now been advocating for years.



# Infectious Diseases: Lessons Learned from Ebola to Zika

*In the wake of the Ebola epidemic in Africa, the WHO has declared a global public health emergency based on clustered conditions thought to be caused by the Zika virus. The headline-grabbing viruses highlight a global threat from infectious diseases that are estimated to cost US \$30 – \$50 billion each year. Research on infectious diseases from AIDS and tuberculosis to Ebola must be combined with culturally sensitive treatments to be most effective.*

## ZIKA VIRUS



**67 countries and territories have reported evidence of mosquito-borne Zika virus transmission since 2015.**

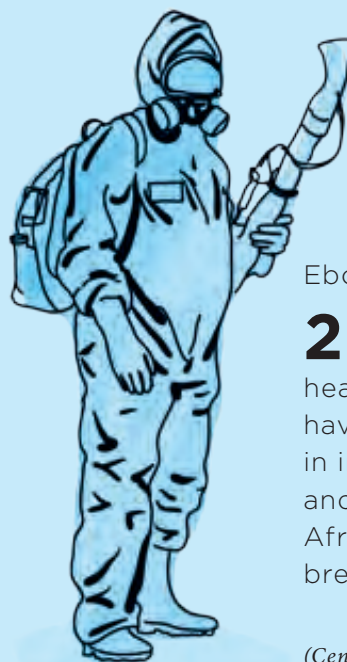
(WHO, 2016)

## EBOLA OUTBREAK



Since 1976, 6,023 people have died from the Ebola virus in Africa, 75% of which were in West Africa in 2014 alone.

(Centers for Disease Control and Prevention, 2015)



Ebola:

**24,655**

healthcare workers have been trained in infection prevention and control in West Africa since the outbreak in 2014.

(Centers for Disease Control and Prevention, 2015)

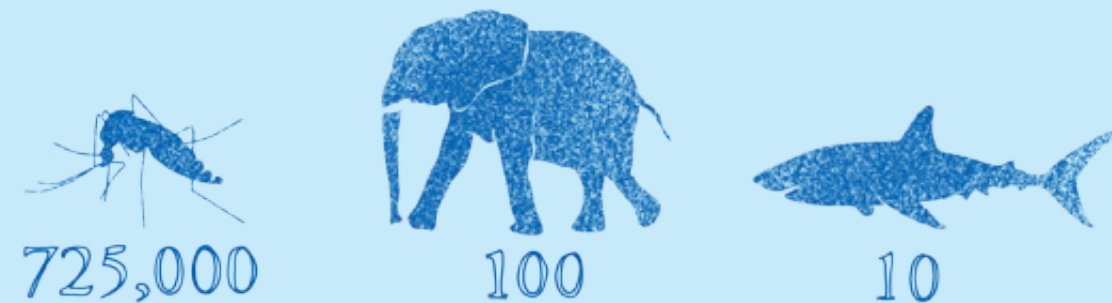
## DENGUE FEVER



In 2015, there were major outbreaks of dengue fever worldwide, with the Philippines reporting more than 169,000 cases and Malaysia an excess of 111,000 suspected cases, a 59.5% and 16% increase in case numbers over the previous year, respectively.

(WHO, 2016)

## MORTALITY RATE



The world's deadliest animal? The mosquito passes on diseases that kill approximately 725,000 people each year.

(WHO, 2014)

## TUBERCULOSIS

infected 10.4 million people in 2015 and killed 1.8 million. Over 95% of TB deaths occur in low- and middle-income countries. Asia, for example, accounts for 61% of new cases, followed by Africa with 26%.

(WHO, 2016)



## MAIN DISEASES

"The big three," namely AIDS, malaria and tuberculosis, cause nearly 33% of all infectious disease deaths.

(Max Planck Institute, 2016)



## STATEMENT

**A lot of forces I ascribe to the Anthropocene are creating a whole new set of issues related to the expanding portfolio of infectious diseases.**

Prof. Dr. Peter J. Hotez (President of the Sabin Vaccine Institute) at WHS 2016





## World Health Summit — Berlin 2016

# Need for Progress

*Technological innovation and women's empowerment were in focus at the World Health Summit 2016 as hundreds of the world's top public health thinkers gathered in Berlin.*

The World Health Summit's international character was striking. The three-day event brought over 1,600 participants from more than 80 countries to historic halls of the German Foreign Ministry. The Summit was also available via live-stream, and about 3,000 people tuned in and joined the active debate on social media. The global interest was a hopeful sign that a top goal of everyone there – namely, breaking down the silos that prevent the insights of one discipline from being applied to others – was within reach.

The Summit featured addresses by leading experts in global health, fundamental research, public and private policy. At the opening ceremony on Sunday afternoon, German Federal Minister of Health Hermann Gröhe called for cooperation: "Due to war and instability, we are facing an unprecedented influx of migration. Securing healthcare for refugees is becoming an increasingly difficult challenge," Gröhe said. "Success can only be attained by joint and coordinated efforts."

His speech was followed by remarks of Alain Berset, Federal Councillor and Head of the Federal Department of Home Affairs in Switzerland, and Ren Minghui, WHO Assistant Director-General for HIV/AIDS, Tuberculosis, Malaria and Neglected Tropical Diseases. Emmanuelle Charpentier, Director of the Max Planck Institute for Infection Biology in Berlin, then spoke strongly in fa-

vor of fundamental research. The French microbiologist reminded the audience that regulations can put science – and national science programs – at a disadvantage. "CRISPR/Cas9 is a good example of how some countries can react faster than others," Charpentier said. "In some countries, the train has already left the station, while in others, they're still discussing the design of the train."

The sessions that followed touched on issues including antimicrobial resistance, polio eradication, addiction and cardiovascular health. University College London researcher David Napier explained the importance of culture in health and infant mortality, stem cell research and access to medicine in Africa. Dario Campana of Singapore's National University Cancer Institute urged patience when it comes to seeing benefits from basic research. And Paul Hudson, CEO of Novartis Pharmaceuticals, emphasized industry's role in transforming how healthcare is delivered. "All of the conditions are here for us to do the right thing," he said, "and for pharma to play its part."

The role of entrepreneurs was highlighted by the World Health Summit Startup Track, a competition that brought ten finalists to present their ideas in front of a jury and the Summit's expert audience.

Audiences at the Summit were diverse, both in terms of geography

and age. Nobel Prize laureates and a class of curious high schoolers from the US passed each other in the halls, students from international public health programs pressed senior scientists on their findings and policy recommendations, high-ranking representatives of civil society and the private sector shared tables during sessions and breaks alike.

One of the Summit's key topics this year was the role of women, a theme that was reinforced by a panel discussion on "Women, Empowerment and Health" that closed the Summit. Fittingly, the Summit's final day coincided with the International Day of the Girl.

The need for progress made by women in the public health sector was underlined by panelist Heidemarie Wiczorek-Zeul. Indeed, "There is no path to this goal if we do not empower women and girls," Wiczorek-Zeul said.

WHS Presidents Antoine Flahault and Detlev Ganten joined incoming WHS President Hélène Boisjoly on-stage to read the M8 Alliance Declaration – a call to action on points like guaranteeing refugees healthcare and urging governments to continue investing in research, development and innovation. "It's not the closing ceremony, it's the beginning of a new era," Ganten said.

The entire M8 Alliance Declaration can be found beginning on page 65. ■



# WHS 2016 – Day 1

Sunday, October 9, 2016



Novartis Foundation head Ann Aerts (1) addressed the impact of non-communicable diseases. At the opening ceremony, microbiologist Emmanuelle Charpentier (3) made a case for basic research and WHS President Detlev Ganten (2) welcomed high-ranking officials (6) and top researchers. Participants discussed key issues (4, 5).



10:30 AM  
**Workshop**  
Ending the AIDS Epidemic  
Room Adenauer

"The modern paradox is the fact that what is haunting our society more than the epidemic is the stigma associated with being gay or an intravenous drug user," said Luiz Loures, Deputy Executive Director of The Joint United Nations Programme on HIV/AIDS (UNAIDS).

1:30 PM  
**Panel Discussion**  
Infectious Diseases  
Europasaal

"Ebola is a peace and wartime disease. Now is the peace time – and we need to be preparing for war," said Stefan Kaufmann, Director of the Max Planck Institute for Infection Biology. "It's more expensive to deal with the disease than implement protective measures."

5 PM  
**Opening Ceremony**  
Weltsaal

"The involvement of non-governmental organizations is indispensable for solving global health problems," said German Minister of Health Hermann Gröhe. "An unwavering commitment to solutions and perspective is important when isolationist voices are threatening to divide us," emphasizes Erwin Böttinger, CEO of the Berlin Institute of Health.



WHO's Ren Minghui (1) called for cooperation across disciplines. German Minister of Health Hermann Gröhe, Alain Berset of the Swiss Federal Council and Erwin Böttinger, CEO of the Berlin Institute of Health, met at the Summit (3). WHS President Antoine Flahaut (2) welcomed participants.

*"The 2030 Agenda provides us with an incredible opportunity to accelerate the progress of public health. That comes with an increased commitment to fund research."*

**DR. REN MINGHUI**  
Assistant Director-General for HIV/AIDS, TB, Malaria and Neglected Tropical Diseases (WHO)







# Faces and Voices in the Crowd

Here I have learned how health is approached from a global perspective, with a focus on containing outbreaks and managing migration. It is very different from Cambodia, where we worry most about weak governance.

**SEAN TSI**  
National University of Singapore, Singapore



I went to a session on government for health. I had not thought of corruption as a transparency issue before. It is a sensitive topic; it was nice to hear people speak so openly about it.

**LEILA YOUSIF**  
Management Center Innsbruck (MCI), Austria



What brought me here were the topics and meeting the community. I was familiar with the concept of “value and health” but at the session they developed it so much further.

**ANNIKA CALOV**  
KfW Development Bank, Germany



If you want to learn about what is really going on in healthcare you come to the WHS. This year they have hit the nail on the head: planet health, antibiotic resistance, migration and health, SDGs – I think these topics are going to be there with us for the next 10 years.

**DR. BOGOSI MOGALE**  
Embassy of the Republic of South Africa, Belgium



Here you can feel solidarity amongst different stakeholders in public health and the desire to share knowledge. We are all here to make something happen.

**OCHE ITODO**  
EHESP School of Public Health, France



As a student I feel like you can absorb so much here. It is a great chance to find new ideas and actually pursue them, to understand what you want to do in the field of public health.

**LIANA PETROSOVA**  
Maastricht University, Netherlands

*“If you are a refugee, you are more likely to face physical and mental health risks that could destroy your future.”*

**HELLE THORNING-SCHMIDT**  
CEO of Save the Children International



9 AM  
**Workshop**  
Coalition for Epidemic Preparedness Innovations (CEPI)  
Room Adenauer

“We don’t know which country will be hit by the next epidemic. The only way to make sure we have the right resources to meet those challenges is to co-invest,” said John-Arne Rottingen, Director of the Division of Infectious Disease Control at the Norwegian Institute of Public Health.



Helle Thorning-Schmidt of Save the Children International (1) pushed for refugees’ rights to healthcare. The Weltsaal was packed (2) during major

panels on topics like technological innovation (3). After a long day of talks participants gathered at the WHS Night to network and relax (4, 5).



11 AM  
**Panel Discussion**  
Planetary Health  
Europasaal

“There are two types of tuberculosis: active and latent,” said Sanofi Aventis Vice-President for Access to Medicines Robert Sebbag. “In case of climate change, or decreasing humidity, you can change from latent to active TB. Migrants in particular are affected by this fact.”

# WHS 2016 – Day 2

Monday, October 10, 2016



4 PM  
**Keynote**  
Technological Innovation for Health  
Weltsaal

“By 2020, it is estimated that 80% of the adults on the planet will have access to a smartphone,” said Stanford University School of Medicine Dean Lloyd B. Minor. “That is going to change the way people get information about their health, and give us data so we can better understand how to treat and prevent diseases.”





German Minister of Health Hermann Gröhe (1) announced the Startup Track winner iFeel Healthy, an asthma-treatment app, at the WHS Night. Urszula Wójtowicz (2) represented Pelvifly, one of 10 startups competing.

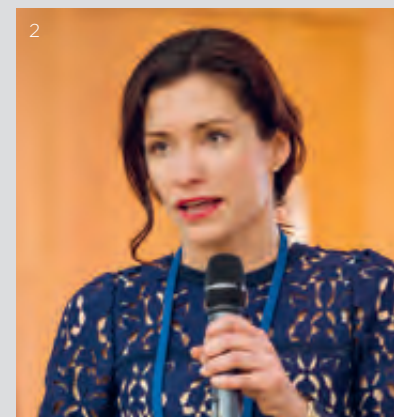
patron of the event,” explained Minister Gröhe in his speech. Shortly after, Elad Fein, CEO of iFeel Healthy, emphasized just how important this opportunity is: “We want to help the hundreds of millions of people that have respiratory problems in a fun way.” Key to reaching those people is reaching a global audience, which is one of the reasons why iFeel Healthy applied to the WHS Startup Track 2016.

Other startups echoed the sentiment. “The World Health Summit is the collection of all the pieces of the puzzle in global health,” said Joshua Okello, the CEO and co-founder of Uganda-based startup WinSenga. “That is why we came here.” WinSenga is a portable ultrasound device. It connects to a smartphone and allows midwives in resource-poor regions to monitor fetuses. Okello described it as a modern update on the Pinard horn, a low-tech 19th century listening device, for those who cannot afford another alternative.

Symptoma, an Austrian startup, also proposes a high-tech solution to an age-old problem. Healthcare professionals can enter different symptoms and lab results into the platform, then the software weighs the differ-



The WHS Startup Track put 10 businesses from Austria, Greece, Germany, Israel, Poland and Uganda in front of an expert jury and audience to present their ideas (3).



ent possibilities to produce a diagnostic report. “Experts once deemed something like this impossible,” said Symptoma CEO Dr. Jama Nateqi. Today, the technology has caught up. “Now we are showing that it is possible and that medical misdiagnoses are a problem worth trying to solve.”

An all-in-one blood sampling device that integrates blood collection with testing and analytics was pitched by midge medical UG from Germany. Using a smartphone as a bar code scanner, it can also connect to a database that helps healthcare workers manage patients. Michael Diebold, the firm’s CTO, said the device – which is simple, easy to use and does not need power – was particularly practical in rural environments and emergency situations where electricity was hard to come by or intermittently available. Each midge testing pod even comes with its own disinfectant wipe.

Other startups included Care Across, a network connecting cancer patients and their caregivers with medical experts within hours; evivecare, a speech therapy app for stroke patients; Glasschair, a Google Glass app that drives a wheelchair with head movement; OneWorldDoctors, a platform that connects doctors and specialists to improve medical infrastructure in underserved regions; Pelvifly, which attempts to help millions of women who have issues with incontinence due to age or pregnancy complications. Finally, Germany’s Cold Plasmatech is seeking ways to harness the power of cold plasma for dermatological and antibacterial applications.

## Breathe Easy

*A winning idea*



Elad Fein pitched his iFeel Healthy app to a jury of experts.

“How can a mobile game that you love help you with asthma?” Elad Fein asked the jury and audience at the WHS Startup Track this year. Fein, who is the CEO of iFeel Labs, won the WHS Startup Track 2016 competition with the iFeel Healthy app.

iFeel Healthy monitors and analyzes respiratory function using popular mobile games with a small wearable device. It also helps manage maladaptation to stress. Users are trained to breathe properly and strengthen their lungs. If the data from the pulse oximeter in the wearable senses that the heart rate and breath are not in sync, the game is locked. The user has to breathe properly in order to unlock the game and continue playing.

Over 300 million people suffer from asthma worldwide. When presenting the award at the WHS Night, German Federal Minister of Health Hermann Gröhe said the startup was a “revolutionary approach to one of the biggest global health problems today.”

iFeel Healthy is an example of medical insights paired with technological innovations. But the transition is difficult. Reaching the right audience, such as the governments and institutions present at the World Health Summit, is important: “Winning the WHS Startup Track 2016 could push us forward and help make digital health available to a large audience,” said Elad Fein. ■

## WHS Startup Track Tech Takes the Stage

*The World Health Summit Startup Track draws attention to the roles business and entrepreneurship have in improving the global healthcare system.*

At the World Health Summit 2016, technology was a hot topic. To help small companies and startups compete against well-established players, the WHS Startup Track – now in its second year – invited young entrepreneurs to present concepts for healthcare of the future in a competitive pitch session in front of a jury and audience.

This year, 10 ambitious innovators took the stage in the Europasaal. The general focus was on new smart devices, software and applications. In a sense, they were already winners: The startups represented some of the most outstanding healthcare business ideas garnered from a pool of 80 proposals from 22 countries. Each participant made a three-minute pitch and addressed questions from the jury.

Later that day, German Federal Minister of Health Hermann Gröhe, patron of the WHS Startup Track, announced the WHS Startup Track Winner: iFeel Healthy from Israel.

“The Startup Track offers young companies from all over the world a unique opportunity to network with each other and make important contacts. That’s why I took over as



# WHS 2016 – Day 3

Tuesday, October 11, 2016



*“Women constitute an army of unpaid care providers and the highest proportion of paid health-care professionals. Healthy women are so important.”*

**MATSHIDISO REBECCA MOETI**  
Regional Director for Africa of the World Health Organization (WHO)



WHO official Matshidiso Rebecca Moeti und Sanofi's Karen Linehan (1, left and right), Nobel laureate Elizabeth Blackburn (3) and Afghan Ambassador Suraya Dalil (4) strongly advocated for women in research. Christina Akerman, Eric Hans Eddes, Norbert Hauser, Stefan Larsson, Jan Kimpen and Paul Hudson (5, from left) discussed the role of pharma in making health-care affordable. Interactive workshops brought new insights (2).



9 AM  
**Workshop**  
Cardiovascular Diseases  
Room Rathenau

“To prevent cardiovascular disease, the first step is to make sure that everyone knows their own blood pressure, even children. The material is cheap, it is easy to handle – people just have to have access and know how to use it. We have to bridge this knowledge gap,” said Daniel Lackland, President of the World Hypertension League.

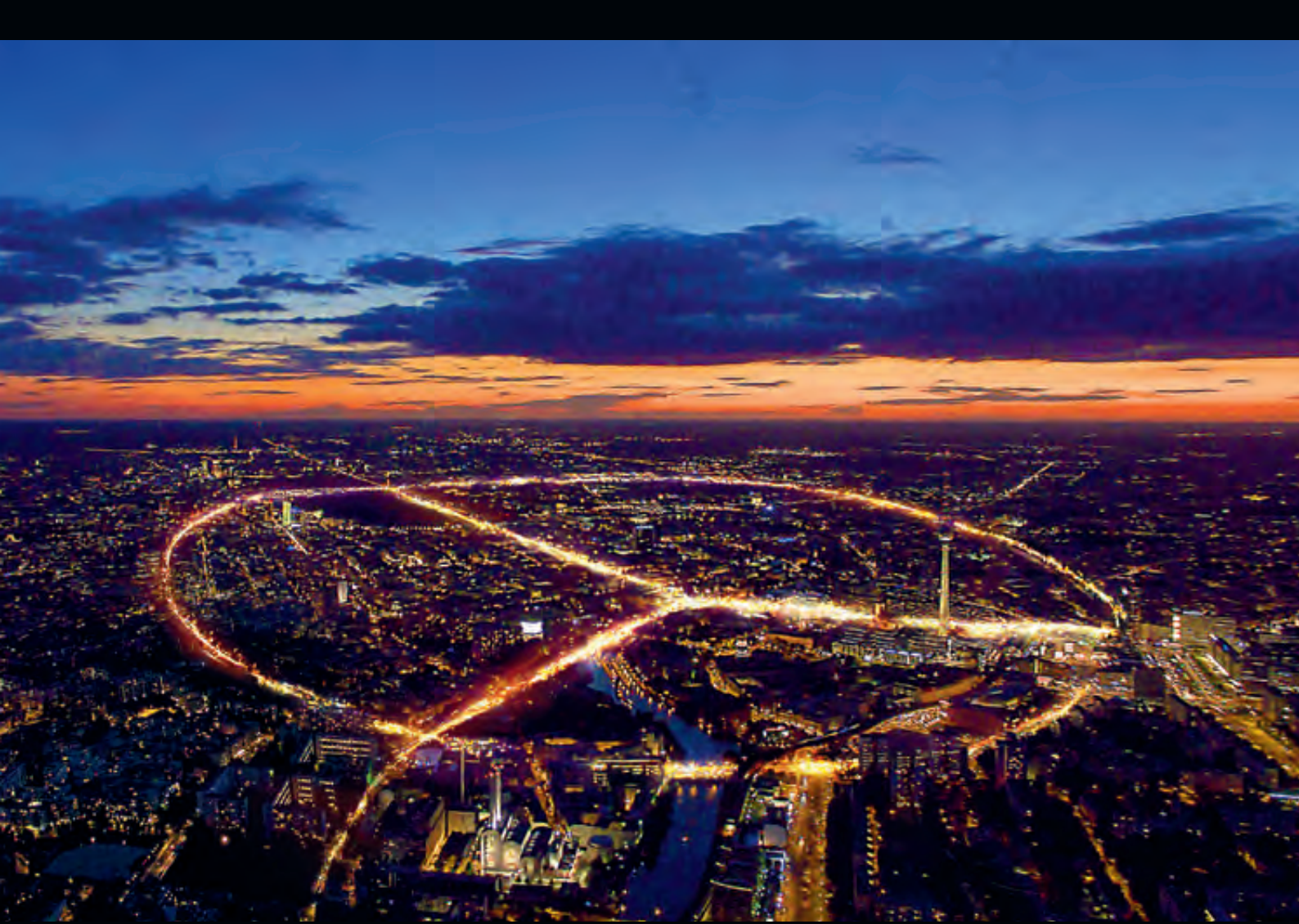
9 AM  
**Panel Discussion**  
Value in Healthcare  
Europasaal

“A lot of healthcare is delivered by communities. That's an opportunity – fewer or no sunk costs, no existing infrastructure and less divided public opinion puts us in a position to leapfrog old technology,” said Norbert Hauser, Chair of the Board of The Global Fund to Fight AIDS, Tuberculosis and Malaria.



2 PM  
**Workshop**  
Implementing the Health-Related SDGs  
Room Rathenau

“Academic institutions and think tanks should take their models to the ground. They should not wait for countries to shop around. They should work in countries directly to implement them,” said Joy Phumaphi, Executive Secretary of the African Leaders Malaria Alliance.



# At home in Berlin.

Mercedes-Benz Berlin – official mobility partner of the WHS 2016.



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## Fresh Ideas for your Health

What's new in medical treatment, alternative medicine, wellness and fitness — as well as nutrition and beauty? In Good Shape is the weekly health show on DW, covering all aspects of healthcare. We present current topics, in-depth interviews with specialists, and offer you opportunities to ask your own questions.

# The M8 Alliance Declaration World Health Summit 2016

This year's World Health Summit (WHS) took place in a political context of great hope and serious alarm. Immense strides were made to strengthen commitments to the Sustainable Development Goals and to global health action at the UN General Assembly, the World Health Assembly of the WHO, as well as at G7 and G20 meetings. The right of all people to universal health coverage (UHC) has been emphatically endorsed. But at the same time, the plight of millions of people on the move, the predicament of refugees and the unacceptable destruction of health facilities clearly showed the limits of humanitarian and global health action when there is a lack of political will to ensure human rights, peace and security.

The past year has reinforced that we must face global health challenges collectively: the challenge of antimicrobial resistance has been likened to climate change; the Ebola crisis has been followed by severe Zika and yellow fever outbreaks; and there is increasing concern that the target of polio eradication might not be reached on time.

Crises are a key determinant of health – be they war, insecurity, ecological or financial upheaval. Around the world, 130 million people need humanitarian aid, more than 60 million people have been forcibly displaced from their homes, the global migration and refugee movement shows no sign of abating and many countries are still burdened with the health consequences of austerity. A new mix of health inequity, humanitarian, ecological and security challenges has emerged which confronts us with the limits of existing systems.

Donor countries are stretched to keep their global commitments as pressure increases at home to set new priorities and cut development aid. Terrorist attacks all around the world have increased a general feeling of insecurity and have led to protectionist responses. This raises basic questions about global solidarity in a world of great wealth.

We, the members of the M8 Alliance, call on heads of state and government to invest in people and to ensure that no one is left behind. Following the discussion at this year's World Health Summit, action in five key central areas of global health is mandatory:

1. Empowerment of Women and Girls
2. Right to Health of Refugees and Migrants
3. Resilience and Global Health Security
4. Antimicrobial Resistance
5. Investment in Research, Development and Health Innovation

### I. EMPOWERMENT OF WOMEN AND GIRLS

Achieving progress in global health requires addressing the health, education and empowerment of women and girls. Indeed, advancing gender equality creates measurably healthier and more productive communities and could add US \$12 trillion to global GDP by 2025. Supporting all women, especially the most marginalized, in reaching their full potential at every stage of life is a priority. This includes equal access to healthcare, sexual health and rights, enhancing

reproductive health, improving infectious and chronic disease protection and treatment, and addressing aging issues. It also requires applying a gender lens to all health issues.

#### Call for Action:

The M8 Alliance calls for supporting policies which increase women's control of their life choices and ensure their bodily integrity. This includes the right of women to modern family planning and safe abortion. We recognize that progress has been achieved for women over the past decades, but in many countries the reality on the ground continues to fall short. The main determinants of women's health are not being addressed appropriately by governments. We are particularly concerned about the ongoing epidemic of gender-based violence. We also call for a greater recognition of the contribution of women as paid and unpaid health workers and see a clear need to address the global care chain in the context of health worker migration.

### II. RIGHT TO HEALTH OF REFUGEES AND MIGRANTS

Global health still fails the most vulnerable: populations in fragile states, victims of war, refugees, asylum seekers, trafficked populations, people in forced labor, slaves and global migrant workers. Refugees and migrants have the same universal human rights and fundamental freedoms, including the right to health. Our approaches to global health must integrate people's movements as a key determinant of health and we must develop strategies that can respond to the diversity of people on the move, as well as their needs.



*Call for Action:*

The M8 Alliance calls for a welcoming of the outcome of the first UN Summit on large movements of refugees and migrants in 2016, which guaranteed the safety, dignity, human rights and fundamental freedoms of all migrants and reinforced the legal frameworks for refugees. The response framework that has been developed will guide further action, also in health. It reinforced that everyone has the right under international law to the highest standards of physical and mental health. It has also highlighted the need for equity and access. We underline the need to monitor the follow-up to these commitments and to ensure the full accountability of UN organizations, humanitarian actors and nation states.

**III. RESILIENCE AND GLOBAL HEALTH SECURITY**

Significant activity to improve prevention, detection and response time to outbreaks has been underway around the world following the Ebola crisis. We welcome the many actions and initiatives to build health resilience, including the new WHO Health Emergencies Programme, the Global Health Security Agenda, the launching of the Pandemic Emergency Financing Facility, and the support for the Ebola-affected countries in building their health systems. The continuing concern of the G7, the G20 and the UN will be critical to establish a global system of preparedness and response and secure sustainable financing for work on health crisis and to invest in UHC. This includes ongoing attention to other public health emergencies of international concern (PHEIC) such as polio and Zika.

*Call for Action:*

The M8 Alliance calls on all countries and development partners to ensure the full implementation of the International Health Regulations (IHR) capacities. We encourage all countries to engage in tabletop and simulation exercises to test gaps in capacity and to do this in full cooperation with many sectors. Health systems must be strengthened, professionals trained and communities

fully involved. Mechanisms for accountability to the global community – through reliable, independent and external evaluations – must be established. This includes the commitment to ensure the last phase of polio eradication and the transition of its assets into national health systems.

**IV. ANTIMICROBIAL RESISTANCE**

At the UN General Assembly this year, the heads of state and government acknowledged that the resistance of bacterial, viral, parasitic and fungal microorganisms to antimicrobial medicines is the greatest and most urgent global risk, requiring increased attention and coherence at the international, national regional levels. Following the recommendations of the WHO, they have called for a global development and stewardship framework which brings together the many stakeholders – from health and agriculture to food, animal health, development banks, and UN agencies – to address the enormous challenge to humankind. The M8 Alliance will work hard to implement a multi-stakeholder approach in the development of national, regional and global alliances and strategies to address antimicrobial resistance (AMR).

*Call for Action:*

The M8 Alliance calls for an endorsement of the political declaration on AMR and the WHO action plan on AMR. In particular, we support research and development of new antimicrobial medicines, vaccines and diagnostics. We further call for determined action on implementing the One Health approach to fight AMR and we reinforce the need to ensure access and affordability. All healthcare institutions and professions must do their utmost to fight AMR.

**V. INVESTMENT IN RESEARCH, DEVELOPMENT AND HEALTH INNOVATION**

We must harness the enormous potential of science to better meet urgent global health needs. A stronger

focus on translational research can help turn early-stage innovations into new health products, advancing innovation to the point where it becomes attractive for further development by the medical industry or healthcare agencies. Many new discoveries have the potential to improve health, but turning those ideas into deliverable products can prove extremely difficult. We require a stronger focus on the cooperation between public and private sector and between basic scientists, clinical researchers, clinicians and patients to drive novel observations about the nature and progression of disease that often stimulate basic investigations. This requires new incentives, innovative funding streams and new solutions to challenges in relation to intellectual property, as has been outlined in the report of the UNSG High Level Panel on Access to Medicines issued this September 2016.

*Call for Action:*

The M8 Alliance calls for cross-sectoral contribution to developing strategies in translational research, securing the translation of results from clinical studies into everyday clinical practice and health decision-making, while ensuring that new treatments and research knowledge actually reach the patients or populations for whom they are intended. We also commit to ensuring patients' participation in such developments. The M8 Alliance will promote the effective translation of new knowledge, mechanisms and techniques generated by advances in basic science research into new approaches for prevention, diagnosis and treatment of disease, so that the essential goal of improving health from bench to bedside can be reached. We understand that this will require new forms of cooperation between the public and the private sector.

The M8 Alliance emphasizes that the challenges facing global health have become too numerous and too complex for a business-as-usual approach. We will continue to do our utmost to engage actors at all levels and from all sectors to move this agenda forward. ■

[http://bit.ly/M8-Declaration\\_2016](http://bit.ly/M8-Declaration_2016)



# Before it became a medicine,

It was 5,000 researched compounds.

87 different protein structures.

500,000 lab tests.

1,600 scientists.

80-hour workweeks.

14 years of breakthroughs and setbacks.

36 clinical trials.

8,500 patient volunteers.

And more problems to solve than we could count.

Before it became a medicine,

It was an idea in the mind of a Pfizer scientist.

Now it's a medicine

That saves lives every day.



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# Technological Innovation

By 2020, 4.6 billion people will own a mobile phone. The opportunities for improving healthcare are tremendous: Technology makes it possible to communicate better with patients and collect data that deepen our knowledge of disease.

But there are threats, too. Deep-seated distrust of technology is widespread, along with fears that big data will lead to “Big Brother”-like abuses of personal information.

As technological advancement races ahead, can public health keep up? And equally importantly, is it possible to distribute technology’s benefits evenly? “Global health needs to push for affordable, sustainable innovation,” said Antoine Flahault, Director of the Institute of Global Health at the University of Geneva, at the WHS Opening Ceremony. “It needs to work in a framework of human rights and dignity.”





## OVERVIEW

# IMPROVING HEALTHCARE DELIVERY

**Digitization, data and connectivity are changing the way the world works. Today, virtually every industry – from publishing to agriculture, from aerospace to travel – is being profoundly disrupted.**

Yet, compared to progress in other industries, healthcare is still just in the infancy of a data-driven revolution. Digitization offers a golden opportunity to tackle our biggest health challenges in a move towards outcome-based care delivery. Further still, it could enable unprecedented improvements to care access, particularly to those in resource-limited settings.

To put the challenge we face in context: Populations are aging and chronic conditions continue their relentless rise. Health systems are creaking under the pressure. Meanwhile, the industry tends to work in silos optimized around medical specialties rather than the patient. This, in turn, results in high levels of waste and misdirected resources. Misdiagnosis is just one stark example. For cancer care, the figure stands at 20-30%, depending on which survey you read.

It is little wonder that most resources go to episodic acute care or that cross-workflow collaboration is scarce, as opposed to efforts being directed towards addressing societal trends, root causes or striving for integrated solutions.

While healthcare remains a somewhat conservative and regulated industry, we are seeing digitization and connectivity, through big data, unlock insights for deep and far-reaching industry transformation.

One immediate challenge is how we manage this transition to digital health effectively and efficiently. In mature health systems, vast amounts of data input fields remain “analog” and have yet to be digitized. Incremental

increases in digital health technologies will, of course, bring even greater data proliferation and more connected measurable insights. In emerging markets, this challenge becomes an opportunity. In places where legacy infrastructures are not so embedded, we can achieve a “leapfrog” moment in health transformation in a straight-to-digital approach.

In both scenarios, long-term thinking and a solutions-oriented approach are required to manage digital transformation and unlock the potential of connected health.

For large-scale transformation, one clear trend is the “industrialization” of care. The principle is simple: break down any complex process into its constituent parts and, once you’ve digitized, you can stitch together each component seamlessly online. That’s how great online retailers or logistics providers make a complex service feel joined-up and efficient. For healthcare, the concept is a gem!

Industrialization is also driving systematic improvements in care delivery – supporting the move from reactive acute care to proactive chronic disease management and stimulating greater patient and clinical investment in lifestyles and prevention. Further still, precision medicine, the delivery of precise and first-time-right diagnosis, is now an emerging reality thanks to new smart diagnostic technologies and better connectivity across the health continuum.

The cloud plays a huge role here, which leads to the next trend: the “personalization” of care.

The proliferation of smartphones and other connected devices means that consumer and professional healthcare is converging. Increased patient, and consumer, empowerment is one immediate outcome – allowing patients to remain informed, proactive and have more choice in their own health and medical well-being. Further still, when harnessed well, individualized treatment plans can be informed by connecting multiple data points.

There is tremendous value in how we build, scale and analyze patient profiles. By harnessing and processing a diverse range of individual patient data across the full spectrum of care, we can apply a deeper understanding of wider population trends. As such, big data and analytics are forging impactful population health management solutions that offer real opportunities to reduce the cost of care and ease pressures on overburdened health systems.

When coupled with “tele-health” or remote monitoring solutions that connect population patterns with real-time patient-data, the potential is tremendous, especially when it comes to reaching less engaged patients in resource-limited or deprived areas. This is where population health delivers highest impact by increasing patient health literacy and engagement, and in addition, providing critical access that is all too often absent – all without placing a heavy burden on primary care.

This is not a substitute for face-to-face care. But, by maintaining a continuously-connected relationship with high-risk patients remotely, care providers can identify individual and population health issues and formulate combined prevention and treatment strategies.

One compelling example is in Liverpool, UK. Philips partnered with the NHS to deliver a large-scale self-supported care pilot targeting chronic disease management for patients in the city’s most impoverished areas. Over three years, 2,234 patients with one or multiple chronic diseases including COPD, heart failure and diabetes were enrolled. The program combined tele-monitoring equipment in the home with the support of a clinical hub and a structured program for case management, monitoring, education and coaching.

By engaging patients using a full array of connected technologies, the program achieved reductions in emergency admissions and secondary care costs ranging from 22 to 32%. Ninety percent of patients felt more in control, have gained confidence and / or felt better able to cope with their condition. Again, this is another example of connected care improving lives and saving essential resources.

Finally, the need for inclusive innovation and design is also key to how we manage healthcare transformation. This means breaking out of silos in order to tackle


structural constraints that contribute to poor health alongside primary care needs building a holistic view of universal healthcare in a dual approach to improved care delivery and access.

The value in this approach is immediately clear in emerging markets. For example, Philips Community Life Centers are transforming primary and community-based care in rural Africa. The self-sufficient centers house state-of-the-art primary care health and IT facilities for diagnosis, testing, treatment and training.

While simultaneously acting as mother and child centers to address urgent infant mortality rates, additional value is achieved through the provision of 24/7 sustainable light, power and clean water. This allows the centers to function far beyond the core primary care focus and act as safe and secure sites for community engagement with added communal energy and sanitation resources. Inclusive innovation in this way has embedded the long-term building blocks of improved universal health within the communities they serve, while also dramatically expanding primary care capacity.

Ultimately, if we are to fully capitalize on the potential of digitization and connected care, we require a different end-to-end approach in how we define and manage healthcare systems, with better outcomes, lower waste and variance. We are only scratching the surface of the potential. Technological innovation for robust and high quality data insights is necessary. But, most important is getting the processes right so that what we’re connecting is transparent and logical – changing consumer, patient and clinical behaviors to adapt to new ways of working.

Deep collaboration and co-creation with partners will also enable us to further develop high impact consultative solutions. This means sharing joint responsibility for outcome-based metrics like improved efficiency, higher quality, reduced costs and, ultimately, better patient health outcomes with customers and partners.

This is progressive work, and it is very promising. But we have much to do to make integrated digital health a reality. 



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## ESSAY

# INNOVATIONS IN HEALTHCARE DELIVERY

**Technology – whether mobile, online or device-based – has revolutionized our daily lives. Its role in global health is that of a strategic enabler and sustainable change-maker, dependent on its complex relationships with individuals and health systems. The benefits of integrating? Priceless.**

The five horsemen of technology are nanotechnology, biotechnology, information communication and technologies (ICT), robotics and applied cognitive science. Together, they have changed daily life for billions around the world. Over 3.6 billion people in the world own a mobile phone, a number the global mobile phone association, GSMA, estimates will reach 4.6 billion by 2020. In the world of international development and global health, that amounts to simple mathematics: 4.6 billion unique mobile phone subscribers equals 4.6 billion opportunities for global health to create a game-changing and sustainable change.

Mobile money, another game-changer, has revolutionized the way businesses operate and individuals make and receive payments. More than 400 million registered mobile money connections are present in the world today.

## TECHNOLOGICAL INNOVATION MUST RELY ON COMPLEX RELATIONSHIPS

Integrating technological changes and innovative platforms with healthcare delivery is not without its own challenges – and yet, it is necessary. Take a generic healthcare patient pathway in India, and we see at least seven relationships to work through: the individual seeking treatment, community healthcare workers, health clinics, laboratories, pharmacies, rural hospitals, and larger, referral hospitals. Add in partners like donors, ministries of health, drug manufacturers and regulators, and one is faced with myriad public and private healthcare systems that are disparate and at times, collaborating together.

Once we add in technological innovations, the core questions become what elements should be prioritized, and what solutions need to be integrated? How has technological innovation led to a more efficient, effective and impactful system that provides the most benefit to the patient?

Technology can also protect patients from counterfeit or “fake” drugs, whether it be by scanning products at each stage of the supply chain to confirm authenticity or by a patient using their mobile to scan or send codes to an authentication service. Technology can also powerfully connect different approaches so that end-to-end security of a supply chain is achieved, ensuring that a medicine goes from factory to patient without issue.

Technological innovation cannot be seen as a standalone solution – it is an enabler in complex connections, whether it is facilitating a relationship between a community health worker and a patient through WhatsApp to provide educational awareness on malaria; creating a relationship between a health clinic and a “rider” providing ARV medicines through riding his bicycle; or building a relationship of trust as a patient agrees to use biometric technology for improving tuberculosis treatment as is done by Operation Asha in India.

## DONORS FUNDING TECHNOLOGICAL INNOVATION FOR GLOBAL HEALTH

Technological innovation is becoming a core part of health ecosystems across countries and at a global level,

with donors and funders supporting innovations. We witness a growth of innovation labs and testing platforms. The US Agency for International Development’s (USAID) Global Development Lab, Unicef’s Innovation Labs and the Gates Foundation’s investments in technology are a few such examples.

The Global Fund to Fight AIDS, TB and Malaria, the world’s largest funding agency to fight the three diseases, remains on track to save over 22 million lives by the end of 2016. It realizes the immense impact technology can leverage by nature of its funding to more than a 100 countries. The Global Fund established the Innovation Hub in 2014 as a partnership engagement platform focused on solutions in three key areas: procurement and supply chain management, financial and risk management, and program quality. As of 2016, the Innovation Hub leads over 30 key relationships, each of which has been identified and tested for maximum impact.

## THE GLOBAL FUND’S ROLE IN ACCELERATING TECHNOLOGICAL PLATFORMS TO STRENGTHEN HEALTH SYSTEMS

Through the Innovation Hub, the Global Fund worked with PharmAccess Foundation and Vodafone in Kenya to develop a mobile health wallet, called M-Tiba, using M-Pesa as the backbone. This allows someone visiting a clinic for a malaria test to pay for it from their mobile phone and allows the clinic software to collect age, gender and test results – in turn providing powerful potential for use of data. M-Tiba stands out as an innovative platform to tackle numerous health challenges through one solution: addressing quality of care and turning real-time data into targeted health services. In Kenya, the Global Fund’s principal recipient, AMREF, now uses M-Pesa to pay salaries and related payments through the health chain. This simple solution has helped incentivize health workers by paying on time, reducing the risk of carrying cash and tracking payments. Beyond M-Pesa, the Global Fund is also partnering with Vodafone Group to deploy inventory platforms in selected countries. Relaying data on mobile, the platforms are aimed at preventing medicine shortages at the regional stores and health center level.

In addition to supporting last-mile delivery and strengthening health system supply chain management, technological solutions and devices have a critical role in the future of eliminating AIDS, tuberculosis and malaria in the coming decades by ensuring that early detection of diseases such as malaria and HIV/AIDS can help save an even greater number of lives. The GeneXpert test, endorsed by the WHO just over five years ago, is a new molecular test that detects the DNA in TB bacteria and gives results in less than two hours. In Nigeria, the biotech innovation of using a urine test for malaria results in diagnoses in less than 25 minutes. And the Boston-based Disease Diagnostic Group’s Rapid Assessment of Malaria

(RAM) – is a mechanical device that promises to detect malaria in only five seconds using a drop of blood. Similarly, self-testing kits for HIV are currently being piloted in Zimbabwe, Malawi, Zambia and South Africa.

## WAMBO.ORG: THE GLOBAL FUND’S ONLINE MARKETPLACE TO POOL PROCUREMENT

The Global Fund has developed a new online marketplace that gives countries the tools to access pooled procurement which helps reduce the price of products. Wambo.org is a simplified procurement platform, requiring only an Internet connection, and it provides implementing partners the power to search, compare, purchase and track the delivery of transparently priced, quality-assured medicines and products.

The Global Fund is also a founding member of the Global Steering Committee for Quality Assurance of Health Products and Services (GSC) to advance coordinated action against counterfeit health products that endanger public health. Members include Gavi, United Nations Development Programme (UNDP), UNITAID, US Agency for International Development (USAID), US Food and Drug Administration (FDA) and the World Bank. They work closely with the private sector to coordinate and amplify activities to strengthen regulatory systems, increase awareness and build and connect reliable data.

In addition, the Global Fund supports the Global Health Assurance Partnership (GHAP) which conducts market assurance reviews and, if necessary, helps the country solve any issues.

## PARTNERSHIPS ARE KEY TO HEALTHCARE DELIVERY

Technology is rapidly advancing and here to stay. Whether it is mhealth platforms in Asia, mobile money in Africa, robotic ATM-like pharmacies in South Africa, or unmanned aerial drug delivery in Rwanda, the future of healthcare delivery is fast evolving and changing. The key to long-term sustainable strengthening of healthcare delivery can only lie in partnerships ensuring that donors, countries, private sector partners, and communities that we serve work together to find the most effective systems for their needs.



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## ESSAY

# PRECISION HEALTH: SEIZING THE MOMENT

**Harnessing the power of big data offers a way forward for health-care on a massive scale, while holding out the promise of solutions that are effective because they are tailored to individual patients. But to get there, researchers and practitioners will have to break down silos and win the trust of patients and doctors.**

Precision Health, the global approach to healthcare that we are championing at Stanford, has its roots in the teachings of Hippocrates. The fundamentals of this approach – individualized care that’s predictive, preventive, and specific – were trumpeted by the ancient Greek physician when he said: “It is more important to know what sort of person has a disease than to know what sort of disease a person has.”

Jump forward a few millennia, and, for the first time in history, we find ourselves in possession of the transformative technology and other tools needed to bring the vision for truly personal healthcare to life. Precision Health involves the precise application of science across the spectrum to predict and prevent disease before it strikes, and cure it decisively if it does. It uses all possible data points – genetics, environment, behavior, and socio-economics – to provide care that’s not one size fits all, but one size fits one.

While most medical research is currently focused on genetics and medical treatment, evidence shows that paying close attention to all four of these data points is key to achieving optimal health. In the 1990s, for instance, Los Angeles was one of the most polluted cities in the world. Now, two decades later, the air is significantly cleaner. A study of this 20-year period by the University of Southern

California demonstrated that lung function had improved in local children: In 1998, 8% of 15 year-olds had significant lung defects; by 2011, that number had fallen to 3.5%.

From a global health perspective, consider the case of clean drinking water. The World Health Organization (WHO) estimates that 2.3 billion people gained access to improved drinking water between 1990 and 2012. During this same time, the number of children dying of diarrheal diseases, strongly correlated with a lack of access to clean water, steadily fell.

And in a behavior-related example, Stanford Medicine epidemiologist Sanjay Basu analyzed a recent change in the payment schedule of Peru’s cash assistance program: The government moved from twice-monthly to once-monthly payments, without changing the overall payment amount. Under the new schedule, he observed a striking increase in the purchase of “temptation goods” – alcohol, sweets and tobacco – that have a negative impact on health. The Peruvian government once again makes its payments every two weeks as a result.

At Stanford Medicine, we’re putting Precision Health into action across every area that influences health. Just one among many real-world uses is our MyHeart Counts app,

developed in partnership with Apple, that taps the iPhone’s built-in motion sensors to both monitor an individual’s own cardiovascular health and share that heart and activity data with researchers at Stanford. Data from the MyHeart Counts study are used to help ordinary people manage their risk of heart disease.

Now is the moment for individuals and practitioners alike to embrace the extraordinary potential of Precision Health – and to surmount the four top hazards that could prevent us from fully realizing what is the most important healthcare goal in generations.

Silos are among the hazards, dominating much of the current medical and scientific research in Precision Health areas. Without question, researchers in these areas need to work together to thoroughly grasp the unique health status of each individual – and they need to engage in extended collaborations across institutions and industries. We’re already seeing glimmers of this in things like the Stanford Woods Institute for the Environment, which is partnering with over 25 groups to explore our effect on the environment and its effect on us, as well as the new US \$250 million Parker Institute for Cancer Immunotherapy, comprised of six of our country’s leading cancer-fighting institutions that are tackling the disease through a team approach. Success requires more of this cross-pollination.

Speed of progress is another obstacle – counterintuitive, yet real. Medical knowledge has advanced so far and fast that a majority of practicing physicians actually went to medical school before the human genome was sequenced. The repercussions of this were captured in a recent Genetics in Medicine survey, showing that many doctors worry about misunderstanding genetic test results or conveying them incorrectly. We need to ensure that all doctors, old and new, are proficient in understanding genetic tests of diagnosis (and predisposition) to disease, and to develop efficient and effective ways to make sure medical knowledge is readily accessible.

Privacy concerns also continue to loom large in the minds of patients. We can hardly blame them: One cybersecurity think tank this year estimated that 47% of Americans had had their medical records hacked in the past twelve months. We must solve the issue thoroughly and systemically, while encouraging individuals to share their information with programs and institutions that are committed to data security. Precision Health won’t keep individuals healthy without data, and we must develop the secure technologies and rigorous procedures to assuage patient fears.

While currently a roadblock, cost will not always be. Detractors of the more precise approach say individual genetic sequencing tests (a pipe dream a decade ago) are too pricey. True, these tests can cost thousands of dollars,

which insurance companies may now be reluctant to pay. Developing targeted drugs with their associated diagnostic tests isn’t cheap, either. But costs will decrease as technology progresses. We’ve seen it before – take MRIs. We can help history along by maintaining our focus on reducing costs whenever and wherever possible. Moreover, prescribing drugs and other treatments based upon information on which patients will benefit, rather than using the same approach for everyone, will decrease the cost to the healthcare system overall.

“Experimental audacity that was unimaginable in the past” – this was Stanford Medicine professor Paul Berg’s phrase for the dawn of recombinant DNA in the 1970s, which led us to the brink of today’s biomedical revolution in Precision Health.

Berg laid the groundwork for this revolution with his Stanford peer, Stanley Cohen, when they mixed DNA from different species to engineer new genes and ushered in the molecular biology boom. Cohen and University of California San Francisco Professor Herb Boyer then used that technology to produce the first therapeutic proteins for humans. They patented gene cloning in 1974. This led to, among other things, the founding of Genentech.

Years later, Genentech developed the first real example of precision medicine, tailoring medical treatment to the individual characteristics of the patient – Herceptin for HER2+ breast cancer. We’re now going beyond the spectacular promise of precision medicine to true Precision Health – with its focus not just on effective treatment, but on prediction and prevention.



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## ESSAY

# TRANSFORMING CARE: CONSUMER APPLICATIONS

**Lack of real-time access to data and meaningful insights is slowing innovation in healthcare. Being patient-centric, providing transparency, and leveraging the power of ecosystems will lead to fundamental change.**

Technology has clearly transformed much of what we do in our daily lives: how we manage our finances, how we consume news and entertainment, how we shop. But when it comes to a central part of our lives – our health – digital transformation has lagged behind.

While we've seen encouraging movement toward the digitization of records and significant advancements in the area of data analytics, much of the data remains disconnected, siloed and opaque. Digitizing health information, while necessary, is not sufficient. Real transformation will only happen when information is connected, integrated and delivered in real-time.

The lack of progress toward the digital age in healthcare is driven by a number of factors, including a regulatory environment that does not fully understand or embrace the benefits of technology, competing interests across healthcare stakeholders, and initiatives that are not centered around the patient. However, today's healthcare industry is at a tipping point. The same pressures that have propelled change in other industries are driving the need for new solutions in healthcare: rising costs and the

pursuit of value. Citizens, governments and businesses are more aware and more concerned about increasing costs. Individuals and families are more focused on healthcare quality. Patients have more choices and demand a better experience.

To transform the healthcare industry, we need to take lessons from other consumer services that start with the user at the center and deliver amazing experiences by creating open systems or "platforms" that connect and leverage the power of others.

I propose three core lessons that are most relevant to our work in healthcare innovation:

- Start with the consumer – the patient
- Offer transparency and insight by connecting the enormous amounts of data we have
- Leverage the power of an ecosystem; i.e., the power of others

First, we must start with the consumer. Solutions need to be personalized and have complete, real-time medical

data. They must give patients control over how and with whom information is shared and for how long. And, they need to work on the user's behalf. Knowing the person and the context of their request, applications should deliver the desired result, with minimal input from the patient or healthcare provider.

Second, we need to provide transparency into the massive amounts of available health and healthcare data, connecting silos and giving access to the right stakeholders. We can bring together structured and unstructured clinical data, claims data, genomic data, and data from wearables, as well as operational and financial data from healthcare organizations. Then, we can make the data accessible and meaningful to different stakeholders across the ecosystem, with the patient's permission.

For research communities, we can increase the sample size significantly to use the power of large numbers to garner better, more useful, more accurate insights. We can enable powerful, new correlations and predictions – a major benefit that a more limited view can't offer. We can also use data insights to improve the value-to-cost ratio in healthcare, research and life sciences organizations.

Finally, we need to leverage the power of others. Today's most pervasive technologies are those that have effectively built ecosystems around a platform. The innovation of individual companies can often be inspiring, but it's nothing compared to the innovation of communities. Think, for example, about the iPhone. It is a beautiful product, but it is the community of partners that surrounds it that makes the phone indispensable.

To enable this community, we need to build open platforms, breaking down barriers and working together to foster openness and partnerships. When we collaborate, we can radically improve the experience and value for those we serve.


I believe we can do these three things within healthcare. We can leverage the power of networks to create solutions that are built around the user and turn data into transparency and insights and, in so doing, fundamentally change healthcare as we know it.

This year in the United States alone, about 1.7 million people will be diagnosed with some form of cancer, but only about 5% of these patients will participate in clinical trials. Data on the other 95% of patients is secured in disjointed electronic health records across physician practices and hospitals. In 2015, SAP partnered with CancerLinQ, a non-profit subsidiary of the American Society of Clinical Oncology. CancerLinQ is a health information technology platform that aggregates and analyzes the rapidly-growing store of patient data to uncover insights and trends and to benchmark physicians' care against current recommended guidelines.

CancerLinQ amasses structured and unstructured data from disparate electronic health record systems, unlocking data silos by de-identifying and aggregating patient data from across the United States, revealing patterns and insights that will lead to improved, more individualized patient care from personalized insights. CancerLinQ will offer anonymized data to researchers and pharmaceutical companies for targeted cancer treatment advancements.

CancerLinQ runs on SAP Connected Health built on SAP HANA, an in-memory data management and application platform. CancerLinQ's data lake currently has more than one million patient records, and more than 1,500 physicians from 70 practices have signed up to participate. CancerLinQ allows physicians to view and compare patients' treatment plans to see how peers are treating similar patients, and identifies opportunities in their own patient population to deliver timely, recommended care following appropriate guidelines.

In closing, I ask three things of all of us. First, let's work to update regulations to support – not constrain – data sharing. Let's look at what policies need to shift, what barriers can be lifted, and what progress we can make toward a more open and collaborative ecosystem. Second, let's be willing to share our data and our innovations. Consider whether we have data that would be useful to share, how we can foster a culture of openness and sharing in our organizations, and whether there's an app or solution we're building that would benefit from a collaborative community.

And finally, let's embrace new types of partnerships, seeking out ways to partner with other organizations across the ecosystem to help spark new ideas and new ways to address important issues in health. The advancements we seek will only come from collaboration and working together as a community. 



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## INTERVIEW

# “People indicate that they would like to change”

Jutta Allmendinger is president of the WZB Berlin Social Science Center and former director of the Institute of Employment Research in Nuremberg. A sociologist, her specialty is the impact of institutions on the life course. She has served on national advisory committees for research and innovation and anti-discrimination. In cooperation with the research institute infas and the German weekly DIE ZEIT, she recently conducted a large, nationally representative survey of popular attitudes towards key aspects of life, including work, family, nutrition and technology. Among the topics addressed in particular was healthcare technology.

*You’ve just completed a huge study asking three thousand citizens between the ages of 14 and 80 about their understanding and acceptance of healthcare technology. What were the most important lessons you learned? Is the basic idea that people who trust technology now think they will in the future as well?*

**Allmendinger:** — The basic question is to what extent people accept improvements in healthcare technology. We can say that about half are adamantly opposed to genetic diagnostics and individual health monitoring. Those are impressively low numbers.

*Low compared to other countries?*

No, low in absolute terms. Many technological innovations have the potential to keep people healthy longer, but first people have to use them. For that to happen, we need to have basic acceptance. That’s at the core of preventive medicine.

To measure basic acceptance, the use of new technologies is one indicator. The potential use of new technologies is another. Therefore, we have not only asked “What kinds of healthcare technology do you use?” but also whether people would recommend using these technologies to future generations. Moreover, the boundaries of acceptance are important to identify. So, we asked: “What extent of use do people recommend, and what is over the top?”

What we found is that people who actually use healthcare technology today are quite in favor of its use in the future, and would recommend it to others. Of the



27% saying: “yes, I use healthcare technology for monitoring my health,” 95% would like to pass this on to future generations.

*So they’re open to it?*

Absolutely. In addition, we can identify those people who do not use it themselves but are still open to change. Taken together, we see little evidence that people reject the idea of using technology in the future.

However, there is serious concern that the developments will be in such a direction that people cannot and do not want to adopt. These are the boundaries of acceptance that I mentioned before. People recommend advancement to a certain extent but they expect developments to go beyond. This is viewed as a future role of healthcare technology that they do not want to accept or would recommend accepting.

*Were you surprised about the initial openness?*

Most people recommend to future generations exactly what they themselves are doing. This willingness to go with technological change surprised me.

The second surprise was that people who are disadvantaged are the ones who are actually in favor of this improved health technology. We usually assume it’s society’s more privileged people who use all the newest technologies. This is in fact not what we found. That is good news. People with a poor education and low income

are much more likely to fall ill because of wrong lifestyle choices. It turns out they’re the ones who are most open to change. I hope that they will really do this and get the support they are going to need.

The third surprising fact is that people are moving forward somehow but are afraid of going all the way. They are really afraid of the future they expect.

*Could it be that poor people are more impressed by doctors? That they are more willing to trust the experts?*

I don’t think so. They are poor, they don’t think of themselves as having good job opportunities. Maybe many of them feel that healthcare is the last system that will provide the same opportunities for everyone – regardless of their income and social position, which do limit their chances in the educational system.

*Can these findings be applied to other countries?*

This is a Germany-specific survey, and although we have now been asked by Italy to replicate the study there, I don’t know the results yet. But we know that other countries are further along when it comes to thinking about healthcare technology. They are also more open to communication technology and the Internet in general than are Germans. For historical reasons, Germans have serious problems with privacy rights connected to big data, which is one of the venues in which healthcare delivery is making enormous advancements. And they’re right, I guess.

*So what are the lessons for policymakers and doctors?*

The message is: We have to educate people and make them familiar with new technologies and how those new technologies can bring them better health over their entire life course. Simply put, there needs to be much more education on health than what we have at the moment.

The other lesson points in the opposite direction. Given the fact that some groups show initial acceptance, you have to reassure them that they can keep the right to opt out of or reject the use of those technologies. There’s a school of thought that believes if they give away personal or private data, corporations like health insurance companies will be able to do whatever they wish to do with the data without asking. It’s suddenly turning into a question of privacy rights. This can also be shown with our data: Over half of the respondents firmly reject the idea of giving data to insurance companies.

*If you want to develop a national digital health system or improve things on a large scale, can some people opt out?*

Yes, I think that you need to give them that opportunity. Or else they won’t be willing to opt in in the first place. 🍀

*“A lot of these technological innovations have the potential to keep people healthy longer, but first they have to use them.”*

**PROF. DR. JUTTA ALLMENDINGER**  
President | WZB Berlin Social Science  
Center | Germany



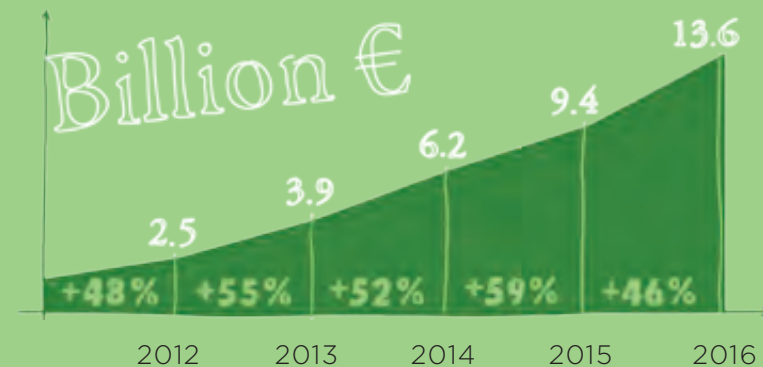
# Technological Innovation: Improving Healthcare Delivery

Successful healthcare quality and delivery depends on the tools and devices used for prevention, diagnosis, treatment and rehabilitation. Technological innovations in the field are helping reduce inefficiencies in healthcare delivery while, at the same time, streamlining access, reducing costs, improving quality and making medicine more personalized and precise.

## BIG DATA

Due to rapidly increasing data volume and new technologies for data analytics, big data is a huge topic in medical circles. In Germany alone, revenue from big data analysis is expected to reach € 3.6 billion in 2016.

(Bitkom, 2014)



## BOOMING BUSINESS

The market for medical robots is expected to reach US \$11.4 billion by 2020, up from US \$4.2 billion in 2015 – a compound annual growth rate (CAGR) of 22.2%.

(MarketsandMarkets, 2015)



## STATEMENT

**Digital transformation is lacking in healthcare. The data is analog, siloed and opaque. Transformation is driven by connection, and data needs to be integrated and real-time.**

Steve Singh (SAP SE President for Business Networks and Applications) at WHS 2016

## 3D PRINTING

# 1984

3D printing was born. Charles Hull invented the stereo-lithography, a printing process that enables a tangible 3D object to be created from digital data. The technology is used to create a 3D model from a picture.

(International Journal of Multidisciplinary Research and Development, 2015)

# 2016



A team from Doctors without Borders created 3D models and a virtual reality reproduction of a recently designed facility in the Philippines that was later built to help people after a 2013 typhoon.

(Doctors without Borders, 2016)

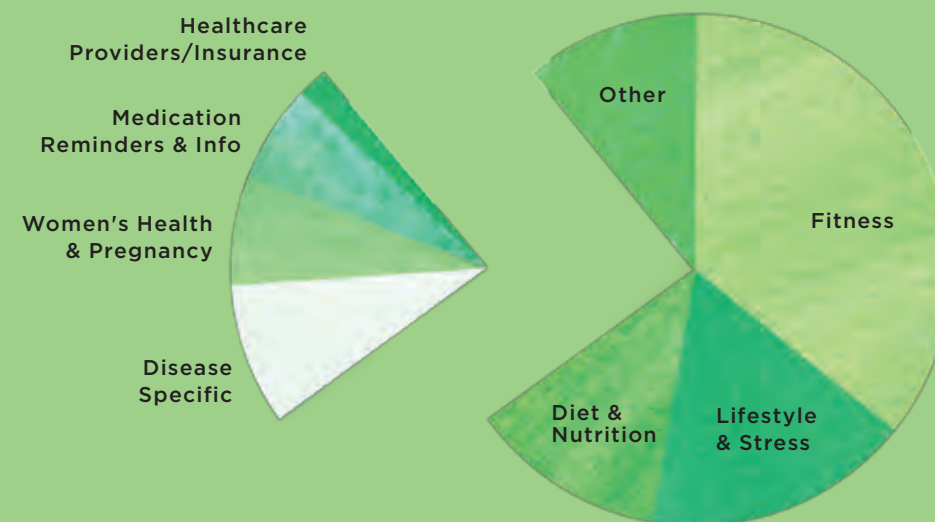
## PEAK



**With US \$104 billion invested in the health IT market, 2016 was one of the biggest years for healthcare technology ever. The worldwide health IT market is expected to reach US \$228 billion by 2020.**

(MarketsandMarkets, 2015)

## MOBILE APPS



Less than 1/4 of all mHealth apps are about specific diseases, medication reminders and healthcare providers.

(IMS Institute for Healthcare Informatics, 2015)

## NANOROBOTICS

**In 2016, researchers from the University of Montreal and McGill University developed new nanorobotic agents capable of navigating through the bloodstream to deliver anti-cancer drugs directly to tumors.**



(University of Montreal, 2016)





# WHS Geneva Meeting 2016 Combined Conferences Break Records

On the occasion of the Geneva Health Forum's sixth edition and 10 year anniversary, the World Health Summit Regional Meeting 2016 was organized in Geneva and called the WHS Geneva Meeting. This partnership emphasized the deep friendship of these global networks, expressing the desire to mutually support each other on an international level and across all sectors. Both the organizers and the more than 1,200 attendants in Geneva agreed that collaborations like this are pivotal to improve health on a global scale as agreed.

## WORKSHOPS ESCAPE THE USUAL ROUTINE

After more than a year of preparations, the WHS Geneva Meeting presented eight specially marked sessions organized by members of the M8 Alliance. The workshops discussed major global health issues like research funding, medical education, sustainability and affordability.

Simultaneously, the Geneva Health Forum (GHF) organizers convened 11 groups of experts from six continents to answer major questions on health issues. The goal was to address

topics in depth in specially designed workshops, breaking away from the usual routine of many international conferences. The sessions tackled a wide range of topics, including access to cancer treatment for children in the poorest countries, mental health in remote regions and telemedicine. These experts repeatedly met via teleconferences and in person in a closed session on April 19 to refine their data and presentation. The findings and recommendations were presented in open parallel sessions on April 20 and highlighted in the last plenary session on April 21. The results were published later on

for further adaption in and beyond the healthcare sector.

## TOMORROW'S AFFORDABLE HOSPITAL

The theme "Global Health: Sustainable and Affordable Innovation in Healthcare" palpably permeated the GHF 2016's three days' program. A special highlight for participants as well as media representatives was the "Tomorrow's Affordable Hospital" exhibit. A small hospital was reconstructed, allowing visitors to discover several innovations at the individual stands. The inventions on display were selected according to two criteria: their accessibility (i.e., affordability for all) and their low environmental impact (i.e., sustainability).

5. Logistics: tackling issues of water purification and protection against infections.
6. Training and research: unveiling various telemedicine systems that allow doctors in rural hospitals to contact urban experts.

Highlights included a pharmacy equipped to detect counterfeit drugs, a digital radiology unit customized for tropical climate conditions for a fraction of the market price, guidance on how to wash your hands while only consuming 10 cubic centimeters (or 10 milliliters) of water, and even a shower that used only a single liter of water.

## THE FEDERAL CAFÉ - A PLACE TO MEET

The Federal Café sessions offered an ideal spot for Swiss organizations and especially non-governmental organizations (NGOs) to introduce topics of special interest. Presentations included "Globalization of Clinical Trials," "Mastering Health Data" and "Health Promotion." Many participants eagerly used these sessions to discuss new global health perspectives in an open debate while enjoying beverages and snacks. They established new communities and networks of shared interest with people from all around the world.

## 1,200 PARTICIPANTS FROM 80 COUNTRIES

The GHF 2016 hosting the WHS Geneva Meeting proved to be a unique opportunity for collaboration between the academic and hospital world, policymakers, experts from major global health NGOs, public-private partnerships, and representatives of the private sector. On its tenth anniversary, the Geneva Health Forum attracted a record 1,200 participants from 80 countries, showing that two internationally leading conferences working together for the shared goal of improving health worldwide could be a tremendous success.



As World Health Summit 2016 President Professor Antoine Flahault put it, "the 6th edition of the GHF hosting the World Health Summit defined how we want to act on global health at Geneva. It demonstrated our deep commitment to ethics and values, from advocating against violence against women to debating the IT revolution's impact on the health sector. The world we want must provide health innovations to all."

The next Geneva Health Forum will be held in 2018. The next WHS Regional Meeting will be organized in May 2017 in Montreal, Canada. ■

[www.worldhealthsummit.org](http://www.worldhealthsummit.org)  
[www.ghf2016.g2hpn.net](http://www.ghf2016.g2hpn.net)



The WHS Regional Meeting 2016 was held in Geneva, Switzerland (1), where researchers gathered to debate important issues (2). Antoine Geissbuhler gave an Innovation Award to Audrey Garcia (3). Didier Pittet, Mauro Poggia and Bertrand Levrat (4, from left) discussed healthcare policy.





# Translational Research

In a society that prizes results and deliverables, the importance of basic research is sometimes overlooked. Yet from infectious disease treatments to cancer cures, the mechanisms of our biology must be understood before doctors can devise treatments.

While major breakthroughs in science sometimes take years of translational research to make the leap from bench to bedside, only continued investment in our understanding of basic biology can continue pushing medicine forward.

That's a challenge public health professionals must be willing to tackle. "The system we have in most countries is one where science and care are largely disconnected," Erwin Paul Böttinger, CEO of the Berlin Institute of Health, said at the WHS. "We need to bring science, research and clinical care together."







## OVERVIEW

# TRANSLATIONAL MEDICINE: VALUE FOR PATIENTS

**While considerable progress has been made in advancing the understanding of health and disease mechanisms, scientific advances have not always resulted in direct benefits to patients. Translation of biomedical ideas into societal and economic benefits that improve people's quality of life is necessary.**

The scale of the demographic challenges ahead, rising healthcare costs, the burden of progressive diseases and their impact on our societies, on healthcare, and on research have all become familiar but are nonetheless significant. These developments will lead to far-reaching changes in patient care, biomedical research and the whole healthcare sector in this century. Future healthcare will be marked by a range of influential trends.

## FACING POWERFUL CHALLENGES

Due to the rising average age of citizens in the industrialized societies, there are an increasing number of people with chronic diseases. Thus, there will be more people at higher risk of needing care. Progressive diseases in particular lead to a reduced quality of life for sufferers and high treatment costs for healthcare providers. In response to these developments, within modern healthcare systems the reimbursement of healthcare services is increasingly dependent on improved quality and quantifiable results. These value-based programs – for example, the Quality and Outcomes Framework in the United Kingdom – have, in the initial analysis, achieved better results at lower cost. On top of that, they have reduced socioeconomic disparities in healthcare provision.

Another evolving challenge which will affect the healthcare system is a new paradigm of biomedical research. A better understanding of the underlying mechanisms and causes of diseases as well as technological advancements are transforming medicine from a reactive to a proactive

and personalized discipline. Systems medicine approaches to biology and medicine provide patients and clinicians with personalized information about each individual's unique health experience at the molecular, cellular and organ levels. This information will make disease care radically more cost-effective by personalizing care to each person's unique biology and by treating the causes rather than the symptoms of disease. Systems medicine is a holistic approach to the challenge of biological complexity. In order to yield a comprehensive understanding of human biology, it uses high throughput technologies – such as DNA and RNA sequencing – to produce global data sets tracking multiple dimensions of dynamic network interactions. With this information, scientists and clinicians can begin to understand how an individual's genetic make-up and environment mutually influence health and disease.

Above that, the digital revolution introduces radically enhanced capabilities for collecting, integrating, storing, analyzing and communicating data and information, including conventional medical histories, clinical tests and the results of the tools of systems medicine (e. g., bioinformatics, data science). Also important is patients' access to information and rising interest in "managing" their own health.

## MOVING MEDICINE FORWARD FASTER

However, these are not the only trends and challenges to be considered. The efficient translation of biomedical

science and engineering technology to the clinic is one of the most pressing research and development issues worldwide. The path leading from knowledge about basic human biology and disease mechanisms to clinically applicable diagnostics, therapeutics and prevention measures presents a variety of hurdles and bottlenecks. These include communication and collaboration gaps, separate infrastructures, insufficient research time for clinicians, and lack of access to a wide range of data from both pre-clinical and clinical practices. More work is needed to support innovation and the creation of value. New education and training programs will be essential to ensure that scientists and clinicians become the driving force behind translating today's discoveries into health benefit.

In short, in a shifting healthcare landscape, translational medicine has become a global priority. In order to overcome these challenges, foster the transformation towards a value-based, innovative and even more personalized medicine, and increase success rates, key issues have to be addressed.

## SOLUTIONS TO FOSTER INNOVATION IN TRANSLATIONAL MEDICINE

More than ever before, technology plays a significant role not just in supporting research, but also in driving key advancements in science and discovery.

**Digitization:** Digitization is transforming research and healthcare. The introduction of universal electronic health records and digital clinical information systems has helped revolutionize the quality of healthcare in some countries including, for example, the United States. Linking clinical data with information from insurers, data on people's fitness and even genome-level data allows clinicians to make informed decisions in real time and enhances the development of personalized medicine.

**Patient involvement:** Fostered by digitization developments, patients are increasingly taking on a more active role in the treatment of their own diseases and are thus contributing to research and healthcare. In the future, patients will become even more involved in helping researchers formulate important research questions, and will often benefit directly from the contribution of their personal data. This will lead to significant advances in clinical research approaches and methods.

**Systems medicine research:** New technologies in systems medicine research involving genetic, systems biological, clinical, environmental and behavioral data must be used to develop markers and models that characterize inter-individual differences better to improve diagnoses and risk predictions, particularly for distinct subgroups.

**Advanced therapies:** Stem cell technologies and gene-editing techniques are two of the most promising recent

developments in biomedical science. The ability to re-program common cells, such as those in blood, and turn them into the multipurpose cells the body uses to regenerate tissue has already become a powerful treatment tool. And the use of enzymes to alter gene sequences, for example, by repairing disease-causing mutations, could soon be widespread. Both are valuable in developing personalized therapies.

**Innovation:** The physical process of bringing new ideas and promising therapies to fruition is one of the toughest challenges in biomedical research, and one of the most important for a translational medicine center to do right. Researchers must know what to do with promising results, have a clear pathway to follow, and have expertise to support them in bringing a therapy to market.

## TRANSLATIONAL RESEARCH IN GERMANY

Coupled with advances in digital medicine and information sciences, these innovative fields have created huge opportunities to develop new ways of tackling disease and advancing translational medicine. In Germany, six Centers for Health Research, launched by the German federal government in 2010, are addressing the challenge of translational research in common diseases. As inter-institutional centers with a decentralized structure, these centers pool knowledge and expertise from universities and their teaching hospitals plus extra-university institutions. Berlin Institute of Health (BIH) is yet another translational research organization bundling strengths in one location and focusing on personalized medicine. The institute with its member entities (Charité – Universitätsmedizin Berlin and Max Delbrück Center for Molecular Medicine in the Helmholtz Association) addresses the key solutions outlined above as part of the "BIH Strategy 2026." BIH aims to achieve scientific breakthroughs and ultimately develop tools that predict disease as well as therapies that save lives and prolong quality of life. And, BIH wants to achieve significant medical achievements with a truly integrative and interdisciplinary systems medicine approach, new alliances and research initiatives as well as an entrepreneurial culture of innovation. The ultimate objective: long-term, sustainable impact for humankind. ▲



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## ESSAY

# NOVEL TARGETS FOR THERAPY

**The Brain Imaging Network core infrastructure of Portugal hosted at the University of Coimbra's Institute of Nuclear Sciences Applied to Health (ICNAS) is a translational biomedical research effort that ranges from new molecular probes to human imaging of brain structure, chemistry and function.**

**W**e feature a fully translational biomedical research effort, from the design of new molecular probes to human imaging of brain structure, chemistry and function with a focus on the human brain (Medical Imaging Branch of Euro-BioImaging). ICNAS started in 2008 and operates a mature imaging infrastructure facility. We have leading expertise, instrumentation and cutting-edge imaging facilities.

Together with five universities, we have eight collaborating research nodes. Several European networks are also collaborating with us. Our mission includes developing and exploiting new imaging technologies driving development and access to state-of-the-art imaging instrumentation. Together with CHUC (the University Hospital of Coimbra) and its Nuclear Medicine Department, we also cover advanced research and clinical areas in the areas of cardiology and oncology.

We have defined training programs, including short- and medium-term courses in advanced neuroimaging methodologies. Initiatives such as the Brain Imaging Network are instrumental to help solve the societal challenge of obtaining a sustainable healthcare system. We hope to accomplish this by helping establish the use of the most updated imaging technologies to provide advanced diagnostics in combination with better and more cost-efficient treatment.

Our participation in the National Roadmap, approved after international evaluation, is justified by the importance of our National Medical Imaging Infrastructure. In fact, the range of our activities covers all the medical imaging work packages of Euro-BioImaging, from translational research using molecular and functional imaging techniques to basic and clinical research in neuroscience, including clinical trials.

The level of complementarity is also very high because of our specialized radiochemistry unit, which can synthesize new compounds for molecular imaging in humans and animals, using several tracers, including C11. Moreover, we also have the possibility of developing new magnetic resonance imaging (MRI) approaches, taking advantage of the research collaboration with Siemens and interactions with centers such as John Hopkins Hospital and the Martinos Center at Harvard Medical School. Our infrastructure has proven its ability to study large cohorts of healthy volunteers (more than 600 on a recent study of aging of different visual functions) and patients (hundreds of patients studied in several national and international neuroimaging/phenotyping projects on neurodegenerative diseases). This helps us design new molecular probes for imaging of structure, chemistry and function with a focus on the human brain. We published multimodal studies in top basic and clinical neuroscience journals, by adding possibilities to unravel molecular mechanisms of disease to the development of novel diagnostic imaging biomarkers to better define and detect early disease processes and test new therapies.

We have implemented MR- and PET-based imaging probes based on dopamine, GABA and glutamate, which are neurotransmitters that have been related to developmental, aging, neurological and psychiatric diseases affecting cortical-basal ganglia interactions such as Parkinson's Disease and related syndromes including Huntington's disease, schizophrenia and autism. The potential was demonstrated by recent publications in prestigious journals such as *Brain* and *Neurology* that confirmed in humans the hypothesis raised in animal models of impaired inhibitory neurotransmission. We prioritize understanding diseases associated with vision and aging and neuropsychiatric disorders associated with striatal-frontal lobe dysfunction.


This strategy is anchored in our success, as shown by international evaluations of the main affiliated research units, in providing leading publications linking vision, neuroscience, healthy aging and neurodegeneration, cognitive sciences and neuroengineering in health and disease.

From a methodological point of view, we have consolidated the ability to combine different modalities (as shown in our success performing simultaneous EEG/fMRI studies to study cognition and mechanisms of disease such as in epilepsy). Finally, we have a research agreement with Siemens, which allowed for the first time to implement GABA measuring sequences in their scanners (and together with a collaboration with John Hopkins University a clinical neuroscience study). We have also implemented a novel data-mining biomedical facility with significant impact in the development of novel diagnostic tools and therapeutic targets.

Internationalization is well grounded, with partnerships including Euro-BioImaging, the International European Consortium on Imaging Infrastructures, the Joint Program of Neurodegenerative Diseases (EU), European Networks, E-Rare European Initiatives (two consortia), as well as European projects with a focus on neuroimaging and neuropsychiatric diseases (BrainTrain and Autism Consortia).

Our strong radiopharmaceutical expertise is well substantiated by our track record in molecular probe production and molecular imaging. We have unique expertise and the equipment for developing imaging markers in brain, heart and cancer imaging. ICNAS can run Phase 0 microdosing studies, and clinical imaging trials in humans. It also develops new imaging techniques in partnership with industry, and labels candidate drugs for scientific and industry studies. Aside from hosting the national core

brain imaging network infrastructure, we began distribution of our own FDG formulation in 2012 and quickly became the market leader, supplying 80% of the country's active PET scanners in 2012. This provides tight coupling between research and services to the community.

In sum, we cover a broad range of disciplines, which is well documented by the interdisciplinary nature of our staff. These include MDs, pharmacists, biomedical engineers, psychologists, biologists and biochemists, each with a broad interest in complex biomedical data, clinical trial design and biomarker research. 



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## ESSAY

# ASIA-PACIFIC BEACON OF MEDICAL RESEARCH

**National Taiwan University Hospital (NTUH) is known for pioneering research on diseases endemic to Taiwan and providing a basis for treatment guidelines in many clinical disciplines. NTUH plays a leading role in clinical trials and research in the Asia-Pacific region.**

NTUH was founded in 1895. It was initially located at Dadaocheng, Taipei, and then was relocated to the present site in 1898. The building was initially constructed out of timber and then it underwent renovation in 1912 to become a tropical renaissance-style building. When completed in 1921, it was the largest and most modern hospital in Southeast Asia. Currently, the hospital employs just over 6,000 staff, has approximately 2,400 beds and serves over 8,000 outpatients daily. Each year, approximately 2,075 clinical interns and medical students, 1,010 residents, and 790 other healthcare workers receive clinical training at NTUH. NTUH is also committed to promoting international collaboration, thereby gaining experience and knowledge from the medical development of advanced countries, and thus enhancing the delivery of high-quality medical care in Taiwan.

## PROVIDING HIGH-QUALITY AND PATIENT-CENTERED CARE

For more than a hundred years, NTUH has been providing the people of Taiwan with high-quality and compassionate medical services. The success of NTUH medical care services lies in the prompt and effective introduction of the latest medical knowledge to and prevent disease and improve the care of patients. NTUH continues to uphold its philosophy of “patient-centered” medical

services to provide medical care at the highest level. The objective is not only that these efforts will enable NTUH to set an example of medical care in Taiwan, but also in Southeast Asia and other developing countries.

NTUH is committed to the promotion of international cooperation. NTUH runs myriad exchange programs with top international academic medical centers to facilitate access to the latest knowledge and information on medical treatments in order to improve medical research and continuing medical education, and advance the quality of medical care in Taiwan. In accordance with the principles of equality and mutual benefit, there are a number of ongoing international cooperative training programs, including programs for medical students, attending physicians, and other medical professionals. There are active collaborative programs with institutions in France, Japan, Korea and Estonia.

## MEDICAL RESEARCH AS ONE OF NTUH'S CORE VALUES

As a university hospital and medical center, NTUH has identified medical research as one of its core missions because it not only affects competitiveness, but also has a far-reaching impact on the nation's healthcare technology, teaching and research. NTUH firmly believes that the

essence of medical research is innovation and the fruit of research and development is the direct result of the unrelenting dedication of each staff to meet “patients’ medical needs.” NTUH’s focus on “medical research” has enabled it to carry out clinical breakthroughs in the world and Asia. NTUH has enjoyed a reputation for world-class pioneering achievements in hepatitis research, organ transplantation, cancer diagnosis and treatment, biophotonics, tissue materials, emergency and critical care, immunology, cardiology, infertility, dermatology, ophthalmology, orthopedics and minimally invasive surgeries.

In order to pursue high-quality research and conform to international research ethics standards, NTUH proactively participates in the Association for the Accreditation of Human Research Protection Program. The pharmacogenomics laboratory received accreditations from the Taiwan Accreditation Foundation and the College of American Pathologists. More than 200 clinical trials are initiated at NTUH each year, many of them part of global multinational trials. There are more than 40 ongoing new drug Phase I trials at NTUH.

## INNOVATIVE RESEARCH ACHIEVEMENTS IN THE PAST 5 YEARS

1. Investigators at the Department of Medical Research of NTUH and the Department of Chemical Engineering of National Tsing Hua University collaborated to work on the latest Enterovirus (EV) vaccines. Using molecular biology techniques, the joint team researched and developed a virus-like particle (VLP) vaccine. Animal trials of this VLP vaccine on macaque monkeys were successfully completed. The results showed the animals developed substantial concentration of antibodies, as well as the ability to neutralize EV-71. This research finding was published in the journal *Vaccine*. This research team is the international frontrunner in the research and development of EV vaccines.
2. A multi-center randomized trial led by the investigators from the Department of Internal Medicine of NTUH confirmed the efficacy of a novel sequential treatment as the first-line treatment for *Helicobacter pylori* infection – a common pathogen for gastric diseases. In this research, the research team extensively analyzed antibiotic resistance, designed a decision model that could predict the efficacy of anti-*H. pylori* treatment in different regions around the world, and disseminated an important message that the optimal regimen should be tailored to the local prevalence rate of the antibiotic resistant strains. Results of the study were published in one of the top medical journals, *The Lancet*, in 2013.
3. The pneumothorax research team conducted a randomized clinical trial to verify that the addition of minocycline pleurodesis after the standard treatment of aspiration and drainage for primary spontaneous pneumothorax can effectively reduce the rate of recurrence and the probability of a follow-up operation. The study was published in *The Lancet* in 2013.
4. Through a collaborative team effort, researchers from National Taiwan University Hospital (Department of Internal Medicine and Department of Medical Genetics), National Taiwan University College of Medicine and Academia Sinica discovered the genes that cause antithyroid drug-induced agranulocytosis. Results of this research were published in *Nature Communications* in 2015. ▲



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## ESSAY

# THE POWER OF TRANSLATION

**Translational research promises to use the discoveries of fundamental biomedical research to develop new clinical applications. Whether this promise has been kept is a matter of intense debate. Here we demonstrate how both fundamental and applied research play roles in the development of new and innovative treatments.**

This summer, the US Food and Drug Administration (FDA) has approved two drugs called Alirocumab and Evolocumab. Both are inhibitors of the proprotein convertase subtilisin kexin 9 (PCSK9) and have the potential to replace the well-established statins as the standard treatment for lowering blood cholesterol levels. The approval of PCSK9 inhibitors by the FDA is a paradigmatic example that fundamental research oriented toward a general understanding of biological principles can create the knowledge base for the development of new drugs. The PCSK9 gene was found during research to better understand how proproteins and their convertases function. It was quickly recognized that it encodes a new proprotein convertase, but its function in regulating cholesterol levels was only uncovered when PCSK9-deficient mice and humans with crippling PCSK9 mutations were analyzed and found to have strongly reduced cholesterol levels in the blood. It took over 10 years from the original discovery of PCSK9 to the first FDA approval of PCSK9 inhibitors as new drugs. Some have even argued that it is questionable whether PCSK9 would have been found by research directly targeted at finding new cholesterol regulating enzymes.

## DISEASES IN THE CROSSHAIRS OF APPLIED RESEARCH: THE EXAMPLE OF THE ARTIFICIAL PANCREAS

One of the most fascinating developments in the field of applied medical research is the artificial pancreas to treat diabetes type 1. The development of the artificial pancreas is based on extra-corporal insulin pumps that are used

today by people with type 1 diabetes. These patients have to carefully manage their blood glucose levels to avoid hypo- or hyperglycemia. This is particularly difficult at night, where periods of hypoglycemia remain the most common adverse effect of insulin therapy. The newest generation of the artificial pancreas, which should be available to patients within the next 2-3 years, use computer algorithms that allow a precise dosing of insulin and glucagon in response to varying blood glucose concentrations, which are measured using a sensor. The monitoring of blood glucose and the activation of the insulin or glucagon injections are continuous and will ideally be reviewed by the patient via smartphone applications and should increase the quality of life of diabetes type 1 patients significantly.

## NEW BIOMARKERS AS “COMPANION DIAGNOSTICS” FOR PRECISION MEDICINE

Biomarkers are now used increasingly in clinical practice to follow the course of a disease more precisely and to select suitable treatments more adequately, for instance, according to an individual patient's genetic make-up or to identify therapy responders within entire patient cohorts. Biomarkers can be genetic variants, metabolites or substances which, once introduced into an organism, allow a physician to monitor a specific physiological parameter or even the function of whole organs. Rubidium chloride, used to evaluate heart muscle perfusion, is one such example. Other biomarkers may indicate changes in expression of proteins or metabolites that correlate with the course of a disease,

with individual risk or with a specific prognosis. Even brain images can be used as biomarkers as recent examples from psychiatric research shows. Recognizing and diagnosing mental illness has always been a particular challenge for psychiatrists and researchers alike. However, recently, functional magnetic resonance imaging or functional MRI (fMRI), which is a neuroimaging procedure, has been used to measure blood flow and thereby neuronal activity. A recent report showed that fMRI markers could identify autistic patients with good accuracy. This is most certainly a major advance in the diagnosis of mental illnesses.

## USING IMMUNE CELLS TO TREAT CANCER

Harnessing the body's own immune system against cancer cells has long been on the mind of oncologists and cancer researchers. This idea stems from old but largely anecdotal observations that cancer patients suffering from viral infections sometimes had a more favorable outcome than their non-infected counterparts. The concept is plausible, since cytotoxic T-cells that can recognize and kill virus-infected cells are part of our immune defense and their “killer” capacity could be directed against tumor cells. Recently, we have witnessed a comeback of this idea in the form of a new therapy that uses so called chimeric antigen receptor carrying (“CAR”) T-cells. Here, T-cells are collected from a cancer patient by apheresis and are treated to express a CAR, which is nothing else than a modified T-cell receptor able to recognize a specific tumor antigen expressed on the surface of a cancer cell. The CAR-carrying T-cells are then expanded in vitro and re-injected into patients, where they eliminate the cancer cells that carry the cognate antigen. Examples are T-cells with CARs directed against the disialoganglioside GD2, which can recognize and kill neuroblastoma cells expressing GD2 or T-cells with CARs for CD19, which have already shown high potential to kill B-cell type leukemia cells.

## NEW GENOME EDITING TOOLS FOR GENE THERAPIES AND THE RISK OF “GENE DRIVE”

A new genome editing tool called CRISPR/Cas9 is another example of how discoveries from fundamental, non-targeted research can provide powerful tools for clinical applications. By investigating how bacteria deal with foreign DNA, for example coming from bacteriophages, researchers have discovered the CRISPR/Cas system. The immense significance of this discovery and its potential for biomedical research and gene therapy was immediately recognized and experiments with these new tools are now present in laboratories the world over. CRISPR associated, or “Cas”, proteins are RNA-guided DNA endonucleases. CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats and together with the protein Cas9, for instance, enable bacteria to degrade foreign DNA at specific sites. When the Cas9 nu-

lease and the right guide RNA molecules are delivered into a cell, the genome of this cell can be cut at a precise location, exactly where the guide RNA finds a complementary sequence. This enables the removal or destruction of genes, corrections of mutations or the introduction of new mutations in any given genome. This opens infinite possibilities to design new therapies in particular for monogenetic diseases, but also for infectious diseases or to revert therapy resistance. CRISPR/Cas genomic editing has been tested and already proven capable of correcting gene defects in mouse models for sickle cell anemia, muscular dystrophy and cystic fibrosis; hence for diseases where single gene mutations are at the root of the problem. Other applications include the targeting of viruses (e.g., herpes, hepatitis B or even HIV) where a DNA intermediate is required for their life cycle and which can be targeted by Cas9 and suitable guide RNAs to be eliminated or incapacitated.

In 2014, researchers from MIT and their colleagues who co-discovered the CRISPR/Cas9 system described a way to use this editing tool to “drive almost any genome alteration through sexually reproducing populations.” They declare that “gene drive could benefit human health for instance by altering insect populations transmitting diseases such as malaria.” However, the spreading of genome alterations through entire populations could have unpredictable consequences and it remains to be seen whether the elimination of entire species by gene drive – even if it concerns flies transmitting deadly diseases – is controllable. Therefore, some of the researchers that were involved in the discovery of the CRISPR/Cas9 system and had demonstrated its potential to manipulate entire genomes have called for a moratorium on using CRISPR/Cas9 on the human germ line. This ongoing debate reminds us again that many new scientific discoveries and breakthroughs, as exciting as they are, still bear risks that we have to weigh with caution against all potential benefits. ▲



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## INTERVIEW

# “You make the biggest impact by doing basic research”



Elizabeth Blackburn is president of the Salk Institute for Biological Studies, one of the world's preeminent research centers. In 2009, Blackburn won the Nobel Prize in Medicine for discovering telomeres, which serve as protective caps on chromosomes and are essential for preserving genetic information. Telomeres seem to play a key role in aging and diseases such as cancer, and Blackburn's work helped jumpstart new research in these areas.

*Congratulations on your recent appointment to head the Salk Institute. Are you here to advocate on behalf of the translational potential for basic research?*

**Blackburn** — I think I'm more here to cheer for health. To me that is the overarching consideration. Jonas Salk invented a vaccine for polio in the 1950s. And he didn't get rich from it, but he had this vision: You make the biggest impact by doing basic research.

Despite all our knowledge, there is still such a lot that we don't understand about how diseases unfold, especially the non-infectious ones. Those diseases are not really well understood. Alzheimer's is a really dramatic example.

*Please tell us about your experience researching the telomere – did you think it would have clinical applications?*

It began as very basic research – what's at the end of chromosomes? Nobody knew. I was using whatever molecular techniques were available to get an answer.

It turned out that telomeres had inherent properties that could mean chromosomes would become unprotected over time. What has been exciting over the years has been finding out how that actually plays out in human lives. Of course, we have life expectancies in developed

countries of 80 years or more, so in humans you have to ask questions in ways that you can't ask in rapid, short life model organisms.

Non-communicable diseases are basically when the complex machine of the human body starts breaking down. They are truly huge killers – diabetes, cancers, cardiovascular diseases, strokes, even lung disease. And then neurodegenerative disease is having such an impact, not so much by killing people but by having a real impact on quality of life. When telomeres shorten too much over decades of life, that starts to accelerate these diseases and make them worse.

*How did you make that transition from looking at telomeres in the model organisms to humans?*

I went to a medical school and somebody says to me, oh, would you like to join our cancer investigation. By then people knew the enzyme we'd discovered played a role in most human cancers.

Then a young colleague, Elissa Epel (Department of Psychiatry, University of California) came in one day and said, “When human beings are stressed, then they look more and more aged, what happens to their telomeres?” That grew a whole field looking at what things in people's

lives influence their telomeres. So many conditions in people's lives actually impact on disease risks, but it was very hard to accept that your neighborhood is actually a risk factor for cardiovascular disease and diabetes. It turns out stress makes your telomeres wear down faster.

*How do you bottle that knowledge?*

It's very interesting because it turns out that everything your mother told you to do is right, in terms of the effects on maintaining telomeres. Every good parent says, “sleep well, eat healthily, get some exercise, have a good attitude.” All these things help preserve the ends of our chromosomes, it turns out. You're not asking for an untested drug. It doesn't cost you anything to walk.

If we emphasize treatments but we don't emphasize prevention, then we're never going to get anywhere. The biology of prevention is more complex and less urgent-seeming, but in terms of public health overall, it's simple: that's where we also need to be putting the money. Nobody likes this because it's too distant-seeming and does not have the same commercial attractions as disease treatments.

Thus, prevention is a much more challenging question, because the incentive is always to treat a disease that is there right now. Of course, by that time it's way too late and the disease has already done a lot of damage. With telomeres we have a really good molecular biomarker.

That, to me, is very practical. No one could love Western medicine more than me, but at some point you realize that part of the picture is preventing and intercepting disease.

*“It turns out that everything your mother told you to do is right, in terms of the effects on maintaining telomeres.”*

**PROF. DR. ELIZABETH BLACKBURN**  
President | Salk Institute for Biological Studies |  
La Jolla | USA

*In your presentation you gave a great example: People who have bladder cancer and simultaneously have both shorter telomeres and depression at the time of diagnosis of their cancer are far more likely to die than people with just one of those conditions – also that people with depression have shorter telomeres. What's the link?*

Depression has big physiological readouts and clear increases in risks for co-morbid diseases like cardiovascular and diabetes. It clearly causes a big physiological change. If someone who is depressed has cancer, the host – the body – in which the cancer is growing is not the same as a non-depressed host.

And there is a clear dose dependency between telomere shortness and depression history and severity.

When you look at telomeres in a number of cohorts, the more days of lifetime accumulated untreated depression a person has in their past the shorter their telomeres. If you could measure telomere length in long-term depressed individuals, you might be able to assess their risk of co-morbidities.

*Is there a way to systematize the dialogue between clinicians and basic scientists?*

That can be done at a sort of policy or strategic level from the national funding agency. In my experience, the National Institutes of Health in the US showed a real willingness to see the value in why this kind of research should be funded. That's been one thing I've observed that has really changed in the last decade, in a good way.

*You mean encouraging as many different disciplinary approaches as possible in a grant?*

If you're going to write a good proposal to do good research on complex problems – and human biology is complex! – you're going to need to talk to people who have very different training, a very different mindset, and different languages that they use.

I think it works more when there are really material incentives. In my case it was grants. I did it within, by and large, a big research university. But then I felt it was really very easy to do between research universities as well. You need the right sort of openness, which is to say to one's basic scientists that your clinical colleagues are actually really smart, but in ways that are different from your smartness. I found you need to talk one-on-one because you really need to make sure you're talking about the same things.

*So it's a matter of changing the funding and the culture?*

I have been a basic scientist for decades, and it wasn't that hard to start conversations. But you have to think that there was some value to it.

*If you could come up with a pill to preserve telomerase, would I want to take it?*

You'd be stupid because significant research in humans indicates that you'd increase your risks of some cancers.

*Because my cells would never die?*

Increases in telomere maintenance is associated with increased risks for some cancers. When you're looking at things over decades and decades of life, small effects can cumulatively add up to big overall cumulative risks from cancer – imagine the risk goes up a few percent each year, but that plays out for three decades. That's going to have a big overall risk effect.

We already have ways that we know are better at maintaining telomeres – exercise, rest and reducing stress, for instance. They are free, so those are the smart things to go with.



# Translational Research: Advancing Innovative Treatment

*Translational research is advancing innovation, making it even more attractive for further investment and development. A central aspect of this process is the effective translation of knowledge, mechanisms and techniques generated by advances in fundamental scientific research, turning them into novel approaches for prevention, diagnosis and treatment.*

## GLOBAL FUNDING



Diseases mostly found in low-income and middle-income countries like malaria and tuberculosis receive just 1% of all global funding for health research, despite WHO estimates that these diseases account for more than 12.5% of the global disease burden.

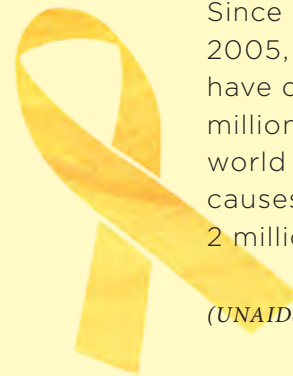
*(Lancet, 2013/WHO, 2016)*

## LIFE EXPECTANCY RISING

**71.4 Years** in 2015.  
**69.8 Years** in 2010.  
**68.0 Years** in 2005.  
**66.4 Years** in 2000.

*(WHO, 2016)*

## FIGHTING AIDS



Since the disease's peak in 2005, AIDS-related deaths have dropped: In 2015, 1.1 million people around the world died from AIDS-related causes, a 45% drop from the 2 million people killed in 2005.

*(UNAIDS, 2016)*



## MARKET SUCCESS



**1 IN 10,000** scientific discoveries makes it to market.

*(National Center for Advancing Translational Sciences, 2013)*

## STATEMENT

**It's very important for decision-makers to incentivize this kind of work. This is where we will see the next step up to unlocking the potential of value-based healthcare.**

Christina Akerman (President International Consortium for Health Outcomes measurement) at WHS 2016

## BIG INVESTMENT

On average, it costs US\$ **2.6 billion** to develop and gain marketing approval for a new drug.

*(Tufts Center for the Study of Drug Development, 2014)*



1990 2015

## CHILD MORTALITY

Worldwide, the rate **fell by more than half from 1990 to 2015**, and deaths of children under 5 fell from 12.7 million to 6 million, having dropped from 90 to 43 deaths per 1,000 live births.

*(United Nations Development Programme, 2016)*





## WHS REGIONAL MEETING - NORTH AMERICA, MONTREAL 2017

### TOPICS

#### New Frontiers in Medical Treatment

Development of precision medicine, rare and genetic diseases, viral infections, diabetes and antibiotic resistance.

#### Health and Healthcare Delivery for Specific Groups

First Nations health, health and immigration, health in the workplace, healthcare quality and patient safety.

#### Environmental, Social and Cultural Determinants of Health

Transformation of the urban environment and its impact on the health of city dwellers, the promotion of healthy lifestyle habits and its influence on healthcare costs.

#### Medical Education for Optimal Healthcare

Medical education and the evolution of physicians' role in society, the global health curriculum and the accreditation of medical schools.

#### SAVE THE DATE

REGIONAL  
MEETING  
NORTH AMERICA  
MONTREAL  
MAY 8-9, 2017

#### SAVE THE DATE

WORLD HEALTH  
SUMMIT  
GERMANY  
BERLIN  
OCT 15-17, 2017

## WORLD HEALTH SUMMIT BERLIN 2017

### TOPICS

#### Health Policy in the G7/G20:

##### The Future of Global Health Governance

The Sustainable Development Goals underline the need for financial and political commitments to solve global health challenges.

#### Global Health Security:

##### Policy Responses to Planetary Challenges

Communication and cooperation are key to protecting the world from health threats.

#### Healthy and Resilient Cities:

##### Rethinking Urban Transformation

Health must be integrated into urban planning and policy decisions.

#### Vaccination and Disease Eradication:

##### The Role of Research & Development

Vaccine research is a must when it comes to controlling dangerous pathogens.

#### New Frontiers in Health Sciences:

##### Remodeling Healthcare

Improving the health of patients must be at the center of efforts to restructure healthcare.

#### Big Data for Health Governance:

##### Benefits, Frameworks & Ethics

Data can improve health outcomes, but collecting personal information poses ethical, regulatory and technical challenges.

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**EDITORIAL DEADLINE** November 1, 2016



## INNOVATION FOR LIFE

**HOPE IS WHAT ENERGIZES OUR RESEARCHERS TO PUSH  
THE FRONTIERS OF MEDICAL INNOVATION EVERY DAY.**

To fight against dengue fever, hypercholesterolemia,  
diabetes and atopic dermatitis, our researchers help  
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