VACCINES BEAT

NEW VACCINE PLATFORMS

A conversation with the father of reverse vaccinology
Prof. Rino Rappuoli

August
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"IMMUNIZATION IS A GLOBAL HEALTH AND DEVELOPMENT SUCCESS STORY SAVING MILLIONS OF LIVES EVERY YEAR"

WORLD HEALTH ORGANIZATION

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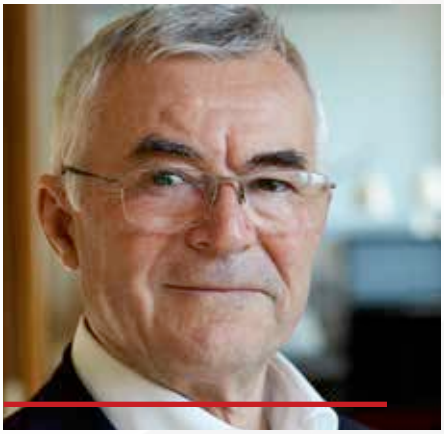

Message from Prof. Rino Rappuoli

Prof. Rino Rappuoli is known globally for his work on vaccines discovery and immunology. He co-founded the field of cellular microbiology, a discipline combining cell biology and microbiology, and pioneered the genomic approach to vaccine development known as reverse vaccinology, an improvement of vaccinology that employs bioinformatics and reverse pharmacology practices. As part of his many posts, Prof. Rappuoli led some of big pharma's most influential research & development units. He also served as visiting scientist at Rockefeller University and Harvard Medical School and, in 2017, he received the European Inventor Lifetime Achievement Award for his ground-breaking new generation of vaccines, which eradicated infectious diseases such as diphtheria, bacterial meningitis and whooping cough in the developed world.
Prof. Rappuoli's contributions to vaccine science and immunology are nothing short of transformative. His pioneering work in reverse vaccinology fundamentally reshaped how vaccines are developed, moving from traditional empirical methods to a more precise, genomics-driven approach.

Full Bio

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LETTER FROM EDITORS

Welcome to Issue 002

Building on the success of our first issue, we are excited to continue our mission of informing, educating and promoting knowledge in vaccinology and vaccination.

In our "Coffee with an Expert" section, we are honored to feature Professor Rino Rappuoli, who shares his insights, experiences and opinions on his legacy in vaccine discovery, the present and future of vaccine platforms, avian influenza, pandemic preparedness, and his thoughts on the importance of vaccine acceptance, encapsulated in his message: "Don't be afraid of vaccines."

Our "Editor's Corner" section delves into the threat of avian influenza, while the "Best Practice" section highlights the impact of a single-dose Hepatitis A vaccine as an effective public health intervention, with supporting data from Argentina and other countries.

The "Guest Contributor" section explores the complex factors influencing access to medicines and vaccines, emphasizing the need for a globally equitable approach.

As always, this issue features the "Latest Scientific Publications" and the most recent and significant "News and Alerts."

We hope you find this August issue informative and engaging. We look forward to continuing this unique effort in support of a healthier planet.

Javier Casellas, M.D., Ph.D.

Chief Editor

Enrique Chacon-Cruz, M.D., MSc

Chief Editor

Javier Casellas

Well-recognized Argentinian Pediatrician and Infectious Diseases Specialist with more than 17 years of experience on Medical Affairs & Clinical Research on Vaccines field within different multinatinational & recognized Pharmaceutical Companies. (GSK and Novartis Vaccines)

From 2005 to 2015 Dr. Casellas worked as Vaccines Medical Affairs / Clinical Research Director (GSK and Novartis vaccines in Latam Region) with experience on vaccine clinical research, medical affairs activities, vaccine pharmacovigilance, public & private vaccine market access, strong relationship with MoHs across Latam and supranational organizations (such as PAHO, and Sabin Institute), and has published several scientific papers and posters in international journals and meetings, among the most relevant medical activities.

Since 2016 Dr. Casellas became an Independent Vaccine Consultant. From 2016 to 2018, Dr. Casellas joined an NPO (FIDEC, Miami, FL, USA) as Medical Manager working on vaccine clinical trials along with Bill and Melinda Gates Foundation. Currently, Dr. Casellas works on global & regional Vaccine and Infectious Diseases (IDs) trials at IQVIA as Global Medical Director within the Infectious Diseases and Vaccines Team.

Enrique Chacon Cruz

Enrique Chacon-Cruz, M.D., MSc, Mexican-born medical doctor with a degree from Guadalajara, Mexico, and further specializations in Pediatrics and Infectious Diseases from institutions in Mexico City and the USA (Eastern Virginia Medical School). He also holds a Master's degree in Vaccinology and Drug Development from the University of Siena, Italy.

He is an Overseas Fellow of the Royal Society of Medicine of the United Kingdom and a member of several international associations in Infectious Diseases. Currently, he is the CEO and Founder of "Think Vaccines" (Research, Education, and Consultancy for Vaccines and Vaccinology) based in Houston, Texas.

With over 140 research items published and/or presented at international meetings and more than 500 international lectures, all focused on vaccines, vaccination, clinical trials, and vaccine-preventable diseases. The latter conducted independently or in association with the Centers for Disease Control and Prevention (CDC), the University of California in San Diego, Eastern Virginia Medical School, and several other institutions.

Additionally, he is a member of the Mexican Committee for the Elimination of Measles, Rubella, and Congenital Rubella, and the Scientific Committee on Health Issues of the Mexican Government in Baja-California. He is also the former Director of the Mexican Active Surveillance Network for Bacterial Meningitis and the former Head of the Pediatric Infectious Diseases Department and the Research Department at the General Hospital of Tijuana, Baja-California, Mexico.

Coffee with the Expert

NEW VACCINE PLATFORMS

A conversation with the father of reverse vaccinology, Prof. Rino Rappuoli

Authors:
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Prof. Rino Rappuoli is known globally for his work on vaccines discovery and immunology. He co-founded the field of cellular microbiology, a discipline combining cell biology and microbiology, and pioneered the genomic approach to vaccine development known as reverse vaccinology, an improvement of vaccinology that employs bioinformatics and reverse pharmacology practices.

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Reverse Vaccinology

Prof. Rappuoli's contributions to vaccine technology have indeed been monumental, with his work significantly impacting public health. The huge success of many vaccines based on reverse vaccinology, on Prof. Rappuoli's invention, lends to unsurmountable appreciation of his legacy to public health and the inevitable question about its future.

Reverse Vaccinology emerged from Prof. Rappuoli's insight into the potential of genomics for vaccine development. When he and his team embarked on this journey in the mid-1990s, it was driven by the challenge of developing a vaccine against meningococcus B, a pathogen that was proving resistant to conventional methods. The sequencing of the Haemophilus influenzae type b genome by Craig Venter was a pivotal moment that inspired this approach.

"And that was clearly a new, fascinating, revolutionary technology. I mean, we had never seen a complete genome of anything before. And the idea came that, if we could know the genome, we could make a vaccine," reminisces Prof. Rappuoli, smiling at the thought of what now seems like a Stone Age of genomics.

By decoding the genome, Prof. Rappuoli and his colleagues could identify potential vaccine targets, dramatically shifting the vaccine development paradigm. After the years, genomes became routine.

"And you know, today, we do every day, hundreds, or if we want, thousands of bacterial genomes, or human genomes, which are much bigger than that. So basically, what we did at that time was the beginning of a new technology, which has become routine, which has become much faster.

And today, I would say what reverse vaccinology is, basically, is everything," he humbly asserts.

Today's genomic capabilities are a testament to the revolutionary impact of reverse vaccinology. Currently, the database of COVID and SARS-CoV-2 genomes is around 16 million. This vast database and the rapid sequencing technology underscore how far the field has come. The scale is different, but the pioneering principle is the same.

This progress has not only enhanced vaccine development but also deepened our understanding of pathogens and immune responses. As genomic data becomes more comprehensive, future directions could lead to more personalized vaccines tailored to individual genetic profiles or specific pathogen strains.

Beyond reverse vaccinology, Prof. Rappuoli highlights the significance of structural vaccinology, which has accelerated and refined vaccine development by allowing detailed analysis of protein tridimensional conformation.

Structural Vaccinology

Structural vaccinology builds on the principles of reverse vaccinology by adding a crucial layer: structural biology. While reverse vaccinology identifies potential antigens from a pathogen's genome, structural vaccinology takes this a step further by using detailed information about the protein structures to design and optimize these antigens.

"But now, structural vaccinology is also pervasive in the design of every single antigen. Because not only you can solve a problem pre-fusion, post-fusion, but, you know, for people that have been doing vaccines, the stability of the antigens, the proteolytic cleavages, all these kinds of things are nightmares. I mean, you can spend years trying to fix these things with classical technologies," said Prof. Rappuoli, an Honorary Professor of Vaccinology at Imperial College in London.

It certainly represents a major leap forward from reverse vaccinology, integrating structural biology with genome-based techniques to refine and optimize vaccine antigens. Prof. Rino Rappuoli's insights into this field reveal its profound impact on vaccine development and its role in addressing complex challenges.

"Today, you can design the structure you want and the conformation you want, and then you can use normal algorithms. But mostly today artificial intelligence, to increase the thermal stability of your product, to eliminate proteolytic cleavages, so that your antigens are perfect. They will expose the right antigens for a long time. They will be stable at room temperature, or much more stable than any of the other ones. So, basically, that will be produced in large quantities, because you can engineer the amount of proteins that you can make. So, basically, you design everything on your antigens today," eagerly expanded Prof. Rappuoli.

Conjugate vaccines

A conjugate vaccine is a type of subunit vaccine which combines a weak antigen with a strong antigen as a carrier so that the immune system has a stronger response to the weak antigen. Conjugate vaccines, for Hemophilus, meningococcus and pneumococcus, are among the safest, most effective and most important vaccines ever made.

"It's true that, in the case of pneumococcus, we started with seven variants, and then we got to 13, now we are at 20. There are people working on 25, and others are 25, I think, 24, 25, are already in clinical trials, while the people are already thinking about 32, 34. And, as you said, there is one thing that is happening, which is where you go from seven to 13 to 20 and 24. I mean, you lose a little bit of the peak titers of the immunogenicity," exemplified Prof. Rappuoli, Senior Professor of Molecular Biology at the University of Siena.

"It's not so worrisome for the moment, because the antibody titers are still pretty good, but that's happening. So, it's going to be difficult, probably, to go beyond 30 or more serotypes, but it's already a great achievement. Now, is there an alternative protein-based? I think, if we did a systematic approach or reverse vaccinology to pneumococcus or other bacteria, we could design a protein-based vaccine," he continued.

The problem with a protein-based vaccine for pneumococcus is that it would be impossible to license. The reason is that the conjugate technology works so well that a protein-based vaccine should show that it is at least as good, if not better, than the conjugate.

"But every child in the world is already vaccinated with a conjugate, so how do you show that your vaccine is better? So, the clinical trial is actually, if you come up with a design to license a protein-based vaccine for pneumococ-

cus, I'll be delighted to listen. But, all the people I've asked and every time I've tried, it became impossible to design and try. Because you need to be better at something which is extremely good, and every child is vaccinated. So, that's the problem for pneumococcus," he pointed out.

For antibiotic-resistant bacteria, Klebsiella and Shigella, among other examples, protein-based vaccines are still a possibility.

mRNA

Before the pandemic, mRNA vaccines were only a myth. Licensed globally since then, they became extremely popular not only for COVID, but also for respiratory syncytial virus (RSV) and many other infectious agents.

"I strongly believe in mRNA vaccines. The way they were licensed for COVID was because they were fast, and they were kind of mature enough, because they've been in a few phase I, phase II clinical trials. But, actually, they were not ready for commercial use. Without the pandemic, probably the mRNA vaccines were not going to become licensable for another seven or eight years, because they were not, still are not stable, temperature stable," conveys Prof. Rappuoli, who thinks they are extremely powerful but still too reactogenic, especially when adding multiple valences.

Clearly, one incredible advantage of RNA is speed. According to Prof. Rappuoli, if you have a well-designed study, you can go to phase I clinical trial in 30 days. As a comparison, before the pandemic, it took 18 months with proteins before going to phase I. Hence, during the pandemic, the protein-based vaccine was lost in terms of speed and it's now challenged as an option. Will mRNA vaccines replace other platforms?

"Well, there are some vaccines that cannot be replaced. Conjugate vaccines can't. I have no idea how you can even think of doing a conjugate with RNA. So, those are out of scope. All the others, in theory, you could do them with RNA. The question is, are they better, worse, equivalent?" inquiries Prof. Rappuoli.

RNA seems to be better than the other vaccines in combination with more antigens. With protein-based vaccines, making the new combination is like making another vaccine. Due to the many uncertainties and incompatibilities that it elicits, it requires massive clinical trials.

"While for RNA, it seems that combining more RNAs in one vaccine seems to be pretty straightforward. So, that could allow to have multivalent vaccines, to have influenza vaccines, including neuraminidase. So, basically, it could be very fast. So, those two are clear advantages," he expands.

In contrast, not only are RNA more reactogenic but it looks like the immunogenicity provided doesn't seem to last as long as the protein-based vaccines, especially the ones with adjuvants.

"I don't think there are very solid data yet showing one thing or the other. But if that's true, that's a limitation that we need to keep in mind. So, my position is that RNA will be another technology that allows us to make vaccines, has some advantages and some limitations. Like all the other things, I don't think it's going to replace everything," he confirms.

Prof. Rappuoli believes we will still use all the technologies available for different uses and RNA will become yet another platform, but it will not replace the others because they have shown to be safe, versatile, and provide remarkable immunity. Instead, they will complement and expand the repertoire of tools available for vaccination.

Is AMR driving vaccine technology?

According to the World Health Organization, antimicrobial resistance (AMR) is one of the top global public health and development threats. It is estimated that bacterial AMR was directly responsible for 1.27 million global deaths in 2019 and contributed to 4.95 million deaths. In addition to death and disability, AMR has significant economic costs. The World Bank estimates that AMR could result in US$ 1 trillion additional healthcare costs by 2050, and US$ 1 trillion to US$ 3.4 trillion gross domestic product (GDP) losses per year by 2030.

Prof. Rappuoli asserts that, for bacteria, we should be able to use any vaccine platform. The question is, why are we not developing vaccines for AMR?

"The main reason is that antibiotics have done so well that basically we thought we were going to solve everything with antibiotics. But we created a huge problem, because in the meantime, we basically made all bacteria, or most of the bacteria, globally resistant to antibiotics, and now we are really in trouble," he explained.

"But the problem is that we have been naive in trying to solve such a big problem like

bacterial infections only with antibiotics, because they are one of the tools that we have. The other tool, obviously, are vaccines. And mostly for economic reasons, we had never developed vaccines for key bacteria-resistant antibiotics," expands Prof. Rappuoli.

The first vaccines developed for a bacterial infection were for typhoid fever, now used in Asia and Africa for a bacterium that, otherwise, would be extremely resistant to antibiotics. E. coli is emerging as another big concern, and the antibiotics available are not effective for many of the hypervirulent and pan-resistant cases. Prof. Rappuoli believes vaccines should be developed for bacteria-resistant antibiotics as an alternative tool for prevention and use antibiotics for cure. He recommends investing in other technologies, such as phase therapy or CRISPR-Cas.

"The advantage of vaccines is that usually there is no resistance to vaccines. There are some vaccines which have been around (diphtheria, tetanus, BCG) for a century and still there is no resistance. You can argue, well, but in the case of capsule polysaccharides you have a new capsule emerging. Or in the case of COVID, you have new variants. If you call that resistant, that's okay. But it's not comparison to antibiotics, where once you have a new antibiotic, five years later, it's obsolete because bacteria become resistant everywhere," claims Prof. Rappuoli, a pivotal pioneer in polysaccharide-protein conjugate vaccines.

Some viral vaccines against influenza have indeed proven to decrease the number of antibiotic prescriptions. It would be interesting to know whether this is also the case for the recently licensed vaccines against RSV, now treated with antibiotics. Prof. Rappuoli is convinced it should.

HIV vaccine

Interestingly, RSV vaccines came about trying to solve the HIV scientific dilemma. Even though many efforts are underway, there is currently no vaccine available to prevent HIV infection. Targeting germline precursors of broadly neutralizing antibodies is acknowledged as an important strategy for HIV vaccines. Yet, simulated research was an impossible task with HIV because of the variability of its rapid mutations in every person every day.

"I don't see a vaccine [for HIV] coming up in the short term, because all the approaches

that have been tested trying to induce broadly neutralizing antibodies failed. And out of desperation, the germline targeting approach came out, which is innovative, is fantastic, is making progress," Prof. Rappuoli states.

However, there are new insights coming from a germline targeting vaccines. There is expectation on the upcoming research describing the advances and advantages of germline targeting, which can be done with protein-based and RNA targets, adding speed to this innovation.

"I think we made pretty good progress the first two steps. But the final one is the most challenging one, and we are not there yet. So, the question is, when is it going to come? Not overnight. It's not something that's coming immediately," explained Prof. Rappuoli.

He is not certain whether this approach will work for HIV but believes germline targeting will be yet another reliable platform available for all vaccines, not only HIV.

Impact and future of avian flu: Influenza A or H5N1

H5 bird flu is widespread in wild birds globally, causing outbreaks in poultry and cows with several recent reports in human cases in the United States. While the current public health risk is low, CDC is monitoring the situation amongst people with animal exposures. Prof. Rappuoli has been working with the H5 antigen since 1999 and confirms that H5N1 is on every infectious disease specialist's list of priorities.

"We did all the vaccines for H5N1. And then the H1N1 came, and we stopped working on that. But basically, back in 2004, 2005, 2006, 2007, H5N1 was the one that we thought will basically be the next pandemic," he recalls.

Since it had been around for so long, some scientists were skeptic H5N1 was ever going to jump into humans. Today, we are seeing an unprecedented wave of evolution of the virus and, although still rare, starting to spread into mammals.

"But basically, I believe we should really be very scared about this. We absolutely need to be prepared because I think we are seeing a new evolution of this virus and is getting closer and closer to evolve into human-to-human transmission," fears Prof. Rappuoli.

His concerns are indeed serious and reflect a deep understanding of the virus' potential impact. H5N1 is being a subject of intense study due to its capability to cause a severe pandemic.

Lessons learned from the pandemic

For Prof. Rappuoli, this pandemic has been a somewhat fascinating scientific experience. He claims science did things that had never been done before, like the speed of RNA vaccines licensing.

"We have seen the power of vaccination. I mean, we got out of this pandemic because we had vaccines quickly. And so, despite that, I think there is a lot of controversy about vaccines and the world has been polarized and more anti-vax now than we had before," he ponders.

Prof. Rappuoli has been working on calculating the economic value of vaccines during the pandemic. His estimations rendered that the return of investment on the 12.5 billion (U.S. dollars) spent was of approximately 660%. He claims that the reduction in global economic losses due to the pandemic was a direct result of the rapid availability of vaccines.

"And the reason is that, basically the 12.5 billion were recovered by anticipating the vaccines by 12 hours. Because in 2021, basically 2020, 2021, there was a moment where the global economy was losing 900 billion [U.S. dollars] per month," Prof. Rappuoli calculates.

Some lessons learned and future concerns are the lack of synergies between governments unable to work together. Something WHO is trying to mend through the pandemic prevention, preparedness and response accord.

"And obviously, now they are trying to come down with this pandemic treaty, basically trying to see whether we can avoid the bad things that happened this time. Hopefully, I mean, you know, I think they're going down to try to sign these things, but it's very difficult," he asserts.

After all the reviews and edits, Prof. Rappuoli, who supports diversifying vaccine production to low- and- middle income countries, is skeptic about the effectiveness of this agreement.

"And now nobody talks about the pandemic anymore. And people really are in a moment where they don't want to think about it. And that's true for governments, for policy makers, for politicians, for everybody. So very short memory," he worries.

Divide and Conquer

As Chief Scientific Officer of the Fondazione Biotecnopolo di Siena, set up by the Italian government with the aim to have an entity that would help better prepare for future emerging diseases and infections, Prof. Rappuoli's strategy is to get all the big players around the table, integrate the knowledge available, and share the work ahead. Under this proposition, he gathered international experts under the premise that together we can better prepare the world for emerging diseases.

"Basically, if we have 30 groups and each of them takes a family of viruses, maybe in five years, we have a solution for 30. If all 30 groups are going to go after the same virus, in five years, we're going to have one solution," explained Prof. Rappuoli, who earned his doctoral and bachelor's degrees in biological sciences at the University of Siena.

The big question remains, who is going to coordinate and lead the way to integrate global efforts of preparedness? Even though WHO is very influential and sets the priorities worldwide, Prof. Rappuoli believes it should be a deliberate decision to participate on this integrated global preparedness initiative, which includes CEPI and the NIH, among other influential stakeholders.

"And the answer is that nobody can lead. It has to be a voluntary collaboration between different groups," he continued, emphasizing that each government's commitment and ultimate responsibility is to their taxpayers.

Prof. Rappuoli's career is a testament to how visionary thinking and cutting-edge science can converge to solve some of the most pressing health challenges of our time. His legacy in vaccine development will likely influence future generations of scientists and public health professionals.

News & Alerts

MOST RELEVANT MONTHLY NEWS ON VACCINATION AND EMERGING DISEASES WITH BIBLIOGRAPHIC ALERTS

A summary of the latest News & Alerts in the fields of vaccinology, vaccines, vaccination, and vaccine-preventable diseases. We curate the latest information on regulatory updates, emerging trends, breakthroughs in vaccine technology, vaccine safety and efficacy, global immunization developments and outbreak alerts, as a resource to keep our community informed.

WHO Director-General declares mpox outbreak a public health emergency of international concern
Date published: August 14, 2024

https://www.who.int/news/item/14-08-2024-who-director-general-declares-mpox-outbreak-a-public-health-emergency-of-international-concern

Mpox caused by human-to-human transmission of Monkeypox virus in the Democratic Republic of Congo with spread to neighboring countries
Date published: August 7, 2024

https://emergency.cdc.gov/han/2024/han00513.asp

WHO Africa alerts
Published: August, 2024

Weekly bulletins on outbreaks and other emergencies | WHO | Regional Office for Africa

United States (CDC): During 2024, a total of West Nile virus human disease cases from which 42 were neuroinvasive cases in 21 states
Date published: July 30, 2024.

https://www.cdc.gov/west-nile-virus/data-maps/current-year-data.html

Oropouche fever outbreaks in parts of Brazil, Bolivia, Colombia, Peru, and Cuba (see map). Oropouche fever is spread by the bite of infected midges (small flies) and mosquitoes
Published: June 27, 2024

https://wwwnc.cdc.gov/travel/notices/level1/oropouche-fever-brazil

An outbreak of Listeriosis in the United States (34 people from 13 states), 32 hospitalized and two deceased. Apparently all linked to liverwurst consumption
Date published: July 26, 2024.

https://www.cdc.gov/listeria/outbreaks/delimeats-7-24/details.html

In 2024, reported cases of pertussis increased across the United States, indicating a return to more typical trends. Preliminary data show that more than three times as many cases have been reported to date in 2024 compared to the same time in 2023
Published: July 23, 202

https://www.cdc.gov/pertussis/php/surveillance/index.html#:~:text=In%202024%2C%20reported%20cases%20of,the%20same%20time%20in%202023

European vaccination will be piloted in five countries
Published: July 22, 2024

https://www.vaccinestoday.eu/stories/european-vaccination-card-will-be-piloted-in-five-countries/

The virus that causes Polio has been found in Gaza. Here's why that is grim news
Date published: July 22, 2024.

https://www.science.org/content/article/virus-causes-polio-has-been-found-gaza-here-s-why-grim-news

WHO Global dengue surveillance: The year of 2024 is the worst year in terms of recorded cases of dengue. As of July 23, more than 10 million cases had been reported in 176 countries in all regions of the World Health Organization (although the Americas account for the majority of cases), with more than 24,000 severe cases and 6,508 deaths. This figure already exceeds the number of cases in 2023, which was also a record year
Date published: July 22, 2024

https://worldhealthorg.shinyapps.io/dengue_global/

New study confirms mammal-to-mammal avian flu spread
Date published: July 20, 2024.

https://www.sciencedaily.com/releases/2024/07/240724122226.htm

Study shows promise for a universal influenza vaccine
Date published: July 19, 2024.

https://www.sciencedaily.com/releases/2024/07/240719123816.htm

Australia is heading towards a whooping cough epidemic, with cases surging past 11,000 over the past six months, compared to 2,447 in all of last year
Published: June 20, 2024

https://www.abc.net.au/news/2024-07-01/whooping-cough-epidemic-cases-surging-australia-superbug-vaccine/104023220

First confirmed case of Avian Influenza A(H5N2) in Mexico
Published: June 14, 2024

https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON524

As of 30 April 2024, over 7.6 million dengue cases have been reported to WHO in 2024, including 3.4 million confirmed cases, over 16 000 severe cases, and over 3000 deaths. While a substantial increase in dengue cases has been reported globally in the last five years, this increase has been particularly pronounced in the Region of the Americas
Published: May 30, 2024

https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON518

Taiwan reports first Japanese encephalitis cases of 2024
Published: May 18, 2024.

Taiwan reports first Japanese encephalitis cases of 2024 (substack.com)

The Center for Infectious Disease Research and Policy (CIDRAP) at the University of Minnesota released the 2024 Update of a Research and Development (R&D) Roadmap for Nipah Virus to accelerate the development of medical countermeasures (MCMs), including diagnostics, therapeutics and vaccines, to enable effective and timely emergency response to Nipah virus (NiV) outbreaks
Published: 2024 update.

https://www.cidrap.umn.edu/sites/default/files/Nipah%20Roadmap%20Final%20-%207-1-24.pdf

Latest Relevant Publications

LATEST PUBLISHED PAPERS AND COMMENTARIES FROM THE CHIEF EDITORS

Latest impactful scientific publications that stand out for their potential bearing on healthcare. We introduce groundbreaking research findings, innovative treatment modalities, results from phase 1 to 3 vaccine clinical trials, or paradigm-shifting discoveries that redefine our understanding of infectious diseases and therapeutic approaches for all vaccine-preventable diseases.

01

"Estimated number of lives saved by COVID-19 vaccination programmes in the WHO European region from December 2020, to March 2023: a retrospective surveillance study"
Published: Lancet Respir Med. August 7, 2024. https://doi.org/10.1016/S2213-2600(24)00179-6

Editorial comment: In this retrospective study, in overly 2.5 years, COVID-19 vaccines reduced deaths by 59% overall representing approximately 1·6 million lives saved (range 1·5–1·7 million) in those aged 25 years or older: 96% of lives saved were aged 60 years or older and 52% were aged 80 years or older; first boosters saved 51% of lives, and 60% were saved during the Omicron period. Both vaccine priming and boosting had a significant impact on lives saved by COVID-19, however, a better mathematical model would further evaluate the indirect effects of immunization vs SARS-CoV-2. This is another serious publication in favor of COVID-19 widespread vaccination.

02

"The impact of infant Bacillus Calmette-Guérin vaccination on the immunogenicity of other vaccines: a randomized exploratory study"
Published: Pediatr Infect Dis J. August 2024. https://doi.org/10.1097/INF.0000000000004373

Editorial comment: This study provides additional evidence of the benefits of Calmette-Guérin (BCG) vaccination in infants, beyond its moderate protection against tuberculosis. By promoting a stronger T-cell mediated immune response, BCG enhances the immunogenicity of various vaccines, including protein-conjugate polysaccharide vaccines such as meningococcal and pneumococcal.

03

"Global seroprevalence of tick-borne encephalitis antibodies in humans, 2956-2022: a literature review and meta-analysis"
Published: Vaccines. July 30, 2024. https://doi.org/10.3390/vaccines12080854

Editorial comment: A thorough and detailed meta-analysis of tick-borne encephalitis and how (and why) its incidence is increasing. Additionally, this global summary explores how serological methods can be used to assess TBE vaccination coverage and potential exposure to TBEV or measure TBE burden and highlights the need for standardized methodology when conducting TBE seroprevalence studies to compare across populations.

04

"Interchangeability of different COVID-19 vaccine platforms as booster doses: a phase 3 study mimicking real-world practice"
Published: Vaccine. July 25, 2024. https://doi.org/10.1016/j.vaccine.2024.05.009

Editorial comment: In this excellent phase-3 study, three different vaccine platforms against SARS-CoV-2 (adenovirus-vector, mRNA and recombinant protein). Their findings were that all three vaccine platforms were equally well tolerated and immunogenic against ancestor SARS-CoV-2 and Omicron sub-lineages in fully primed adults with 0–2 prior boosters, however, though BNT162b induced the highest immune responses, also developed the most rapid waning of antibodies 3 months after vaccination.

05

"Preliminary evaluation of safety and immunogenicity of a novel protein-based pneumococcal vaccine in healthy adults aged 18-49. A phase Ia randomized, double blind, placebo controlled, clinical study"
Published: Vaccines. July 23, 2024. https://doi.org/10.3390/vaccines12080827

Editorial comment: Protein-conjugate pneumococcal vaccines encounter reduced immunogenicity as more serotypes are added to higher valence formulations. A protein-based approach, though challenging to develop, could potentially address this issue.

06

"The problem with delaying measles elimination"
Published: Vaccines. July 22, 2024. https://doi.org/10.3390/vaccines12070813

Editorial comment: A compelling analysis that examines all factors contributing to the global inability to eliminate measles.

07

"Adaptive immune response to Bordetella pertussis during vaccination and infection: emerging perspectives and unanswered questions"
Published: Expert Rev Vaccines. July 17, 2024. https://doi.org/10.1080/14760584.2024.2383745

Editorial comment: An intriguing publication that explores the history of Pertussis vaccination, the reasons behind the introduction of acellular Pertussis (aP) vaccines, and the immunological factors explaining the lack of mucosal and indirect immunity provided by aP vaccines.

08

"COVID-19 infection and vaccination during first trimester and risk of congenital anomalies. Nordik registry based study"
Published: BMJ. July 17, 2024. https://doi.org/10.1136/bmj-2024-079364

Editorial comment: COVID-19 infection during pregnancy is well known to be associated with significantly higher morbidity and mortality for both the mother and the offspring. Nonetheless, concerns have been raised about whether vaccination against SARS-CoV-2 during the first trimester of pregnancy might be associated with congenital anomalies. However, by implementing logistic regression, in this Scandinavian study, the evaluation of over 17,700 newborns with congenital anomalies found no association between congenital anomalies and either SARS-CoV-2 infection or vaccination during the first trimester.

09

"Burden of vaccine-preventable diseases in people living with HIV"
Published: Vaccines. July 16, 2024. https://doi.org/10.3390/vaccines12070780

Editorial comment: People living with HIV face numerous vaccination-related challenges, including limited access to vaccines in developing countries, poor knowledge about vaccine safety and effectiveness, and a lack of information.

10

"SARS-CoV-2-Vaccines: the importance of mucosal vaccine delivery and local immunity".
Published: Vaccines. July 15, 2024. https://doi.org/10.3390/vaccines12070795

Editorial comment: SARS-CoV-2 enters the body through the respiratory tract. Administering a vaccine via inhalation could hypothetically strengthen mucosal immunity and potentially provide a better herd effect compared to intramuscular vaccines. This paper reviews this issue and presents interesting mucosal vaccine candidates.

11

"Characterization of Streptococcus pneumoniae isolates obtained from the middle ear of US children, 2011-2021"
Published: Front Pediatr. July 14, 2024. https://doi.org/10.3389/fped.2024.1383748

Editorial comment: This study is part of the US-SENTRY Antimicrobial Surveillance Program established in 1997. Among the 199 S. pneumoniae isolates that were identified in the participant hospitals between 2011-2021, 56.8% were from children aged <2 years. Six serotypes accounted for around 60% of isolates: 35B (16.6%), 15B (14.6%), 15A (7.5%), 19A (7.5%), 19F (7.5%), and 3 (7.0%). Serotypes included in PCV13, PCV15, and PCV20 accounted for 23.1%, 30.2%, and 54.8% of isolates, respectively. Overall, 45.2% of isolates were penicillin non-susceptible, and 13.6% were multidrug resistant (MDR), of which 48% were serotype 19A. Seven serotypes (19A, 15A, 15B, 15C, 23A, 33F, and 35B) accounted for the majority of non-susceptible isolates.PCVs, particularly PCV20, may prevent a substantial fraction of S. pneumoniae otitis media (OM), including OM due to non-susceptible serotypes. The addition of serotypes 15A, 23A, and 35B would improve coverage against susceptible and non-susceptible pneumococcal OM.

12

"Nirsevimab and hospitalization for RSV bronchiolitis"
Published: N Eng J Med. July 11, 2024. https://doi.org/10.1056/NEJMoa2314885

Editorial comment: An excellent real-life study demonstrating the effectiveness of monoclonal antibodies against RSV (Nirsevimab) in preventing hospitalized bronchiolitis in infants in France. This study adds significant value to existing research from Chile, Spain, and other forthcoming studies, including one from the same authors proving effectiveness of Nirsevimab on diminishing RSV-related ambulatory bronchiolitis. It is essential for all countries to adopt this immunization strategy, as it will lead to a substantial reduction in infant mortality and save millions of dollars.

13

"Dengue versus COVID-19: comparing the incidence of cardiovascular, neuropsychiatric and autoimmune complications"
Published: J Travel Med. July 2024. https://doi.org/10.1093/jtm/taae081

Editorial comment: A retrospective study in Singapore based on claims databases comparing 11,707 patients with Dengue and almost 2.5 million contemporaneous cases of COVID-19. A higher proportion of post-acute cardiovascular and neuropsychiatric complications was observed in Dengue survivors, when contrasted with COVID-19 patients.

14

"Prior respiratory syncytial viral infection contributes to COVID-19 illness: a nationwide cohort study"
Published: Allergy. April 5, 2024. https://doi.org/10.1111/all.16118

Editorial comment: This is a United States, population-based nationwide cohort study that investigated the association between prior RSV infection and COVID-19 severity. In total, 18,535 of 8,644,520 individuals in the National Health Insurance Service cohort database had a record of RSV infection in the previous 3 years (2017–2019). Their findings were that individuals who had an RSV infection within 3 years of COVID-19 development were at an increased risk of severe illness from SARS-CoV-2 infection, hence, suggesting that recent RSV infection contributes to the burden of COVID-19. This is imperative since vaccination vs RSV in subjects 50 years of age and older, as well as COVID-19 immunization are routinely recommended in the US.

Editors Corner

AVIAN INFLUENZA, A GLOBAL THREAT

Are we all prepared or just some countries?

The COVID-19 pandemic revealed our society's vulnerability to a novel pathogen capable of causing a potentially devastating pandemic. Accordingly, global preparedness is essential.

Since November 2022, a new approach by the World Health Organization (WHO) has been implemented that focuses on entire classes of viruses and bacteria rather than individual pathogens. Over 200 scientists from 53 countries are independently evaluating evidence related to 30 viral families, one core group of bacteria, and "Pathogen X" – an unknown pathogen with the potential to trigger a severe global pandemic..

Avian influenza (AI) is currently one of the virus groups capable of causing a new pandemic.

Influenza A viruses (IAVs) are adapted to infect a wide array of hosts, spanning divergent taxonomic groups, and hundreds of birds and mammal species, including humans. Despite an expansive host range, the genetic constellation for the vast majority of antigenic mutations of IAs occur in the gut of aquatic/migratory birds and is primarily hosted by two highly divergent avian orders: Anseriformes (e.g. ducks, geese, swans) and Charadriiformes (e.g. gulls, plovers, skimmers).

Avian influenza viruses (AIVs) represent significant challenges to global public health systems due to their widespread circulation and considerable mortality rates. AIVs, which belong to the influenza A genus, have an eight segment genome and encode at least 11 different proteins, including hemagglutinin (HA) and neuraminidase (NA) glycoproteins. HA and NA in avian species are classified into 16 and 9 subtypes, respectively. These two proteins divide and determine distinct serotypes of AIV based on their genetic variations.

Highly Pathogenic and Low Pathogenic AIVs:

Low Pathogenic Avian Influenza (LPAI): Mostly cause either no signs of disease or mild disease in chickens/poultry (such as ruffled feathers and a drop in egg production), however, can mutate into highly pathogenic avian influenza viruses.

Highly Pathogenic Avian Influenza (HPAI): Cause severe disease and high mortality in infected poultry. Only some avian influenza A(H5) and A(H7) viruses are classified as HPAI A viruses, while most A(H5) and A(H7) viruses circulating among birds are LPAI A viruses.

Although AIVs A(H5), A(H6), A(H7), A(H9), and A(H10) have been proven to infect humans, A(H5N1) and A(H7N9) account for the majority of cases. However, other strains such as A(H5N2), A(H6N1), A(H10N3), A(H10N7), A(H10N8), and A(H7N2) have also been reported in recent years, raising concerns about an increasing rate of mutations.

Globally, almost 2,000 cases of AI have been reported in humans. Since 2003, over 23 countries have reported more than 880 human infections with A(H5N1) to the WHO. Although human-to-human transmission of AIVs is extremely rare, the lethality can exceed 50%. Additionally, human cases have originated not only from poultry but also from other animals, such as cows, with four cases reported in the US this year. Accordingly, the fear of mutagenic changes enhancing both human-to-human and other mammals-to-human transmission has raised concerns about a potentially disastrous pandemic.

Actions to be taken:

Surveillance based on the status quo situation:

1. Anticipation: Conduct viral/molecular surveillance in wild animals, particularly migratory birds.
2. Primary Prevention: Prevent spillover by reducing deforestation and climate change. Vaccination in humans at high risk.
3. Early Detection in Emergence Scenarios: Implement syndromic surveillance through clinicians and healthcare practitioners (HCPs).
4. Containment of Localized Transmission: Use epidemiologic surveillance for contact tracing.
5. Control and Mitigation in Case of an Epidemic: Scale up healthcare services (hospitals, intensive care units, primary care), enforce large-scale quarantine, and close businesses and schools as needed.
6. Pandemic Response: Implement all measures mentioned in step 5 but on a global scale.

Vaccination:

For Influenza, vaccination remains the most effective strategy for prevention and control in humans, despite varying vaccine efficacy across strains. However, the highly diverse mutagenic nature of AIVs makes this task particularly chal-

lenging. Current ongoing trials for AI vaccine platforms include live attenuated, inactivated, virus-like particles (VLPs), and mRNA vaccines, particularly targeting AH5N1, AH7N9, and AH9N2.

For all vaccine candidates, comprehensive quality assessments (gene sequence verification, impurity testing, exclusivity testing, trypsin assay testing, embryo lethality testing, and antigenic characterization) and determination of attenuation (pathogenicity testing in chickens and ferrets) are mandatory before initiating phase 1 clinical trials in humans.

The Food and Drug Administration (FDA) has approved three AI vaccines. As of June 2024, the U.S. has ordered 4.8 million doses of a cell-based, adjuvanted A(H5) vaccine for avian flu preparedness. Additionally, even without a single case of human AI, the government of Finland has started vaccinating high-risk individuals, and 15 European Union countries have secured 40 million doses.

Inequity, the never-ending problem:

While developed countries are implementing primary measures to prevent an AI pandemic, including large-scale molecular surveillance, upgrading healthcare facilities, and manufacturing and administering vaccines, many other parts of the world face budget constraints that prevent investment in potential threats like this disease. If AI spreads easily among humans, people in developing nations will suffer the most. However, as with COVID-19, the more industrialized world will inevitably be affected, potentially repeating the same story.

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Best Practice

HEPATITIS A VACCINE: THE CASE OF A 1-DOSE SCHEDULE IN CHILDREN

Hepatitis A virus (HAV) causes inflammatory liver disease that may progress to fulminant liver failure. HAV is transmitted primarily via the fecal/oral route through ingestion of contaminated food and water, or through direct contact with an infectious person (for example, contact with a case within a household). The incidence of HAV infection correlates with socioeconomic indicators, decreasing with increasing income, and access to clean water and adequate sanitation.

In line with the WHO classification, levels of endemicity are based on HAV seroprevalence: high (≥90% by age 10 years); intermediate (≥50% by age 15 years with <90% by age 10 years); low (≥50% by age 30 years with <50% by age 15 years); and very low (<50% by age 30 years).

Data from 2019 regarding the global burden of disease estimated 159 million acute HAV infections, resulting in 39,000 deaths and 2.3 million disability-adjusted life years worldwide; with 97% of hepatitis A deaths occurring in low- and lower-middle-income countries. Preventive strategies such as low-cost vaccination plans are needed for vaccine equity reasons in these countries.

Following the successful propagation of HAV in cell culture in 1979, several hepatitis A vaccines have been developed - being inactivated HAV vaccines (IHVs) the most widely used worldwide.

IHVs are licensed for use in subjects aged ≥12 months, to reduce the potential of interference with pre-existing maternal antibodies. A complete vaccination schedule usually consisted of 2 doses administered intramuscularly with an interval of 6-12 months between doses. Compliance and costs of a 2-dose schedule can make it unfeasible to introduce IHVs to the immunization calendar in many low-middle income countries worldwide.

High efficacy of post-exposure prophylaxis with IHVs is well documented. In Israel, a community wide HAV outbreak in a low socioeconomic setting was completely interrupted within a few weeks following administration of a single dose of IHV administered to >90% of the pediatric population.

But what about incorporating a single dose into the regular HAV immunization schedule for children?

e impact of 1-dose IHV programs has been increasingly demonstrated in diverse settings,

including in Argentina, Brazil, and Russia. Specifically in Argentina, HAV had been the leading cause of fulminant hepatic failure and liver transplantation in children in the assessed pre-vaccination period. After the introduction of universal single-dose childhood vaccination in 2005, not a single case of liver failure or transplantation due to hepatitis A was observed, thus demonstrating the favorable impact of vaccination on these critical outcomes.

A review of studies assessing long-term protection of a single dose (1-dose) of IHV as part of the national immunization program, found that protective anti-HAV antibody levels can persist for more than 10 years, and that antibody titers can increase or reappear after booster vaccination. Furthermore, detectable antibodies are estimated to persist for up to 30 years with single-dose schedules based on mathematical modeling and on anti-HAV kinetic studies.

The WHO recommends introducing vaccination against HAV into national immunization schedules for individuals aged 12 months and older. For children, the vaccine can be administered as a single-dose or a two-dose schedule.

Long-term HAV-specific memory humoral and cellular responses have been demonstrated in single-dose vaccinated pediatric populations. This response was independent of demographic characteristics or plasma antibody levels and suggests that individuals with waned Ab titers may still be protected. It has recently been demonstrated that T cells protect against HAV-mediated liver injury. The CD8+ T cell responses are relevant by these cells' antiviral cytokine production and direct cytolytic activity, while CD4+ T cells act by making antiviral cytokines or helping cytotoxic T lymphocytes.

Recently Brazil reported that one-dose inactivated hepatitis A vaccination was effective in controlling hepatitis A at a national level, with the target-NIP population (children aged 1–4 years) receiving the greatest benefit.

A single dose of IHV provides a great impact on public health, anyway - long- term follow up of protection/effectiveness against Hepatitis A of children receiving a single dose of IHV is a must.

Policy makers in other Latin American countries may utilize these 1-dose schedule to tailor their universal vaccination strategies for hepatitis A.

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Guest Contributors

THE MANY VARIABLES BEHIND ACCESS TO MEDICINES

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One of the most controversial business decisions for the healthcare industry is to establish equitable access to essential medicines and technology with a reasonable return on investment after spending a significant amount on failed vaccines, or any drug, before reaching a successful one. Pharmaceuticals set drug prices with the argument that it finances research and development (R&D) for better treatments or for the development of a vaccine. Even if this calculation is true, maximizing profits for shareholders might be a variable of influence at the expense of access to medicines and, arguably, beyond ethical standards. Thus, establishing market access is, in essence, an issue of values that weighs the widespread availability of a drug and its profitability.

Promoting fair prices and cost-effective interventions is central to the achievement of the universal right to health coverage on the global agenda. Yet, the conversation around access goes well beyond market prices and should include other important variables like suitable regulatory landscapes for innovation, clear drug evaluation and approval protocols, well-defined pharmacovigilance studies, fitting patent protection laws, investment in health according to national Gross Domestic Product (GDP), updated national patient registries, updated clinical practice guidelines, availability of evidence-based data, interdependency of supply chains, transparent procurement and compliance mechanisms, reasonable manufacturing costs, and an overall ethical regulatory environment, to name a few. Other elements that hinder access are more directly linked to blunt criminal actions, like regulatory capture, fraud, or lack of financial controls and the divergence of public funds.

Political will and collective action are also essential to this discussion and include a wide array of diverse stakeholders like governments and industry, civil society, regulatory agencies, patient groups, scientific societies, international organizations, insurance companies, hospitals, universities, and the list goes on.

Humanitarianism: Is purpose bigger than resources?

The WHO's Constitution of 1946 envisages "the highest attainable standard of health" as a fundamental right of every human being. Recognizing health as a human right acknowledges an ethical obligation to ensure equitable access to timely, adequate, and affordable healthcare. The question is, who pays the humanitarian bill?

In addition to examining the level and structure of health spending in 2020, WHO's *'Global Health Expenditure Report: Rising to the Pandemic's Challenges'* focused on the response of health systems during the COVID-19 pandemic.

"Sharp rises in government spending on health at all income levels reinforced the surge in health spending to a new high of $9 trillion (approximately 11% of global GDP)," claims the report.

"Reported per capita health spending on COVID-19 from government and compulsory insurance financing arrangements in 2020 averaged US$212 in 16 high income countries and US$14 in 21 low- and middle-income countries with comprehensive data. Most reported health spending on COVID-19 was allocated to treatment (41%) and general preventive care and administration (36%)," it expands.

"Across the 50 countries with data, per capita total health spending rose 6% on average in real terms in 2020," the report continues. "Per capita spending on preventive care rose substantially, by 32% on average—and at a higher rate than total health spending in 41 of the 50 countries."

Moreover, according to the United Nations' report on *The impact of COVID-19 on organized crime*, robust evidence on the appropriation of public funds on "aid destined for distressed companies, medical and pharmaceutical goods, public works such as improvements to hospitals, and waste disposal services will be particularly at risk."

The noticeable difficulty in identifying and properly channeling health resources could mean that actual spending might have been even higher. WHO's report calls for more timely and detailed data reporting by Member States to determine the full impact of the pandemic on health services.

Thus, if experts' claims that we are due an imminent zoonotic flu pandemic are true, fasten your public health wallets.

Equitable ACCESS or illness as a business model

In order to promote equitable access to vaccines, WHO has set an ambitious 'Immunization Agenda 2030: Leave No One Behind' (IA2030). With the support of governments and countries, the IA2030 is an overarching strategy that promotes global vaccination for the decade 2021–2030 to prevent more than 20 life-threatening diseases and save over 50 million lives.

Adding dimension to this objective, the global vaccines market is projected to grow from US$83.98 billion in 2024 to US$139.17 billion by 2032. Vaccines remain the most powerful and cost-effective way to protect the population worldwide from life-threatening infectious diseases. In fact, the return on investment (ROI) from immunization programs across two decades (2011–2030) is of approximately USD$22.2 billion using the cost-of-illness approach for ninety-four low- and middle-income countries.

Immunization efforts, supported by heightened awareness and government initiatives, have been instrumental in preventing 2-3 million deaths each year. Greater investment coupled with mergers and partnerships of companies are boosting the manufacturing and sales of new vaccines globally.

Simultaneously, in recent decades, a growing share of healthcare budgets has been allocated to paying for costly drugs that treat a small fraction of the population. Specialty drugs, which treat serious rare diseases, can often come with enormous price tags. These scientifically breakthrough therapies, which can amount to US$2 to US$3 million per treatment, are presenting challenges to governments and insurers with finite budgets. And the sector is expected to keep growing.

The global orphan drugs market is projected to grow from US$189.17 billion in 2024 to US$468.58 billion by 2032. One of the critical driving factors prevailing in the global market is the increasing R&D investments by prominent players for the development of novel products. Protection laws have become an effective instrument for the defense of access to specialty drugs under human rights mandates.

This significant growth projections for the orphan drugs market highlight the increasing financial burden on healthcare systems globally. Yet, healthcare budgets, which tend to be set prospectively, usually set caps on forthcoming spending to reduce financial risk.

Recent epidemiological trends and growth in pharmaceutical expenditure have raised concerns that the provision of 'safe and efficacious medicines for all' may become unsustainable. In response, many countries have implemented aggressive cost-containment policies, including price controls, volume controls, budgeting, second-tier drug options, and market-oriented policies to promote economic and fiscal sustainability.

A clear example is the ongoing legal challenge to the United States Inflation Reduction Act (IRA) of 2022, underscoring the pharmaceutical industry's resistance to the new drug pricing measures it introduced. Recent and past court rejections of several lawsuits filed by big pharma continue to contest the legality of the IRA's price-setting provisions.

A central feature of the IRA's reform, unprecedented in U.S. history, is its authorization for the Department of Health and Human Services (HHS) to directly negotiate drug prices with manufacturers. Although termed as 'price negotiation,' the IRA effectively transforms this process into a price-setting mechanism, granting HHS the final authority over drug prices.

Since the introduction of the IRA's pricing measures, pharmaceutical companies have contested the 'voluntary' nature of these negotiations, questioning the significant authority HHS wields over final pricing outcomes.

Overall, the IRA signifies a fundamental shift in U.S. drug price regulation and may profoundly impact incentives for pharmaceutical R&D, patent litigation, and market entry for competing drugs. With clear implications on the pharmaceutical industry, these price constrains may even have global implications on future investment in innovation.

Tangible tension between equitable access to medicines and the industry's profit-driven model is indeed a pressing issue. The question then becomes, should innovation be left at the sole expense of the private sector?

Strategies to overcome the ACCESS puzzle

As inequalities persist as a major barrier to achieving universal health coverage, several organizations are addressing this complex issue. The debate over access to expensive drugs and medical technologies, along with increasing awareness of disparities in vaccination access within and between countries, has highlighted the importance of health ethics in policy and practice.

The WHO's Health Ethics and Governance team collaborates with technical units to develop disease-specific guidance for conditions such as tuberculosis, COVID-19, HIV, and Ebola. Similarly, the Organisation for Economic Co-operation and Development (OECD) supports countries

in developing high-performing health systems by measuring health outcomes, analyzing resource use, and evaluating policies that enhance access, efficiency, and quality of healthcare.

Developed in 2004 and last published in 2022, the Access to Medicine Index ranks the world's 20 largest pharmaceutical companies according to their ability to make their drugs more available, affordable and accessible in 106 low- to middle-income countries. This index uses World Bank and United Nations classifications to assess economic advancement, human development, and inequality, serving as a tool to recognize industry best practices.

Despite these efforts, there is a pressing need for leadership to shape innovative ideas on healthcare access and regulatory environments. Human rights principles advocate for universal health, yet isolated initiatives often fall short of creating a cohesive plan across sectors. The challenge is to proactively consolidate effective strategies and partnerships while preparing for a potential health crisis.

Fair allocation of finite resources and equitable access to health services should be prioritized in any public health agenda. Balancing cost considerations with all other factors is crucial in discussions about access to medicines. Successful initiatives must involve all actors and foster interdisciplinary dialogue to develop actionable plans that would assure the sustainability of health systems.

A platform focused on reducing health inequalities through ethical practices and evidence-based interventions—supported by a multi-stakeholder alliance of experts—could significantly advance sustainable health policy, access, and education. When policies are properly designed and implemented, these objectives can be synergic.

VACCINES BEAT

Who we are

At Vaccines Beat, we understand that vaccines and immunization have become a crucial topic of discussion at the center of any public health analysis. Therefore, timely, relevant, accessible, and well-curated information for all vaccine preventable diseases is key to advancing better health policies.

For this reason, a team of passionate vaccine professionals has created Vaccines Beat and each month diligently works to share with the healthcare ecosystem information, knowledge, and insights to improve global health.

Vision

Vaccines Beat aims to become the beacon of insight in the public health ecosystem through its distinctive monthly newsletter. With an in-depth 360 perspective, carefully curated information and expert analysis, this novel platform fosters collaboration among a diverse global network of stakeholders.

Mission

Vaccines Beat's main task is to inform through the review of the most recent developments in vaccines, immunization, and vaccine preventable diseases. Our mission extends to sharing best practices from successful initiatives worldwide while building bridges through editorial collaboration with regional and international stakeholders.

Vaccines Beat highlights the importance of information sharing & collaborative efforts within the public health community to boost vaccination campaigns, R&D, public policy, access, awareness, and equity.

Vaccines Beat encourages stakeholders to take action and promote sustainable commitment with continued support through multi-stakeholder synergies.

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