ESWI

RESPIRATORY VIRUS summit

Managing acute respiratory virus infections: Where do we go?

11 JUNE 2026 • BRUSSELS

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Summary Report



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RESPIRATORY VIRUS summit

Managing acute respiratory virus infections: Where do we go?

This one-day Summit brought together leading experts, scientists, and policymakers to strengthen collaboration on respiratory health. The programme connected advances in virus evolution and scientific research with EU health policy, including contributions from the ECDC and DG SANTE on European disease-control priorities for 2026-2030. Scientific sessions covered hMPV, mRNA technologies, mucosal immunity, and next-generation platforms, while a high-level panel examined the innovation pipeline, and early-career scientists took part in the Science Slam.

The Summit also highlighted the often-overlooked burden of respiratory virus infections and non-communicable diseases, as well as the importance of vaccination in chronic care. It concluded with discussions on the value of immunisation, including its economic impact, policy tools, and equitable access across Europe.



OPENING

A United Front for Respiratory Health

EU health policy for respiratory diseases: strengthening preparedness and the role of vaccination.



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Jaroslaw Waligora, *European Commission, DG SANTE, Luxembourg*

Respiratory viruses remain a major cause of mortality, morbidity, healthcare utilisation, and economic disruption, while also offering significant pandemic potential. The post-COVID public-health landscape is highly dynamic, with changing epidemiological patterns and continuing uncertainty, but also with more effective preventive and therapeutic tools than previously available. At EU level, the response has been strengthened through the 2022 Regulation on serious cross-border threats to health, enhanced surveillance and laboratory capacity, early-warning systems, coordinated preparedness planning, the Health Security Committee, and the development of EU reference laboratory capacity for respiratory diseases. Preparedness must extend beyond emergency response to include sustained prevention, surveillance, and vaccination.



Respiratory viruses in the EU: an epidemiological overview and public health needs.



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Edoardo Colzani, *Deputy Head of Unit Directly transmitted and Vaccine-preventable Diseases (ECDC), Italy*

Current EU surveillance indicates that influenza has largely returned to a recognisably seasonal pattern, while COVID-19 lacks clear seasonality and RSV shows prolonged circulation into spring. COVID-19 circulation and its contribution to severe acute respiratory infection has declined, although severe disease remains concentrated among very elderly and frail individuals, with in-hospital mortality rising particularly sharply after the age of 80. The need for improved estimation and prediction of seasonal respiratory-infection burden is essential to support clinical and public-health action.

Influenza continues to impose a substantial health, societal, and economic burden, highlighting the need for better burden estimation and forecasting, stronger protection in high-risk settings such as long-term-care facilities, and improved vaccine uptake. Coverage among at-risk populations remains heterogeneous and generally below the 75% target. Early vaccine-effectiveness estimates are valuable for guiding vaccination and antiviral strategies, although effectiveness could vary during the season.

For COVID-19, vaccination coverage remains low in many parts of Europe, particularly in Southern and Eastern Europe. The importance of accounting for waning protection, vaccination timing, and risk factors beyond age was stressed. RSV prevention has advanced significantly through maternal vaccination and monoclonal antibodies for newborns, with universal infant immunisation considered preferable where feasible. RSV also represents a significant burden among adults, while other respiratory viruses, including rhinoviruses, adenoviruses and metapneumovirus, warrant broader consideration.

A major theme was the two-way relationship between respiratory infections and chronic disease. Patients with cardiovascular and pulmonary conditions face greater risks from infection, while respiratory viruses can trigger or worsen chronic disease, including COPD, cardiovascular disease, and asthma. Preventing infection could therefore deliver benefits beyond reducing acute illness, with existing risk scores potentially helping to identify those most likely to benefit from vaccination.

Respiratory-virus preparedness requires integrated surveillance and a One Health approach, particularly in monitoring zoonotic threats such as avian influenza H5N1. The strategic direction centres on improved surveillance and vaccine-effectiveness assessment, higher and better-targeted vaccination coverage, stronger prevention in high-risk settings, recognition of the interaction between infection and chronic disease, and sustained preparedness for both seasonal epidemics and future pandemics.

The Science Under the Microscope

KEYNOTE

The hMPV Story: From Discovery to Intervention:



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Ab Osterhaus, *ESWI Board Member, TiHO, Germany*

The keynote traced the development of human metapneumovirus (hMPV) from its discovery in Rotterdam in 2001 to its recognition as a major global respiratory pathogen. Initially identified in children with RSV-like illness but negative conventional tests, genetic analysis established hMPV as a distinct virus within the ***Pneumoviridae*** family. Although a possible avian origin was initially considered, widespread pre-existing immunity demonstrated that hMPV had been circulating in humans for many years, with most people infected during early childhood and experiencing repeated infections throughout life.

Despite its importance, hMPV remained under-recognised and underdiagnosed because of limited awareness and restricted access to appropriate testing. Its clinical presentation overlapped considerably with RSV and other respiratory viruses, while co-infections were common. hMPV was an important cause of respiratory disease in young children, older adults, immunocompromised individuals, and patients with underlying conditions including cancer, COPD, congestive heart failure, and diabetes. In some studies, it accounted for approximately 5-9% of hospitalisations among adults, with its contribution in certain populations comparable to that of RSV.

The epidemiology of hMPV broadly resembles that of RSV, with activity occurring predominantly during winter and spring, although the timing and degree of overlap varies. The post-COVID period demonstrated how interventions and changes in population immunity could disrupt established patterns of respiratory-virus circulation. Also addressed were public misunderstanding following reports of increased hMPV activity in China, emphasising that the virus has been recognised globally for approximately 25 years and is a continuously circulating pathogen rather than a newly emerging pandemic virus.

The potential for hMPV interventions includes building on the scientific advances that enabled RSV vaccines and long-acting monoclonal antibodies. Corresponding hMPV vaccines, monoclonal antibodies and antiviral therapies are under development.

PANEL

The Innovation Pipeline

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CHAIR: Ab Osterhaus, *ESWI Board Member, TiHO, Germany*

PANEL:

- **Gülsah Gabriel**, *ESWI Board member, Leibniz Institute of Virology, Germany*
- **Carolien van de Sandt**, *ESWI Associate Member, Murdoch Children's Research Institute, Melbourne, Australia*
- **Peter Openshaw**, *ESWI Board Member, Imperial College, UK*
- **Florian Krammer**, *ESWI Board member, Icahn School of Medicine at Mount Sinai, USA, and Medical University of Vienna, Austria*

Gülsah Gabriel emphasised that biological sex is an important but insufficiently understood determinant of viral pathogenesis and disease outcome. Evidence from the COVID-19 pandemic showed that males were at greater risk of severe acute disease, with research implicating genetic variation affecting aromatase activity and testosterone-to-estradiol conversion as one possible contributor. Conversely, females appear to be at greater risk of developing long COVID, although the underlying mechanisms remain incompletely understood. It was argued that sex-specific biological mechanisms should receive greater attention in respiratory-virus research and clinical disease assessment.

Carolien van de Sandt focused on the challenge of protecting individuals with impaired immunity, who represent a substantial and growing proportion of the global population and are at increased risk of severe respiratory viral disease. This includes older adults affected by immunosenescence, as well as patients with autoimmune disease, cancer, and organ transplants who may receive immunosuppressive therapies. With population ageing expected to increase substantially, future vaccine strategies will need to account for altered immune function and the effects of immunosuppressive medications, both of which can influence susceptibility to infection and the effectiveness of vaccination.

Peter Openshaw highlighted the remarkable progress achieved through collaboration between academic researchers and vaccine manufacturers in developing effective protection against RSV. The emergence of effective prevention is a major scientific achievement and a striking example of the progress that can result from sustained research and industry collaboration. He expressed optimism that the advances made with RSV could herald a broader era of protection against respiratory viruses, including human metapneumovirus.

Florian Krammer introduced the forthcoming discussion of advances in the influenza vaccine and therapeutic pipelines, together with efforts to establish a coordinated European influenza research network. His remarks framed influenza research within a broader objective of strengthening preparedness, accelerating development of vaccines and therapeutics, and improving international research collaboration.

PANEL DISCUSSION:

Gülsah Gabriel addressed the biological basis of sex differences in COVID-19 outcomes, with males experiencing greater acute risk but females appearing more susceptible to long COVID. Two hypotheses are under investigation: the role of sex hormones as transcription-factor inducers, and the persistence of silent viral reservoirs. Her group has found SARS-CoV-2 persisting in both subcutaneous and visceral adipose tissue long after clearance from the lungs, potentially driving chronic inflammation. In response to a **delegate**'s question about whether such sex differences applied beyond COVID-19, **Gülsah Gabriel** confirmed that similar patterns were seen with influenza, although they remain systematically under-researched across respiratory and chronic infections.

A **delegate** asked whether the adipose-tissue findings, initially based on deceased patients, could be confirmed longitudinally in living individuals. **Gülsah Gabriel** explained that her group has demonstrated prolonged viral replication in cultivated adipose tissue obtained from bariatric-surgery patients and is planning a study to track viral persistence in living patients over time. When the **Moderator** asked whether adipose tissue might represent an immune-privileged site, **Gülsah Gabriel** said that it was not classically immune-privileged but occupied an intermediate position, with local macrophages potentially less effective at clearing viral replication. **Carolien van de Sandt** added that adipose tissue's ability to express both HLA class I and II molecules raises further questions about why the virus was not eliminated. **Gülsah Gabriel** acknowledged that this remains an unresolved area of research.

Carolien van de Sandt argued that vaccine development has focused too heavily on neutralising antibodies and CD4 T-cell responses. In response to the **Moderator**'s observation that CD8 T cells were comparatively neglected, **Carolien**



The Science Under the Microscope



van de Sandt explained that these cells could target conserved viral proteins and provide cross-reactive protection against severe disease, although they did not prevent infection. This is particularly important for older and immunocompromised individuals, whose smaller naïve lymphocyte pools, immunosenescence, and lower-affinity responses weaken conventional vaccine protection. Evidence was cited that patients receiving B-cell-depleting therapy could gain protection through T-cell responses to mRNA vaccines. Future vaccines for vulnerable populations should therefore be specifically designed and tested for these groups.

A **delegate** described current pulmonology practice in which patients are vaccinated around three weeks after discharge from respiratory-infection hospitalisation, but noted that many remain on corticosteroids for pneumonia, asthma or COPD. **Carolien van de Sandt** agreed that vaccination remains important even when timing is suboptimal, particularly to reduce readmission risk, but called for larger studies to determine optimal timing and whether medication regimens should be adjusted around vaccination. In response to a further question about innate immunity and NK cells as possible correlates of protection in older people, she stressed that innate immunity was particularly important in children confronting novel viruses, while adaptive immunity offers the advantage of durable memory. The challenge is to understand how both systems can be combined effectively in future vaccine design.

Peter Openshaw highlighted the importance of mucosal immunology and respiratory resident-memory T cells, drawing on evidence from animal studies and human challenge trials involving influenza, RSV, and SARS-CoV-2. He described the rapid progress made with RSV prevention following identification of the prefusion F-protein structure, which has enabled long-acting monoclonal antibodies such as nirsevimab and effective maternal vaccines. These approaches have



substantially reduced severe lower-respiratory-tract disease, although they do not fully prevent nasal or mucosal infection. When the **Moderator** raised questions about the durability and timing of maternal protection against later-onset viruses such as hMPV, **Peter Openshaw** said that waning remains an open question, with possible decline after several years and differing revaccination policies between countries.

Florian Krammer reviewed developments in influenza innovation, including mRNA vaccines, combination vaccines, and promising H5N1 candidates for pandemic preparedness. He highlighted intranasal vaccines and a long-acting antibody-antiviral hybrid in Phase 3 trials.

The panel then considered the need for sustained research infrastructure. **Florian Krammer** advocated a long-term European equivalent of the US CEIRR network, while **Jaroslaw Waligora** noted that although Horizon Europe could support such initiatives, time-limited EU funding makes it difficult to create permanent infrastructure. **Florian Krammer** argued that national funding was inconsistent and short-term, and **Peter Openshaw** stressed the importance of maintaining a critical mass of researchers between pandemics.

The discussion concluded with questions about multi-epitope CD8 vaccines and public resistance to mRNA technology. **Carolien van de Sandt** highlighted the complexity of intracellular epitope processing but identified conserved influenza proteins such as M1 as promising targets. **Florian Krammer** added that delivery and anatomical location are critical, since intramuscular vaccines might not generate the tissue-resident memory needed for rapid protection in the upper respiratory tract. In response to concerns about public acceptance, he argued that basic research and multiple vaccine technologies should continue to receive sustained investment, while improved vaccine performance and reduced reactogenicity would likely do more to restore confidence than communication alone.

The Hidden Burden: Chronic Diseases & Respiratory Viruses

CHAIR: **Marco Goeijenbier**, *ESWI Board member, Spaarne Hospital, The Netherlands*



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KEYNOTE

NCD and pragmatic vaccine trials.

Tor Biering-Sørensen, *University of Copenhagen, Denmark*

Evidence from large pragmatic, registry-based trials demonstrates the substantial benefits of influenza and RSV vaccination among older adults and people with non-communicable diseases (NCDs). The DanFlu2 trial randomised approximately 332,000 Danish adults aged 65 and over to high-dose or standard-dose influenza vaccine. Although the primary endpoint was not met, high-dose vaccination reduced influenza hospitalisations and hospitalisations for cardiorespiratory disease, with the latter effect driven mainly by cardiovascular outcomes, including an approximately 20% reduction in heart-failure hospitalisation. Patients with cardiovascular disease, heart failure, chronic kidney disease, and diabetes had substantially higher baseline risks of hospitalisation, meaning that even similar relative vaccine effectiveness translated into greater absolute benefit and lower numbers needed to vaccinate. Combined analysis with the GALFLU trial in Spain confirmed significant benefits across most prespecified outcomes, although not for all-cause mortality.

The Dan-RSV trial subsequently showed that RSV pre-F vaccination in approximately 132,000 adults aged 60 and over reduced RSV-related respiratory disease by around 84% and lowered the combined risk of cardiorespiratory hospitalisation. In contrast to influenza, this effect was driven mainly by respiratory outcomes. Patients with heart failure, diabetes, and chronic kidney disease again had particularly favourable numbers needed to vaccinate, reinforcing the value of prioritising people with NCDs.

Also highlighted is the persistent gap between vaccine eligibility and uptake. In the NUDGE-Flu trial, involving approximately one million older Danish adults, behavioural messages increased influenza vaccination rates even from a baseline exceeding 80%. Messages highlighting potential cardiovascular benefits were particularly effective. The subsequent NUDGE-Flu Chronic trial showed that all tested messaging strategies increased uptake among approximately 300,000 adults under 65 with chronic disease, with cardiovascular-benefit messaging again producing the greatest effect.

Follow-up data also provided randomised evidence of an approximately 20% reduction in heart-failure hospitalisation among participants encouraged to receive standard-dose influenza vaccination.

The Hidden Burden: Chronic Diseases & Respiratory Viruses



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Stefania Maggi, *ESWI Board member, National Research Council of Italy, Italy*

Frailty was presented as a state of increased vulnerability to external stressors rather than an inevitable consequence of ageing. Although it becomes more common in later life, it can also affect younger people with multiple chronic conditions and may be reversible. It should therefore be regarded as a potential opportunity for intervention, rather than a fixed condition or a reason to withhold preventive or therapeutic treatment.

The presentation focused on the close relationship between frailty, immunosenescence, and respiratory infections. Evidence shows strong associations between respiratory infections in later life and increased risks of hospitalisation, mortality, and disability. Frailty is also associated with changes in innate and adaptive immunity, although the extent of immunosenescence varies considerably between individuals. Contributing biological processes include chronic low-grade inflammation ("inflammaging"), altered B- and T-cell function, mitochondrial dysfunction, oxidative stress, and cellular senescence. These processes interact with comorbidities, malnutrition, obesity, and physical inactivity, suggesting that combined interventions addressing nutrition, physical activity, chronic disease management, and infection prevention could reduce vulnerability.

Respiratory infections could have consequences extending well beyond the acute illness. Studies of influenza, RSV, and human metapneumovirus link frailty with longer hospital stays, slower recovery, and a reduced likelihood of returning home and maintaining independence. Frailty also appears to be an independent risk factor for long COVID. Severe respiratory infections are further associated with longer-term neurological consequences: large UK studies found that hospitalisation for severe respiratory infection remained an independent risk factor for dementia even after accounting for frailty, comorbidities, and age-related disease.

Overall, the evidence suggests a potentially self-reinforcing cycle in which ageing and chronic disease contribute to immune dysfunction and frailty, frailty increases susceptibility to severe infection and impaired recovery, and severe infection then causes further functional decline and future vulnerability. However, this cycle is not necessarily irreversible. Frailty could be managed and, in some cases, reversed. Assessing frailty and addressing modifiable factors such as inactivity, poor nutrition and uncontrolled chronic disease should therefore complement preventive measures such as vaccination. Identifying and addressing frailty could help interrupt the cycle of vulnerability, reduce severe respiratory disease, and preserve independence.

The Hidden Burden: Chronic Diseases & Respiratory Viruses



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Fiona Ecarnot, *University Hospital Besancon Franche-Comté and University Marie & Louis Pasteur, Besancon, France*

Cardiovascular disease is a leading cause of death and disability worldwide, but the impact of vaccination on preventing cardiovascular complications is often underestimated. Respiratory infections such as influenza are not merely temporary illnesses; in people with underlying cardiovascular disease, they can trigger acute events such as myocardial infarction, heart failure exacerbations, and other cardiovascular complications, with potentially serious long-term consequences. Patients and healthcare professionals alike may perceive a heart attack as far more serious than influenza, despite the fact that influenza itself can be fatal and can precipitate equally life-changing cardiovascular events. Vaccination should be regarded as an integral part of cardiovascular prevention, alongside the management of cholesterol, hypertension, and diabetes.

Acute respiratory infections can precipitate cardiovascular disease through several biological mechanisms. The inflammatory response and release of cytokines can destabilise atherosclerotic plaques and trigger acute coronary syndromes. Infection can also create a prothrombotic state, increasing the risk of deep-vein thrombosis and pulmonary embolism, while direct effects on the vascular endothelium may contribute to endothelial dysfunction. These mechanisms are shared to varying degrees by different respiratory viruses, meaning that vaccination across the spectrum of relevant infections is important, particularly for patients with heart failure and other cardiovascular conditions. Preventing the infection in the first place may therefore prevent the cascade of downstream cardiovascular events.

Although studies show substantial reductions in risk associated with vaccination, vaccination remains significantly underused as a cardiovascular prevention strategy. Cardiologists and other specialists may recommend vaccination in a discharge letter, but there are often multiple points at which patients are lost between the initial recommendation and actually receiving the vaccine. The ideal solution could be to vaccinate patients directly during their hospital stay, but this presents logistical and financial challenges.

The presentation concluded that the relationship between cardiovascular disease and infection operates in both directions. Patients with cardiovascular disease are more susceptible to infection and, when infected, are more likely to experience severe disease and complications. Conversely, a respiratory infection in the community can itself precipitate an acute cardiovascular event in a vulnerable individual. Vaccination should therefore be considered a core component of cardiovascular prevention for patients with both acute conditions, such as acute coronary syndromes, and chronic conditions, such as heart failure.

The Hidden Burden: Chronic Diseases & Respiratory Viruses



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Antoni Torres, *University Clinica Barcelona, Spain*

The presentation examined viral exacerbations of chronic respiratory diseases, particularly COPD, and strategies for prevention. COPD and lower respiratory infections are both major global causes of death and interact closely: exacerbations worsen health status, accelerate lung-function decline, and increase the risks of hospitalisation and mortality. Viral infections are important triggers, often followed by bacterial superinfection, making infection prevention a central component of COPD management.

The latest GOLD recommendations include immunisation against influenza, pneumococcal disease and RSV, alongside smoking cessation, appropriate inhaled treatment, and pulmonary rehabilitation. However, many pulmonologists do not routinely review vaccination status or actively update immunisations during consultations. Vaccination should form part of a broader prevention strategy that also addresses smoking and excessive alcohol consumption, nutrition, physical activity, dental hygiene, and swallowing disorders, since aspiration contributes substantially to community-acquired pneumonia. Reducing exposure to infection and using protective measures such as masks when appropriate could also help.

Rhinovirus, influenza and RSV are among the main viral triggers of COPD exacerbations, although older studies may have underestimated RSV and hMPV because systematic PCR testing was not available. More recent evidence suggests that RSV could produce a greater disease burden than influenza in some COPD populations and might be associated with more severe disease, intensive-care admission, and mortality. This highlights the need to consider a broader range of respiratory viruses in prevention strategies.

However, it was stressed that vaccination strategies should not simply treat all patients with COPD or asthma as having the same risk. These conditions encompass wide variations in severity, clinical phenotype, and exacerbation frequency. Some patients with severe lung impairment experience frequent exacerbations, while others rarely do. Vaccine-effectiveness studies are also complicated by imprecise disease classification, with groups labelled as COPD sometimes including patients with bronchiectasis, asthma, or overlapping disorders.

The overall message was that vaccination is an important component of preventing exacerbations but needs to be integrated into comprehensive, personalised prevention. Better disease classification, risk stratification, and epidemiological research are required to identify which patients would benefit most from particular vaccines, alongside greater harmonisation of vaccination recommendations between countries and regions.

PANEL

Vaccination as a Vital Tool in Chronic Care



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CHAIR: Marco Goeijenbier, *ESWI Board member, Spaarne Hospital, The Netherlands*

PANEL:

- **Stefania Maggi**, *ESWI Board member, National Research Council of Italy, Italy*
- **Fiona Ecarnot**, *University Hospital Besancon Franche-Comté and University Marie & Louis Pasteur, Besancon, France*
- **Antoni Torres**, *University Clinica Barcelona, Spain*
- **Tor Biering-Sørensen**, *University of Copenhagen, Denmark*

The panel discussion explored how large pragmatic vaccine trials could generate evidence extending beyond their primary cardiovascular and respiratory outcomes, and how such evidence might be translated into clinical practice, patient awareness, and public policy. In response to a **delegate**'s question about possible links between influenza vaccination and neurodegenerative disease, **Tor Biering-Sørensen** explained that neurodegenerative outcomes had been pre-specified in some research programmes. The DAN-ZOSTER trial, involving approximately 156,000 Danes randomised to receive the Shingrix vaccine or control, is expected to provide evidence within several years on whether vaccination might reduce dementia risk. The influenza and RSV trials were not specifically powered for dementia outcomes and had relatively short follow-up periods, although some preliminary signals have emerged. He stressed that all randomised participants would continue to be followed for at least 20 years through Denmark's national registries, providing a major advantage in assessing long-term causal effects.

A **delegate** raised the lack of clarity in European cardiovascular guidelines, noting that although a position paper existed, its recommendations had not been fully integrated into heart-failure guidelines. **Fiona Ecarnot** noted that the highest-level 1A recommendation generally required randomised trial evidence. However, new placebo-controlled trials could be considered unethical when existing evidence already supported vaccination, creating a barrier to obtaining the strongest possible evidence grade. She suggested that randomised comparisons such as the DANFLU-2 trial, which compared high-dose with standard-dose influenza vaccine, might help bridge this evidence gap. Although the absence of a 1A recommendation could create difficulties in healthcare systems linked to strict performance targets, she stressed that consensus recommendations could still influence clinical practice and that the evidence needs to be actively promoted.

Ab Osterhaus asked whether the extensive datasets generated by the trials might reveal additional findings beyond their original vaccination questions, including associations with factors such as obesity. **Tor Biering-Sørensen** explained that the trials had been designed pragmatically to answer relatively simple treatment-effect questions, but acknowledged that the wider Danish registry population could also support observational analyses. He stressed, however, the importance of distinguishing treatment effects from associations: people who received treatment and those who did not could differ systematically, making observational



comparisons equivalent to "comparing apples with oranges". Randomisation therefore remains essential for establishing causal effects, although **Ab Osterhaus** suggested that dedicated analysts could mine the datasets for additional risk factors and clinically relevant findings.

A **delegate** representing the European Heart Network asked how researchers and patient organisations could work together to raise awareness, arguing that patients should have a voice in the discussion rather than leaving communication solely to clinicians and researchers. **Antoni Torres** responded that it was important to communicate the burden of respiratory infections clearly, including distinguishing respiratory admissions from cardiovascular admissions, so that patients could understand the broader consequences of infection. **Fiona Ecarnot** added that prevention should be linked to what matters most to individual patients, such as remaining active, caring for grandchildren, or travelling, rather than focusing solely on abstract clinical endpoints.

Stefania Maggi agreed that patients should help determine which outcomes researchers prioritised, particularly functional capacity and the ability to maintain valued activities. She highlighted the growing use of frailty indices and comprehensive geriatric assessments to guide interventions such as improved nutrition and physical activity.

Stefania Maggi asked **Tor Biering-Sørensen** whether the large trial datasets could support frailty and risk stratification, despite appearing to represent "pure science". **Tor Biering-Sørensen** confirmed that frailty analyses have been conducted, although registry-based measures are limited largely to ICD-10-derived frailty scores. Importantly, frailty is one of the few factors showing significant effect modification: relative vaccine effectiveness appears to be significantly greater among frail than non-frail individuals, although the results remain under review. Large datasets are also being analysed using AI and machine-learning approaches to identify combinations of risk factors that could help target interventions more effectively.

A **delegate** asked how the highly regarded DAN-series research has influenced government policy, identifying the translation of strong science into effective policy as a continuing weakness. **Tor Biering-Sørensen** contrasted Denmark, where health authorities have not adopted high-dose influenza vaccination for older adults despite the available evidence, with Belgium, which has judged the evidence sufficient to provide the high-dose vaccine. He suggested that forthcoming cost-effectiveness analyses might further influence national decisions, but emphasised that policy uptake varies considerably according to national health authorities and local priorities. The **delegate** concluded by stressing that advocacy is not solely the responsibility of industry: scientists and patient organisations also have an important role in ensuring that high-quality evidence is translated into policy and practice.

Early Career Science Slam



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CHAIR: Kevin Ciminski,
ESWI Associate Member, University Medical Center Freiburg, Germany

Aleda Marie Leis, University of Michigan, United States of America examined the long-term consequences of acute respiratory viral infections, noting that their effects could be multisystemic and persist for months or years after the initial illness. Although more common following severe infection, long-term consequences can also occur after mild illness and affect people of all ages. Long COVID demonstrates the substantial personal and economic burden of such outcomes, but Leis stressed that persistent effects are not unique to COVID-19 and remain considerably understudied.

The SUNRISE programme is a prospective cohort study examining the long-term consequences of severe RSV infection among predominantly community-dwelling adults hospitalised with RSV. Participants were followed for up to 12 months, with assessments covering symptoms, healthcare use, independence, physical functioning, and quality of life. The initial analysis focused on breathlessness, quality of life, and self-rated health six to twelve months after hospitalisation.

Approximately half of those hospitalised with RSV were under 60 years of age. Among these younger adults, around 40% were immunocompromised and 56% had cardiovascular disease. Despite their younger age, the severity of the initial illness and the long-term outcomes were similar to those observed in adults aged 60 and over. Quality of life and self-rated health remained significantly worse than population norms in both age groups, while approximately 60% continued to experience moderate or severe breathlessness many months after hospitalisation.

Compared with patients hospitalised with COVID-19, those who had experienced RSV had almost twice the odds of developing more severe



persistent dyspnoea, although no significant differences were observed for other long-term outcomes. The findings indicate that severe RSV could produce substantial and prolonged effects comparable in some respects to those associated with COVID-19, and that the burden is not confined to older adults.

Leis argued that these findings have implications for RSV vaccination policy and communication. Although vaccination is approved for adults aged 18 and over in the United States, recommendations have largely focused on older people, potentially creating barriers for younger adults at increased risk because of immunocompromise or cardiovascular disease. Future research could examine individual recovery trajectories, multimorbidity, and whether vaccination could reduce long-term consequences.

Charlie Franck Amoia, University Alassane Ouattara, Cote d'Ivoire argued that effective pandemic preparedness should begin with controlling endemic poultry diseases that are already widespread in many parts of the world. He illustrated the problem through the example of a farmer finding dead birds with symptoms such as sudden death, diarrhoea, and swollen heads. These signs could result from several diseases, including virulent Newcastle disease and highly pathogenic avian influenza, and could not reliably be distinguished without laboratory testing. Because Newcastle disease is common and often causes routine poultry deaths in areas lacking systematic vaccination, veterinary support, and early reporting, mortality could become normalised rather than recognised as a potential emergency.

This creates a dangerous surveillance gap. A farmer might wait to see whether the problem resolves itself and, if deaths continue, potentially sell apparently healthy birds at market. If the underlying cause is highly pathogenic avian influenza, infected poultry could then be transported to other areas without samples being collected or alerts being raised. The central problem is therefore not simply the lack of advanced laboratories or rapid genetic sequencing, but the fact that a potentially dangerous outbreak could remain invisible because its signs resemble a familiar endemic disease.

Amoia presented effective vaccination against endemic Newcastle disease as one potential solution. If routine poultry mortality were substantially reduced, sudden deaths would become unusual and more likely to trigger reporting, veterinary investigation, and restrictions on the movement or sale of birds. Controlling an endemic disease could therefore improve the sensitivity of the entire surveillance system: reducing the background level of disease would make new and potentially dangerous events easier to detect.

The presentation framed poultry disease control as a One Health issue extending beyond animal health. Stronger disease control could protect the livelihoods of smallholder farmers, including women who rely heavily on poultry for income, while simultaneously strengthening pandemic preparedness. The next major pandemic could begin in a backyard flock in an area where veterinary services were overstretched and a familiar endemic disease had long obscured abnormal mortality.

Dheeraj Sethi, Chelsea & Westminster Hospital, Imperial College London, UK presented research examining the cardiovascular consequences of human metapneumovirus (hMPV) infection. Although increasing evidence links acute respiratory infections with subsequent cardiovascular disease, most research focuses on influenza, COVID-19, and RSV. Because hMPV is biologically related to RSV and can cause similar respiratory illness, the study investigated whether it was also associated with increased cardiovascular morbidity.

The researchers conducted a retrospective cohort study using the TriNetX Live federated database, containing almost 180 million patient records.

Early Career Science Slam

Adults with hMPV infection and no pre-existing cardiovascular disease were compared with carefully matched groups infected with influenza A, influenza B, COVID-19, or RSV. Cardiovascular outcomes over the following 12 months included ischaemic heart disease, heart failure, atrial fibrillation, myocardial infarction, pulmonary embolism, and major adverse cardiovascular events. A separate analysis examined patients with COPD, who were already at increased risk of both respiratory and cardiovascular complications.

hMPV was associated with a higher risk of cardiovascular morbidity than influenza A, influenza B, and COVID-19 across most outcomes studied. The magnitude of risk was broadly similar to that observed following RSV infection, suggesting that hMPV may represent a more important cardiovascular threat than currently recognised. Among patients with COPD, hMPV was associated with approximately a 70-90% higher risk of myocardial infarction compared with influenza and COVID-19, again broadly comparable to RSV. Comparisons with negative-control conditions, including urinary tract infection and negative hepatitis C serology, further support the possibility that the association is specifically related to respiratory infection rather than simply reflecting general healthcare use or underlying illness.

The study adds to growing evidence that respiratory viral infections could have important cardiovascular consequences extending beyond the initial respiratory illness. Future research would examine how risk varies according to age and comorbidities such as COPD, asthma, heart failure, and cancer, and whether the increased risk is concentrated soon after infection or persists over time. Further analyses would also investigate respiratory outcomes and use additional negative controls to strengthen the findings.



Elias Bendl, University Medical Center Freiburg, Germany presented research examining what happens to lung cells that survive infection with influenza A viruses. Although influenza is generally considered a lytic virus, meaning that infected cells are expected to die, the research team has shown that some cells in both the upper and lower respiratory tract can survive infection. This raises important questions about which cells are capable of surviving, what biological mechanisms allow them to do so, and whether these surviving cells undergo lasting changes that could influence lung repair or contribute to post-viral disease.

To study this process, the researchers developed a genetically modified influenza virus containing a Cre recombinase reporter system. When the virus successfully infects and replicates within a cell, the Cre enzyme permanently activates a fluorescent marker, effectively leaving a biological record that the cell has experienced live viral replication. Using this system in mice, they identified a consistent population of approximately 0.5-1% of lung epithelial cells that had clearly experienced viral replication but subsequently survived and no longer contained detectable viral material. Although relatively small in number, these survivor cells persisted in the lungs for at least 48 days, long after the infection itself had been completely cleared.

The surviving cells were found to consist almost exclusively of AT2 cells, one of the two major alveolar epithelial cell types in the distal lung. This is particularly interesting because both major alveolar cell populations could be infected, suggesting that survival is not simply a matter of random chance. Single-cell transcriptomic analysis showed that the surviving cells retain a distinctive molecular signature, including increased activity in type I interferon-related pathways. Further experiments confirmed that type I interferon is essential to the survival process.

The study therefore suggests that a specific population of AT2 lung cells can survive highly pathogenic avian influenza infection through a type



Early Career Science Slam

I interferon-dependent, non-cytolytic clearance process. These cells persist long after the virus has disappeared and retain a lasting transcriptional "footprint" of their previous infection. The important unanswered question is what these altered survivor cells do subsequently: they may contribute to lung repair, but they could also potentially influence the development of longer-term post-viral disease. The presentation therefore emphasised the importance of basic research into these relatively overlooked cellular processes, since understanding what happens to the cells that survive infection may ultimately reveal important mechanisms underlying post-viral illness.

Irene Gonzalez-Dominguez, Icahn School of Medicine at Mount Sinai, United States of America presented research aimed at developing broadly cross-reactive influenza vaccines, with a particular focus on influenza B. Although influenza B has historically received less research attention than influenza A because it is less antigenically diverse, circulates primarily in humans, and has no significant pandemic potential, it still accounts for roughly one-third of influenza infections in some seasons. Its epidemiology can nevertheless change considerably, as illustrated by the apparent disappearance of the Yamagata lineage after more than a decade of circulation.

The research focuses on a new vaccine concept called mosaic hemagglutinins. The hemagglutinin protein contains several antigenic regions that are major targets of the immune response, but these same regions are also prone to mutation, allowing the virus to evade pre-existing immunity. In influenza B, the key regions include the 120 loop, 150 loop, 160 loop, and 190 helix. The researchers created mosaic immunogens by replacing these regions with sequences derived from avian influenza viruses to which humans have little or no pre-existing immunity.

The rationale is that sequential vaccination with different mosaic versions can redirect and broaden the immune response. Rather than repeatedly stimulating antibodies against the same variable, immunodominant regions, the strategy aims to encourage stronger responses against more conserved parts of the hemagglutinin molecule, including conserved regions within the head as well as the stalk domain. The approach is conceptually similar to the chimeric hemagglutinin strategy, which has already shown promise in human clinical trials.

An important finding is that the mosaic approach appears to be platform-agnostic: it works with several vaccine technologies, including recombinant proteins, whole-inactivated and split vaccines, and both adjuvanted and unadjuvanted formulations. More recently, the researchers have tested mRNA-lipid nanoparticle vaccines. In influenza B, the mosaic strategy has demonstrated superior performance to the chimeric approach in mouse studies, and this advantage has more recently been reproduced in non-human primates. The broader implication is that mosaic hemagglutinins could provide a promising route towards more durable and broadly protective influenza vaccines, potentially reducing the need to continually reformulate vaccines to match the latest circulating strains.

Lucy Greenwood, University of Oxford, UK presented a sequence-based predictive model designed to improve the speed and accuracy of seasonal influenza vaccine updates. Because influenza viruses can evolve substantially and become antigenically different from existing vaccine strains, vaccine updates may lag behind circulating viruses by approximately a year. The model aims to predict antigenic change further in advance and potentially reduce this delay.

Using publicly available data, including haemagglutination-inhibition results, viral genetic sequences, and amino-acid physicochemical properties, the model predicted the antigenic distance between viral strains (the likely degree of cross-immunity between them) and how this distance might change over the following year. Three-dimensional smoothing methods were added to account for amino acids that were distant in the genetic sequence but physically close in the folded haemagglutinin protein. Other features, including protein-language-model embeddings, were also investigated.

After feature selection to reduce overfitting, the model performed strongly: 95.6% of predicted antigenic distances between strain pairs were within one antigenic unit of the measured distance, while 85.8% were exact predictions. Antigenic cartography and clustering further showed substantial overlap between measured and model-predicted antigenic relationships, suggesting that the model could reproduce the broad structure of influenza antigenic evolution.

The model was then tested for real-time forecasting. Using a threshold of four antigenic units to indicate when a vaccine strain change might be needed, the one-year-ahead model generally predicted changes that were subsequently shown to be necessary. The proportion of required updates that were missed was mostly below 40%, although this increased towards the end of the dataset because of a previously unseen amino-acid position that the model could not yet handle effectively.

Future work would improve real-time forecasting and incorporate models of viral evolution and protein structure. Ultimately, Greenwood hopes to combine these components in a transmission model capable of estimating the potential public-health benefits of using sequence-based predictions to guide future influenza vaccine updates.

Missa Kouassi Firmin, Centre Suisse de Recherches Scientifiques en Côte d'Ivoire discussed the role of the oropharyngeal microbiome in respiratory tract infections, particularly among children in low- and middle-income countries. Respiratory infections remain a major cause of illness worldwide, especially in children, despite extensive research into the identification of pathogens, vaccine development, and improved treatments. The presentation focused on the community of microorganisms inhabiting the upper respiratory tract, particularly the throat, and their potential influence on respiratory health and susceptibility to infection.

The oropharyngeal microbiome is a complex and largely invisible ecosystem that may help maintain respiratory health when it remains balanced. A healthy microbial community can potentially help protect against infectious agents, whereas disruption of this balance may increase the risk of respiratory disease. To investigate these relationships, the researchers studied schoolchildren in Côte d'Ivoire who were carrying respiratory tract infections. Using metagenomic techniques, they examined the composition of the children's microbiomes and explored their relationship with respiratory pathogens.

The study found that children carrying SARS-CoV-2 had distinct microbial profiles compared with children who were not carriers. In particular, the bacterial genera *Actinobacillus* and *Porphyromonas* emerged as microbial markers associated with viral carriage. These alterations in the microbial community may also be linked to differences in immune responses, suggesting that the microbiome could influence – or reflect – the body's response to respiratory infection.

Also highlighted is the value of combining microbiome research with genomic surveillance. Genomic techniques can monitor viral evolution and identify circulating variants, while microbiome

analysis provides information about the wider microbial ecosystem in which respiratory infections occur. Studying these factors together could therefore provide a more comprehensive understanding of respiratory disease than focusing on the infectious pathogen alone.

Finally, identifying consistent microbial signatures associated with infection could potentially support the development of microbiome-based interventions, including probiotics or other strategies designed to modify the respiratory microbiome. Such approaches might eventually contribute to the prevention or treatment of respiratory tract infections in children, although further research is needed to establish the precise mechanisms involved and determine whether these microbial associations can be translated into effective interventions.

Shweta Mahajan, National Institute of Public health and Environment, The Netherlands discussed the importance of broad immunity in influenza vaccination and pandemic preparedness. She explained that influenza's internal proteins are highly conserved across strains and variants and can stimulate T-cell responses capable of recognising a wide range of viruses and helping to protect against severe disease. Evidence from human challenge studies and observational research suggests that these broadly reactive T cells are an important component of pandemic preparedness.

The presentation highlighted a potential limitation of current seasonal vaccines. Inactivated and live-attenuated vaccines primarily induce antibodies against surface proteins such as haemagglutinin and neuraminidase, providing effective short-term protection against seasonal influenza. However, because vaccination does not involve actual infection, it might not generate the same broad T-cell responses against conserved internal proteins. By contrast, natural infection could induce broader cellular immunity, potentially offering some protection against a novel pandemic strain. The ideal universal influenza vaccine would therefore combine strong seasonal protection with broader immunity against viruses with pandemic potential.

To investigate this question, researchers conducted a large mouse study involving 320 animals. They compared two seasonal vaccines, Influvac and the live-attenuated Fluenz, with a universal mRNA vaccine containing conserved internal proteins including NP, PB1, and M1. Unvaccinated animals were also included. The animals were then assessed following seasonal influenza infection and, over a longer period, infection with a pandemic influenza virus. T-cell responses were measured in lung and spleen cells using peptide stimulation and ELISpot assays.

The universal mRNA vaccine induced strong responses against the conserved internal proteins in both the lungs and spleen. Interestingly, unvaccinated animals also developed substantially stronger splenic responses than those receiving the seasonal vaccines. This supports the hypothesis that conventional seasonal vaccination might, in some circumstances, limit the development of the broader T-cell immunity that could otherwise follow natural infection. Similar patterns were observed across several internal viral proteins.

The researchers are continuing to analyse the extensive results, but the findings suggest that broad, cross-reactive immunity should be considered more explicitly when evaluating influenza vaccines. Future strategies might need to balance the immediate protection provided by strain-specific antibodies with the broader and potentially longer-lasting protection offered by T-cell responses against conserved internal proteins.

Toby Look, UK Health Security Agency, UK explained that highly pathogenic avian influenza viruses remain a significant pandemic threat, but



assessing antibody protection against them is difficult because live-virus neutralisation assays require high-containment laboratories. The research is therefore focusing on developing safer, lower-containment alternatives that could produce results comparable to those obtained with live viruses.

The main approach involves pseudovirus neutralisation assays using replication-defective lentiviral particles displaying the haemagglutinin (HA) and neuraminidase (NA) proteins of contemporary H5 avian influenza strains. The team successfully generated pseudoviruses representing H5N8 and several H5N1 clade 2.3.4.4b strains. Because these pseudoviruses could not replicate, they could be handled in lower-containment laboratories, offering a potentially safer, more scalable, and higher-throughput method for assessing antibody responses against emerging H5 viruses.

The researchers systematically optimised the assay, examining virus input, target-cell density, incubation conditions, and overall robustness. Quality-control materials were introduced and monitored over time to ensure consistency. The resulting system was robust and reproducible, with potential for further qualification and use in regulated environments.

A key stage involved comparing pseudovirus neutralisation results with those obtained using wild-type live-virus assays. Across monoclonal antibodies and animal serum samples, the two approaches showed good correlation and acceptable agreement, suggesting that pseudovirus assays could provide reliable surrogate measures while avoiding the safety and scalability limitations of high-containment testing. Comparisons with a reverse-genetics micro-neutralisation assay also showed good correlation, although the pseudoviruses expressed lower levels of HA, which may have contributed to the need for lower serum concentrations for neutralisation.

Further work is assessing precision, specificity, sensitivity, linearity, and analytical range, while additional tools, including an H5 ELISA and a single-cycle avian influenza platform, are also under development. These technologies could make vaccine evaluation against emerging H5 viruses safer, faster, and more scalable, helping to accelerate vaccine development and strengthen pandemic preparedness.

The Value of Immunisation: Policy & Economics



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FIRESIDE CHAT

The Economics of Prevention

CHAIR: **Stefania Maggi**, *ESWI Board member, National Research Council of Italy, Italy*

PANEL:

- **Lotte Steuten**, *Office of Health Economics (OHE), UK*
- **Iacopo Del Panta Ridolfi**, *The European House – Ambrosetti (TEHA), Italy*

Lotte Steuten examined the broader economic and societal value of adult immunisation. Her research assessed vaccination programmes against influenza, pneumococcal disease, herpes zoster, and RSV across ten countries, considering not only health outcomes and healthcare costs, but also mortality, morbidity, productivity, the value of time, antimicrobial resistance, and wider societal effects.

The headline finding was a return on investment of approximately 19 to 1: for every unit of currency invested in adult vaccination, around 19 units of value are generated. Although the precise figure varies according to the vaccine, country and economic methodology used, 95% of the analyses produced a return comfortably above one. Even shingles vaccination, with a return of around four to one, represents an exceptionally strong investment compared with many other areas of government spending.

The research also examined when and where these benefits arise. The value of vaccination increases over time, but for respiratory diseases much of the return on investment is realised within the first year. Furthermore, the benefits extend well beyond healthcare systems. In the UK, the wider economic value of adult vaccination is estimated to be around eight times greater than the value captured by the healthcare system alone, largely because preventing illness among working-age adults reduces absenteeism and other economic costs. This suggests that vaccination programmes should not be assessed solely from a healthcare perspective or targeted exclusively at older people at greatest risk of hospitalisation. From a broader socioeconomic perspective, vaccinating younger adults may also generate substantial benefits, particularly given the considerable economic burden of respiratory infections.

She argued that current health technology assessment frameworks are often too narrowly focused on healthcare costs and outcomes. Policymakers should instead consider the broader value of prevention, including productivity, unpaid work, volunteering, caring responsibilities, and the value of time. In this respect, finance ministries, employers and other decision-makers beyond healthcare need to be involved in discussions about vaccination investment, since many of the benefits accrue outside the health system.

Iacopo Del Panta Ridolfi examined the apparent paradox that, despite the substantial value of prevention and immunisation, relatively little is invested in them. Across the EU, prevention accounts for only around 3.7% of total healthcare

spending, with immunisation representing an even smaller proportion. Comparisons between countries are complicated by inconsistent data, and in some cases the level of investment in immunisation is not even known. This lack of reliable, standardised information makes it difficult to develop effective policy.

He identified several reasons for this underinvestment. The first is a temporal mismatch: the benefits of prevention may accumulate over several years, whereas political decision-making is often shaped by short electoral cycles. Politicians may therefore be reluctant to make investments whose greatest benefits will be realised under a future government. A second problem is that the value of prevention is often assessed too narrowly. Vaccination and other preventive measures generate benefits not only for healthcare systems but also for the wider economy and society, by reducing the need for hospitalisation, preventing people from missing work, supporting caregivers, and preserving productivity. There is also a cultural tendency for people to seek medical care when they are ill rather than take action while they are healthy. Institutionally, prevention is frequently viewed as the responsibility of health ministries alone, despite its wider economic and social consequences.

He argued that recent changes to the EU's New Economic Governance Framework may provide an opportunity to address some of these problems. The framework adopts a multi-year perspective, covering four to seven years rather than focusing solely on annual budgets, making it better suited to investments whose benefits accrue over time. It also identifies economic and social resilience as a priority area, explicitly including health prevention. This creates an opportunity to distinguish between expenditure that is simply consumed and investments that generate substantial long-term returns. He suggested that an even stronger approach would be to introduce a "golden rule" for health prevention, similar to arrangements that make it easier for governments to invest in defence.

Ultimately, he pointed out, the challenge is to recognise prevention not as a short-term healthcare cost, but as a long-term investment whose benefits can substantially exceed its initial expenditure.



POLICY PANEL

Inequalities and Implementation in the EU

CHAIR: Stefania Maggi, *ESWI Board member, National Research Council of Italy, Italy*

PANEL:

- **Alba Vilajeliu**, *WHO Headquarters, Switzerland*
- **Roman Prymula**, *ESWI Board Member, Charles University, Prague, Czech Republic*
- **Paula Tähtinen**, *ESWI Board Member, University of Turku, Finland*
- **Lotte Steuten**, *Office of Health Economics (OHE), UK*
- **Iacopo Del Panta Ridolfi** , *The European House – Ambrosetti (TEHA), Italy*

Alba Vilajeliu charted the evolution of vaccination over the past 50 years from a predominantly childhood-focused intervention into a life-course strategy covering pregnancy, infancy, adolescence, adulthood, and older age. Since WHO established the Expanded Programme on Immunization in 1974, the number of universally recommended vaccines has doubled, expanding from protection against seven mainly childhood diseases to recommendations covering 14 vaccine antigens, alongside additional vaccines for specific countries, risk groups, and outbreak situations.

The adoption of life-course immunisation has accelerated significantly, particularly following the COVID-19 pandemic. By 2024, more than half of countries worldwide recommend vaccination across multiple stages of life, with upper-middle-income countries showing particularly rapid expansion. The introduction of COVID-19 vaccination drove much of this progress by requiring countries to develop systems capable of identifying and vaccinating large adult populations. These infrastructures now provide a foundation for broader adult immunisation programmes.

Vilajeliu also reviewed recent WHO policy developments, including established recommendations for influenza and RSV prevention and the transition of COVID-19 vaccination from emergency response to routine immunisation. Following recommendations from SAGE in March 2026, WHO published its first permanent position paper on COVID vaccination within national immunisation programmes. Rather than recommending emergency mass vaccination, the new approach allows countries to adapt programmes to their epidemiology, demographics, healthcare capacity, and cost-effectiveness, while prioritising those at greatest risk of severe disease, including older adults, immunocompromised individuals, people with underlying conditions and pregnant women.

Evidence from 2024 and 2025 indicates that protection against severe COVID-19 declines over approximately six months. WHO therefore advises higher-risk groups to receive two doses annually where feasible, spaced around six months apart, with at least one annual dose as the minimum. Pregnant women are advised to receive one dose during each pregnancy, preferably in the second trimester, to protect both mother and newborn.

The presentation concluded by looking towards the future of immunisation to 2050. WHO, Gavi, and UNICEF are exploring scenarios shaped primarily by public trust and international collaboration. High trust and strong global cooperation will support continued progress, whereas declining confidence and geopolitical fragmentation could undermine it. Governments, healthcare professionals, researchers and citizens can all influence which future emerges.

The Value of Immunisation: Policy & Economics



Roman Prymula examined persistent inequalities in vaccination coverage across Europe while highlighting the potential of digitalisation to improve immunisation programmes. During the COVID-19 pandemic, the Czech Republic developed the integrated ICIN information system, combining data on infectious diseases, healthcare capacity, immunisation, and laboratory testing. Linked to GPs and operating online, the system provides near-real-time information on vaccination and disease patterns. It also supports the development of an electronic vaccination record, or eCard, giving individuals and healthcare professionals access to shared immunisation histories.

The system enables detailed analysis of influenza vaccination. Data from almost 7,000 healthcare providers allows authorities to assess coverage and disease patterns across different age groups. However, vaccination coverage varies considerably across Europe, with former socialist countries generally recording particularly low rates. Historical differences in vaccination policy might partly explain this, as vaccines against some diseases have traditionally been mandatory, whereas influenza vaccination has not always been perceived as equally important.

Several obstacles to improving coverage remain. Political divisions and the presence of anti-vaccine views within governing coalitions are undermining consistent communication. Financial arrangements also create difficulties: GPs are required to order vaccines in advance but can be left responsible for the cost of unused doses, discouraging them from ordering sufficient supplies. Proposed risk-sharing arrangements have not yet been implemented.

Despite these challenges, detailed national data has great value for demonstrating the real-world benefits of vaccination. The Czech system assesses protection against outcomes including hospitalisation, intensive-care admission, and the need for ECMO, providing locally relevant evidence when responding to vaccine scepticism. A measles analysis, for example, demonstrated approximately 99% protection among vaccinated children aged two to seven.

The Value of Immunisation: Policy & Economics

Paula Tähtinen emphasised that children should not be overlooked in discussions of adult vaccination and the relationship between respiratory infections and chronic disease. Respiratory infections are a major cause of hospitalisation in children, with SARS-CoV-2, RSV, and influenza particularly prominent among infections leading to intensive-care admission. However, these figures represent only the visible part of the overall burden, since most children experience mild or asymptomatic infections and only a minority are hospitalised or receive a specific viral diagnosis.

Viral infections also lead to important secondary consequences. Finnish data shows that approximately 40% of children with influenza develop acute otitis media, and around half receive antibiotics. This increased antibiotic use has implications not only for individual patients but also for the wider challenge of antimicrobial resistance. Children are also important transmitters of respiratory viruses: they often have high attack rates, shed virus for longer periods, and carry substantial viral loads, particularly in daycare settings. Vaccinating children therefore provides both direct and indirect protection for parents, grandparents, and other vulnerable people by reducing community transmission. Preventing infection also reduces parental absence from work and associated social and economic costs.

Significant inequalities in access to childhood vaccination exist. Vaccines can only provide protection if they are actually administered, requiring both effective systems and informed decisions by parents and healthcare professionals. Data from England shows that influenza vaccination coverage among children aged two to three is below 60% overall and below 50% in London, with substantial differences between ethnic groups. Children of white British background are considerably more likely to be vaccinated, while only around one quarter of children born to mothers of Caribbean ethnicity receive influenza vaccination.

These disparities demonstrate that simply making vaccines available is insufficient. Public-health systems need to identify and address cultural, informational, financial, and organisational barriers, while healthcare professionals require the knowledge and confidence to recommend vaccination effectively.

PANEL DISCUSSION

A **delegate** asked whether the success of regular preventive dental check-ups could offer lessons for vaccination. **Iacopo Del Panta Ridolfi** explained that prevention operates within both EU and national regulatory frameworks, but suggested that successful prevention depends largely on institutions prioritising it and citizens demanding political investment. He noted that Italy does not currently have the same culture of regular preventive care. **Paula Tähtinen** described Finland's well-baby and well-child clinics and regular school health checks, which make routine childhood vaccination highly effective. However, seasonal vaccines are more problematic because parents must actively arrange appointments. She suggested that digital reminders or text messages could help families know when it is time for seasonal vaccination. **Lotte Steuten** added that vaccination should be made as convenient as possible by meeting people where they are, for example through pharmacies with extended opening hours and the possibility of receiving several vaccines during the same visit. She also stressed the importance of communication that respects people's autonomy, provides honest information about benefits and risks, and addresses people not only where they are physically but also where they are in terms of their values and concerns.

Paula Tähtinen explained that Finland's high childhood vaccination rates are partly related to how vaccination is presented. Rather than asking parents whether they would like a vaccine, healthcare professionals present it as the normal next step, while parents retain the right to decline. This approach has resulted in coverage of around 95-98% for most routine childhood vaccines, although influenza vaccination remains an exception. **Roman Prymula** drew a distinction between preventive examinations, such as dental screening, and immunisation, noting that vaccine hesitancy has increased significantly, from approximately 7-8% of the population two decades ago to around 15-16% today. He also pointed out that, in some forms of preventive screening, regular attendance may be more important than very frequent attendance: for example, a well-organised five-yearly cervical screening programme can be more effective than annual screening if the latter results in a significant proportion of people not attending at all.

Ab Osterhaus raised the problem of misinformation, disinformation, and non-acceptance of vaccination, asking whether these issues should simply be regarded as an unavoidable reality or addressed through policy. **Alba Vilajeliu** stressed that the issue is ultimately one of trust – not only trust in vaccines but trust in institutions and society more generally. People continue to rely heavily on trusted healthcare professionals such as GPs, midwives, obstetricians, and nurses, so these professionals need to be equipped to listen to concerns, acknowledge doubts and respond to misinformation with evidence-based information delivered in an emotionally intelligent way. **Ab Osterhaus** also highlighted ethnic inequalities in vaccination uptake, arguing that policies must address why certain communities are being missed. This is important not only for the individuals concerned but also because lower vaccination rates can facilitate transmission within communities and to vulnerable older people. **Lotte Steuten** suggested that the growing understanding of links between infectious and non-communicable diseases might itself influence attitudes towards vaccination. People who are not particularly worried about influenza, for example, might reconsider vaccination if they become aware of possible associations between infections and conditions such as Alzheimer's disease. She emphasised that this was a hypothesis requiring further research.

A **delegate** asked how the growing number of people consulting AI systems about symptoms and test results instead of immediately returning to their doctors, might affect health policy. **Iacopo Del Panta Ridolfi** sees AI as both an opportunity and a threat. It is already being used in some settings to support primary-care physicians, but the risks increase when such technologies are unregulated or poorly organised. The rapid pace of technological development also means that regulation struggles to keep up, making this an important area for future policy development.

Another **delegate** returned to the relationship between infectious and non-communicable diseases, arguing that greater awareness was needed not only among patients but also among physicians and other healthcare professionals. The idea that an infection that does not kill you merely makes you stronger overlooks the potential long-term consequences of inflammation and infection, and this misconception also needs to be addressed within the healthcare system. **Paula Tähtinen** agreed on the importance of communicating reliable scientific information more effectively. Scientists and physicians need to counter fake science and highly charismatic anti-vaccination voices by communicating through the channels people actually use, including social media platforms such as TikTok. To address inequalities in vaccine uptake, she advocated working directly with communities and involving respected healthcare professionals and trusted figures from those communities themselves. Experience in Finland during the pandemic showed that messages delivered by respected members of a community could be more persuasive than messages delivered by distant national figures.

Uptake & Confidence: Building Trust in Vaccination



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PANEL DISCUSSION
Building Trust Across Generations

CHAIR: Ed Hutchinson, *ESWI Board member, University of Glasgow, UK*

PANEL:

- **Ted Van Essen**, *ESWI Associate Member, Retired General Practitioner and vocational trainer, Amersfoort, The Netherlands*
- **Emilie Karafillakis**, *University of Antwerp, The Vaccine Confidence Project, UK*
- **George Kassianos**, *ESWI Board Member, Occupational Health Physician, UK*
- **Jane Barratt**, *Global Advisor on Ageing, Health and Social Policy, Canada*

Ted Van Essen focused on the challenge of explaining to older adults why booster vaccinations are necessary, particularly when immunity wanes and pathogens evolve. Immune protection weakens over time. This may occur because immune memory declines, or because viruses and bacteria change, reducing the ability of existing antibodies to recognise them.

Some infections, such as measles, generally provide long-lasting protection after childhood vaccination. Others, such as influenza, require regular vaccination because immunity wanes and the virus continually changes. COVID-19 lies somewhere in between, with both waning immunity and evolving variants contributing to the need for boosters. RSV protection is relatively new and its long-term duration remains uncertain.

Regarding influenza, the public message is relatively straightforward: influenza viruses continually change, so a new vaccine is produced each year. Immunity also declines over time, making regular vaccination necessary.

Protection against COVID-19 declines moderately and the virus continues to evolve. Although the terminology differs from influenza – evolving variants rather than antigenic drift and shift – the practical message is the same: periodic booster vaccination helps maintain protection, particularly against severe disease.

With RSV, communication is more difficult because the duration of protection is still being established and reinfections are common. Current evidence suggests protection lasts at least two years and may last longer, but precise recommendations will evolve as more data become available.

Turning to pneumococcal vaccination, earlier polysaccharide vaccines required repeat vaccination approximately every five years, whereas newer conjugate vaccines can provide longer-lasting protection with a single dose. However, the changing prevalence of pneumococcal serotypes complicates the scientific picture and is difficult to explain simply to the public.

Emilie Karafillakis presented a largely pessimistic assessment of global trends in vaccine confidence, based on more than a decade of research through

the Vaccine Confidence Index, which measures perceptions of vaccine importance, safety, and effectiveness. Confidence has declined in almost every country, with the COVID-19 pandemic accelerating a trend that had already begun in some places. Europe has consistently recorded the lowest vaccine confidence globally, with 2024 data showing that only around 64% of Europeans consider vaccines safe, 69% effective, and 72% important. Confidence varies substantially between countries, with Northern Europe generally performing better than Eastern Europe.

The decline is particularly marked among younger adults aged 18-34, with reduced trust in governments emerging as an important associated factor. The experience of COVID-related restrictions and other public-health measures appears to have influenced how some young adults view vaccines and health-protection measures more generally. Women show lower vaccine confidence than men in most regions, with European women recording the lowest levels globally. This is potentially significant because women often carry much of the responsibility for vaccination decisions within families.

Politicisation and the changing information environment are other major influences on vaccine confidence. Vaccination has increasingly become a political issue, although confidence is shaped by a complex combination of political, social, and institutional factors. Misinformation has increased substantially since the pandemic, while AI is transforming the information landscape further. AI could provide personalised and translated health information to underserved groups, but could also generate new risks, including sophisticated misinformation and deepfakes that might become increasingly difficult to distinguish from genuine content.

She argued that public-health organisations have been too slow to engage with social media and must not repeat that mistake with AI-driven communication. Trust has to be built before a crisis occurs, but effective trust-building requires more than simply developing the right messages: it involves establishing relationships, listening to concerns, and responding in ways that acknowledge people's perspectives. The future of adult immunisation will therefore depend not only



on better vaccines and information, but also on understanding changing attitudes, building trust in advance, and adapting rapidly to an increasingly complex information environment.

George Kassianos presented a European consensus calling for vaccination to be treated as a fundamental pillar of infection prevention throughout the entire life course. The signatories, representing clinicians, nurses, pharmacists, scientists, public-health specialists, and other stakeholders, argue that Europe needs a coordinated, life-course immunisation strategy that brings together policies for different age groups, risk categories, and healthcare systems, rather than treating vaccination as something primarily associated with childhood.

The proposed strategy should establish concrete vaccination objectives by 2027 for protection against major respiratory and invasive infections, including influenza, RSV, COVID-19, pneumococcal disease, meningococcal disease, and pertussis. These objectives should cover maternal immunisation and protection of infants, adolescents, people with clinical risk factors, and older adults. The emphasis is on a comprehensive approach in which vaccination is integrated into healthcare at every stage of life and adapted to the particular risks faced by different groups.

This approach should not be confined narrowly to the EU. Wider cooperation across the European continent, including the UK and European Economic Area partners, is needed to align immunisation standards, promote cross-border cooperation, and reduce regional disparities. Greater consistency in policy and practice would, in his view, help accelerate the uptake of vaccines capable of preventing serious illness and saving lives.

Achieving this will require a whole-of-society effort. Healthcare professionals, patients, caregivers, civil-society organisations, social and long-term care services, and local communities all need to be involved. Europe already possesses the scientific knowledge and practical tools necessary to provide broad protection against vaccine-preventable disease; the challenge is to coordinate policies, improve uptake, and ensure that protection reaches all groups. Action is needed now rather than waiting for the next major outbreak or public-health crisis.

Jane Barratt argued that poor adult vaccination uptake should not be viewed simply as a communication failure or an individual "attitude problem". Despite decades of vaccination experience, uptake often remains poor or is declining, suggesting that broader issues of institutional trust and structural ageism need to be addressed. Moreover, systems, policies, research, and healthcare practices frequently treat older adults as a homogeneous, passive, or deficient group rather than as diverse individuals with their own knowledge, preferences, and decision-making capacity.

She challenged the assumption that older people cannot understand complex information and therefore need messages to be simplified or "dumbed down". Communication should instead be targeted without being patronising and should reflect the complex realities of people's lives, including chronic disease, frailty, culture, gender, and socioeconomic circumstances. Research could also be ageist when older people are excluded or grouped together too broadly, for example by treating everyone over 60 as a single category. This fails to capture differences between stages of later life and the functional consequences of illness and hospitalisation beyond mortality and admission rates.

Practical examples of structural ageism include arbitrary age-based eligibility criteria whereby a 65-year-old might qualify for vaccination while a

64-year-old with serious chronic disease might not. Older adults could also be treated as passive recipients rather than active decision-makers, while paternalistic communication undermines autonomy. One-size-fits-all public-health campaigns similarly fail to address the layered risks associated with multiple conditions and other vulnerabilities.

In addition, vaccination uptake is fundamentally a question of trust rather than ignorance. People need to trust vaccines and healthcare professionals, but also governments, institutions, and their communities. Complex healthcare systems, changing eligibility rules, and increasingly digital services could make it difficult to understand entitlements and access vaccination, weakening institutional trust. Communities should therefore be genuine partners in designing vaccination programmes, with older adults and other high-risk groups involved meaningfully in co-design and leadership rather than being included merely symbolically.

This involves a shift from a "deficit model" towards a genuinely person-centred approach. Tackling structural ageism, recognising the interaction between age, health, culture, gender, and socioeconomic circumstances, improving healthcare communication and addressing misinformation, including AI-generated misinformation, are essential to close the gap between vaccines being available and people actually receiving them.

PANEL DISCUSSION

In response to the **Moderator**'s question about whether AI could enable more tailored communication while creating new risks, **Ted Van Essen** said he was not particularly concerned about AI, citing an RSV information platform capable of answering questions in around 200 languages and adapting its language to users. He acknowledged that such systems require careful oversight of their sources and information architecture. If properly developed, AI could provide accurate, culturally appropriate, and country-specific vaccination information, although significant investment is required. **Jane Barratt** agreed, describing AI as a powerful communication medium comparable to radio or television in earlier decades. Since almost everyone now has access to a phone, she argued that AI offers a unique opportunity to deliver more relevant vaccination information.

Responding to a **delegate**'s question about the origins of institutional mistrust, **Emilie Karafillakis** argued that vaccine hesitancy should not be treated simply as an individual problem or as being fundamentally "about vaccines". Visible behaviour might instead reflect deeper underlying social and institutional problems, and her research examined national, social, and individual resilience. **George Kassianos** noted that vaccination rates vary substantially between socioeconomic and ethnic groups, with deprivation and ethnicity both important factors. He emphasised the role of trusted healthcare professionals, while warning that healthcare workers cannot effectively address hesitancy if they are themselves insufficiently informed. **Jane Barratt** linked these disparities to the broader social determinants of health, arguing that communication needs to take account of culture, gender and socioeconomic circumstances. People living in poverty might be focused primarily on immediate survival concerns, while faith leaders and other trusted figures could be particularly influential within specific communities. Public-health authorities, she argued, too rarely invest in understanding specific subgroups, co-designing interventions with them, and scaling up approaches that proved effective.

Uptake & Confidence: Building Trust in Vaccination

The panel then considered the practical challenges of reaching underserved communities. The **Moderator** noted that people with rational reasons for distrusting government are less receptive to government health messaging, while rebuilding trust requires costly community engagement rather than simply translating leaflets. **George Kassianos** explained that the UK already provides information in numerous languages and that healthcare professionals sometimes work directly with specific ethnic communities or use local radio and television. These approaches improve uptake, but often only modestly. **Emilie Karafillakis** stressed that different communities, including different migrant groups, have entirely different reasons for low vaccination rates. Diaspora networks, social media, and continuing links with countries of origin influence attitudes and healthcare decisions. She warned against assuming that mistrust is always the explanation: research among London's Haredi Jewish community, for example, found that low uptake is primarily a practical problem for families with many children who struggle to attend appointments, rather than a religious objection. This reinforces the importance of genuine co-design and of understanding specific local barriers. **George Kassianos** suggested pharmacies as one practical solution, since they offer more accessible vaccination than general practice.

Discussing declining vaccination rates among people under 35, particularly future parents, **Emilie Karafillakis** argued that there could be no universal solution because the causes vary between countries and populations. Some of the decline might reflect how COVID-19 vaccination has been communicated: younger people have often been asked to make significant sacrifices for the benefit of others without sufficient acknowledgement of what they themselves have given up. They are also heavily exposed to misinformation through social media. Potential solutions include understanding local reasons for hesitancy, using peer-to-peer communication, and involving people who genuinely understand younger people's experiences. **Jane Barratt** agreed but returned to the problem of funding, questioning how governments and funders could be persuaded to invest in prevention and long-term vaccination strategies when essential current interventions are already inadequately funded. Without such investment, she warned, today's under-vaccinated younger population could become tomorrow's older population with even greater accumulated vulnerability.

The discussion considered whether the contradictory messaging and differing national policies during the COVID-19 pandemic damaged trust. **Emilie Karafillakis** agreed that conflicting information is a major obstacle to informed decision-making. Contradictions occur not only between countries but also within individual healthcare systems, where, for example, a pregnant woman might receive different advice from her midwife, gynaecologist, and pharmacist. She suggested that greater European harmonisation of immunisation policy and communication could simplify the system and strengthen public-health messages. A more unified approach could make communication more consistent and persuasive, although she acknowledged that achieving a harmonised European immunisation programme would remain politically challenging.

Closing Remarks



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Colin Russell, *ESWI Chair, Academic Medical Center, University of Amsterdam, The Netherlands*

Colin Russell concluded the meeting by reflecting on how societal change is achieved and who is responsible for making it happen. He argued that everyone represented at the meeting is, in some way, an agent of change: educators inform people, scientists generate knowledge, doctors apply it to protect patients, industry develop vaccines and antivirals, and policymakers seek to translate evidence into action. Yet despite enormous investment in surveillance, research and medical interventions, the global burden of influenza remains broadly similar to two decades earlier, illustrating both the slow pace of progress and the difficulty of doing more than "running to stand still" in the field of respiratory viruses.

Moreover, evidence-based messages increasingly have to compete with misinformation and claims that vaccines are unsafe or ineffective. Nevertheless, meetings such as the Summit remain important because they bring together people from different disciplines, generate new ideas, and create opportunities for inspiration. He challenged participants to identify the ideas that have particularly influenced them and share them with colleagues, friends, and wider networks, so that the meeting itself could become a catalyst for change.

He emphasised that meaningful progress requires a community and is necessarily gradual. Although the scale of global problems could be discouraging, abandoning the effort would simply allow those problems to worsen. Participants therefore need to continue "fighting the good fight", working together to create positive change despite the obstacles and inevitable frustrations.

Colin Russell concluded with a call to "change the world together", recognising that those attending shared a desire to improve health and still face many difficult challenges.



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