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Global Health Security at Risk: A Public Health Perspective on the Impact of US Policy Shifts on Influenza Surveillance

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ABSTRACT

The Global Influenza Surveillance and Response System (GISRS), coordinated by the World Health Organization (WHO), depends on continuous, cross-border data sharing to select vaccine strains twice a year and detect emerging pandemic threats before they outpace the public health response. The United States, through the Centers for Disease Control and Prevention (CDC) and two WHO Collaborating Centres, has historically contributed a disproportionate share of the virological data and financial resources that sustain GISRS's analytical capacity. Recent US policy decisions, including formal withdrawal from WHO in 2025, have raised practical questions about how this architecture will function with reduced American participation.

This review examines how this policy changes affect the operational integrity of global influenza surveillance. We discuss the structure and function of GISRS, the specific role of US institutions within it, and the downstream consequences of diminished engagement: delayed detection of antigenic drift variants, increased vaccine mismatch risk, and weakened pandemic early warning capacity. We also analyse the Nagoya Protocol and the Pandemic Influenza Preparedness (PIP) Framework, the legal instruments governing pathogen sharing, and how political disengagement could complicate both. Special attention is given to consequences for countries such as India, which carry large influenza burdens while depending on WHO-coordinated guidance for vaccine selection and outbreak response.

The review concludes that surveillance gaps created by policy-driven disengagement carry clinical and epidemiological costs. Maintaining depoliticized scientific exchange, protecting virus-sharing pathways, and securing predictable funding for global surveillance are practical measures that can limit those costs. The public health community has a responsibility to make these technical stakes legible to policymakers before the consequences become irreversible.

Keywords: *Influenza surveillance, GISRS, WHO withdrawal, global health security, vaccine mismatch, pandemic preparedness, PIP Framework*

INTRODUCTION

Influenza kills between 290,000 and 650,000 people each year [1,2]. That range, wide enough to conceal a small war, reflects

persistent gaps in how the world counts respiratory deaths attributable to influenza, particularly in low-income settings where health information systems are thin and cause-specific mortality data remain incomplete. The viruses responsible mutate faster than most clinically significant pathogens. Last season's dominant strain drifts enough during replication that this season's vaccine, formulated months earlier, may no longer match what is actually circulating. That is why global vaccine composition is updated twice annually rather than once, and why getting that update right depends on continuous, geographically representative surveillance data flowing through a coordinated international network [2,3].

That network is the Global Influenza Surveillance and Response System, known by its acronym GISRS. Established in 1952 as a small collection of reference laboratories, it has grown into an architecture spanning 150 national influenza centres across 127 countries, six WHO Collaborating Centres in Atlanta, London, Melbourne, Beijing, Tokyo, and Memphis, four WHO H5 Reference Laboratories, and thirteen Essential Regulatory Laboratories [1,2]. National centres collect clinical specimens and perform preliminary characterization, forwarding representative samples to Collaborating Centres for more detailed antigenic and genetic analysis. Twice yearly, WHO convenes a technical consultation that draws on this accumulated data to recommend which viral strains should be included in the coming season's vaccines. The recommendations are not binding, but in practice nearly every national vaccine authority follows them [2].

The United States is not a peripheral participant in this system. The CDC operates two WHO Collaborating Centres for influenza and runs one of the world's most extensive sentinel surveillance networks, combining hospital-based surveillance, outpatient sentinel sites, and virological sampling from multiple geographic zones. In some surveillance cycles, US laboratories have contributed roughly a third of the influenza sequence data submitted to global databases [3]. Financial contributions have been proportionally significant as well: the US has historically funded between 15 and 22 percent of WHO's total assessed budget, with GISRS-related activities partially supported through that contribution [4].

In January 2025, the Trump administration initiated formal US withdrawal from WHO, citing governance and financial concerns. Public debate focused on institutional disruption and budget shortfalls. The operational consequences for influenza surveillance attracted comparatively little attention. This review is an attempt to address that gap directly. We examine how GISRS functions, what US participation contributes to it, and what reduced engagement risks in practice: for vaccine strain selection accuracy, for pandemic early warning capacity, for the legal frameworks governing pathogen sharing, and for the populations in low- and middle-income countries who bear the largest influenza disease burden and have the least capacity to compensate for upstream surveillance failures.

THE GLOBAL INFLUENZA SURVEILLANCE AND RESPONSE SYSTEM: ARCHITECTURE AND FUNCTION

Understanding what US disengagement might damage requires more than knowing that GISRS exists. The system's specific structural dependencies reveal where vulnerabilities lie. GISRS is not a single institution with a headquarters that can absorb reduced contributions from one member without effect. It operates as a federated network where data quality at the center depends directly on sample quality and submission completeness at the periphery.

National influenza centres form the base of the network. They collect respiratory specimens from clinical settings, perform preliminary viral identification, and forward representative isolates to WHO

Collaborating Centres. The Collaborating Centres conduct hemagglutinin inhibition assays, full genome sequencing, and antigenic cartography that maps the distance between circulating strains and current vaccine components [1,2]. This analysis feeds directly into the strain selection consultations. The six Collaborating Centres also maintain reference virus panels and produce the calibrated antisera that national laboratories need to characterize local isolates against WHO standards.

The February and September strain selection consultations are where all this data converges. Representatives from Collaborating Centres present analyses of which variants are spreading, which show evidence of significant antigenic drift from existing vaccine strains, and which appear likely to dominate in the coming season. WHO then issues recommendations specifying the H1N1, H3N2, and influenza B lineage strains for inclusion in northern and southern hemisphere vaccines respectively [2]. These recommendations must reach vaccine manufacturers early enough to allow sufficient production time: the northern hemisphere consultation in February gives manufacturers until approximately October for delivery, a timeline with essentially no slack [12].

Two operational properties determine whether that process works well: timeliness and coverage. Timeliness means that samples collected during the autumn-winter circulation period in the northern hemisphere need to have been characterized and submitted before the February consultation. A country that submits late contributes to the dataset, but not to the decision [1]. Geographic coverage means that samples from sufficient diversity of locations are represented, so that a variant gaining ground in one region does not go undetected simply because surveillance capacity there is thin. Both properties degrade when major contributors reduce participation [3,8].

Stable funding is the third structural requirement, and the one most easily overlooked in technical discussions. National influenza centres in low- and middle-income countries depend significantly on externally provided resources to maintain functional laboratory equipment, trained staff, cold-chain capacity for specimen transport, and data management systems that allow timely submission [4,5]. When major funding contributors withdraw, these operational capacities erode. The degradation is gradual rather than immediate, which can make it politically invisible until the consequences appear in a season's vaccine effectiveness data.

US PARTICIPATION IN GISRS: SCOPE AND SIGNIFICANCE

The scale of US contribution to GISRS is worth stating precisely rather than abstractly. The CDC Atlanta Collaborating Centre has historically served as the principal reference laboratory for antigenic characterization of influenza A viruses circulating in North America and has been a primary contributor to H3N2 antigenic cartography, the component of strain selection most technically demanding and most consequential for vaccine match [1]. The CDC Memphis Collaborating Centre has contributed substantially to influenza B characterization. Together, these two centres have provided reference materials and technical support that smaller national centres rely on for their own laboratory work.

The sequence data contribution is substantial. North America generates significant influenza diversity because of the scale of its human population, the volume of its international air connectivity, and the extensive agricultural-human interfaces in US rural areas where zoonotic spillover events have historically occurred [3,6]. Losing this surveillance window does not simply produce a smaller dataset for WHO consultations. It creates geographic blind spots in coverage of the North American continent that can allow variants to gain epidemiological traction before they appear in European or Asian surveillance data—typically weeks later.

Financial dimensions compound the technical ones. Assessed budget contributions from the US to WHO have been substantial in absolute terms, and their interruption affects not only WHO Headquarters operations but the technical assistance and capacity-building programmes that WHO runs for national influenza centres in low-income countries [4]. These programmes include laboratory training, equipment grants, and technical consultancies that allow peripheral nodes of the surveillance network to maintain minimum functional standards. When such support is reduced, the practical question is not whether a particular national centre disappears overnight—it usually does not—but whether it can continue to submit timely, quality specimens that the network can actually use [5,7].

There is also an informal contribution that does not appear in any budget document but matters practically: US CDC scientists have played active roles in WHO technical working groups, training programmes, and emergency consultations. The accumulated institutional knowledge that these scientists carry into international discussions is not easily replaced by formal budget transfers or multilateral agreements. Its loss from international forums is slower to manifest but no less real over a multi-year horizon.

IMPLICATIONS OF US POLICY SHIFTS FOR INFLUENZA SURVEILLANCE

Data Gaps and Vaccine Mismatch

The most direct and measurable risk from reduced US engagement with GISRS is compromised vaccine strain selection. Vaccine mismatch is not an exotic or hypothetical outcome. It is a regular occurrence, occurring to varying degrees in multiple recent seasons, with documented public health consequences [2]. In years when vaccine strains diverge meaningfully from circulating variants, vaccine effectiveness against influenza A H3N2 in particular has fallen from a typical range of 40–60% to below 20%, with corresponding increases in hospitalizations and mortality among high-risk populations [1,8].

The mechanism through which reduced US data submission could drive mismatch is straightforward. Antigenic drift in H3N2 strains has historically been detected first through sequence analysis of specimens from surveillance systems that sample broadly across multiple geographic locations and demographic groups [3]. When a single major contributor reduces submission, the apparent prevalence of variants emerging from that contributor's surveillance area looks artificially low relative to what is circulating globally. If a drift variant is gaining ground in North America but is underrepresented in the data available for February strain selection, the WHO consultation may not recommend updating the H3N2 component—and the resulting vaccine may poorly match what actually circulates in the following autumn and winter [1,2].

Pandemic Early Warning

The scenario that pandemic preparedness experts consider most dangerous is not a missed seasonal strain but a missed early signal of zoonotic spillover and adaptation. Influenza viruses circulating in avian and swine populations represent ongoing pandemic risk precisely because they mutate independently of human immune pressure and can acquire human-adaptive mutations through reassortment or gradual evolution [9,14]. H5N1 avian influenza has circulated in poultry populations across multiple continents since its reemergence in 2003 and has caused sporadic human infections with a documented case-fatality rate exceeding 50% in confirmed cases, though ascertainment bias likely inflates this estimate [15]. H3N8, H7N9, and other zoonotic influenza subtypes have also caused human infections in recent years.

The agricultural landscape of the United States, with its large-scale poultry and swine operations, represents one of the more significant human-animal influenza interfaces in the world. H5N1 was detected

in US dairy cattle herds in 2024, representing the first sustained mammalian epidemic of that subtype in North American livestock, with associated human infections among farmworkers [15]. The ongoing characterization and international reporting of these events has proceeded through CDC. If US disengagement with WHO channels weakens the speed or completeness of that reporting, WHO and other member states would have a degraded picture of ongoing zoonotic spillover events originating in the world's third most populous country. The window between emergence and international awareness would be wider, and the time available for a coordinated preparedness response correspondingly shorter [6,7].

The 2009 H1N1 pandemic provides an instructive baseline. A novel swine-origin H1N1 virus was identified in Mexico in April 2009 and characterized within days through collaborative work between Mexican health authorities, CDC, and WHO Collaborating Centres [14]. Specimens moved across borders quickly because established sharing agreements were in place and relationships between national and international scientists were active. That speed mattered: it enabled the WHO to declare a Public Health Emergency of International Concern within weeks, accelerating vaccine development and public health response. Friction in any part of that information chain would have delayed the response—and in a pandemic scenario, delay is measured in lives [4,10].

THE NAGOYA PROTOCOL AND PIP FRAMEWORK: LEGAL SCAFFOLDING FOR PATHOGEN SHARING

The biological sharing that sustains GISRS does not happen spontaneously or purely through scientific goodwill. It is governed by international legal instruments that structure the rights and obligations of participating countries. Two are directly relevant: the Nagoya Protocol and the WHO Pandemic Influenza Preparedness Framework.

The Nagoya Protocol, adopted in 2010 under the Convention on Biological Diversity, establishes a framework for access to genetic resources and the equitable sharing of benefits arising from their use [9]. Under its provisions, countries retain sovereign rights over biological material originating on their territory and may regulate access to that material. Applied to influenza viruses, this creates a theoretically significant tension: a country could delay sharing a novel influenza specimen pending negotiation of terms, including guarantees around vaccine access in the event the specimen leads to a commercially valuable product.

This was not a theoretical problem during the H5N1 era. In 2007, Indonesia withheld H5N1 specimens from GISRS, arguing that the existing system allowed wealthy-country pharmaceutical companies to profit from developing countries' biological resources without providing affordable vaccines in return [4]. The confrontation exposed a fundamental inequity in the surveillance system: countries with high disease burden were contributing the most clinically important specimens while having the least guaranteed access to the resulting medical countermeasures.

The PIP Framework, established by WHO in 2011, was the institutional response to that confrontation [4]. It creates a fast-track mechanism specifically for influenza viruses with pandemic potential: member states agree to share specimens promptly through GISRS in exchange for access to vaccines, antivirals, and diagnostics developed using those specimens. Pharmaceutical manufacturers operating within the framework make standard material transfer agreements that include benefit-sharing obligations. The arrangement has functioned with reasonable effectiveness when the broader WHO membership has remained engaged with it.

A US outside WHO occupies an ambiguous position relative to both instruments. Nothing in the Nagoya Protocol or the PIP Framework prevents continued bilateral specimen sharing between US laboratories

and their international counterparts; scientific exchange does not require formal WHO membership. But the structured legal obligations, the rapid access mechanisms for novel specimens, and the formal consultation processes through which the US has historically provided technical input into PIP governance would no longer apply in the same way [7]. If a zoonotic influenza strain with pandemic potential were detected in US livestock or poultry and specimens were requested through GISRS channels, the response would need to be negotiated outside the existing framework—potentially introducing days or weeks of delay at exactly the moment when speed is most critical [6].

IMPACT ON LOW- AND MIDDLE-INCOME COUNTRIES

The equity dimension of this policy shift requires direct attention. Countries with large populations, high influenza burden, and limited domestic surveillance capacity depend on GISRS not only for strain recommendations but for the technical support, laboratory reagents, and operational guidance that WHO coordinates. When the system's major contributors reduce engagement, the populations who bear the largest burden are the ones with the fewest alternatives.

India illustrates the stakes. With a population exceeding 1.4 billion people and respiratory disease among its leading causes of morbidity, India's domestic influenza burden is substantial even though it is incompletely characterized [3,11]. India is also home to the Serum Institute of India, one of the world's highest-volume vaccine manufacturers, which produces influenza vaccines under WHO prequalification for domestic use and for international procurement mechanisms including UNICEF and Gavi [12]. The composition of those vaccines follows WHO strain recommendations derived from GISRS data. When GISRS data quality deteriorates, the vaccines produced—including those procured for other low-income countries—become more likely to be mismatched.

The institutional disruption runs deeper than vaccine composition. Studies of previous instances of major-country withdrawal from or reduced engagement with WHO have documented rapid disruption to ongoing technical programmes, including surveillance support, laboratory quality assurance, and emergency coordination [4,5]. Informal channels built on trust and established scientific relationships can compensate partially for formal channel disruption, but they are slower, less reliable, and vulnerable to personnel changes on both sides. Countries that depend on WHO-mediated technical cooperation for influenza response cannot simply substitute bilateral US agreements overnight.

There is a broader equity argument worth making explicitly. Countries that contribute minimally to the surveillance failures caused by major-power political disengagement bear the clinical consequences of those failures disproportionately. A poorly matched vaccine distributed to high-income populations produces measurable excess illness. The same mismatch distributed to populations with higher baseline influenza mortality, limited access to antivirals, and health systems less able to manage severe respiratory illness produces substantially worse outcomes [8,11]. The distribution of harms from surveillance degradation is not random; it tracks existing global health inequity.

PANDEMIC PREPAREDNESS: HISTORICAL CONTEXT

Influenza's pandemic history makes the risks concrete in a way that abstract risk assessments sometimes fail to do. The 1918 H1N1 pandemic killed between 50 million and 100 million people globally in under two years—a toll that dwarfed World War I casualties and remains the largest acute mortality event in recorded history [13]. No coordinated international surveillance system existed at the time. There was no mechanism for early detection, no framework for vaccine development, and no established channel for nations to share

information about an accelerating respiratory outbreak. The virus spread globally before most governments understood what they were dealing with.

The subsequent pandemic events of 1957, 1968, and 2009 each tested the evolving international response architecture in different ways. The 2009 H1N1 pandemic is the most directly relevant to the present discussion, because it was the first pandemic to unfold within a functional GISRS with sufficient global reach to test whether the system worked. It partially did. The novel swine-origin H1N1 virus was identified and genetically characterized within weeks of the first reported cases in Mexico, vaccine development was initiated rapidly, and WHO coordination enabled an internationally synchronized response [14]. The weaknesses that emerged—particularly around inequitable access to vaccines for low-income countries—were part of what motivated the PIP Framework [4].

The 1976 swine flu episode provides a different historical lesson. When a swine-origin influenza strain was detected among military personnel at Fort Dix, New Jersey, the US government launched a mass vaccination programme under significant political pressure before robust epidemiological data could clarify the actual pandemic risk. The programme was ultimately associated with excess cases of Guillain-Barré syndrome, a serious neurological complication, and was halted after approximately 48 million vaccinations [15]. One interpretation of this episode concerns the dangers of overstating pandemic risk; another concerns the risks of a national surveillance and response apparatus operating without sufficient integration into international scientific assessment. Both interpretations argue for exactly the kind of open, technically grounded, internationally coordinated surveillance that GISRS is designed to provide—and that benefits from US engagement rather than withdrawal.

The ongoing H5N1 situation reinforces the lesson. Human infections with H5N1 have been occurring sporadically since 1997. The virus has not yet acquired sustained human-to-human transmission, but its continuing evolution in animal reservoir populations, its documented spillover into US dairy cattle, and its high clinical severity in confirmed human cases mean that it remains one of the most credible pandemic threats under active surveillance [15]. That surveillance depends on international cooperation: most of the human H5N1 cases in recent years have occurred in countries in Africa and Asia where domestic laboratory capacity is insufficient for autonomous characterization of novel strains. GISRS provides the infrastructure that allows those specimens to be characterized promptly [1,2]. An international system with weaker participation from major contributors is slower and less comprehensive in exactly the scenario were speed and comprehensiveness matter most.

POLICY RECOMMENDATIONS

The policy implications that follow from this analysis are not about reversing political decisions—that is outside the scope of a public health review. They concern how surveillance damage can be minimized within whatever political constraints exist. Four areas merit specific attention.

Maintain Depoliticized Scientific Exchange

The most directly protective measure is preserving active US laboratory participation in GISRS technical activities regardless of formal WHO membership status. Scientific exchange between CDC laboratories and WHO Collaborating Centres in other countries does not require WHO membership at the institutional level; it requires bilateral agreements and institutional commitment. These channels should be explicitly maintained through documented laboratory-to-laboratory partnership agreements that are insulated, as far as possible, from political developments affecting the formal US-WHO relationship [7]. The CDC has a history of

bilateral scientific cooperation with national health authorities worldwide; those relationships represent practical infrastructure that should be actively preserved rather than allowed to lapse through institutional inertia.

Clarify the US Position on the PIP Framework

The US should formally clarify its relationship with the PIP Framework and the obligations it is prepared to maintain. Ambiguity about the legal status of US virus-sharing obligations will be resolved conservatively by laboratory directors and institutional legal counsel: when in doubt, they will share less [4,7]. A clear statement that the US intends to continue participating in rapid influenza specimen sharing under agreed terms—even absent formal WHO membership—would reduce this uncertainty and preserve the practical functioning of the pathogen-sharing system for novel strains with pandemic potential.

Invest in Regional Surveillance Capacity

One structural response to the vulnerability created by any centralized system is building regional nodes capable of more autonomous operation. WHO's regional offices—particularly SEARO and AFRO—already provide some technical support for influenza surveillance in their respective areas, but laboratory capacity at the national level in many countries remains limited and dependent on external support [2,5]. Increased investment in regional influenza surveillance networks, both financial and technical, can reduce the system's reliance on any single major contributor's continued engagement and build resilience against future disruptions of this kind. This investment represents both a response to the current situation and a long-overdue correction of structural vulnerability in the global surveillance architecture.

Secure Predictable Alternative Funding

If WHO assessed contributions from the US are reduced or interrupted for a sustained period, alternative funding channels should be actively pursued to sustain the operational capacity of GISRS national centres in low-income countries. Options include increased voluntary contributions from other major-economy WHO members, philanthropic funding through established global health foundations, and development finance mechanisms that can provide multi-year commitments to surveillance infrastructure. The annual cost of maintaining functional peripheral surveillance capacity in low-income countries is modest relative to the economic and mortality costs of a pandemic response that begins weeks behind schedule because early warning systems were degraded [11,12]. That cost-benefit calculation should be made explicit in discussions with potential alternative funders.

Communicate the Technical Stakes to Policymakers

Decisions about international organizations are made by politicians and diplomats who may not have a detailed picture of how disease surveillance networks actually function or what operational consequences follow from participation decisions. The public health and scientific communities have a responsibility to provide technically specific accounts of what particular policy changes will damage—not in general terms about 'global health cooperation' but in operational specifics about what data flows will be disrupted, which vaccine composition decisions will be affected, and what the likely clinical and epidemiological consequences are [6,7]. That kind of technically grounded communication is more likely to influence policy than generalised appeals to international solidarity, and it is more honest about what is actually at stake.

CONCLUSION

Influenza surveillance has always been a collective endeavour. No single country's data, however extensive, can substitute for the distributed global picture that GISRS assembles. The United States has been a

major structural contributor to that picture—through virological data, through laboratory capacity, through financial support, and through the technical and diplomatic engagement of CDC scientists in international forums. US withdrawal from WHO puts all of those contributions at some degree of risk, and the risk is not symmetrically distributed: the populations least able to absorb influenza burden will absorb the consequences of surveillance failures they had no hand in creating.

The core public health argument does not require certainty about how political events will unfold. It requires only clarity about what surveillance systems do, why they need broad participation, and what happens when participation narrows. Surveillance gaps produce vaccine mismatch. Vaccine mismatch produces preventable illness. Weakened pandemic early warning delays coordinated response. These are not speculative harms; they are documented patterns from the historical record of influenza surveillance failures.

The constructive response is not alarm but specificity. Which particular data flows are most critical and most threatened? Which bilateral agreements can substitute, at least partially, for disrupted multilateral channels? Where should alternative funding be directed to maintain minimum operational capacity in peripheral surveillance nodes? Those questions have practical answers, and identifying them is the most useful contribution that the public health community can make in a period of policy uncertainty. The technical stakes are real, and making them legible is the first step toward protecting them.

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