illumina®

A genomics-based approach to global public health surveillance

Advancing global pandemic preparedness and infectious disease monitoring for a healthier world

What is public health surveillance?

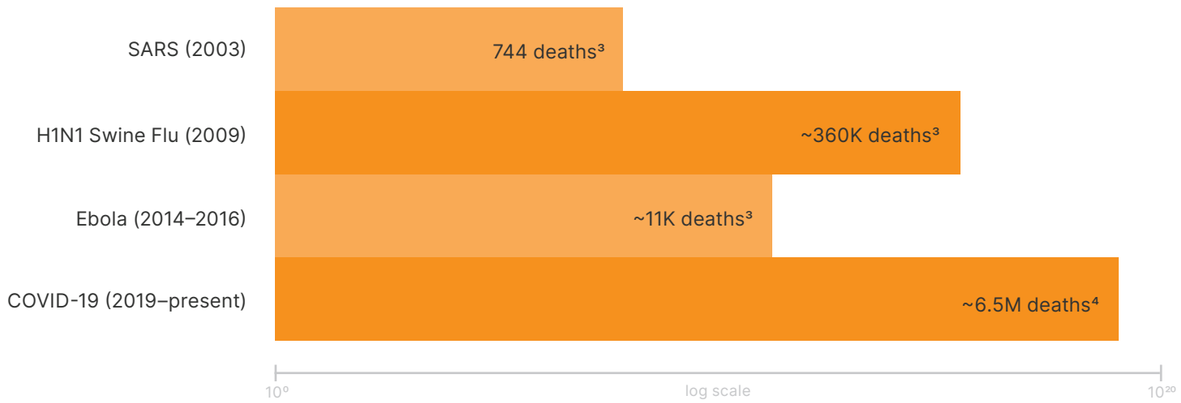
Public health surveillance is the ongoing, systematic collection, analysis, and interpretation of health-related data essential to planning, implementation, and evaluation of public health practice.[1]

The goal of public health surveillance is to collect, analyze, interpret, and disseminate public health data to be used for health action by ministries of health, public health personnel, government leaders, and the public to guide public health policy and programs.[2]

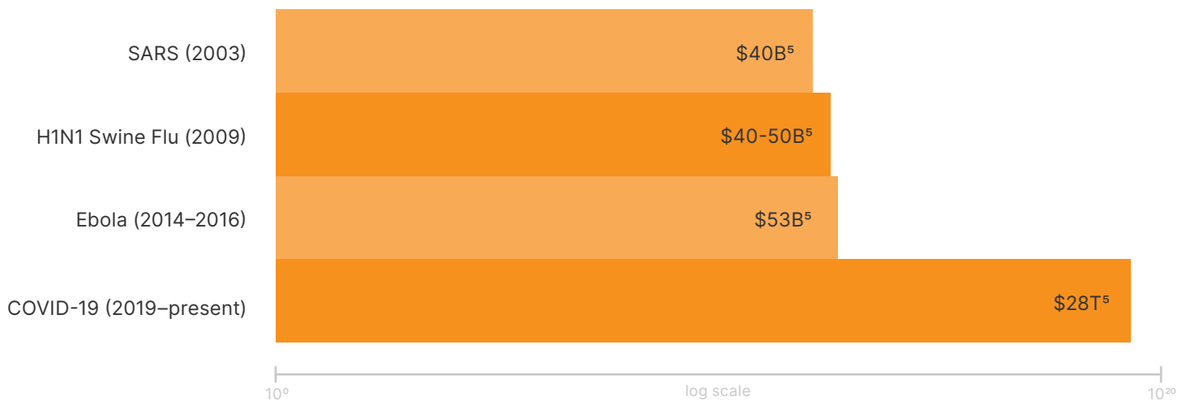
The growing threat of infectious diseases to public health

Modern urbanization of historically isolated habitats, widespread accessibility to global travel, and rising global temperatures have all facilitated the increasing risk of exposure to, and transmission of, new infectious diseases. Infectious disease outbreaks impact not only the personal health of individuals, but also lead to long-lasting effects on employment, healthcare systems, education, travel, and quality of life at a local, national, and global level.

Estimated direct global mortality of recent infectious disease outbreaks



Estimated global economic impact of recent infectious disease outbreaks

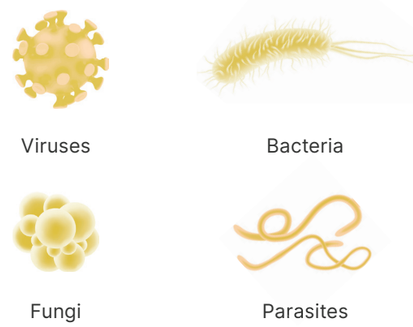


What is genomics-based public health surveillance for infectious diseases?

A core function of public health as an effort is to help achieve equity within our communities. By focusing on community-wide prevention and overall health, public health saves our communities money, improves our quality of life, helps children thrive, and reduces human suffering.

Genomics-based surveillance integrates next-generation sequencing (NGS) and public health surveillance for genomic-level monitoring of infectious diseases. NGS technology has significantly and rapidly deepened our understanding of pathogen behavior, evolution, and circulation within global populations.

Infectious diseases can be caused by:



Genomics-based public health surveillance uses NGS to monitor pathogens at the level of their genetic makeup (DNA/RNA)

How does genomics contribute to public health surveillance?

Genomics-based public health surveillance allows for:

- Detection of novel, emerging, and circulating pathogens
- Tracking of infectious agent transmission and disease spread within a community
- Understanding of pathogen behavior (infectivity and pathogenicity) and mapping the evolution of variants
- Development of diagnostics and design of therapeutic vaccines and treatments

> **"There is a clear need for a globally coherent, pathogen agnostic, global genomic surveillance strategy for pathogens with pandemic and epidemic potential."**
>
> —World Health Organization (WHO)[6]

Impact of NGS on infectious disease monitoring

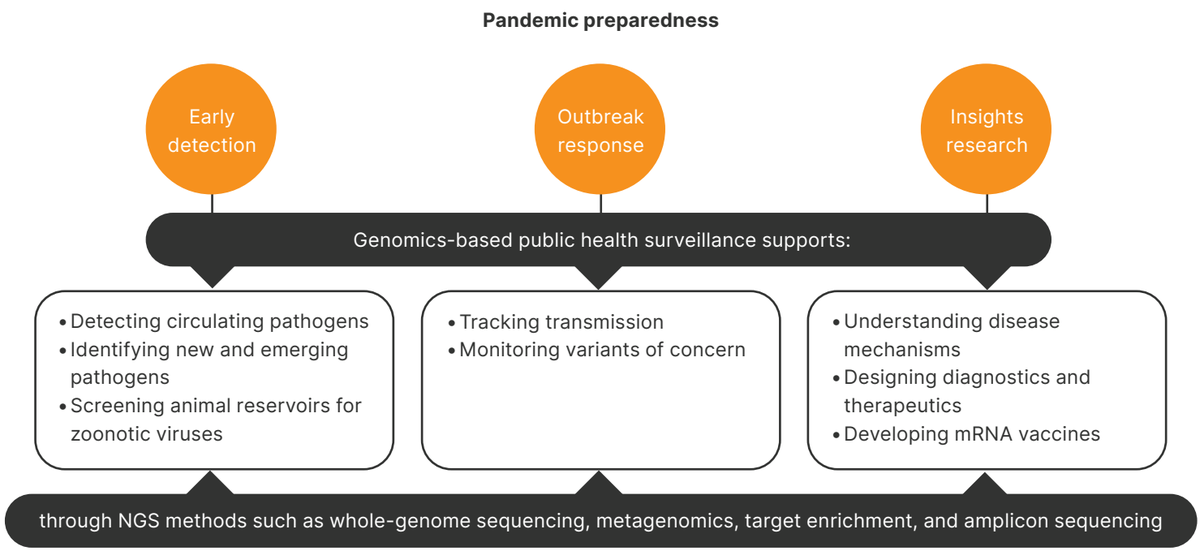
NGS technology is bringing genomics to the forefront of public health surveillance, providing unprecedented speed and scale to infectious disease monitoring and pandemic response.

	COVID-19 pandemic (2019–present)	SARS epidemic (2002–2003)
Availability of NGS	✓	✗
Time from first reported case to identification of causative virus	26 days[7]	4 months[8]
Time from first case to first publicly available genome	22 days[9]	6 months[10]
Publicly available genomes (9 months into outbreak)	~80,000 genomes[11]	31 genomes[12]
Time from first case to first commercially available PCR-based diagnostic test	3 months[13]	6 months[14]
Time from first case to first approved mRNA-based vaccine	20 months[15]	N/A[a]

a. Not applicable.

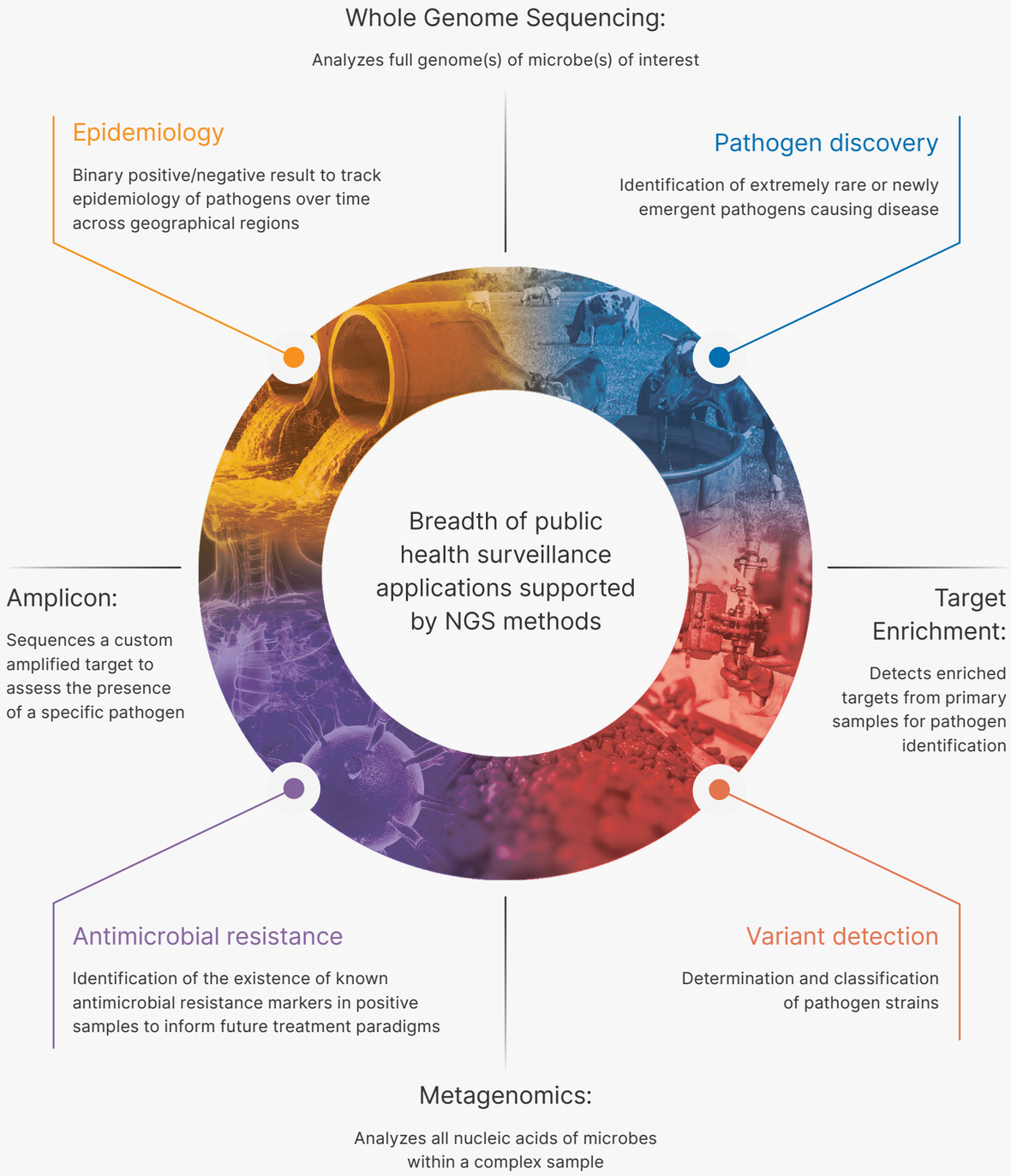
Three pillars of pandemic preparedness supported by NGS-based genomics

Three pillars of pandemic preparedness provide a framework for advancing pathogen detection within a population, improving rapid responses to ongoing outbreaks, and supporting research towards the discovery of emerging infectious agents. Each pillar can be upheld by the implementation of NGS-based genomics.



"Advance planning and preparedness are critical to help reduce the impact of a pandemic."

—Centers for Disease Control and Prevention (CDC)[16]



Improving global access to NGS-based public health surveillance

> **"Current uses and future applications of genomic technology are critical for improving the health and livelihood of people in all parts of the world, regardless of economic status."**
>
> —World Health Organization (WHO)[6]

Illumina offers a wide range of educational, support, and training programs to facilitate the globalization of NGS-based public health surveillance tools:

Global education programs
Providing STEM education tools to bring the powerful field of genomics into local classrooms

Comprehensive global product support services and supply chain
Tailored service plans for accessing Illumina expertise through global customer support teams, manufacturing locations, and regional supply chains

Online webinars and training videos
Streamlined how-to videos catered to inexperienced NGS users

With these established outreach programs, Illumina has built a proven track record of:

- Enabling the accessibility of NGS technology to public health labs from various regional economies
- Supporting a variety of global public health networks with NGS tools and education
- Establishing sequencing capabilities in resource-constrained countries to build critical public health surveillance capabilities

Illumina Solutions: Designed for a perfect fit

Uphold pandemic preparedness by using NGS to bolster early detection, monitor outbreak response, and support insights research. Ask virtually any question related to the genome with NGS library prep kits optimized for Illumina sequencing systems. Illumina provides various software solutions for customer needs. For example, the DRAGEN™ Bio-IT Platform provides accurate, comprehensive, and efficient analysis of NGS data, driving insights. Even new-to-NGS users will find the workflows and applications easy to adopt. In addition, a team of experts is available to support you 24/7 globally.

Method	Library prep and panel content	Data analysis
Whole-genome sequencing	• Illumina DNA Prep	• BaseSpace™ Sequence Hub • DRAGEN Bio-IT Platform • Explify™ Platform • Illumina Connected Analytics (ICA)
Metagenomics	• Illumina DNA Prep	
Target enrichment	• Illumina RNA Prep with Enrichment • Respiratory Virus Oligo Panel (RVOP) • Viral Surveillance Panel (VSP) • Pan-Coronavirus Panel (Pan-CoV) • Illumina Respiratory Pathogen ID/AMR Panel (RPIP)	
Amplicon sequencing	• Illumina COVIDSeq™ Assay • Illumina COVIDSeq Test[a]	

a. For Use Under An Emergency Use Authorization Only

Partnering with Illumina

Partnering with Illumina provides easy access to NGS tools and workflows for your public health surveillance and infectious disease monitoring needs.

NGS platforms with proven performance
Illumina NGS instruments have been adopted by leading institutions around the globe, both big and small, and are the production platform for many genome centers.

Each sequencing platform delivers exceptional data quality and performance, with flexible throughput and simple, streamlined workflows—for every scientist, for every project.

Visit www.illumina.com/systems to learn more.

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The time to prepare for the next pandemic is now.

This is the genome era.

At Illumina, we offer technology and support to cover integrated NGS workflows, from library preparation to data analysis and sharing.

Our optimized end-to-end workflows are unrivaled in operational simplicity, fast turnaround times, and streamlined use.

Our passionate customer and partner care network is committed to creating a global network to support critical public health surveillance strategies through NGS-powered genomics.

Learn more

https://ilmnmkt.illumina.com/2016010003

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