Genpax IDEM

Next Generation Infection Surveillance

The Power of WGS – Transforming Infection Control and Public Health

IDEM Insight Series: Document 1 of 6

Advancing Infection Prevention and AMR Surveillance

About This Document

This is Document 1 of 6 in the IDEM Insight Series, designed to guide you from understanding the power of Whole Genome Sequencing (WGS) in infection prevention and control through to the benefits, performance, and practical use of IDEM.

The full IDEM Insight Series includes:

1. **The Power of WGS –** Transforming Infection Control and Public Health.
2. **IDEM Introduction –** Next-Generation Genomic Surveillance.
3. **IDEM Performance Overview –** How Accuracy, Resolution, and Connectivity Drive Results.
4. **IDEM Technical Validation Guide –** In-Depth Data and System Design.
5. **Health Economic Impact –** How Proactive WGS Saves Lives and Costs.
6. **IDEM Instructions for Use (IFU).**

For more information, visit www.genpax.co or contact support@genpax.co.

Insight Series Progress

[■] 1. The Power of WGS → [□] 2. IDEM Intro → [□] 3. Why IDEM Works →[□] 4. Technical Guide [□] 5. Health Economics → → [□] 6. IFU

Harnessing Whole Genome Sequencing for Infection Control and Public Health

Whole Genome Sequencing (WGS) is transforming how we detect, analyse, and prevent the spread of bacterial pathogens and antimicrobial resistance (AMR) across healthcare, food safety, and public health. By providing genetic insights, WGS enables infection prevention and food safety teams to move beyond reactive outbreak containment and towards proactive surveillance and large-scale data-driven interventions.

This document explains **why WGS is now ready for routine use** and provides an overview of the three core use cases, helping readers understand its importance and how it can support infection control and food safety efforts:

1. **Reactive Outbreak Analysis** – Confirming and containing outbreaks when infection rates rise, or unusual patterns emerge.
2. **Proactive Surveillance** – Detecting hidden transmission routes and reservoirs before outbreaks occur.
3. **Nationwide Surveillance & Policy Impact** – Using large-scale WGS data to track AMR, identify hotspots, and inform public health interventions.

Why WGS is Ready for Routine Use

While WGS has transformed outbreak detection and antimicrobial resistance (AMR) surveillance, several key barriers have slowed its widespread adoption in routine infection prevention and control (IPC) and public health practice.

Historically, WGS has faced three major challenges:

- **Cost** – The expense of sequencing has been prohibitive for routine use. However, costs have now fallen significantly, making regular surveillance workflows increasingly affordable.
- **Speed** – Early sequencing and analysis workflows were too slow to support real-time IPC decisions. Today, with improvements in both laboratory processes and analytics, WGS can now deliver results within timeframes that support effective interventions.
- **Bioinformatics Complexity** – Most significantly, bioinformatics has been a persistent bottleneck, requiring specialist expertise and complex systems that have limited usability, scalability, and confidence in results.

These bioinformatics challenges have typically included:

- **Slow Turnaround Times (TATs)** – Traditional pipelines often take days to deliver results, missing critical intervention windows where rapid action could prevent onward transmission.
- **Limited Species Coverage** – Many platforms only support a narrow range of pathogens, reducing their value for hospitals managing diverse healthcare-associated infections (HCAIs) and AMR threats.
- **Insufficient Resolution** – Difficulty distinguishing between closely related strains reduces confidence in tracking transmission pathways and understanding outbreak dynamics.
- **Poor Connectivity** – Systems are often isolated within single institutions, lacking the ability to securely compare and contextualise data across hospitals, regions, or national networks.
- **Dependency on Specialist Bioinformatics Expertise** – Many solutions require expert operators to run analyses and interpret results, making routine use unrealistic in clinical settings.

- **Inconsistent Standards** – Variability in outputs and methods across different sites prevents reliable comparisons and limits the potential for joined-up surveillance.

These limitations have historically slowed the wider adoption of WGS in routine IPC and national surveillance.

Genpax IDEM platform was built specifically to overcome these barriers through its Accuracy, Resolution and Connectivity framework, delivering:

- Validated **Accuracy** to ensure trust in results.
- High **Resolution** to detect and track transmission events.
- Seamless **Connectivity** to integrate data across sites and support coordinated action.
- **Rapid turnaround**, delivering actionable insights in **under 2 hours** from sequencing data upload.
- Comprehensive species coverage, with **99.9% of bacteria causing human infections included**, enabling broad, routine surveillance.
- An intuitive, automated system that requires **no specialist bioinformatics expertise**, making WGS accessible for clinical teams.

Core Use Cases

1. Reactive Outbreak Analysis – Confirming and Containing Outbreaks

When infection rates rise – whether in hospitals, food production facilities, or the wider community – rapid and precise action is critical. Traditional microbiology lacks the ability to determine whether cases are linked or just coincidental. WGS enables definitive outbreak confirmation or exclusion, helping both healthcare and food safety teams:

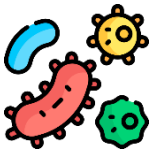
- Determine if cases are genetically related, pinpointing transmission events.
- Identify sources of infection in hospitals, food chains, or environmental reservoirs.

- Avoid unnecessary resource deployment when no outbreak is present.
- Optimise containment measures when outbreaks are confirmed.

This approach is used both in hospitals for Hospital associated infections (HAIs) and antimicrobial resistance (AMR) outbreaks and in food safety to trace contamination sources and prevent recalls.

EXAMPLE: Reactive Outbreak Analysis – Confirming and Containing Outbreaks

1



Increase in *K.pneumoniae* infections detected in ICU

2

Samples from blood, urine, wounds, & sputum are **collected**.

3

Whole Genome Sequencing (**WGS**) is **performed** on the samples.

4

IDEM

IDEM Analysis:
Determines if samples are related or Unrelated.

Unrelated Samples = No Outbreak

- ✓ Strains show high genetic diversity, suggesting unrelated sources.
- ✓ No IPC escalation needed.
- ✓ **IDEM with WGS avoids unnecessary quarantines & interventions.**

Related Samples = Outbreak

Transmission Path Analysis

- ✓ Identify common sources (e.g., endoscopes, ventilators, or HCW contamination).
- ✓ Track spread between wards/hospitals.
- ✓ **IDEM with WGS supports public health interventions.**

2. Proactive Surveillance – Stopping AMR Spread Before It Starts

Proactive WGS enables the **early detection of bacterial transmission and hidden reservoirs before outbreaks arise**, without requiring changes to current sample collection practices. Rather than modifying workflows, hospitals and food safety teams can expand the use of WGS on existing cultures – especially in high-risk environments such as ICUs, oncology units, transplant wards, and neonatal care. This allows for:

- **Early identification of bacterial transmission routes**, detecting how both resistant (e.g., MRSA, MDR *E.coli*) and susceptible (e.g., Methicillin-susceptible *Staphylococcus aureus*) strains spread between patients, wards, and hospitals before clinical outbreaks emerge.
- **Uncovering hidden reservoirs of infection** in healthcare, food production, and environmental settings – including persistent contamination sources in equipment, water systems, or high-risk hospital wards.
- **Tracking bacterial populations over time**, distinguishing between single-source introductions and ongoing transmission within a facility.
- **Providing real-time genomic evidence** to guide targeted infection control measures, ensuring interventions focus on breaking transmission chains rather than responding reactively to outbreaks.

Proactive WGS surveillance allows infection control teams to **map where bacteria persist, how they move through healthcare and food systems, and where interventions can be most effective** – stopping outbreaks before they happen.

EXAMPLE: Proactive WGS Surveillance – Detecting Hidden Transmission Routes & Reservoirs Before Outbreaks Occur.

1. Collect samples as usual from patients with suspected infections, high-risk wards (ICU, oncology, neonatal), and environmental swabs (sinks, ventilators, catheters).

Routine Cultures from Patients & Environment

2. Apply WGS to a broader set of routinely collected cultures before infections escalate.

Perform Whole Genome Sequencing on These Samples

3. Compare patient and environmental isolates to identify silent transmission routes.
   - Track AMR and virulence gene trends before resistant strains cause outbreaks.
   - Identify persistent reservoirs of infection (e.g., colonised patients, contaminated sinks/equipment).

IDEM Analysis: Detecting Transmissions & Reservoirs

No Concerning Transmission = Continue Routine Monitoring

- ✓ Maintain surveillance to ensure early detection of future threats.
- ✓ Helps refine antibiotic stewardship strategies based on AMR patterns.

Transmission Detected = Early IPC Intervention

- ✓ Identify transmission sources before widespread infections occur.
- ✓ Enhance decontamination & cohorting strategies in affected wards.
- ✓ If linked to food/water sources, define strategy to mitigate.

3. Nationwide Surveillance – A Unified Front Against AMR

By combining WGS data from hospitals, food sources, and environmental surveillance, governments and public health agencies can build a comprehensive, real-time map of AMR transmission. This approach enables:

- Monitoring of AMR hotspots across hospitals, farms, and wastewater.
- Linking of hospital-acquired and foodborne AMR infections.
- Early warning systems for emerging drug-resistant bacterial strains.
- Policy-driven national interventions to curb AMR spread and guide antibiotic use.

By unifying data from healthcare, food safety, and environmental monitoring, WGS becomes a critical tool in the global fight against antibiotic-resistant infections.

Why WGS? Why Genpax IDEM?

With rising AMR, evolving hospital pathogens, and increasing foodborne threats, conventional infection tracking methods are no longer sufficient. Whole genome sequencing (WGS) is the key to effective infection tracking, AMR surveillance, and outbreak prevention. However, for WGS to be successful, bioinformatics tools must deliver **high accuracy, high resolution, and seamless connectivity**.

Discover why the **Genpax IDEM platform** is the only tool up to the task.

Get Started with IDEM Today

- **Contact us**
- **Learn More**
- **Schedule a Demo**

EMAIL: support@genpax.co

Next in the IDEM Document Series:

➡️ *IDEM Introduction – Next-Generation Genomic Surveillance*

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