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GENOMIC EPIDEMIOLOGY IN PANDEMIC PREPAREDNESS

LESSONS & OPPORTUNITIES FOR PRECISION PUBLIC HEALTH

AARON BENCOMO, MD
CHIEF MEDICAL OFFICER | PHRONETIK

www.phronetik.com

Executive Summary

The future of pandemic preparedness relies on the ability to monitor, detect, and respond to pathogen mutations in real time. Genomic epidemiology—the integration of genome sequencing with public health data—empowers healthcare systems to track and mitigate the spread of infectious diseases. However, the global response to pandemics, such as COVID-19 and Ebola, has highlighted the critical need for equitable access to genomic technologies. Phronetik, a pioneer in genomics and precision medicine, is advancing a vision of accessible, community-centered genomic surveillance that enhances public health security and supports underserved populations. Through innovative technologies like iHarmony-Seq™, proprietary bioinformatics tools, and partnerships, Phronetik is driving real-time, effective genomic surveillance to bolster pandemic preparedness worldwide.

Introduction

As pandemics continue to challenge global health systems, real-time pathogen monitoring has become essential. Genomic epidemiology offers insights into pathogen evolution, transmission dynamics, and vaccine effectiveness. The COVID-19 and Ebola pandemics have demonstrated that timely, accurate genomic data can inform public health interventions and mitigate disease spread. This whitepaper provides an analysis of recent public health data on genomic surveillance, highlights case studies, and proposes future models for pandemic preparedness. We also explore Phronetik's unique contributions to genomic epidemiology, underscoring our commitment to equitable health solutions and sustainable public health partnerships.

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Genomic Surveillance Today

During COVID-19, genomic sequencing was crucial in tracking variants and adapting public health responses accordingly. Phronetik's iHarmony-Seq™ software exemplifies a cutting-edge approach to identifying viral mutations in real time, enabling health systems to understand transmission patterns and variant prevalence across populations. Through advanced analytics, iHarmony-Seq™ synthesizes data from multiple sources, producing actionable insights that empower health authorities to target interventions more precisely.

- *In a pilot project with an international partner, iHarmony-Seq™ reduced data processing time by 40%, accelerating the reporting of SARS-CoV-2 variants by identifying mutations of interest in near real time. By integrating cultural and linguistic variables, iHarmony-Seq™ tailors insights to address specific community dynamics.*

During the 2014-2016 West African Ebola outbreak, portable sequencing devices made it possible to track viral mutations in remote regions. Building on this concept, Phronetik has developed iConcordia®, a portable sequencing and analysis system designed for use in both urban and rural health settings. Leveraging our experience in clinical genomics and bioinformatics, iConcordia® can be deployed to quickly sequence pathogens and identify variants, providing local healthcare teams with actionable data even in resource-constrained environments.

- *In a simulated outbreak scenario, iConcordia® demonstrated effectiveness in rural health clinics by processing samples in under 24 hours demonstrating multiple real-world, use-case applications for regions with limited laboratory infrastructure.*

- *iConcordia® empowers healthcare workers to independently operate genomic surveillance tools for sustained public health resilience.*

Genomic epidemiology has become invaluable in mitigating disease spread and impact as history continues to reveal disparities in genomic sequencing capacity worldwide. Despite progress, great challenges like logistical constraints, the need for trained personnel, and the physical lack of sequencing facilities- which delay real-time data access for global, developing, and rural public health teams, remain constant.

Trends in Public Health & the Phronetik Ideal

Increased Variant Detection & Characterization

- *Genomic surveillance has identified variants with increased transmissibility and vaccine resistance. Phronetik's iHarmony-Seq™ detects such changes efficiently, equipping public health teams with necessary insights to adjust vaccination and containment efforts proactively.*

Accelerated Response Times

- *Countries with strong genomic infrastructure responded more quickly to COVID-19 variants, reducing morbidity and mortality. In partnership with Microsoft, Phronetik has optimized data pipelines for our platforms, allowing rapid sequence analysis even in low-bandwidth environments.*

Addressing Data Gaps for Equity

- *Phronetik's work emphasizes the importance of inclusive data to combat health inequities. By focusing on underserved communities, our solutions ensure that genomic data collection extends beyond traditionally represented populations. This commitment improves data representativeness and enriches our understanding of community-specific viral dynamics.*

The Future of Sequencing

Distributed Genomic Hubs with iConcordia®

- *Phronetik advocates for the establishment of regional sequencing hubs, where local teams can utilize iConcordia® for sample collection, sequencing, and preliminary analysis. Each hub can act as a point of contact for local health authorities, providing genomic data that reflects community-specific disease characteristics.*

AI-Driven Insights for Mutation Tracking

- *Phronetik's AI capabilities offer enhanced predictive modeling for variant tracking. By integrating real-time data into our systems, iHarmony-Seq™ can highlight emerging patterns in viral mutations, flagging mutations of concern that could affect vaccine or therapeutic efficacy.*

Public-Private Partnerships for Data Integration

- *Phronetik's collaborations, including our strategic alliance with the Gwen Lily Research Foundation, support a model of shared genomic data that emphasizes both security and accessibility. Our cloud-based infrastructure allows cross-national data exchange, fostering a coordinated global response to emerging pandemics.*

Policy Recommendations for Equitable Real-Time Surveillance

Public-Private Partnerships for Data Integration

- *Establish formal partnerships between public health agencies, private companies like Phronetik, and community health organizations. By leveraging Phronetik's technology and expertise, these partnerships can scale genomic capabilities in under-resourced regions.*

Localized Genomic Training Programs

- *Partner with local universities and training institutions to create skill-building programs in genomic epidemiology. Phronetik has successfully led such programs through our Phronetik Academy initiative, increasing the capacity of local healthcare teams to conduct independent genomic surveillance.*

Funding Portable Sequencing Initiatives

- *Allocate resources for tools like iConcordia® to reach remote settings, bridging the gap between urban and rural healthcare infrastructure. During recent field tests, iConcordia® was shown to reduce costs by up to 60%, a key metric for sustainability in resource-limited contexts.*

Data Access & Sovereignty Protocols

- *Data-sharing agreements that respect national data sovereignty while promoting global transparency. Our partnership framework prioritizes local data ownership, ensuring that communities benefit from and control their own health data.*

Conclusions

Phronetik is at the forefront of genomic epidemiology, offering scalable, community-centered genomic solutions through proprietary platforms like iHarmony-Seq™ and iConcordia®. Our technologies deliver timely, actionable insights that empower local health systems to detect, monitor, and respond to pathogen threats effectively. Our commitment to equitable access and strategic public-private partnerships ensures that communities worldwide can benefit from advanced genomic epidemiology.

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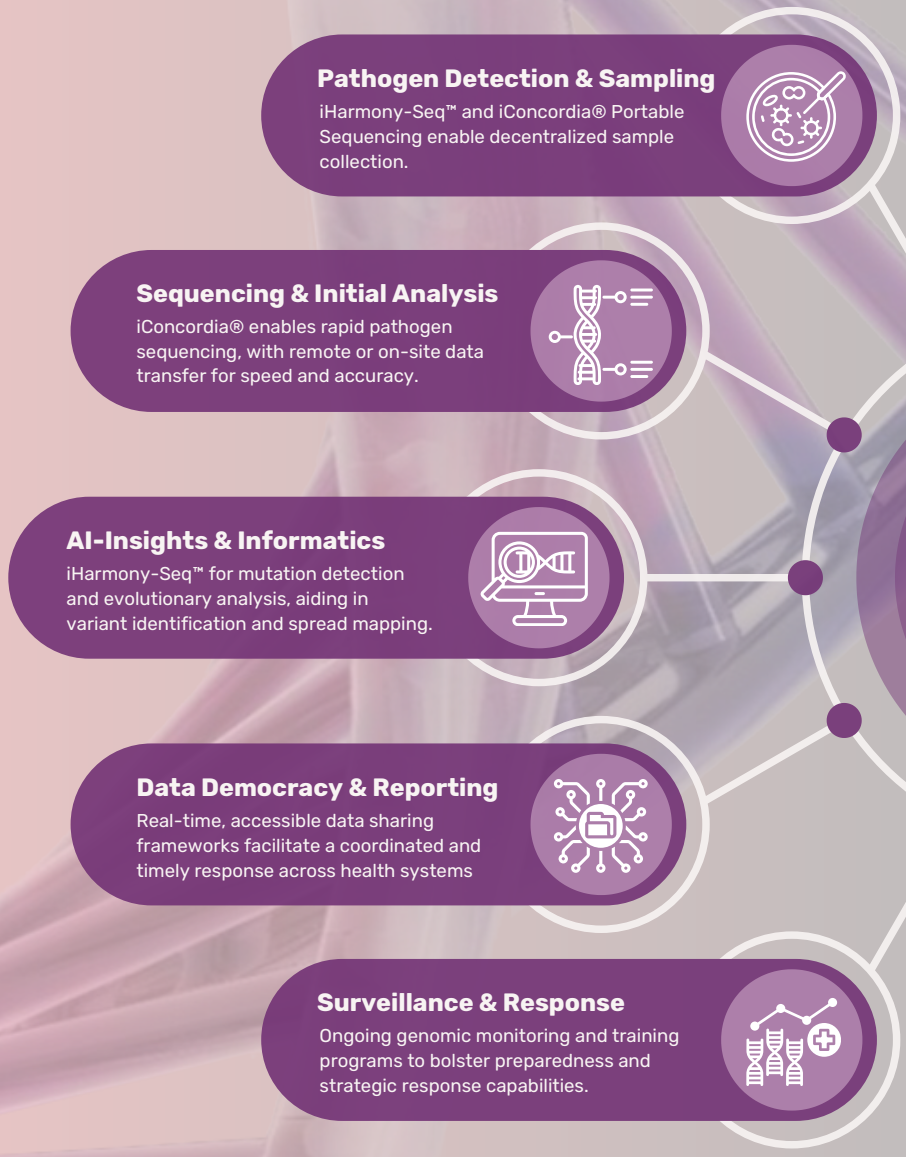
Equitable Genomic Surveillance for Global Health Security

Phronetik's mission to advance global health security through accessible genomic epidemiology positions it as a vital player within the pandemic preparedness landscape of today.

By integrating cutting-edge technology, a commitment to equity, and sustainable community partnerships, Phronetik effectively bridges the gaps between pathogen detection, data analysis, public health strategy, and long-term resilience. This multifaceted role is what makes Phronetik a critical player in ensuring that genomic epidemiology is not just technologically advanced but also adaptable and inclusive.



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