Genomics and Risk Analytics to Create Safer Food Systems
From innovation to (proposed) rule/determination

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National Academies Food Forum

Washington D.C., September 4-5, 2024

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Disclosures

I am a managing director at EpiX analytics

EpiX receives funding for R&D, consulting, and training from many sources, including regulators, academic partners, private institutions, and industry organizations. See list here https://epixanalytics.com/clients-and-collaborators/

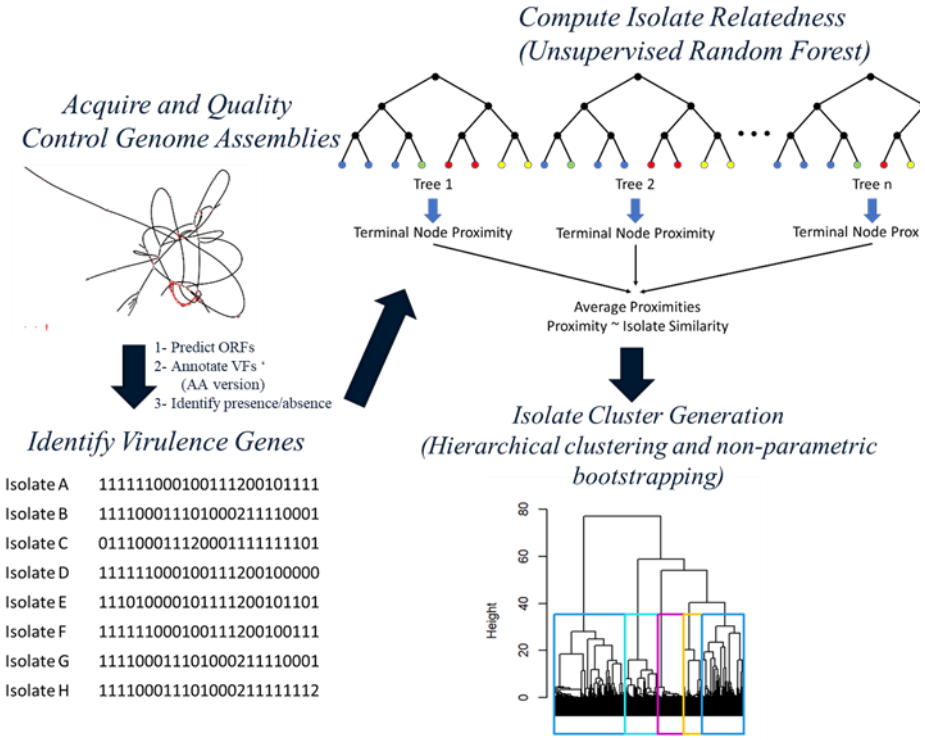
Genomics to find higher (HV) and Lower Virulence (LV) groups (patent pending)

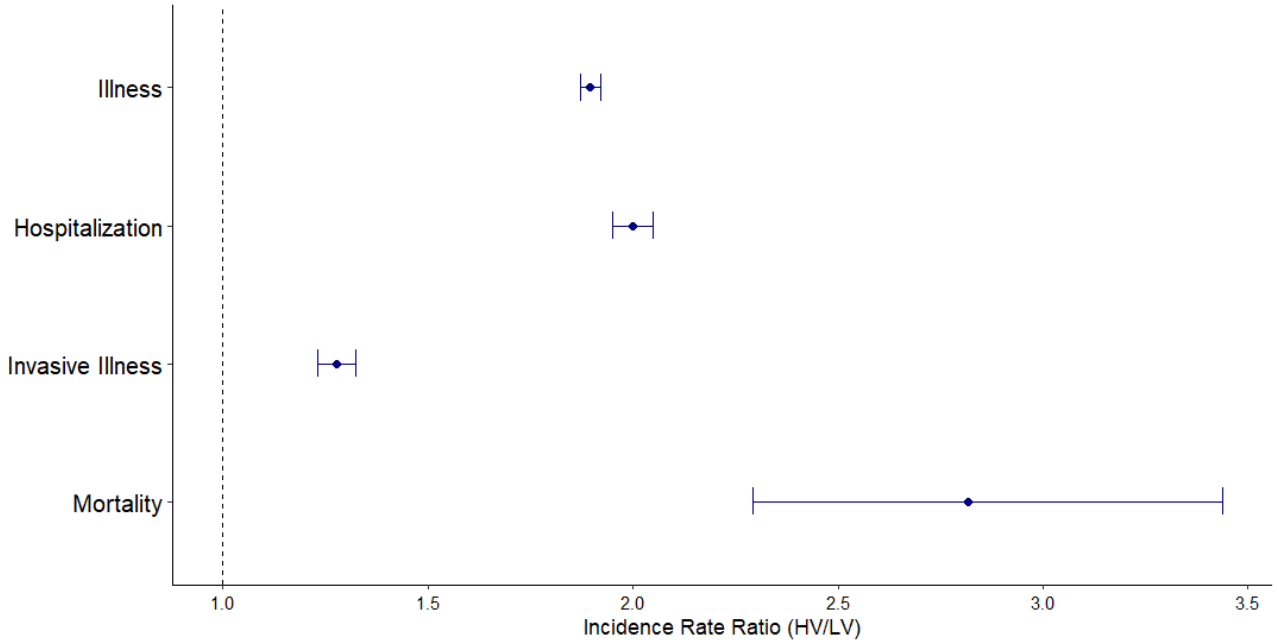
Most often implicated in foodborne outbreaks of any cause
2X higher incidence in sporadic cases

Higher virulence

- Enteritidis
- Typhimurium
- Newport
- I 1,4,(5),12:i:-
- Hadar
- Saintpaul
- Muenchen
- Paratyphi B
- Berta
- Dublin
- Litchfield
- Blockley

Fenske GJ, Pouzou JG, Pouillot R, Taylor DD, Costard S, Zagmutt FJ. ***The genomic and epidemiological virulence patterns of Salmonella enterica serovars in the United States.*** PLoS One. 2023 Dec 5;18(12):e0294624. doi: 10.1371/journal.pone.0294624

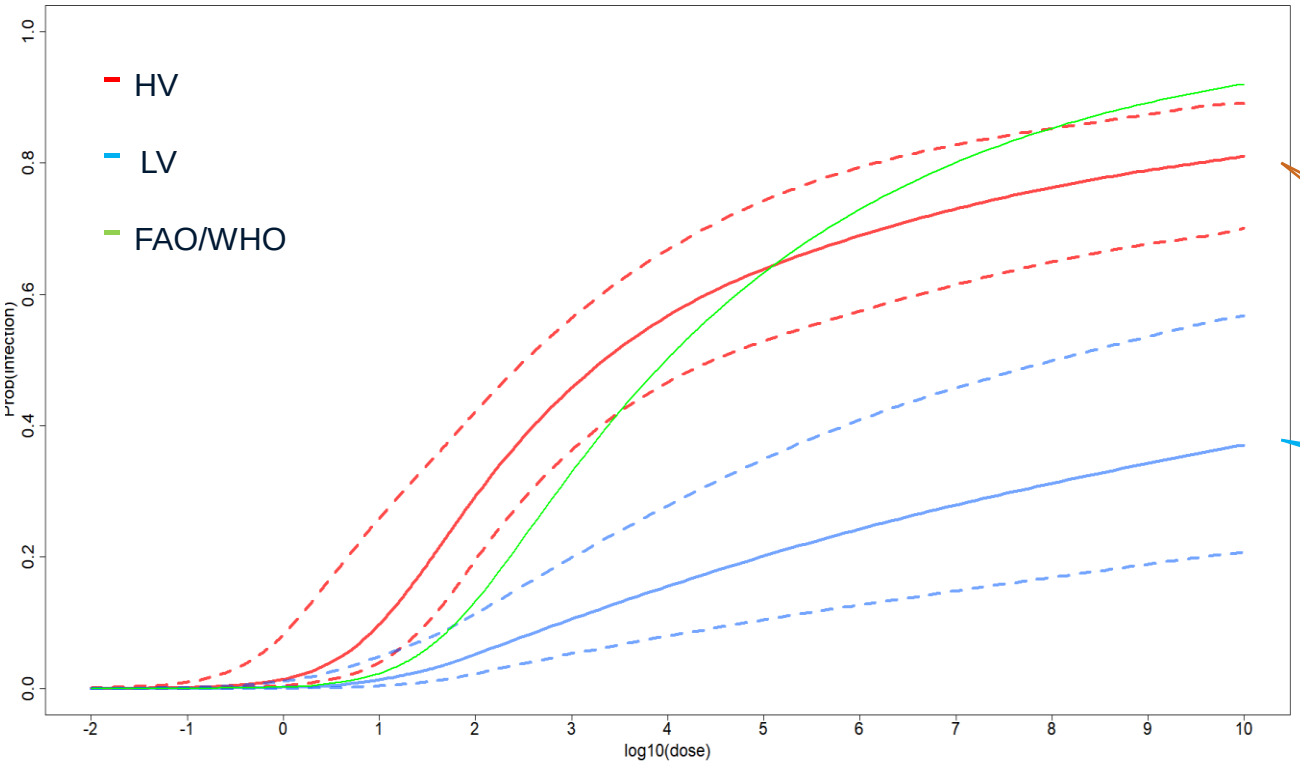




USDA FSIS. *Quantitative Risk Assessment for Salmonella in Raw Chicken and Raw Chicken Products. Appendix A:* ***EpiX Analytics' Report "Using genomics to identify nontyphoidal Salmonella serovars of concern, and estimating dose-response models amenable to risk assessments in poultry".*** https://www.fsis.usda.gov/sites/default/files/media_file/documents/Chicken_SRA_July2024.pdf

Connecting load to illnesses, by virulence (patent pending)

Zagmutt F, Pouillot R, Pouzou J, Taylor D, Costard S (2023) *A Novel Framework to Estimate Salmonella Dose-Responses Accounting for Genomic Serovar Virulence and Exposures from Food Sources*. IAFP, Toronto, Ontario, Canada.
https://www.foodprotection.org/upl/downloads/meeting/archive/64e8d700d785811b835b2.pdf



Our virulence-based dose-responses

FSIS' poultry risk assessments

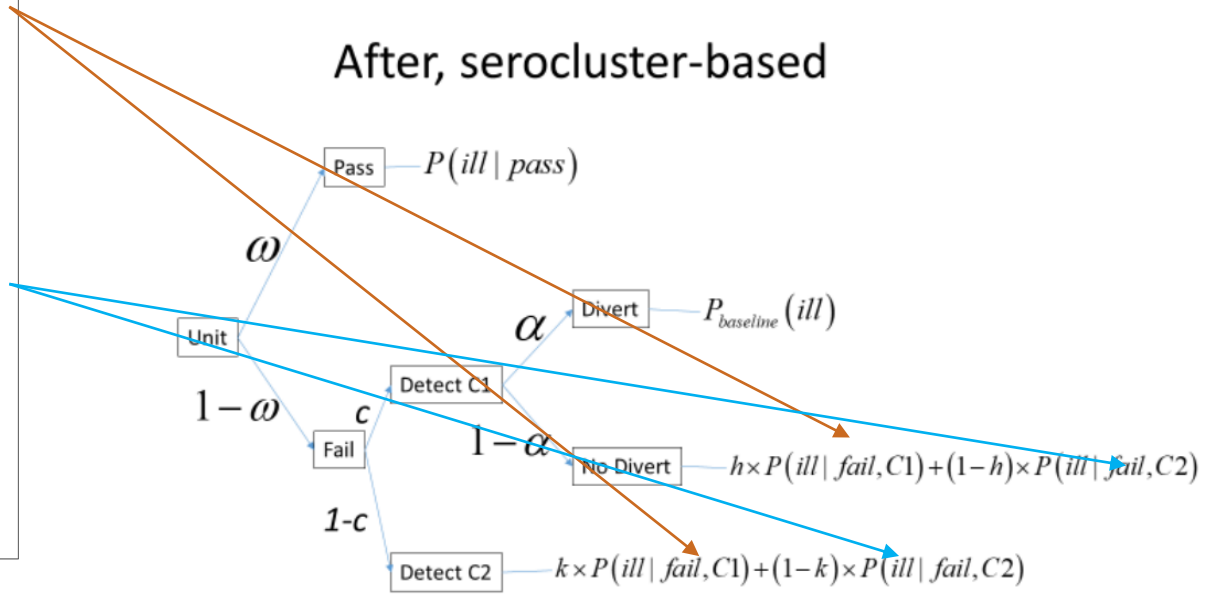


Figure 21:Schematic depiction of the 3 possible pathways through which all product moves after the implementation of a serotype-based final product standard.

USDA FSIS. ***Quantitative Risk Assessment for Salmonella in Raw Chicken and Raw Chicken Products. Page 99.***
https://www.fsis.usda.gov/sites/default/files/media_file/documents/Chicken_SRA_July2024.pdf

Opportunities for the future…

Need to formalize implementation of genomics and ML/AI into the risk analysis process, particularly hazard ID and hazard characterization (e.g. CODEX)

Further understanding genomic drivers of “virulence” (i.e. infectivity, pathogenicity, virulence) = better prediction = better risk management

Public availability of data KEY (US federal genomic data is vast and open, unlike most of the world), but foodborne illness data highly restricted everywhere

Food safety innovation requires federal investment -> funding well suited for academia, but incentives for private sector innovation lagging

Acknowledgements

Dr. Jane Pouzou
Dr. Dan Taylor
Dr. Mason Munro-Ehrlich
Dr. Régis Pouillot
Dr. Solenne Costard

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- Beef virulence and risk assessment (Patent pending):
  - Partly funded by a grant from the Foundation for Meat and Poultry Research and Education.
  - This work utilized the Summit supercomputer, which is supported by the National Science Foundation (awards ACI-1532235 and ACI-1532236), the University of Colorado Boulder, and Colorado State University. The Summit supercomputer is a joint effort of the University of Colorado Boulder and Colorado State University.
  - FoodNet Data: The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
- Addition of poultry isolates partly funded by FSIS via a cooperative agreement with University of Maryland:
  - This material is based upon work supported by the USDA, FSIS, No. (FSIS-C-16-2022)
  - Any opinions, finding, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of UMD or FSIS

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