

# **Quantifying uncertainty about future antimicrobial resistance: comparing structured expert judgement and statistical forecasting methods**

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The increase in antibiotic resistance is a defining development in the treatment of infectious diseases in this century. In response, the international community is investing in programs to protect access to effective antibiotics. Information is needed on the uncertainty surrounding the future trajectory of resistance. Mathematical and statistical models capable of projecting future rates are challenged by the paucity of data and the complexity of the emergence and spread of resistance, but experts have relevant knowledge. We use the Classical Model of structured expert judgment to elicit projections with uncertainty bounds of resistance rates through 2026 for nine pathogen-antibiotic pairs in four European countries and empirically validate the assessments against data on a set of calibration questions. The performance-weighted combination of experts projects rates of resistance in 2026 will range from 1% for carbapenem-resistant *Escherichia coli* in France (90% credible range: 0.10% to 8%) to 50% for third-generation cephalosporin-resistant *Klebsiella pneumoniae* in Italy (90% credible range: 40% to 70%). We use historical data from the European Antimicrobial Resistance Surveillance Network (EARS-Net) to develop statistical forecasts with exponential smoothing and autoregressive integrated moving average (ARIMA) models. Results from the statistical models differ from each other and from the judgmental forecasts in many cases. The judgmental forecasts include information from the experts about the impact of current and future shifts in infection control, antibiotic usage, and other factors that cannot be easily captured in statistical forecasts. Structured expert judgment is a useful tool for better understanding uncertainty about future antibiotic resistance.

Keywords: antibiotic resistance, international community, statistical forecasting methods, structured expert judgement

Colson, A. (2018). *Quantifying uncertainty about future antimicrobial resistance: comparing structured expert judgement and statistical forecasting methods*. Abstract from Scenario Planning and Foresight 2018, Coventry, United Kingdom.