# Modelling antimicrobial-resistant *Campylobacter* spp. in broiler chicken in Canada using an integrated assessment model

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## RESEARCH QUESTION

What is the number of Canadians potentially exposed to antimicrobial-resistant *Campylobacter* from chickens and their meat in Canada from farm to retail?

## STEP 1: LITERATURE SEARCH

- Described in detail elsewhere [1]
- 7,344 articles entered primary screening
- 724 articles entered secondary screening
- 29 articles contained data for resistant *Campylobacter* in broiler chicken
- **15 articles included** in quantitative synthesis

## STEP 2: DETERMINING THE BASELINE

- Defined as the likelihood a pre-placement chick in Canada will be colonized with *Campylobacter* that has a particular antimicrobial resistance (AMR) without any specific intervention

$$baseline = pert(0, 0, [bl\_max])$$

pert(*min.*, *mode*, *max.*)

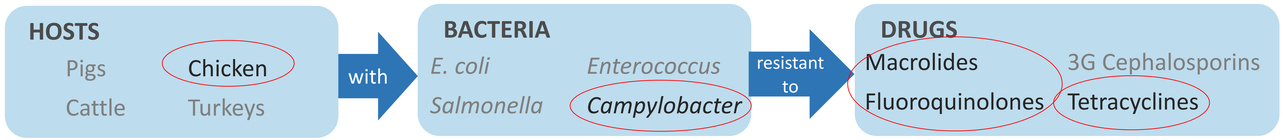
- Such that bl_max=bern(0.5)

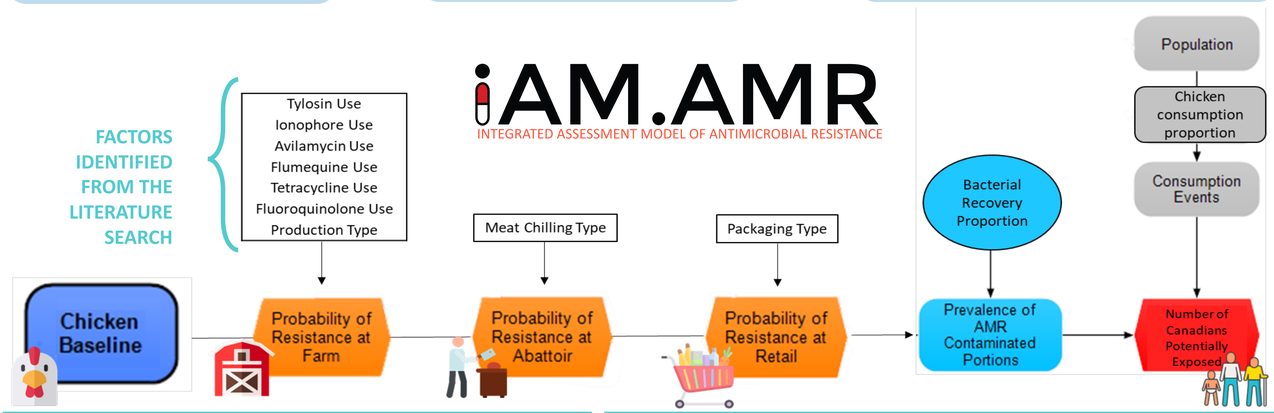
bern(*prob. success)*

- Where bl_max is a Bernoulli distribution defined by data from two sources:
  1. Agunos *et al*. 2018 [2]
  2. CIPARS 2018 [3]

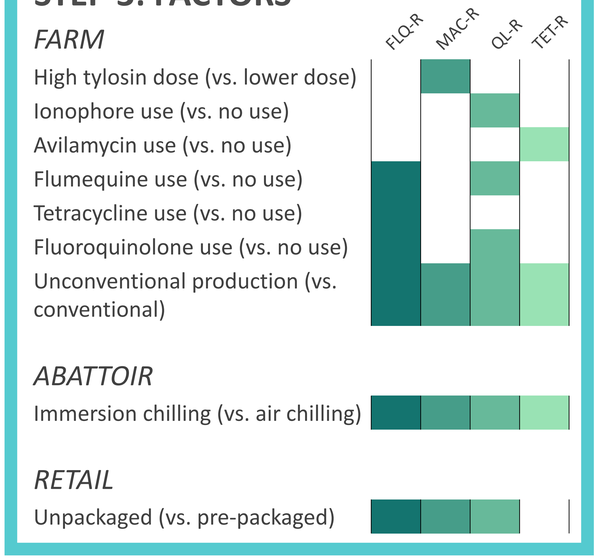
## THE iAM.AMR PROJECT & MODELLING SCENARIOS

The Integrated Assessment Model for Antimicrobial Resistance (iAM.AMR) aims to use disparate data sources to describe the potential for exposure to resistant bacteria from particular bacteria-drug-host scenarios along the farm-to-fork pathway




## STEP 3: FACTORS




## STEP 4: MODELLING

- The overall probability of *Campylobacter* having a particular drug resistance at each node is calculated given the possible factors identified (Step 3)

$$P\_res\_node = \Sigma set_i$$

$$set_i = (OR_i)(freq_i)$$

Where $OR_i$ is the odds of a bird having resistant *Campylobacter* given a certain factor (i)

Where $freq_i$ is the frequency of certain factor (i) occurring

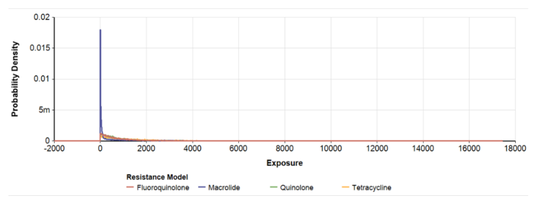
- A stochastic process using Median Latin Hypercube sampling to determine the uncertainty of the final outcome

## RESULTS

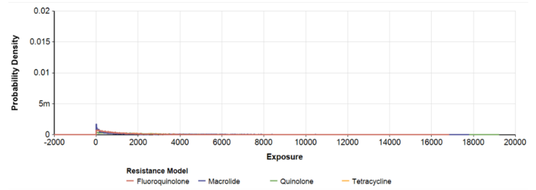
- Estimated **number of people (per 100,000) exposed** to antimicrobial-resistant *Campylobacter* from chicken:

| | No Factors | Canadian Factors |
|---|---|---|
| FLQ-R | 611.19 | 965.12 |
| MAC-R | 101.71 | 1,721.47 |
| QL-R | 613.05 | 1,915.63 |
| TET-R | 986.10 | 1,805.15 |

Scenario 1: No Factors




Scenario 2: Canadian context




## TAKEAWAYS

- Antimicrobial use, unconventional production, immersion chilling, and unpackaged sales increase estimated exposure
- Persistent estimated exposure to FLQ-R *Campylobacter* despite decreasing FLQ use on-farm
- Large data gaps in prevalence of resistant *Campylobacter* at chick placement

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[1] Phillips, C., Chapman, B., Agunos, A., Carson, C. A., Parmley, E. J., Reid-Smith, R. J., Smith, B. A., & Murphy, C. P. (2022). A scoping review of factors potentially linked with antimicrobial-resistant bacteria from turkeys (iAM.AMR Project). Epidemiology and Infection, 1–57. https://doi.org/10.1017/S0950268822001224
[2] Agunos, A., Arsenault, R. K., Avery, B. P., Deckert, A. E., Gow, S. P., Janecko, N., Léger, D. F., Parmley, E. J., Reid-Smith, R. J., & McEwen, S. A. (2018). Changes in antimicrobial resistance levels among *Escherichia coli*, *Salmonella*, and *Campylobacter* in Ontario broiler chickens between 2003 and 2015. *The Canadian Journal of Veterinary Research*, *82*, 163–177.
[3] Public Health Agency of Canada. (2020). *Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) 2018: Integrated Findings*. Government of Canada.