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A quantitative risk assessment for transfer of ESBL-producing E. coli to calves via waste milk.

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**Purpose:**
Antimicrobial resistant bacteria are an increasing problem and a major concern for both animal and human health. Antimicrobial usage is considered a major determinant for the selection and spread of resistant microorganisms which can become refractory to front line treatments in hospitals, rendering them ineffective.
Waste milk is milk unfit for human consumption, including that from treated cattle. It may contain antibiotic residues which could increase the risk of selection for resistant bacteria. In the UK it can be common practice to feed waste milk to calves.
**Methods:**
A stochastic simulation model was developed to assess the risk of transfer of, and selection for, E. coli with resistance to extend-spectrum β-lactam antibiotics (ESBL E. coli) to calves, via the feeding of waste milk. Scenarios were modelled to investigate the impact of practical control measures aimed to minimise the risk.
**Results:**
The results of the baseline model predict an average farm level prevalence (over 5,000 simulated farms) of calves with ESBL E. coli in their faeces of 75% (5th and 95th percentiles (pctl) 0% and 100%), while the average prevalence of calves with residues in their gut was 83.3% (5th and 95th pctl 0% and 100%). The baseline model predicted an average concentration of ESBL E. coli in calf faeces of 5.6 log cfu/g (5th and 95th pctl 1.3 - 8.7 log cfu/g), while the average concentration in scenarios with no residues present was only 2 log cfu/g. There was very wide variability and uncertainty in the actual dairy cow prevalence of ESBL E. coli, sensitivity analysis of the model suggests that this is very important with regards to the ESBL E. coli prevalence and microbial load in calves predicted by the model.
**Conclusions/Relevance:**
The scenario analyses indicated that completely stopping the practice of feeding waste milk to calves was the most effective measure, but a scenario assuming complete eradication of ESBL E. coli and residues from the waste milk was almost as effective. Thus, the model suggests that any potential intervention package targeted at the waste milk tanks must be able to deliver a large reduction of both ESBL E. coli and residues in the waste milk tank in order to be considered effective.