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Quantitative Risk Assessment for *Cryptosporidium parvum* Associated with Dairy Cattle in Urban and Peri-Urban Nairobi, Kenya

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Abstract

Urban agriculture involves around 1 billion people, generating income and employment and providing cheap and nutritious food to poor city dwellers. However, this new farming system involves new risks, including novel diseases and increased transmission potential. Risk analysis is a powerful tool for assessing and managing these risks.

Cryptosporidium parvum is an emerging zoonotic disease which mainly affects malnourished children and people with HIV. Cattle are believed to be the major reservoirs for human infection and city dairying is a possible 'hot spot' given the close proximity of animals to people and difficulties of livestock waste disposal in urban areas. We carried out a quantitative risk assessment to assess the risk of infection with *C. parvum* in a peri-urban community in Nairobi, using the Codex Alimentarius framework, which comprises hazard identification, hazard characterisation (including dose-response assessment), exposure assessment, and risk characterisation.

A questionnaire was administered to 300 dairy-keeping households selected from a sampling frame of all dairy farmers in the Dagoretti administrative area and to 100 neighbouring households. This included questions on husbandry, hygiene, consumption of dairy products, and manure management. Cattle faeces were tested for *C. parvum*, and of the 78 households with positive cattle, 20 were selected based on meeting pre-defined criteria for a more detailed study mapping pathways of *C. parvum* from cow to person at risk.

Five major transmission pathways were identified and an event tree constructed to assess disease exposure in the two most vulnerable populations (malnourished children and people with HIV). Based on this, a deterministic quantitative risk assessment model was developed and parameterised with data from the questionnaire survey, detailed mapping and data from literature.

This suggested a daily risk of 2 exposures to *C. parvum* per 1000 people in the at risk groups. Contra-intuitively, although cattle are the source of disease, the risk from eating vegetables was almost 3 times that associated with consuming milk. This was largely explained by good milk-handling practice and poor manure handling practice.

Information on risks associated with different pathways was used to develop community-based interventions for decreasing risks associated with city dairying.

Keywords: *Cryptosporidium parvum*, quantitative risk assessment, urban dairying