Using system effects modelling to evaluate food safety impact and barriers in low-income countries: an example from urban Cambodia

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Background and objective

More than 80% perishables are sold in informal (or wet or traditional) markets because they are affordable and accessible. There is a large gap in data on disease hazards, burden and exposure, but also a lack of information on the perspectives of consumers buying food in these markets.

The study tested the applicability of a system effects model developed for high-income countries to low- and middle-income settings. The objective is to better understand the damage caused by foodborne diseases, and barriers for consumers in accessing safer food as perceived by consumers.

Materials and methods

In January 2018, 10 group sessions with 66 participants were held in Phnom Penh, Cambodia: 5 in low-income and 5 in middle-income areas of the city. The participants, half of them women, were purposively recruited, of similar background but not knowing each other. Each group discussion consisted of two exercises that was completed by each participant individually. The first exercise mapped impacts to visually depict the complexity of peoples' experience of unsafe food including damage caused, flows of effects, and interconnections between them (Figure 1). In the second exercise, barriers to avoiding unsafe food were illustrated; and circumstances, incidents, pre-existing conditions that make it harder to get safe food were described.

The data were entered into MS Excel, items grouped and coded, individual adjacency matrixes generated for each respondent and each question, and then aggregated and visualized in Gephi 0.9.2 (https://gephi.org/).

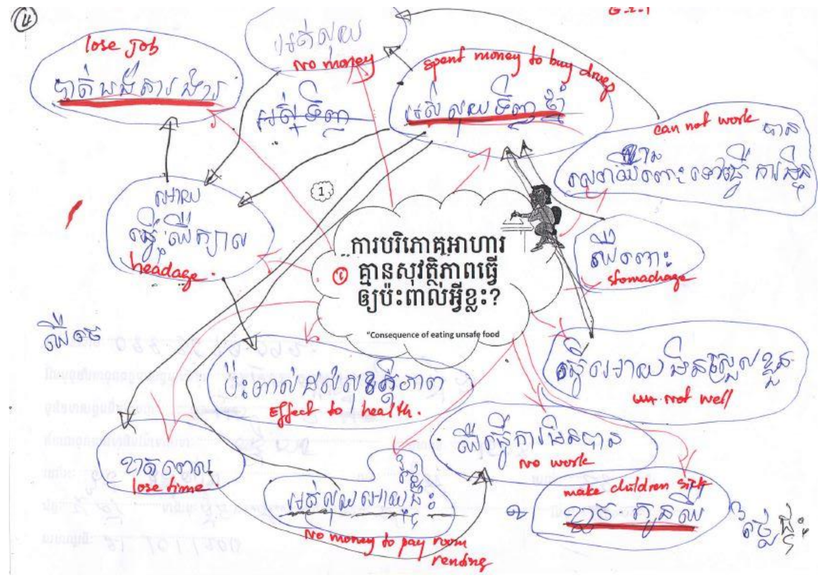


Figure 1. Individual output on "consequences of eating unsafe food" from a female participate in the low income setting (ILRI/Kristina Roesel)

Item	weighted indegree	page ranks	eigen centrality
Get sick	87	0.088	1
Lose time	65	0.033	0.499
Need to pay for treatment	56	0.049	0.749
Can lose the job	54	0.046	0.657
Lose money/income	54	0.042	0.615
Effect on family income	41	0.063	0.811
Living standard goes down	29	0.105	0.878
Cannot work or go to school	21	0.075	0.580
Lose hapiness	16	0.059	0.697
Lose opportunities	16	0.049	0.662
Family members worry (unhappy)	12	0.0444	0.616
Cannot cover for basic needs	12	0.043	0.715

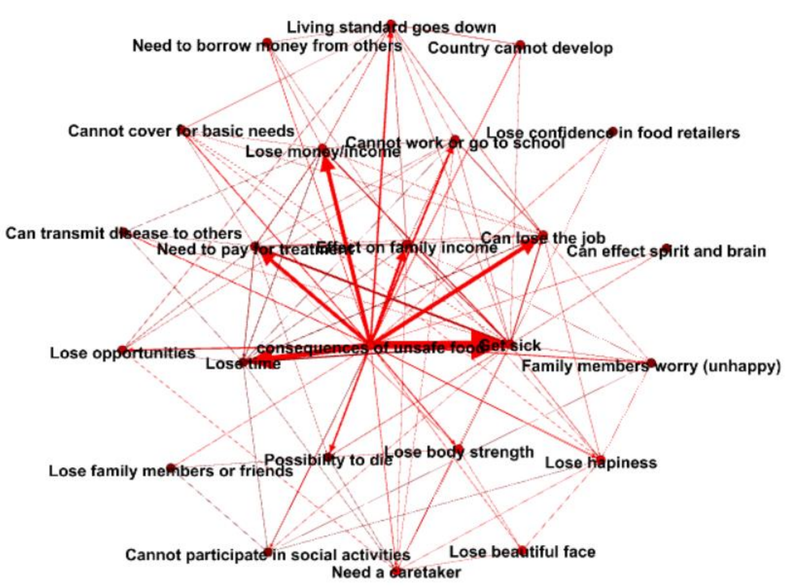


Figure 2 (above). Directed network graphs where nodes (n=24) represent the particular consequences of eating unsafe food and the connections (edges) identify the links between them (n=116). Network diameter = 6; average path length = 2.16. Factors that rank highly on eigencentrality and pagerank are the most 'interactive' causes in the system; weighted indegree are the most prominent drivers for the consequences map.

Preliminary findings and conclusions

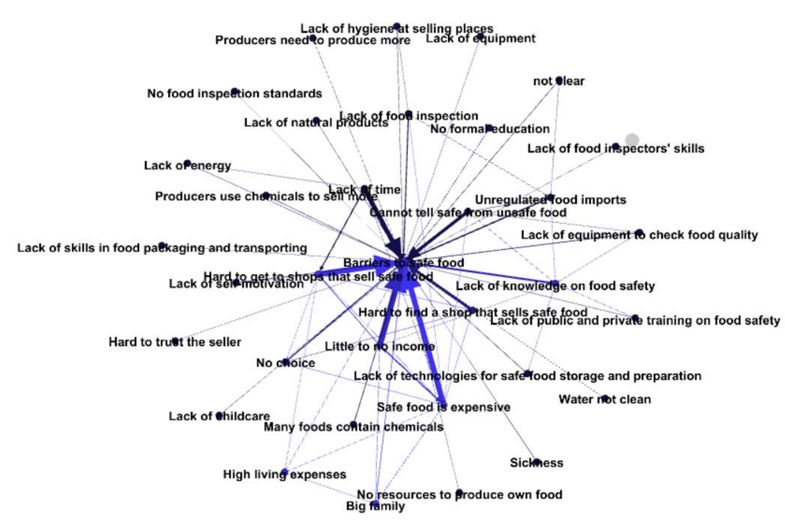
- More than 600 items were listed for consequences, more than 250 items for barriers.
- The determinants identified are heterogeneous and depend on individual experience (see number of nodes in Figures 2 and 3).
- The connections between the nodes are complex (see number of edges in Figures 2 and 3).
- The consequences map is much more complex and interactive than the barriers map (density for consequences = 0.21; density for barriers = 0.69).

Next steps

- Comparison between the perceptions of men vs. women, low-income vs. middle-income settings.
- Discussion on information bias (data collection through a mediator, language constraints can bias coding, unknown level of knowledge of consumers).
- Consider these perceptions when designing food safety management options.

Figure 3 (below). Directed network graphs where nodes (n=34) represent the particular consequences of eating unsafe food and the connections (edges) identify the links between them (n=77). Network diameter = 5; average path length = 2.97. Factors that rank highly on eigencentrality and pagerank are the most 'interactive' causes in the system; weighted outdegree are the most prominent drivers for the barriers map.

Item	weighted outdegree	page ranks	eigen centrality
Little to no income	70	0.098712	0.507223
Safe food is expensive	66	0.15642	0.783975
Hard to get to shops that sell safe food	64	0.131567	0.63532
Lack of time	52	0.020387	0.145376



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