



The SWITCH experience with strategic planning for Sustainable and Integrated Urban Water Management, using Quantitative Microbial Risk Assessment in Accra

Herve Labite, Isabella Lunani, Ewinur Machdar, Peter van der Steen, Liqa Rashid and Piet Lens



Contents

- Role of QMRA in strategic planning for IUWM
- Introduction QMRA method
- Accra's Urban Water System
- Application of QMRA in Accra
- Conclusions and reflections

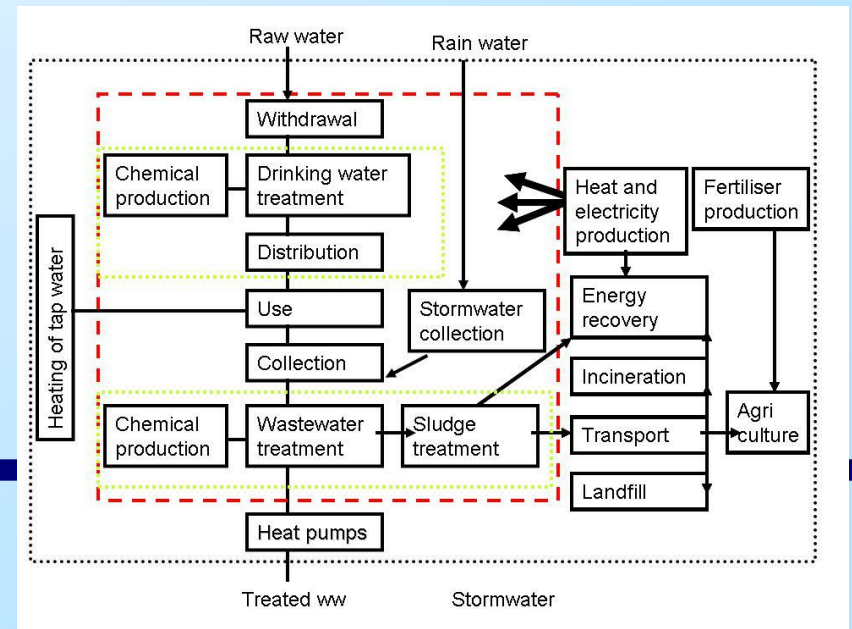
Contents

- Role of QMRA in strategic planning for IUWM
- Introduction QMRA method
- Accra's Urban Water System
- Application of QMRA in Accra
- Conclusions and reflections

SWITCH hypothesis on Urban Water Management

UWM strategies need to aim at increasing the sustainability of the total urban water system.

Optimisation of the entire system will result in more sustainable systems than optimisation of separate elements (sub-systems).



Contents

- Role of QMRA in strategic planning for IUWM
- Introduction QMRA method
- Accra's Urban Water System
- Application of QMRA in Accra
- Conclusions and reflections

Transmission of infectious diseases



Quantitative Microbial Risk Assessment

1. Assessment of exposure (number of pathogens ingested)
2. Dose response relation

$$P_I = f(N, N_{50}, a)$$

P_I = probability of infection

N = number of pathogens ingested

N_{50} = number that will infect 50% of population

a = constant

Method

- QMRA gives predicted number of cases of disease
- (Compare with reported incidence)
- Evaluate different interventions in terms of effect on incidence and disease burden and costs
- Inform decision makers/planners about where to invest to maximise health benefits

Contents

- Role of QMRA in strategic planning for IUWM
- Introduction QMRA method
- **Accra's Urban Water System**
- Application of QMRA in Accra
- Conclusions and reflections

Main challenges Accra:

- population growth/urbanisation
- lack of reliable water supply system
- lack of proper sanitation / wastewater treatment
- health risks
- stormwater drainage and solid waste collection

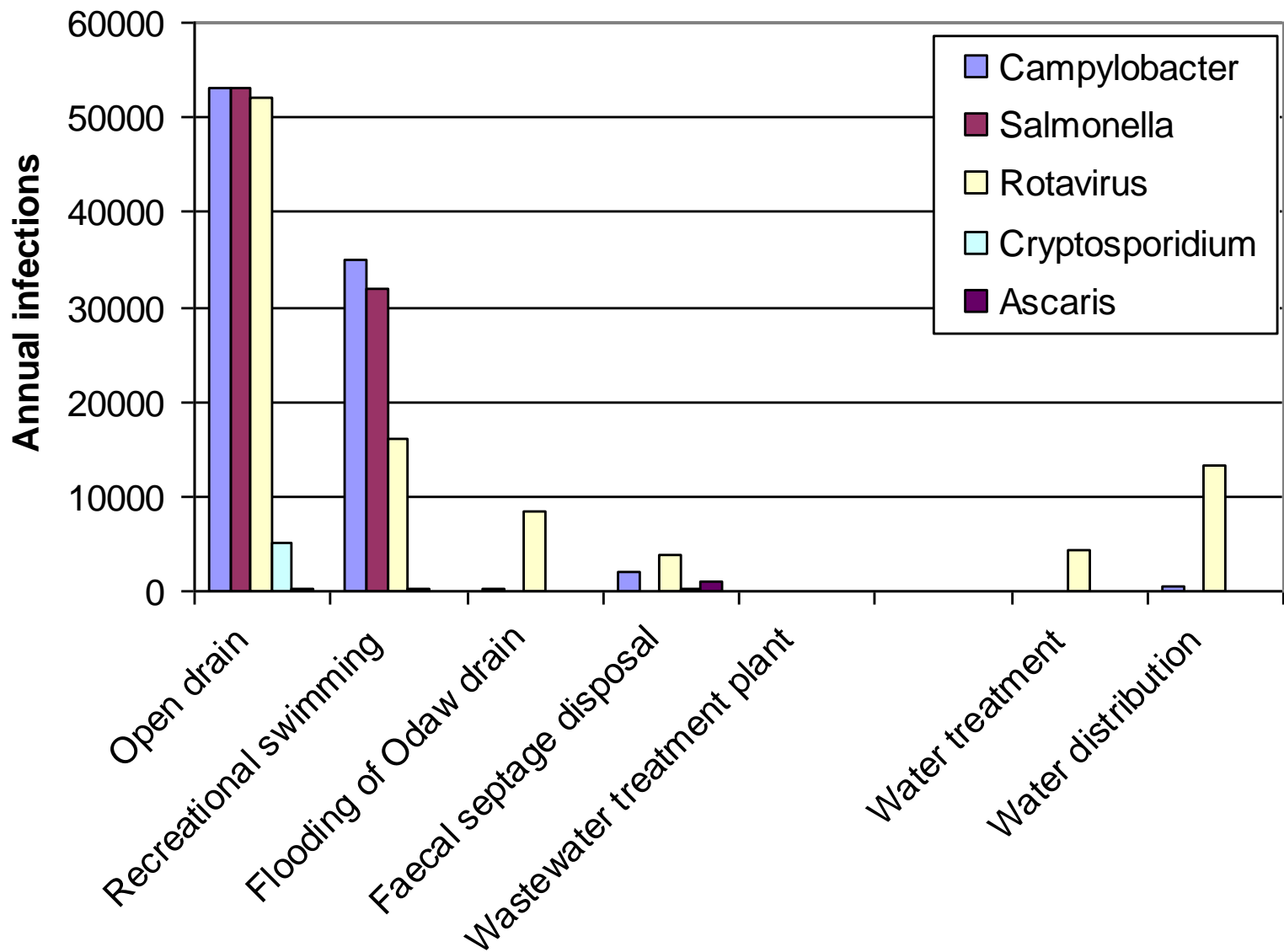


Contents

- Role of QMRA in strategic planning for IUWM
- Introduction QMRA method
- Accra's Urban Water System
- **Application of QMRA in Accra**
- Conclusions and reflections

Inventory of disease transmission pathways

- Existing water system
- Others – such as food hygiene or non-piped water supply – not included (initially)



Intervention A: sewerage net work

Intervention B: sewerage network and treatment plant.

Intervention C: coverage of the roadside drains.

Intervention D: further improvement of water supply system.

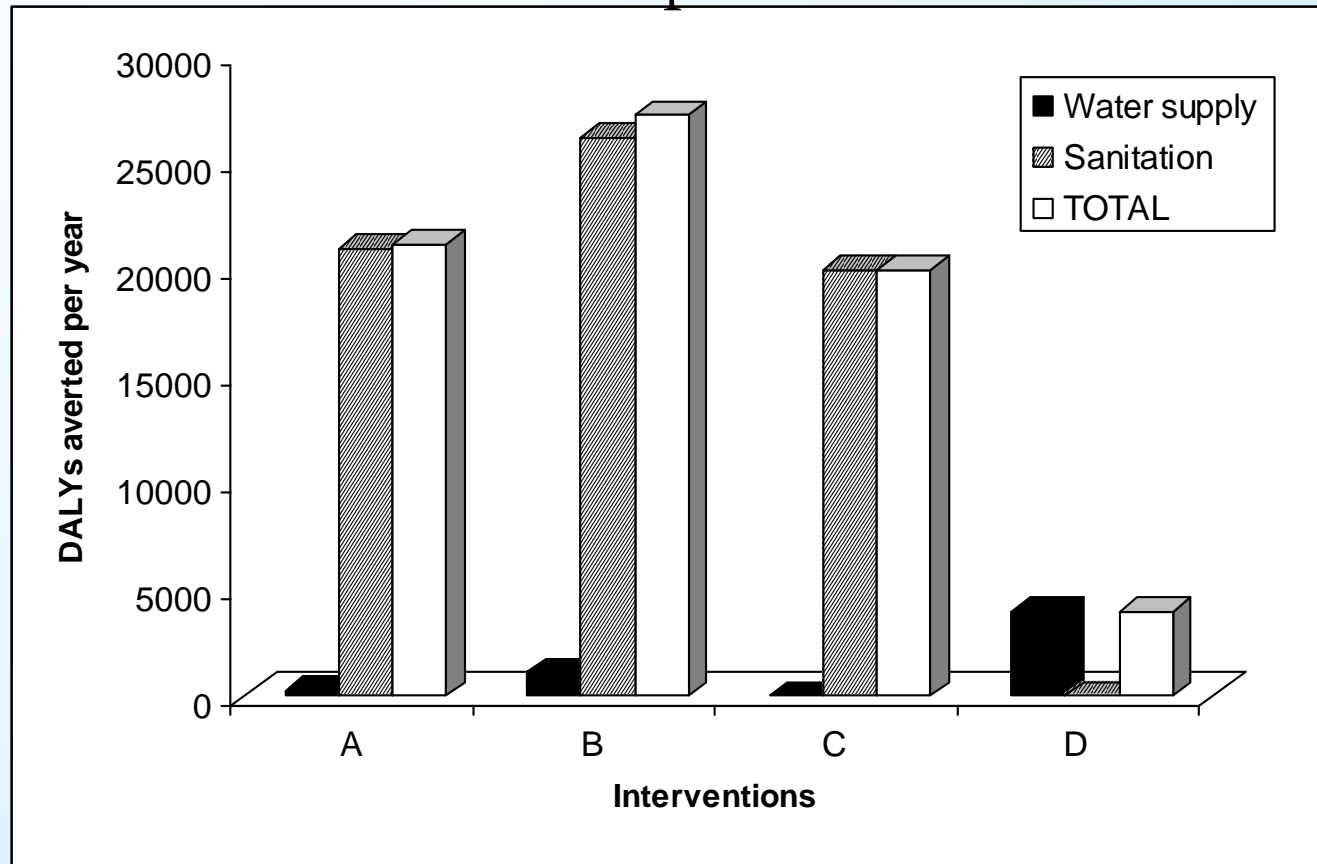


Intervention A: sewerage net work

Intervention B: sewerage network and treatment plant.

Intervention C: coverage of the roadside drains.

Intervention D: further improvement of water supply system.



Effectiveness in US\$ invested per DALY averted

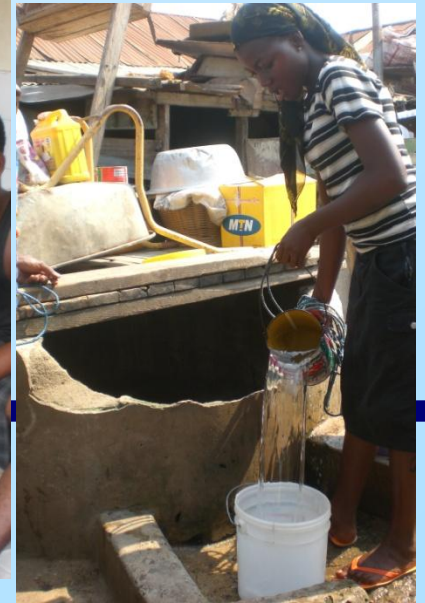
Intervention A 742

Intervention B 1105

Intervention C 516

Intervention D ?

Including various water supply sources; Nima case study



Drinking water pathway	Population using the source (%)	Number of affected people in Nima	Number of samples	Mean <i>E. coli</i> cfu/100 ml
Private yard taps	17	1.17E+04	14	0.2 (ns)
Communal taps (running)	25	1.73E+04	17	0.5 (ns)
Communal taps (dry; storage)	0	0	25	7.7
Water tankers	0	0	20	0.8
Household storages	46	3.17E+04	110	12.9
Communal wells	3	2.07E+03	16	37.8
Water sachets –regular	9	6.21E+03	20	0.1 (ns)
Water sachets –irregular	91	6.28E+04		

Interventions

US\$/DALY

Option 1	Increase water in household connections to 7/7	556
Option 2	Increase water in communal taps to 7/7	756
Option 3	Reduce contamination of distribution network by 50%	1039
Option 4	Improving quality of stored water (1 log removal)	35
Option 5	Improving quality of stored water (2 log removal)	14
Option 6	Prevent children from drinking from communal wells	151

Intervention**Cost effectiveness
(USD/DALY)**

Sanitation

**Improvement of sanitation facilities and sewerage
coverage plus connection to treatment plant** **1,105**

**Improvement of sanitation facilities and sewerage
coverage** **742**

Covering road side drainage **516**

Water supply

Increase distribution reliability to 7/7 **550-750**

Improve water quality in distribution network **756**

Household disinfection and hygiene promotion **14-35**

Contents

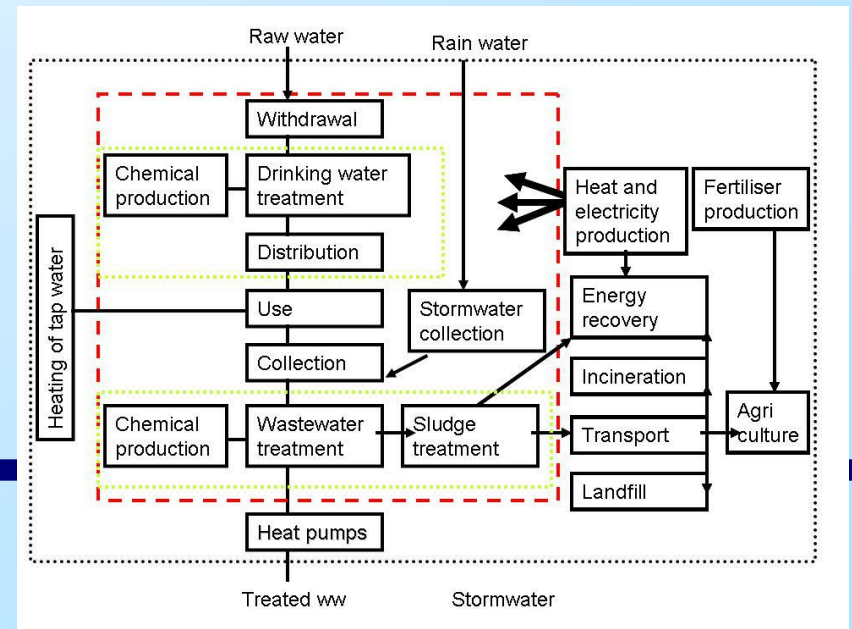
- Role of QMRA in strategic planning for IUWM
- Introduction QMRA method
- Accra's Urban Water System
- Application of QMRA in Accra
- **Conclusions and reflections**

Conclusions QMRA

- The two catastrophic pathways at the sanitation side were found to be recreational swimming and the open drainage channels.
- Household storage is the major pathway at the water supply side
- Most cost-effective intervention: improve household water storage practices
- QMRA could be used as a decision support tool, for more efficient investments

SWITCH hypothesis on Urban Water Management

Optimisation of the entire system will result in more sustainable systems than optimisation of separate elements (sub-systems).



QMRA, Strategic Planning, Impact in Accra?

- Results presented to the Learning Alliance
- Health gain (DALY per dollar) included in set of indicators – suggestion
- Strategic directions document
- Institutional set-up and integrated management – prioritising, budgets, mandates

Thank you for your attention!

Questions?

UNESCO-IHE INSTITUTE FOR WATER EDUCATION



Analysis of the Public Health Risks of the Urban Water System in Accra by Microbial Risk Assessment

Isabella Lunani

MSc Thesis ES 07.25
April 2007



UNESCO-IHE INSTITUTE FOR WATER EDUCATION



Analysis of Health Benefits versus Costs of Interventions in the Urban water system in Accra, using Quantitative Microbial Risk Assessment

Herve Labite

MSc Thesis ES 2008-22
April 2008



UNESCO-IHE INSTITUTE FOR WATER EDUCATION



Application of QMRA for analyzing public health risk from drinking water supply in a low income area in Accra, Ghana

Ewinur Chairati Machdar

MSc Thesis (ES. 10. 13)
April 2010

