

Investigation of occurrence of *Salmonella typhi* and *Vibrio cholerae* in spring water as potential risk factors for Typhoid and Cholera outbreaks in Lubigi catchment, Kampala-Uganda

Study under the T-Group Project: Experimenting with practical Transition Groundwater management strategies for the Urban Poor in Sub-Saharan Africa

Background



- Major source of water for domestic use for the urban poor (Grönwall *et al.*, 2010; Howard *et al.*, 2003)
- Piped water is deemed expensive and unaffordable (Kulabako *et al.*, 2010).
- Faecal contamination (Nyenje *et al.*, 2014; Kulabako *et al.*, 2007; Howard *et al.*, 2003; Haruna *et al.*, 2005).

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- There have been several cholera and typhoid outbreaks in Kampala, notably the typhoid outbreak in March (2015) and the cholera outbreak between December (1997) to March (1998).
- These have been linked to the non-piped water sources used by the people (e.g., Nansinyama *et al.*, 2000)

Study objectives

Main objective

Investigate the spatial and temporal variations of *Salmonella typhi* and *Vibrio cholerae* bacteria in protected springs as potential risk factors for typhoid and cholera outbreaks in Lubigi catchment.

Specific objectives

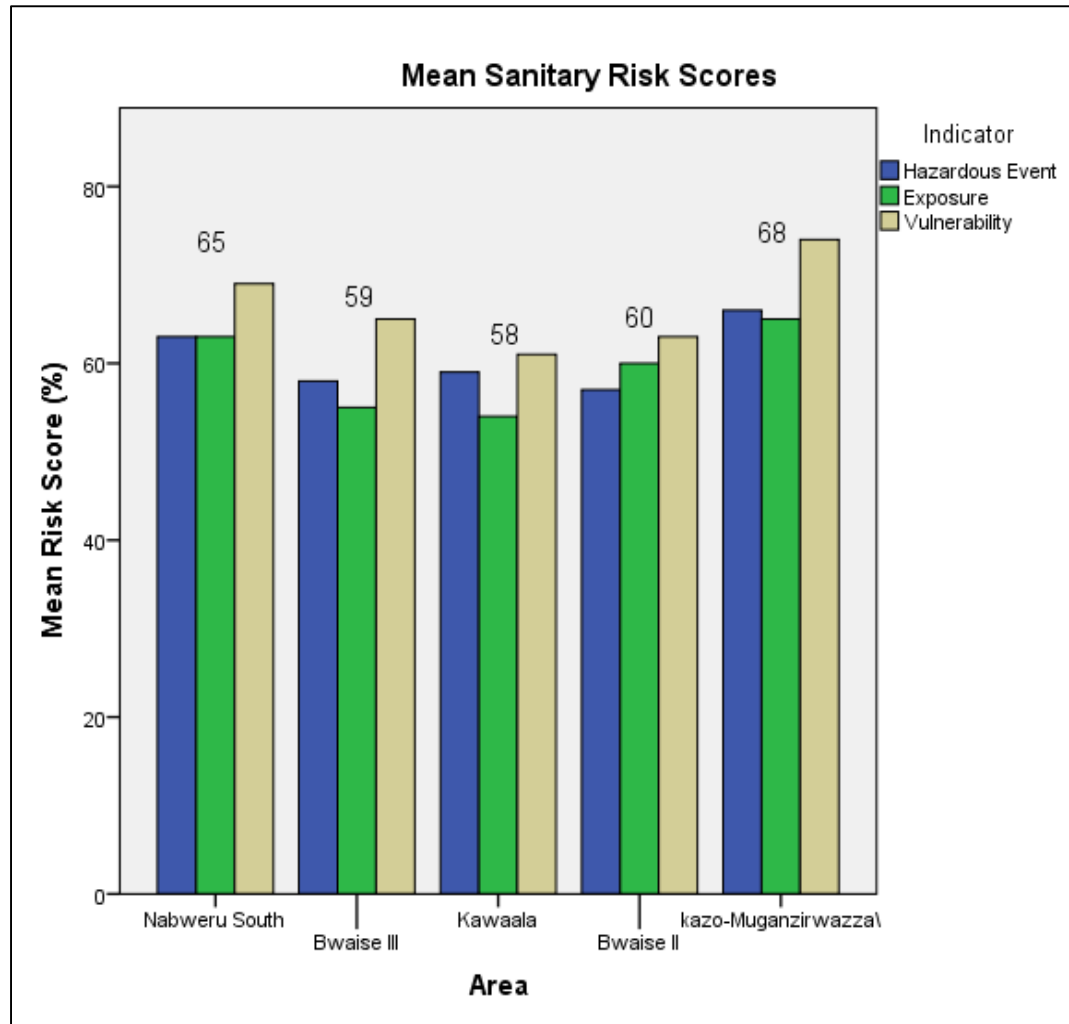
- i) Assess the sanitary condition of selected study springs.
- ii) Determine the physico-chemical and bacteriological (*E.Coli*, *Salmonella typhi* & *Vibrio cholerae*) water quality of the selected springs with time.
- iii) Assess if there is a link between the spatial and temporal variation of the determined bacteria in the selected springs with the typhoid and cholera disease occurrences.

Materials and Methods

- Sanitary inspection surveys (WHO, 1985)
- Rapid Participatory Situation System Risk Assessment (RPSSRA) (Campos *et al.*, 2015)
- Spring water quality monitoring (Physico-chemical parameters: pH, EC, Temperature, Turbidity, Nitrates, TS, TDS; Bacteriological: *E. Coli*, *Salmonella Typhi* and *Vibrio Cholerae*)
- Epidemiological data about Typhoid and Cholera incidences from Health Centres (Kawaala Kampala Capital City Authority Health Centre III found in Kasubi Parish, Jordan Medical Centre (a private clinic found in Bwaise III), Nabweru Health Centre III found in Nabweru Parish and Mulago National Referral Hospital)

Results

Sanitary risk assessment scores



Spring name	Location	Risk score- %/Rank
Abdu Mukulu	Bwaise III	40
Mulira	Kazo-Nabweru	60
Late Nsambo	Kazo-Muganzi wazza	60
Zammunyo	Kazo-Muganzi wazza	60
Kafunda	Kazo-Nabweru	70
Nabukalu	Kawaala	40
SP13-13R	Kawaala	60
SP10-10R	Kawaala	60
SP06-06R	Kawaala	50
Nazzooli	Kazo-Muganzi wazza	50

Water quality characteristics

Parameter	Range		ANOVA (P-Value)
	Dry	Wet	
pH	5.14 - 7.02	5.40 - 7.01	0.007
Temperature (deg C)	21.7 - 25.9	22.0 - 25.0	0.000
EC(μ S/cm)	168 – 759	182 – 857	0.168
TS(mg/l)	120 - 658	28 – 622	0.688
TDS(mg/l)	24 - 516	50 – 554	0.061
Turbidity(NTU)	0 - 14	0 – 9	0.059
Nitrates(mg/l)	12.0 – 44.0	11.9 - 58.5	0.009
<i>E. Coli</i> (cfu/100ml)	<1 – 1.6E6	<1 - 2.5E6	0.076

Occurrence of *S.typhi* and *V.Cholerae* in the Spring waters

Week	Item	Location				
		Bwaise III	Bwaise II	Kazo-Muganzirwazza	Nabweru- South	Kawaala
Week 1 (wet) 10-15 th , April	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	1	0	0	1	2
	<i>V. cholerae</i>	ND	ND	ND	ND	ND
	Cholera cases	0	0	0	0	0
Week 2 (wet) 8-13 th , May	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	0	0	0	2	3
	<i>V. cholerae</i>	ND	ND	ND	ND	ND
	Cholera cases	0	0	0	0	0
Week 3 (dry) 15-20 th , May	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	0	0	1	1	0
	<i>V. cholerae</i>	ND	Detected	ND	ND	ND
	Cholera cases	0	0	0	0	0
Week 4 (dry) 22-27 th , May	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	0	0	0	0	0
	<i>V. cholerae</i>	ND	ND	ND	ND	ND
	Cholera cases	0	0	0	0	0
Week 5 (wet) 29 th May – 3 rd June	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	0	0	0	0	1
	<i>V. cholerae</i>	ND	ND	ND	ND	ND
	Cholera cases	0	0	0	0	0
Week 6 (dry) 5-10 th , June	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	0	0	0	0	1
	<i>V. cholerae</i>	ND	ND	ND	ND	ND
	Cholera cases	0	0	0	0	0
Week 7 (dry) 12-17 th , June	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	0	0	0	2	0
	<i>V. cholerae</i>	ND	ND	ND	ND	ND
	Cholera cases	0	0	0	0	0
Week 8 (dry) 19-24 th , June	<i>S. typhi</i>	ND	ND	ND	ND	ND
	Typhoid cases	0	0	0	0	0
	<i>V. cholerae</i>	ND	ND	ND	ND	ND
	Cholera cases	0	0	0	0	0

Conclusions

- Generally the springs are at a risk of faecal contamination as indicated by the risk scores ranging from medium to high (40-70%).
- The drinking water treatment, handling and storage practices are lacking in the communities within the study area contributing to the high risk (58-68%) of exposure of the residents to hazardous events.
- The physico-chemical and microbial quality of spring water varies with space and time. Rainfall events were observed to be of significant impact on the microbial quality of water with levels of E.Coli higher in the rain season compared to the dry season
- There was no *Salmonella typhi* detected in the study springs during the study period.
- No distinguishable link was observed between the occurrence of *Salmonella typhi* and *Vibrio cholera* in spring water, and the incidences of typhoid and cholera respectively.

Thank you for listening!

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