A Comparative Study Evaluating Health Outcomes of Sanitation, Water Services and Hygiene Education in eThekwini District, Durban, South Africa.

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FUNDING

- eThekwini Municipality – Water and Sanitation Unit (Durban)

- World Health Organisation (Geneva)

- SIDA / Stockholm Environment Institute – EcoSanRes (Sweden)

- Swedish Institute of Infectious Disease (Sweden)

BACKGROUND

- **Globally -** 2.6 billion people lack access to sanitation
  - 1.1billion lack access to safe water.

- **MDGs - Water & Sanitation Targets**
  - Halve by 2015 the proportion of people without sustainable access to safe drinking water and sanitation.

- **WHO & UNICEF's Target**
  - Provide safe water & access to Sanitation for All by 31 December 2025.
  - UN declares 2008 IYS and 2005-2015 the International Decade for Action on Water.

- **South African National Targets**
  - provide adequate sanitation for all by 2010 and safe water by 2007.
  - Durban has a backlog of almost 53 000 Households.

INTRODUCTION

○ **eThekwini Municipality**

- Implemented a package of services:

- Free basic water supply (200 litres/household/day)

- Urine diversion toilets (dry sanitation) – installed at 56 377 hh

- Health and hygiene education.

- The Water and Sanitation Unit, requested evaluations to assess health outcome.

STUDY AIM

To evaluate the health outcome of providing sanitation, safe water, health and hygiene interventions in peri-urban households in eThekwini Municipality.

OBJECTIVES

- To measure the occurrence of diarrhoea, worms, vomiting and skin sores.

- To compare health outcomes in the Intervention and Control Areas.

- To evaluate a future risk management approach.

- To provide a baseline for an International and National demographic site, to function as a referral site for future studies.
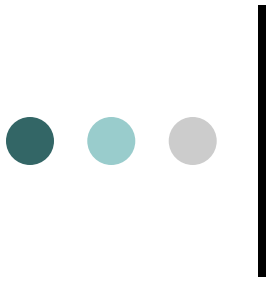
METHODOLOGY

- **Type of Research**

  Epidemiological

- **Study Design**

  Observational, Analytic, Prospective Cohort Study
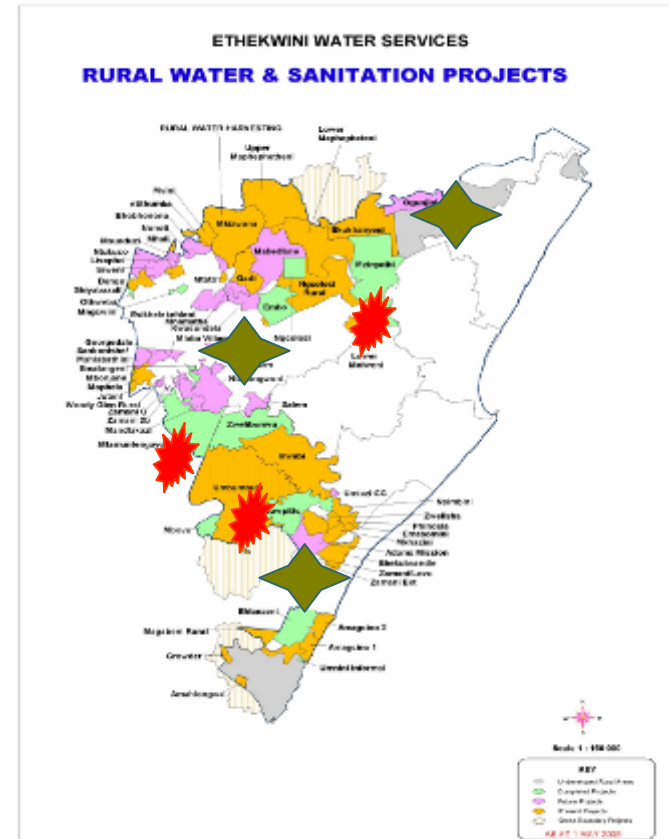
SAMPLE SELECTION

- Multi-stage random sampling approach.
  - **Stage 1**: Random selection of one Intervention and one Control Area per North, South and West Sub-District was undertaken.

Intervention Areas (I)

Mzinyathi (I_1N)

Mtamuntengayo (I_2W)

Sawpitts (I_3S)

Control Areas (C)

Ogunjini (C_1N)

Bux Farm (C_2W)

Adams Mission (C_3S)

ETHEKWINI WATER SERVICES

RURAL WATER & SANITATION PROJECTS

SAMPLING (cont.)

○ **Stage 2**

- A sampling frame of households in the 6 selected areas were obtained using GIS.

- Random selection of 45 household clusters, each comprising of 5 households, randomly selected in each area using a GIS map grid.

- A total of 1350 households were included in the study.
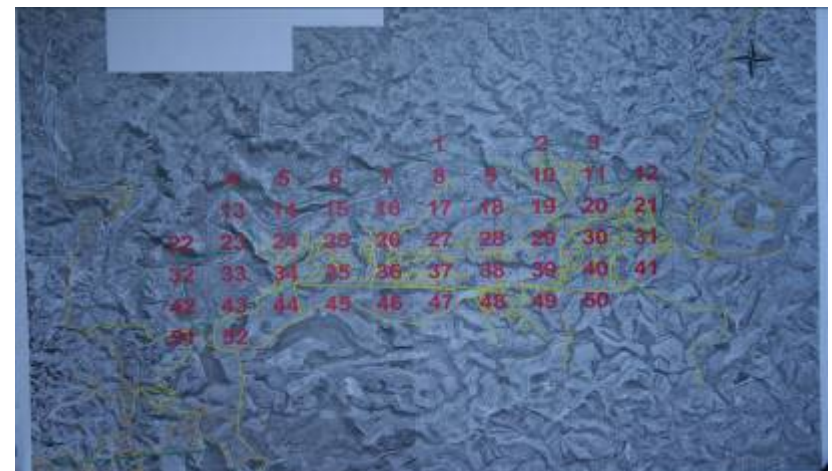
STUDY POPULATION

○ Randomly selected Households and Individuals

- Living in peri-urban areas of eThekwini Municipality.
- Outside access to sewer reticulation systems.

DATA COLLECTION & HANDLING

○ Data collected from key-respondents by 12 trained fieldworkers.

○ Data collection tools:
  Household questionnaires
  Epidemiological questionnaires
  Observational protocols.

○ Each household visited every two weeks for 6 visits.

○ Data captured using EpiData.

○ Data processed and analysed using SPSS version13 and Stata version 9.

ETHICS APPROVAL & PERMISSION

○ **Ethics Approval**

- Biomedical Research Ethics Committee.

○ **Informed Consent**

- Key informant in household.

○ **Permission**

- Ward Councillors

- eThekwini Municipality

- Community Structures

RESULTS

Number (%) of Households, Household Members & Density in Intervention and Control Areas in EcoSan Study, eThekwini, 2006.

Respondent Area	Type of Area	Households No. (%)		Household Members No. (%)		People Per H/hold	Range of H/hold Size
Mzinyathi (I_1N)	UD Intervention Area	228	17.1	1221	16.9	5.4	1 - 14
Mtamuntengayo (I_2W)		201	15.0	1286	17.8	6.4	1 - 14
Sawpits (I_3S)		230	17.2	1446	20.0	6.3	1 - 16
Ogunjini (C_1N)	Control Area	221	16.5	1255	17.3	5.7	1 - 14
Bux Farm (C_2W)		229	17.1	807	11.3	3.5	1 - 12
Adams Mission (C_3S)		228	17.1	1204	16.6	5.3	1 - 16
Total		1337	100.0	7219	100.0	5.4	1 - 16

Comparison of Exposed (Intervention) and Non-exposed (Control) areas

- 27 socio demographic variables measured were factors which could influence diarrhoea related / faecal-oral health outcomes.

- 16 (59%)
  - Not significantly different.

- 11 (41%)
  - Statistically significantly different.

- Only 3 (11%)
  - Bias the results in favour of the Intervention Area
    - Television, Mobile phone & Books in Household

Incidence Rate (IR) & Incidence Rate Ratio (IRR) of Diarrhoea in Intervention & Control Areas

Area	H/hold members	Diarrhoea episodes	IR/1000 person days	Adjusted IRR	P value
Intervention	3945	638	11.66	1.73(1.21-2.47)	0.003
Control	3254	903	16.05		
Total	7199	1541	13.89		

The variables that were controlled for in the poisson analysis to calculate the IRR included the following:
area type; no. of hh members; all children under 4;sub-district; poverty index; sex; education; employed vs unemployed; drinking water source; toilet score; overcrowding, socio-
Economic score and use of ud toilet

Incidence Rate Difference (IRD) & Number Needed to Treat (NNT) for Diarrhoea in Intervention & Control Areas

Area	IR/1000 Person/ d	IRR	IRD	NNT	Episodes averted/ person/ year
Mzinyathi I_1N	9.1				
Ogunjini C_1N	10.9	1.3	1.8	556	0.66
Mtamunten I_2W	13.9				
Bux Farm C_2W	23.3	3.3	9.4	106	3.43
Sawpitts I_3S	12.3				
Adams M C_3S	14.2	1.8	1.9	526	0.69
Intervention	11.7				
Control	16.0	1.7	4.3	233	1.57

Incidence Rate (IR) & Incidence Rate Ratio (IRR) of Vomitting in Intervention & Control Areas

Area	H/hold members	Vomitting episodes	IR/1000 person days	Adjusted IRR	P value
Intervention	3945	55	1.01	4.82(1.46-15.90)	0.010
Control	3254	111	1.97		
Total	7199	166	1.50		

The variables that were controlled for in the poisson analysis to calculate the adjusted IRR included the following: area type; no. of hh members; all children under 4; sub-district; poverty index; sex; education; employed vs unemployed; drinking water source; toilet score; overcrowding, socio-economic score and use of ud toilet.

Incidence Rate Difference (IRD) & Number Needed to Treat (NNT) for Vomiting in Intervention & Control Areas

Area	IR/1000 Person/ d	IRR	IRD	NNT	Episodes averted/ person/ year
Mzinyathi I_1N	0.07	6.8	1.0	1000	0.4
Ogunjini C_1N	1.07				
Mtamunten I_2W	3.11	3.2	0.7	1449	0.3
Bux Farm C_2W	3.80				
Sawpitts I_3S	0.19	10.9	0.9	1149	0.3
Adams M C_3S	1.06				
Intervention	1.01	4.8	0.96	1042	0.4
Control	1.97				

Prevalence of Skin Sores and Worms in Intervention and Control Areas

- This study showed no significant difference in the prevalence of skin sores between the Intervention and Control Areas, P = 0,360.

- The was also no significant difference in the prevalence of worms, with P = 0,574.

- In a subsequent study conducted which used the same database, analysis for the presence of worms was conducted on collected vault content which showed a high prevalence of worms.

- An interesting lesson that was learnt from this, is that a question based approach was a less favourable approach to use to assess worm infestations.

Incidence Rate Difference (IRD) & Number Needed to Treat (NNT) for Diarrhoea in Different Age Groups in Intervention & Control Areas

Age Group	Area	IR/1000 Person/ d	IRR	IRD	NNT	Episodes averted/ person/ year
< 5 years	Int	3.7	2.0	3.5	282	1.3
	Con	7.2				
5 - 59 yrs	Int	1.7	1.6	1.0	1007	0.4
	Con	2.7				
> 60 years	Int	2.4	1.7	1.7	589	0.6
	Con	4.1				
Total	Int	2.0	1.7	1.4	733	0.5
	Con	3.3				

Episodes of Diarrhoea & Vomiting Averted Due to Sanitation Intervention in Ethekwini 2007

o Episodes of diarrhoea reduced
Episodes averted / person X HH with UD X People / household
= 1.57 X 56377 X 5.4
= 477 964 episodes of diarrhoea averted

o Episodes of vomiting reduced
Episodes averted / person X HH with UD X People / household
= 0.35 X 56377 X 5.4
= 106 552 episodes of vomiting averted

Percentage of individuals with Disease Outcome by Drinking Water Safety

Water safety	N	% Diarrhoea	% Vomitting	% Worms	% Skin sores
Unsafe	372	32.5%	5.4%	10.5%	5.6%
Safe outside	4086	22.5%	2.7%	2.9%	4.3%
Safe inside	2755	18.2%	1.3%	2.1%	2.5%
Incidence Rate Ratio & Prevalence Ratio after adjusting for UD toilets					
Safe outside vs. safe inside		IRR 1.23	IRR 2.06	PR 1.38	PR 1.71
Unsafe vs. safe inside		IRR 1.44	IRR 3.31	PR 4.01	PR 1.82

CONCLUSIONS

○ The study provides evidence of significant associations between disease outcomes in relation to the provision of UD toilets, water provision and hygiene education to households in the rural/peri-urban areas.

○ The results show significantly decreased health risks in the Intervention Areas compared to the Control Areas.

CONCLUSIONS (cont)

- A prospective community randomized intervention is planned to verify these findings.

- This study makes significant inroads into the International Agenda, with regard to water & sanitation interventions and its impacts on health.

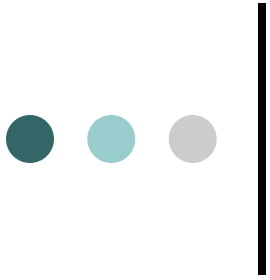# OUTCOMES & INTERVENTIONS ARISING OUT OF THIS STUDY

- eThekwini Municipality's EWS Unit planned & budgeted for the implementation of interventions in Control Areas based on evidence of this research.

- This database has been used by: -

  Master Degree students - University of Stockholm to investigate the presence of Cryptosporidium and Giardia from UD toilet vaults in the Intervention Areas.

  Master student in UKZN to investigate parasite load in the UD vault content.

  Master Degree students from Pollution Research Group, UKZN to conduct water quality sudies in the Intervention & Control Areas.

THANK YOU