Griffith UNIVERSITY

Contribution of saline drinking water to high salt consumption in young adults in coastal Bangladesh

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APHA 143rd Annual meeting, Chicago, Illinois, USA, 2015

Presenter Disclosures

Mohammad Radwanur Rahman Talukder

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

"No relationships to disclose"

Introduction

- Saltwater intrusion is an emerging environmental problem in low-lying countries including in Bangladesh (Mimura, 2013)
- In coastal areas of Bangladesh livelihoods and health of more than 35 million people are currently affected, which is projected to aggravate further (Dasgupta, 2014)
- Ample and well accepted evidence on adverse health effects of high salt consumption, particularly from food→ little information about exposure from increased water salinity (Vineis, 2011)
- This research examined the salt exposure and potential health risks of increasing salinity in potable water in coastal areas of Bangladesh in order to promote relevant intervention strategies.

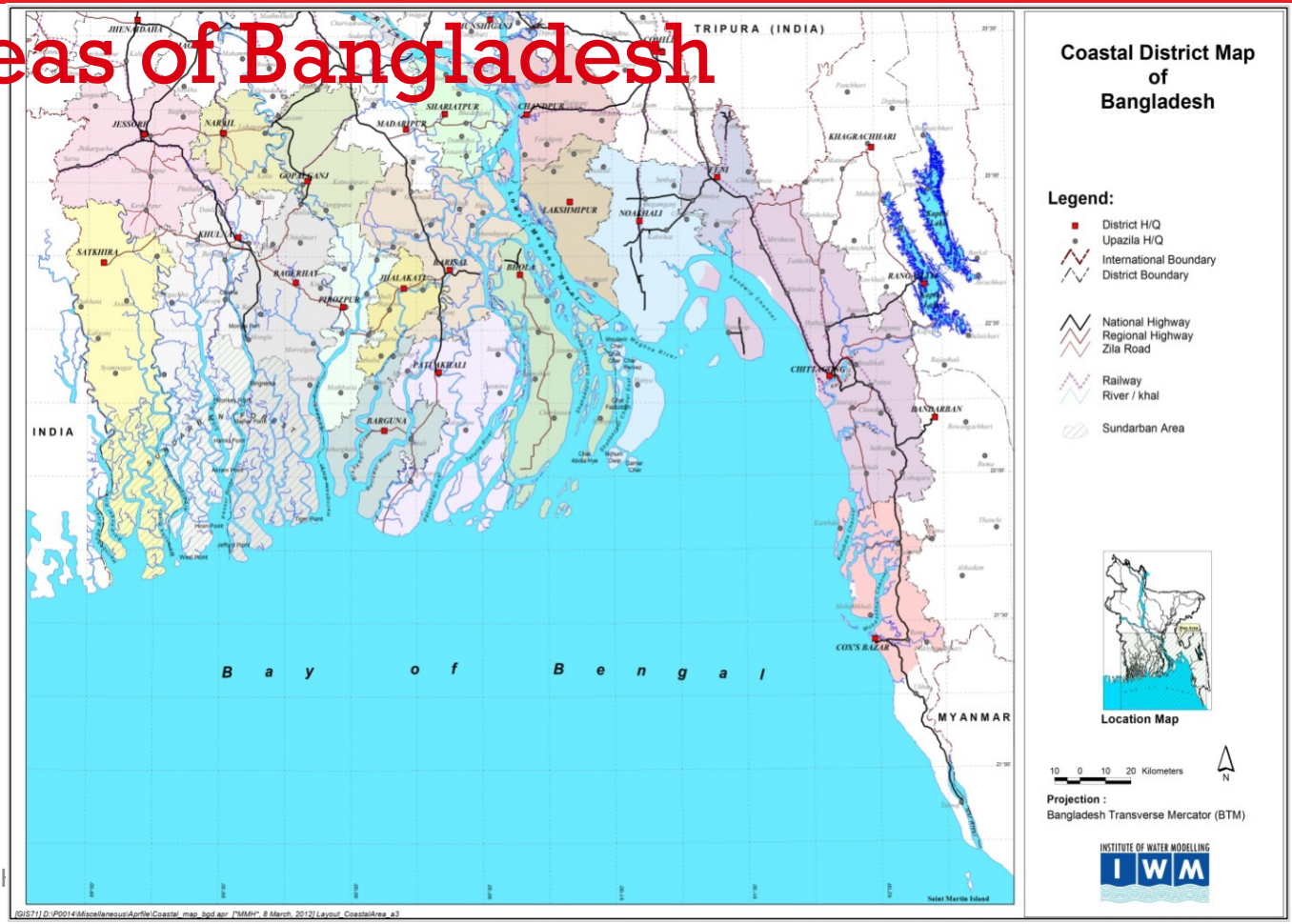
Presentation Outline

- Introduction and Background
- Methods
- Results
- Implications and Conclusions

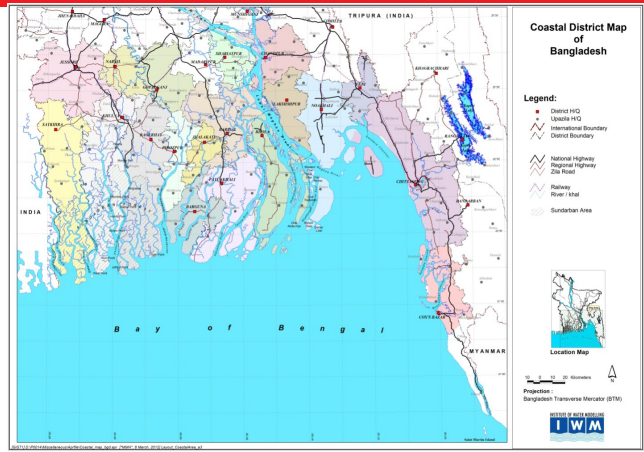
Coastal Areas of Bangladesh

- 19 districts
- 32 percent of the total land area
- ~35 million population

(PDO-ICZMP 2003)



Coastal Areas (contd)

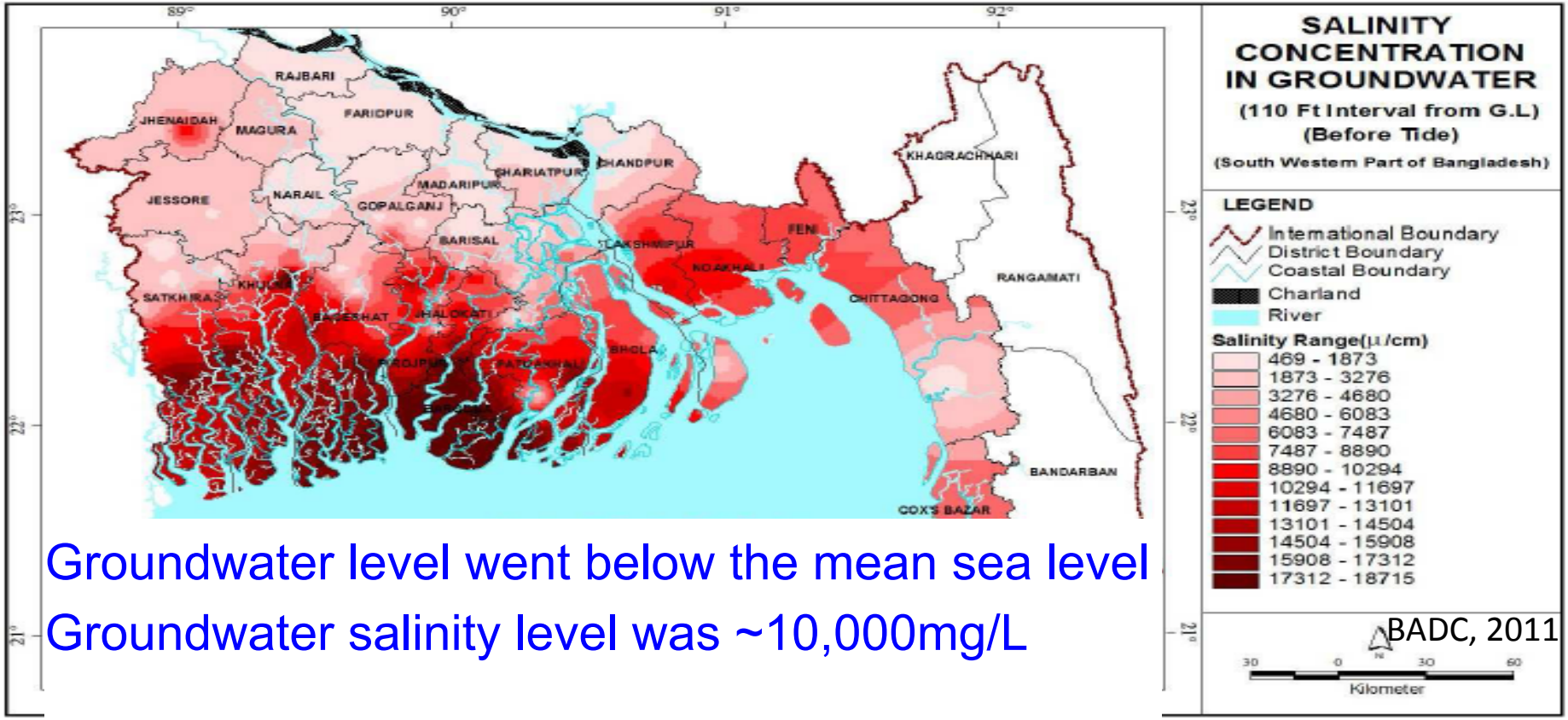


- Areas of multiple vulnerabilities (Minar, 2013)
- Low-lying- 86% of the land have an elevation up to 5 meter (Nishat & Mukherjee 2013)
- 12 districts (half of the coastal total land area)- cyclone risk, salinity intrusion and tidal water movement (Dasgupta, 2014)

Water Supply and Salinity

- Direct water use from natural surface (e.g. pond, river) and groundwater sources (e.g. tubewell).
- Affected by varying level of salinity (Khan et al., 2011)
- Saltwater is moving further inland (BADC, 2011, SRDI, 2012)

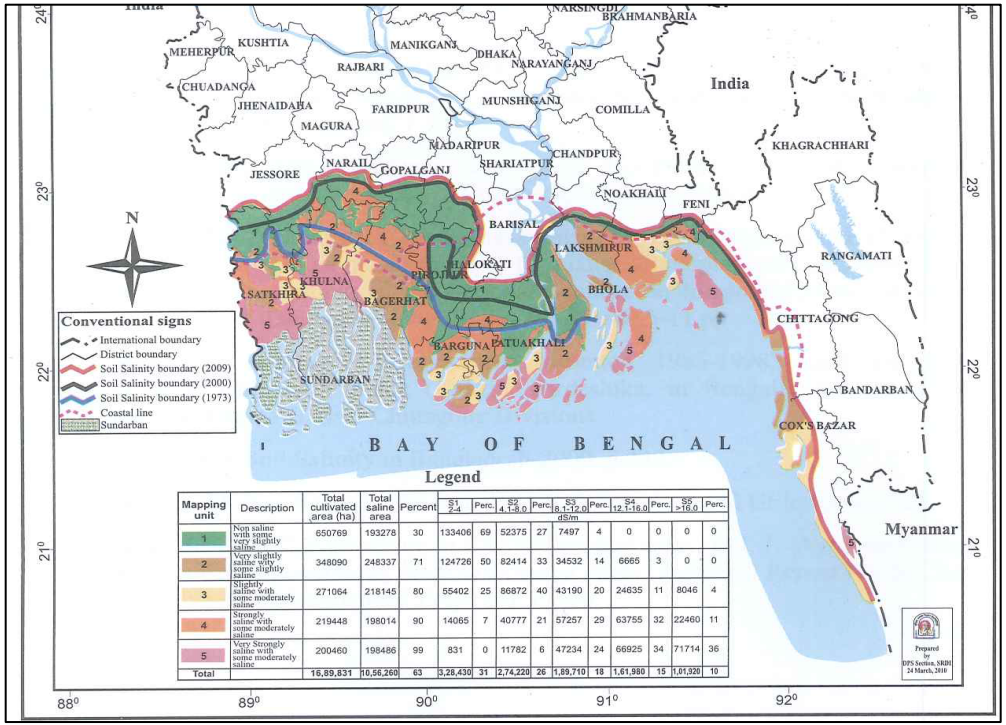
Salinity Concentration in Groundwater



Groundwater level went below the mean sea level

Groundwater salinity level was ~10,000mg/L

Soil Salinity Bangladesh



Mapping unit	Description	Total cultivated area (ha)	Total saline area	Percent	S1 2-4	Perc.	S2 4.1-8.0	Perc.	S3 8.1-12.0 dS/m	Perc.	S4 12.1-16.0	Perc.	S5 >16.0	Perc.
1	Non saline with some very slightly saline	650769	193278	30	133406	69	52375	27	7497	4	0	0	0	0
2	Very slightly saline with some slightly saline	348090	248337	71	124726	50	82414	33	34532	14	6665	3	0	0
3	Slightly saline with some moderately saline	271064	218145	80	55402	25	86872	40	43190	20	24635	11	8046	4
4	Strongly saline with some moderately saline	219448	198014	90	14065	7	40777	21	57257	29	63755	32	22460	11
5	Very Strongly saline with some moderately saline	200460	198486	99	831	0	11782	6	47234	24	66925	34	71714	36
Total		16,89,831	10,56,260	63	3,28,430	31	2,74,220	26	1,89,710	18	1,61,980	15	1,01,920	10

- Salinity level is increasing and more areas are being affected by higher salinity

  (SRDI, 2012)

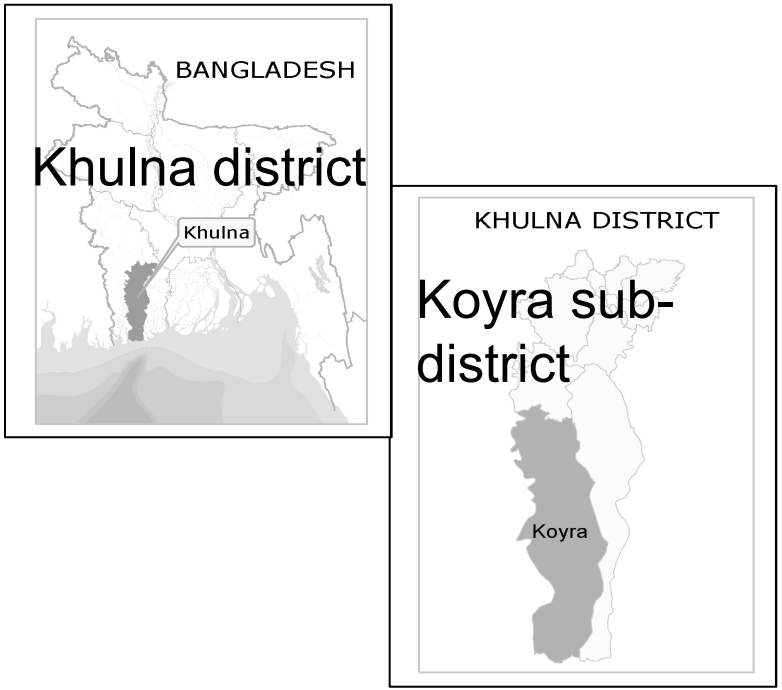
Salt Exposure and Health Effects in Bangladesh

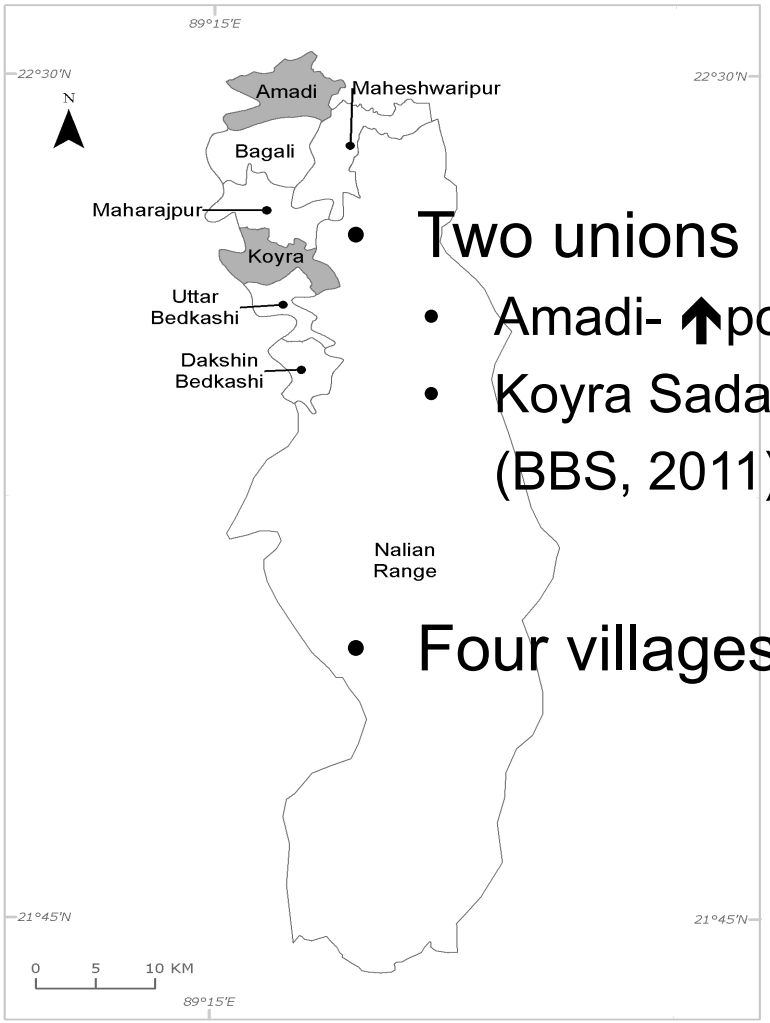
- Limited data available (Vineis et al., 2011)
- Among pregnant mothers-
  - High salt consumption
  - Pre-eclampsia (Khan et al. 2011, 2014)
- Adult (aged 25 years and above)
  - Coastal vs High vs Plain land- High salt consumption (Rasheed et al. 2014)

Methods


RESEARCH
EXAMINE
SEARCH
SCAN
SCIENCE
PROBE
PROJECT
TEACHING
EXPERIMENT
LEARNING
THINK
LEARN
SCIENCE
BOOK
STOCK

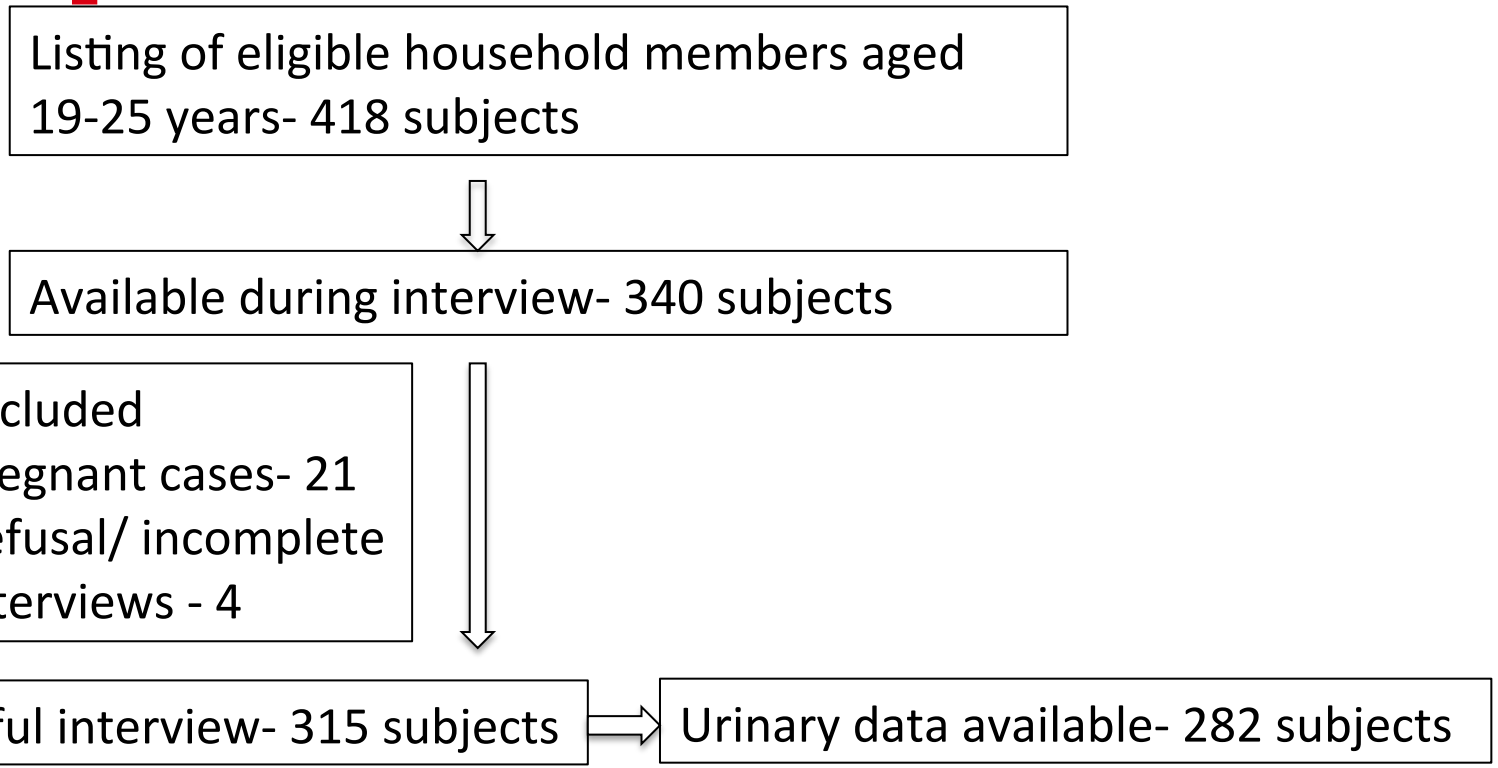
Study settings





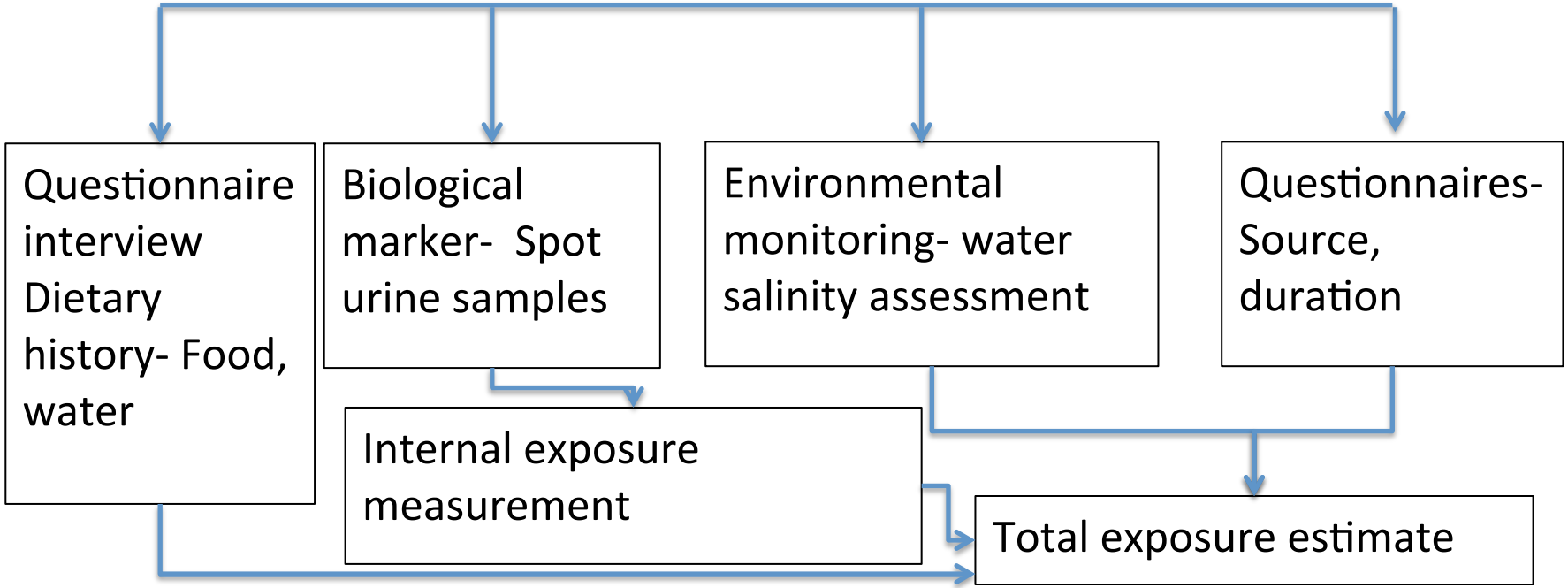
- Two unions
  - Amadi- ↑pond
  - Koyra Sadar-↑TW (BBS, 2011)
- Four villages

Study Population



Data Collection

- May-June 2014

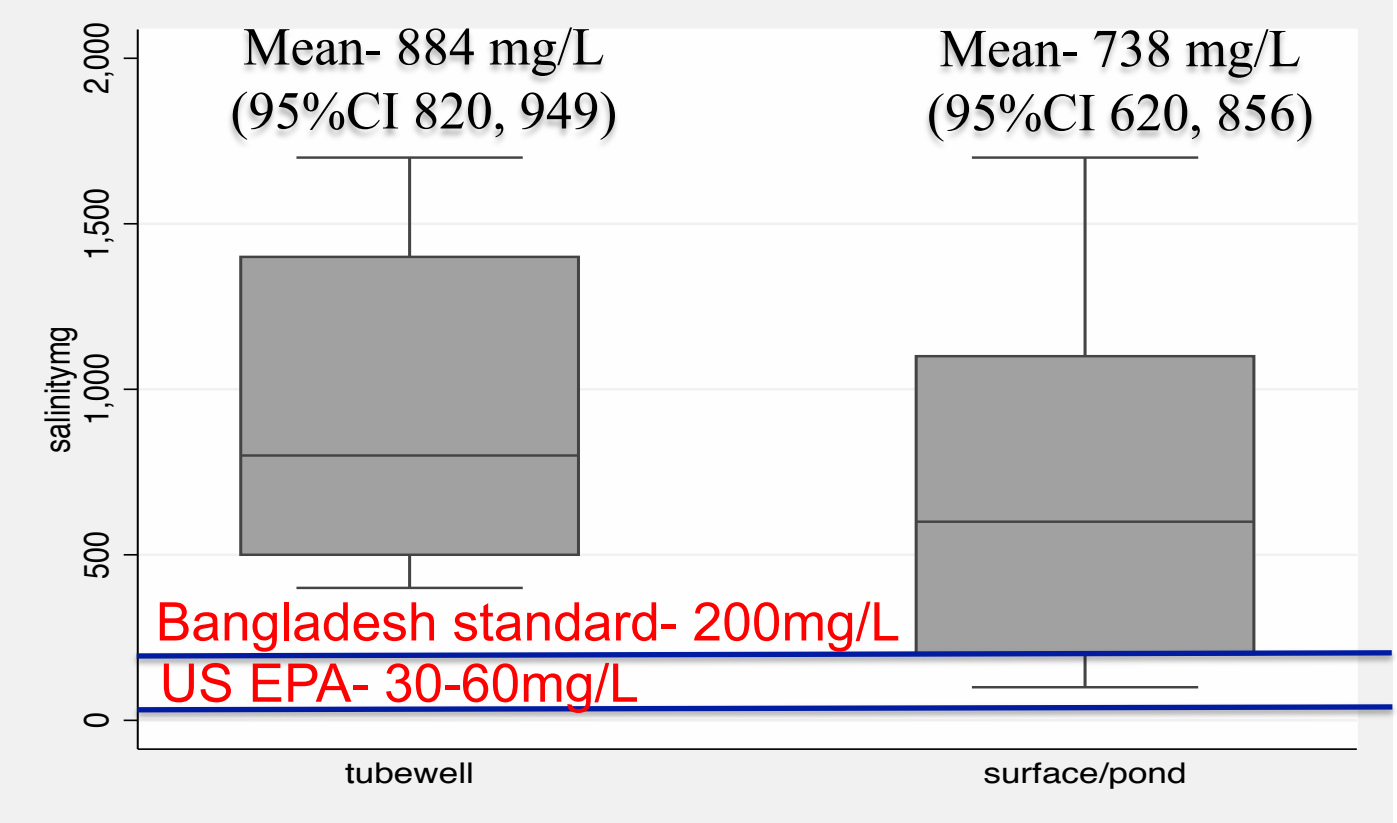


Findings

Characteristics of the Respondents

		N	%/ Mean (sd)
Sex	Female	184	65.9
Education (years)		275	7.7 (2.8) (mean)
Occupation	Physical labour	107	38.3
	Housewife	101	36.2
	Non labour	71	25.5
Wealth index (n=239)	Low	80	33.4
	Middle	83	34.7
	High	76	31.8
BMI (kg/m^2)		279	21.2 (4.1) (mean)

Water Sources and Salinity Level



Urinary Sodium- Spot and Estimated 24-hour Level

N=279	Urinary sodium (UNa) mmol/L	Kawasaki* Estimated 24-hour urinary sodium (mmol/d)	Tanaka* Estimated 24-hour urinary sodium (mmol/d)	INTERSALT* Estimated 24-hour urinary sodium (mmol/d)
Mean± sd	103.7 (70.5)	197.4 (61.0)	137.1 (34.8)	118.6 (27.3)
Median (IQR^)	91.5 (43.3, 154.8)	192.1 (157.6, 233.8)	134.4 (114.7, 156.4)	115.4 (99.9, 133.9)
Range	10.5, 298.0	62.3, 469.6	59.7, 248.3	41.9, 203.6
Abnormal (%) (>100 mmol/d)	-	95.3	88.1	74.9

* formula described in Cogswell et al., 2013

Association between drinking water sources and 24 hour urinary sodium

	B	95%CI	p for trend
Crude (n=279)			
Surface water/Pond	Ref		
Tube well water	9.7	3.1, 16.3	0.004
Adjusted (n=254)*			
Surface water/Pond	Ref		
Tube well water	13.8	7.8, 19.8	<0.001

*Adjusted for sex, education, occupation, socio-economic status, BMI, added salt

Implications

Dietary salt and health risks

- Direct link → Hypertension (WHO, 2012; He, 2009)
  → Cardiovascular and Kidney diseases
  (Koliaki, 2013)
- Increase of SBP→ 1.8-4.3mmHg; increase of DBP→ ~0.0-1.2mmHg (INTERSALT study)

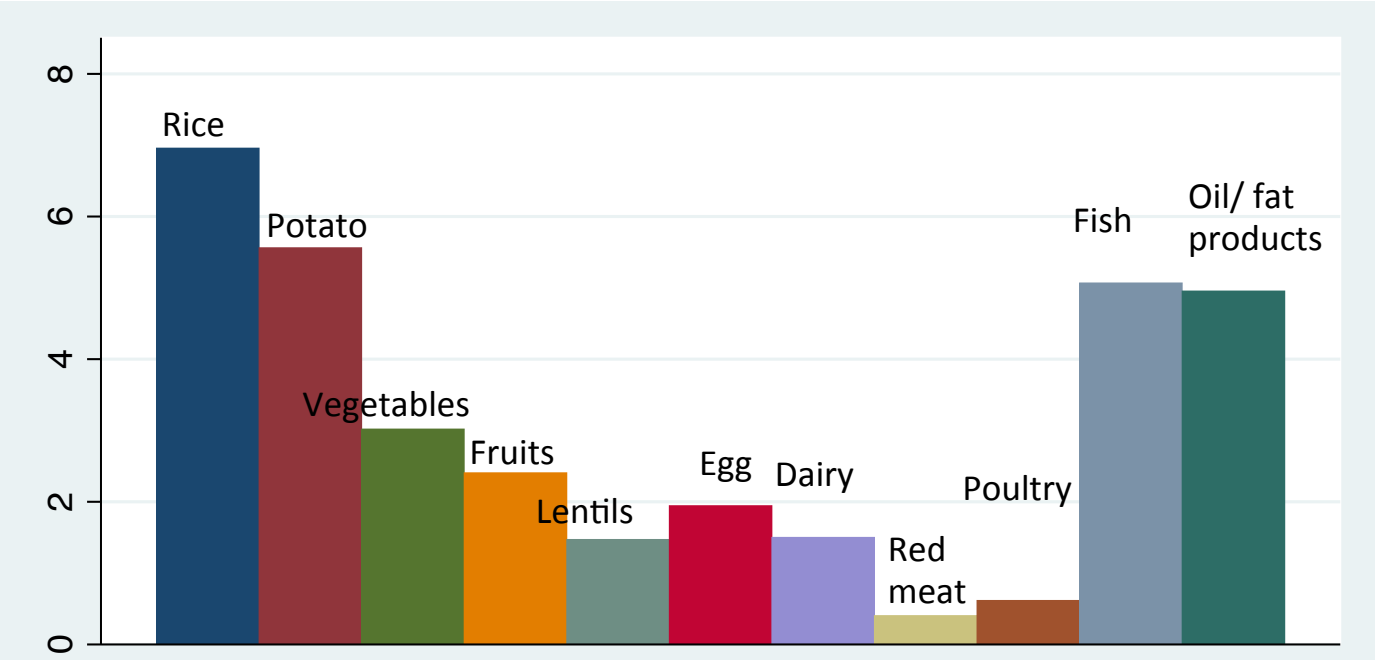
Vulnerability of Coastal Deltas

Nicholls et al., 2007

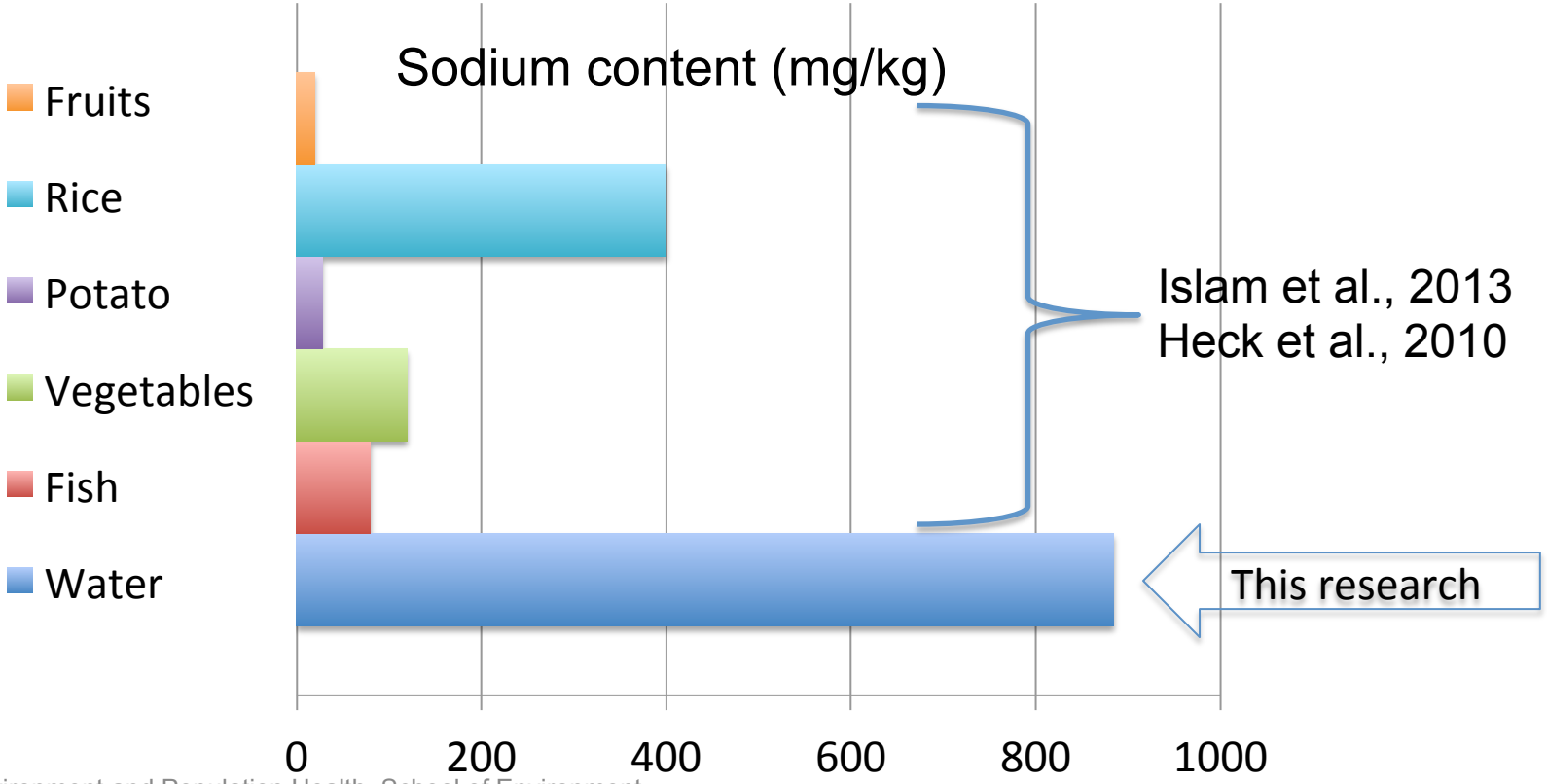
Projected Climate Change and Salinity

- Climate change will cause significant changes in river salinity in the southwest coastal area of Bangladesh (Dasgupta, 2014)
- The freshwater river area (0–1 g/L) is anticipated to decline from 40.8 percent in 2012 (March) to <20 percent for 2050 (Dasgupta, 2014)
- An increase of moderate to highly saline river areas (3 to above 5 g/L) from the baseline in 2012

Food vs Water Contribution



Food vs Water Contribution



Conclusions

- Drinking water contributes to high sodium consumption in young population→ increasing risk of hypertension
- Climate-induced sea level rise is likely to exacerbate already excessive salinity levels
- We need specific health prevention interventions and adaptation strategies

  →Short-medium term- reduction in salt through diet

  →Medium- long term- alternative safe water options

Acknowledgements

- My supervisors
- Griffith University Postgraduate Student Association
- Griffith Asia Institute


THANK YOU