



# High concentrations of sodium in drinking water and raised blood pressure in coastal deltas affected by episodic seawater inundations

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## Abstract

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**Background** In times of seawater inundation in coastal deltas, unprotected drinking water sources, such as ponds and shallow tube wells, take on salt water with each inundation. Daily consumption of these saline sources contributes to overall sodium intake. Although there is evidence that a high dietary salt intake is an important risk factor for hypertension, little is known about the effect of high concentrations of sodium in drinking water on population health. In this longitudinal study, we aimed to measure the effect of high concentrations of sodium in drinking water on blood pressure and to assess the reversibility of raised blood pressure when conventional drinking water sources were replaced by low-saline water.

**Methods** We used a multistage sampling process to recruit participants aged 18 years or older from the salinity-affected sub-districts of Dacope, Batiagatha, and Paikgatchha in coastal Bangladesh. Most participants consumed drinking water from highly saline sources, such as ponds and tube-wells, while a small percentage had access to rainwater. In March, 2013, we recorded: baseline concentrations of sodium in drinking water; participants' blood pressure; and personal, lifestyle, and environmental characteristics. During the study period, some study participants gained access to low-saline drinking water alternatives that were installed for use in the dry season, when water from ponds becomes more saline. In March, 2014, and May, 2014, we made follow-up assessments of drinking water sodium, blood pressure, and repeated the questionnaire about personal, lifestyle, and environmental characteristics. We used generalised linear mixed methods to model the effect of drinking water sodium on blood pressure and assess reversibility of raised blood pressure when participants switched from conventional drinking water sources to low-saline alternatives.

**Findings** We included data from 581 participants in analysis, of which 277 (48%) were male. Median age was 38 years (IQR 30–49). Systolic blood pressures at baseline varied greatly with drinking water sodium: mean systolic blood pressure in the lowest water sodium quintile was 119·4 (SD 13·7) and 138·4 mmHg (SD 25·0) (for participants younger than 60 years and participants 60 year and older, respectively) and in the highest sodium quintile 126·7 mmHg (18·0) and 147·0 mmHg (22·3), respectively. Drinking water sodium concentrations remained, after controlling for personal, lifestyle and environmental factors, highly associated with blood pressures. Furthermore, for a 100 mg/L decrease in sodium concentration in drinking water, blood pressure was reduced, on average, by 0·95/0·57 mmHg and the odds of hypertension reduced by 16% (95% CI 8%–26%).

**Interpretation** Drinking water is an important contributor to daily sodium intake in salinity-affected areas and, therefore, a risk factor for hypertension. Alternative low-sodium drinking water sources could help to prevent hypertension-related morbidity and mortality for the large number of people living in these coastal areas. The practicalities of supply of such alternative sources, including safeguarding the microbial quality, should be further studied.

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**Declaration of interests**  
We declare no competing interests.