

## **Acknowledgements**

My heartfelt gratitude and immense indebtedness to my supervisor Dr. Kazumi Asako, Professor, Institute of Economic Research, Hitotsubashi University, Tokyo, Japan for his constant supervision, valuable suggestions, thoughtful criticism, proper guidance and endless cooperation throughout the period of my research work and preparation of this thesis. Without his guidance, I would not have been able to finish the dissertation.

I would like to express my appreciation and gratitude to Professors Hidetoshi Yamashita, Kentaro Nakajima, Shinkichi Taniguchi, Shun'ichi Teranishi, Takashi Kurosaki, Takeshi Sakurai and Yutaka Arimoto who provided me with invaluable and insightful comments, and without whose help this dissertation could not have reached its present form.

I am thankful to all of the participants at Professor Asako Seminar, Professors Teranishi and Yamashita Seminar, Professors Kurosaki, Sakurai, Arimoto and Nakajima Seminar in Hitotsubashi University, gave me a lot of help and advice on studying economics, I have benefited from their useful suggestions. Thanks to all the people whom I interviewed for data collection.

I would like to express my appreciation and gratitude to Dr. Masao Tsuru and Dr. Kazuya Wada for their valuable suggestions and constructive criticisms.

I duly acknowledge my indebtedness to Dr. Islam and Dr. Akhtar for allowing me to use the relevant data in the chapter two.

I gratefully acknowledge all officer and staffs of the Hitotsubashi University especially Yukie Hada San for their excellent cooperation, help and support during this study.

I am grateful to my beloved family members specially my father and mother, my wife and my daughter for their continuous support, heartiest help, co-operation, affection and encouragement throughout my study period.

Finally, I am also very grateful to the Ministry of Education, Culture, Sports, Science and Technology, Japan for offering four and an half years scholarship to carry out this research work.

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## **List of Abbreviations**

<b>Abbreviation</b>	<b>Full Word</b>
AHS	Arsenicosis Health Status
AIC	Akaike`s Information Criterion
As	Arsenic
AVSTA	Averting Status
BBS	Bangladesh Bureau of Statistics
BGS	British Geological Survey
BIC	Bayesian Information Criterion
BLUE	Best Linear Unbiased Estimator
BMI	Body mass index
CV	Contingent Valuation
CVM	Contingent Valuation Method
DMA	Dimethylarsinic Acid
DPHE	Department of Public Health Engineering
DTW	Deep Tube Well
DW	Dug Well
FAO	Food and Agricultural Organization
GED	General Economics Division
HS	Health Status
HSC	Higher Secondary Certificate
HTWs	Hand Tube Wells
IARC	International Agency for Research on Cancer
ICDDR, B	International Centre for Diarrhoeal Disease Research, Bangladesh
kg	Kilogram

### List of abbreviations (Contd.)

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m	Meter
MDGs	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
ML	Maximum Likelihood
MMA	Monomethylarsonic Acid
MRSA	Mixed Regressive Spatial Autoregressive Model
NAMIC	National Arsenic Mitigation Information Centre
NGOs	Non-Governmental Organizations
NIPSOM	National Institute of Preventive and Social Medicine
NRC	National Research Council
PSUs	Primary Sampling Units
SAR	Spatial Autoregressive
SC	Schwarz Criterion
SES	Socio-Economics Status
SMA	Spatial Moving Average
SOES	School of Environmental Studies
SSC	Secondary School Certificate
STW	Shallow Tube Well
UAs	Urinary arsenic
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WTP	Willingness to Pay
$\mu\text{g L}^{-1}$ or $\mu\text{g /L}$	Microgram per Liter
$\mu\text{g/g}$	Microgram per gram

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## **Abstract**

Adverse human health effects ranging from skin lesions to internal cancers as well as widespread social and psychological problems are associated with chronic arsenic exposure from arsenic contaminated drinking water. Arsenic in drinking water is a major public health concern in Bangladesh, affecting several millions of people who live in rural areas, because of insufficient financial resources and public health infrastructure and lack of awareness. The present study empirically analyzes the arsenic exposure to human, arsenic concentration in urine and tube well water, the determinants of arsenicosis patients' perception about chronic arsenic poisoning, social and psychological implications of arsenicosis, the determinants and spatial dependence of households' knowledge about arsenic contamination, various factors influence arsenicosis health status, averting behavior and willingness to pay for arsenic free water.

A five-stage sampling procedure was undertaken for the selecting the 418 sample respondents for examining the arsenic concentration in urine and body mass index and 86 sample tube well for testing the arsenic concentration in drinking water. A three-stage sampling procedure was undertaken for selecting 150 (90 female and 60 male) respondents from 458 patients for identifying the determinants of arsenicosis patients' perception about chronic arsenic poisoning, social and psychological implications of arsenicosis. The data was collected from the six different sources for the examining the determinants and spatial dependence of households' knowledge about arsenic contamination. A two-stage sampling procedure was under taken for selecting the sample respondents for investigating the factors influence arsenicosis health status, averting behavior and willingness to pay for arsenic free water.

The present study shows that the highest amount of skin lesion was melanosis in palm (43.74%) and the second highest in trunk (37.49%). Melanosis in the palm, sole and trunk were the common signs in the patients. It was found that the sample respondents had an average body mass index of 19.52 while the BMI of the sample respondents varied from 14.06 to 33.4 with standard deviation 3.02 which was represent the broad characteristics of BMI of rural residents. The average level of arsenic concentration in the drinking water was  $285.37 \pm 193.13 \mu\text{g/L}$  with the ranging from 0 to  $715.63 \mu\text{g/L}$ . The mean arsenic concentration in the urine of the sample respondents was  $637.85 \pm 478.69 \mu\text{g/L}$  creatinine. The concentration levels varied from  $93.03 - 3198.00 \mu\text{g/L}$  creatinine. This study found high arsenic concentration in urine and drinking water and low body mass index.

Respondents informed that arsenic poisoning causes a wide range of social and psychological problems. Female respondents were less vulnerable in the case of social problems ( $p < .01$ ) and more vulnerable for the psychological problems ( $p < .001$ ) of arsenicosis than male respondents. The results based on logit analysis showed that education ( $p < .01$ ) and household income ( $p < .05$ ) were significantly correlated to respondents' perception about arsenicosis. The analysis showed that the positive spatial correlation in households' knowledge across neighboring districts at district, divisional and regional levels but the strength of this spatial correlation varied considerably based on spatial weight. The results also found that the literacy rate, daily wage rate of agricultural labour, arsenic status, percentage of red mark tube well of a district contributed positively significantly to the households' knowledge. The ordered logit results from different specifications show that the age, age square, household size, BMI, education, household monthly income, vegetable consumption and smoking behavior had strong consistent association with arsenicosis health status. The binary logit specifications were used to estimate the association between outcomes and key

household attributes. Among the determinants, the present study is focused on whose education was the most influential factor for switching from red source to green source for drinking water. Structure of the model allowed to estimate the marginal effects of latent status of red mark tube wells. Maximum likelihood regression analysis results showed that the education level of respondents, gender, household monthly income, vegetable consumption and participation of NGO(s) activities had a statistically significant association with willingness to pay for arsenic free water.

The arsenicosis related special program (s) needs for clear understanding of people's perception about arsenic exposure for abating the health burden as well as social and psychological problems. These findings have several policy implications those agencies and policy initiatives operating at local and or national levels concerned with tackling the arsenic contaminated drinking water related problems that are primarily concerned with sound health and poverty alleviation agenda. Therefore, key issues for policy development are how to create income generating activities and provide greater opportunities for educational attainment of rural peoples of developing countries like Bangladesh can enhance their ability to access in arsenic free drinking water.