

**Climate Adaptive Action Plans to Manage
Heat Stress in Indian
Cities**

Methodology Workshop

Date: 19th March, 2018, Time: 10.00 am –
3.30 pm **Venue:** Integrated Research and
Action for Development IRADe, New
Delhi

Conference Room

Organised by: Integrated Research and
Action for Development

Workshop Summary

The Methodology workshop was conducted with the partner organizations, IIPH Gandhinagar & Bhubaneswar along with other experts, Senior Advisors of IRADe, at IRADe conference Hall, on the 19th March, 2018. The workshop was intended to discuss extensively on the research methodology and procedures to be adopted in conducting field level surveys and acquisition of required data and information.



Row 1 (L-R): Ms. Chandra Prabha, Ms. Asha Kaushik, Ms. Moumita Shaw, Mr. Mohit Kumar, Mr. Mohit Gupta, Ms. Ananya Mukherjee

Row 2 (L-R): Dr. Probal Ghosh, Prof. Ajit Tyagi, Mr. Harish Chandra, Dr. Lipika Nanda

Row 3 (L-R): Dr. Partha Ganguly, Mr. Rohit Magotra, Dr. Ambarish Dutta

SESSION 1: INTRODUCTION

Introduction and Outline of Project Progress

- *Mr. Rohit Magotra, Assistant Director, IRADe*

Ethical Policy Framework

- *Mr. Rohit Magotra, Assistant Director, IRADe*
- *Ms. Chandra Prabha, Communication Specialist, IRADe*

GIS Methodology and Spatial Mapping of hotspots

- *Mr. Mohit Kumar, Sr. Research Associate, IRADe*

Major Points of Discussion

Ethical Policy Documentation:

Both IRADe and IIPH-G/B shared their Policy document. It was suggested to add the following in the said document:

- a one-page brief about the project, which can stand as an introduction about the project
- a letter of consent (same will be shared by IIP-B)
- Confidentiality Clause
- Gender Equality Clause

GIS mapping:

For the spatial mapping of the heat stress vulnerable zones, shape files of ward-boundary will be acquired from the respective Municipal Corporation. Communication letters will be circulated for the same.

It was suggested that the list of the data (time series) required from IMD is listed down so that specific data is acquired. This will aid in developing hotspots within city & periphery, will also help in recording the change or uniformity noticed in the locations of the hotspots. It is necessary to figure out the frequency of the hot-spots in the maps.

Time series data will be acquired for the past 4-5 yrs. / 10yrs, with the records of the day and night temperature (Max & Min) for the time series analysis. The thermal mapping should be done for each year (at least for the last five years) for the months April, May, June and July. Time Series Data for temperature and humidity for the period- April- July for years 2012-2017.

We need to identify locations for installing the measuring instruments in particular in Rajkot and Bhubaneswar.

SESSION II: RESEARCH METHODOLOGY

Methodology of survey Heat Stress Impact Moderator:

- *Dr. Jyoti Parikh, Executive Director, IRADe/ Mr. Rohit Magotra, Assistant Director, IRADe*

A. Assessing impact on Livelihood & Productivity

Discussants

- *Ms. Moumita Shaw, Sr. Research Associate, IRADe*
- *Ms. Asha Kaushik, Sr. Research Associate, IRADe*

B. Health

Discussants

- *Dr. Partha Sarthi Ganguly, Additional Professor, IIPH- Gandhinagar*
- *Dr. Ambarish Dutta, Associate Professor, IIPH- Bhubaneshwar*
- *Dr. Lipika Nanda, Director, IIPH- Bhubaneshwar*

C. Determination of Sample size, survey locations & survey Period

Discussants

- *Dr. Ajit Tyagi, Sr. Advisor, IRADe*
- *Mr. Rohit Magotra, Assistant Director, IRADe*
- *Mr. Harish Chandra, Senior Advisor IRADe*
- *Dr. Probal Ghosh, Head Modelling Group, IRADe*

Major Points of Discussion

Dr. Dutta opined regarding the health structure, its platform & data architecture, elaborating that for data capturing, a hierarchical modelling will be needed, s data will be captured at individual level and household level wherein age will be a major aspect. This model needs to be developed as only 8 days are left for beginning of the season. Mr. Magotra then explained the reason why this workshop is important so as to understand the gaps and to remain on the same page w.r.t. the project & its methodology. He also stated that epidemiology model is absent but can be procured as per the need of the project.

The models currently being used by IRADe are for data analysis but for capturing the data a model has to be evolved. The data will be captured at individual level and House Hold level, wherein the set of questions will be different for every level explained Dr. Dutta. The 2 datasets can be merged with a unity but the model has to be developed accordingly, for which IIPH-B can take a lead, however time constraint is an issue, explained Dr. Dutta & Dr. Nanda.

Dr. Ghosh mentioned that at individual level age, gender, observation, etc. need to be collected, which was further elaborated by Dr. Ganguly. He stated that status of illness, income and various other factor at individual level needs to be included in the individual time variant questionnaire. The socio-economic profile will be at House Hold (HH) level, but the demographic, health data will be collected at individual

level, summed Dr. Ghosh. He also inquired about the alternate of SPSS model.

Dr. Dutta further explained that SPSS model does multi-level data modelling very badly but Epi Info can be used for the same, IIPH has good past experience in developing platforms in Epi info but for doing the same the final HH level and individual questionnaires would be needed at the earliest. Mr. Magotra confirmed that the questionnaires are a priority and the next two sessions will discuss the questionnaires developed so far and the inputs from all the stakeholders present would be considered while developing the final questionnaires. Dr. Ghosh explained that we need to make a set of four questionnaires, 2 questionnaires will capture socio-economic information for household and individual level respectively while other two will capture info related to heat stress. Dr. Dutta suggested to refer the NFHS HH level questionnaire for drafting HH level/baseline questionnaire for this project. Dr. Nanda also suggested NFSO to be referred for the same, since these are standardized survey formats made for HH level.

Mr. Magotra highlighted that socio-economic vulnerability should be captured. Dr. Nanda explained that such questionnaires are designed to assess vulnerability of housing asset. The asset index developed based on principal component analysis after using the standardized format is of international level, added Dr. Dutta, as it is a part of World Global Demographical Health Survey.

Mr. Magotra asked how IIPH did this survey in the past, to which Dr. Nanda & Dr. Ganguly explained since the vulnerability assessment was done very quickly they were unable to get into the details of the survey, as they were doing a primary study only. Ms. Shaw opined that the questionnaire is very general and it cannot capture the specific data for the study. Dr. Dutta explained that the NFSO/NFHS formats are made for generalized survey and post that individual level survey would outline the heat stress related issues. Dr. Nanda further clarified that this is an index which is followed globally to arrive at an asset. The individual data has to be collected at varied time points/periods suggested Dr. Dutta, Dr. Ganguly suggested to collect data of another month which isn't a heat wave month to see the difference.

Dr. Ghosh asked Dr. Dutta how to do heat stress impact analysis on general public, he suggested that proximal indicators & distal indicators may be used, former captures the coping mechanisms, changes in behavior & mal-adaptive behavior whereas the later indicator will capture ill health conditions needing medication. However, the former is better than the later for assessing impact of heat on public and clarity on these indicators need to be established before the beginning of survey. This would help in proper analysis of data.

Mr. Magotra enquired the feasibility of survey sample, Dr. Dutta opined that a maximum of 250 per city survey samples which will cumulate to approx. 1250 persons would be sufficient. Dr. Ganguly mentioned that sampling size cannot be determined on the basis of city size. The multi-level clustering for cities will show serial auto-correlation in data which will be included in the sampling and analysis strategy, thus, it can be said that 90% of the factors are being overlooked for this scientific statistical probability study it is neither purposive nor probabilistic but something in-between; which Dr Ghosh pointed out to be elaborately given as a disclaimer. Dr. Ganguly suggested the sample size of 50-60 households in 6

different vulnerable zones, high risk areas, hotspots etc. Dr. Dutta further added to cover the occupational workers, construction workers but auto drivers can be overlooked. Mr. Magotra shared his view to sample 15-20 such occupational workers for the said project. Mr. Harish was of the opinion to collect 4 hotspot sampling and 2 non-hotspot sampling for control.

Mr. Magotra pointed out that period & frequency of exposure is an important determinant. He summed up that 50 odd H.H. samples would be collected at 6 identified hotspot locations, from this sample occupational and gender data will be extracted. Dr. Ganguly added that 20-25 occupational samples with temperature data could also become a good study.

Mr. Magotra also summed up that WHO software is available free of cost and maybe used for this study to handle real time data capturing, it is available on mobile as well as computer. The study has to capture gender as a cross-cutting issue therefore, the questionnaire will be structured accordingly for women. Dr. Ganguly shared that mitigation measures are not being considered but only the adaptive measures. Mr. Magotra suggested to produce a report that collate existing adaptive & mitigation measures that are being undertaken & cost of such actions at city level.

Step by Step Discussion of Questionnaire

Ms. Kaushik shared that occupational level questions which include major economic activity or subsidiary activity. Mr. Harish further added that data will be captured for all members of the HH aged 15 and above, but Dr. Ganguly contradicted that children are also to be considered not occupation wise but because they are exposed while in school & NFHS already has a section drawn out for the same.

Mr. Magotra summed up the broad aspects to be covered HH level survey and occupational pattern, transportation, economic activity, duration of exposure, travel time, common place condition. Dr. Ganguly added that NFHS would not capture the exposure levels of Heat stress therefore, the questionnaire needs to be restructured eg. a child going to school will not be considered under economic activity, can be put under activity, which is not given clearly in the NFHS format, & it will be shared by Dr. Dutta. He also questioned the process of identifying & assessing the locations for temporal heat analysis (fortnightly). Dr. Nanda gave an example that OSDMA & Health Dept. are working with the labour dept. to change the working hours or making the work timings flexible in all department engaging labors. Dr. Dutta further said that data which is not of use shouldn't be collected and data which is wrongly collected cannot be used. It was finally decided to collect the fortnightly data.

Ms. Kaushik explained that under transportation section, data will be captured for distance to work place, mode, travel time. Dr. Dutta suggested to collect this data for 14 days on an average basis for a single data point eg. mode= mode of the most commonly used transportation.

Under heat related stress Ms. Kaushik further discussed the questions related to the problems faced while working outdoors in summers, to which Dr. Dutta & Dr. Nanda pointed out that a qualitative analysis will be required. Since the analysis will be quantitative all the questions should have multiple answers to consider all the possibilities. Question related to the days taken off due to heat is acceptable as it is

quantifiable.

Ms. Kaushik discussed days of least pedestrian and two wheeler activity (last Summer) for vendors, one is historic and another is present. Mr. Magotra explained the importance of the historic data to be collected one time with the HH data.

Effects of income level during summers cannot be captured in one single question, as binary data does not give clarity and quantitative data is the key mantra of statistical analysis.

Dr. Dutta summed the 4 survey possibilities:

- HH One time
- HH Longitudinal/Time variant
- Individual One time
- Individual Longitudinal/ Time variant

Thus giving out panel data and cross-sectional data, developing the quantitative questionnaire. Also the wage data can be collected fortnightly along with expenditure. Dr. Ganguly pointed out to include the cost of water as well. Mr. Magotra opined to include migration also as an attribute in the questionnaire, also clothing pattern during peak season.

Dr. Ghosh suggested to consider the electricity expenditure, food expenditure and whether any assets owned like fan, AC, cooler, etc. which would be of great importance economics wise. Dr. Nanda, also suggested to organize a con-call between the two economists of IRADe & IIPH to discuss this section and its viability. Dr. Ganguly also added that medical and health questionnaire will be developed by IIPH, hence the economic part can be delineated by IRADe. Dr. Ghosh explained that these questions will be simple and robust which will be monetized by IRADe and \ cost per family incurred to combat heat stress will be calculated, however distribution of cost over 10 years will be difficult opined Mr. Magotra. He also added that adaptive strategy is also a part of project outputs, therefore identification of existing as well as cost effective adaptation strategies have to be proposed. Dr. Ghosh added that baseline survey will be a longer

survey however, longitudinal survey will take lesser time. Dr. Dutta opined that the questionnaire should be prepared in such a manner so that at least 10 households shall be covered in a day.

Mr. Magotra said that adaptive measures need to be captured to meet the objectives of the project and the indicative list needs to be identified to arrive at quantifiable data, the revised questionnaire will be shared with everyone. Dr. Ganguly and Dr. Dutta will be formulating the health section. The questionnaire will also be reviewed by a Gender Specialist to capture the Gender layers. Then pilots can be conducted to field test the questionnaires and finalize the datasets. The data capturing will start by 3rd week of April, added Dr. Dutta. Identification of hotspots, revision of questionnaire will take this much time, said Mr. Magotra.

Session III – Heat Stress Index

Discussion on Heat Stress Index Background & Methodology

- *Dr. Ajit. Tyagi, Senior Advisor, IRADe*

Conclusion and Way Forward

Major Points of Discussion

Prof. Tyagi said that IMD has temperature data available which is calibrated w.r.t. ground survey, so we can ask questions related to the discomfort felt by the people on the respective days when temperature was really high and through this a viable index can be developed.

Dr. Tyagi explained that this can be the way of doing ground truthing of the heat stress level. Dr. Dutta told that he has used roth-fuzz index for his study, it has following variables - maximum temperature, minimum temperature, humidity, rainfall and wind flow, which is available for most of the cities.

Mr. Magotra asked about the frame-work for capturing this kind of data, whether T max & T min threshold levels will be sufficient for the study or a model analysis is needed, tDr. Nanda shared that the govt. of Odisha, NDMA & OSDMA asked IIPH-A to carry out a threshold assessment and a vulnerability assessment to prepare the heat wave action plan. The vulnerability assessment and heat threshold assessment are the two main features of the guidelines developed by NDMA, which every state is supposed to carry out. Dr. Dutta further presented the methodology called District intact lab non-linear model, it is developed and carried out by IIPH Dr. Dutta explained that T min enables the hazardous effects of T max, called epidemiology effect modification, when T min is more than its median value the effects of T max increases significantly. So, the warning system should consider the T min and was strongly recommended to NDMA, same was adjusted for their study. Prof. Tyagi discussed the technicality of the data evaluation done for the project.

In the end of the meeting Mr. Magotra requested Dr. Dutta to share his paper on heat stress index with IRADe and suggested to guide the team in finalizing questionnaires for collecting datasets Dr. Dutta suggested that, IRADe can share the revised four questionnaires with IIPH-G and IIPH-B after which they can provide their comments and suggestions for improving the same.

Conclusion and Way Forward

1. *Heat Stress Compendium:*

The compendium of the heat stress issues in India, South Asia and global scale will be documented, along with the initiatives taken to mitigate the stress. Public documentations, articles, research papers will be assessed and critically reviewed by group of experts.

The structure and framework for the documentation will be shared with the partners. The compendium will be developed by September and would be circulated among partners and stakeholders.

2. *GIS Mapping*

Before the data workshop, the hotspot mapping may be completed and the same will be shared with all the partners. For the spatial mapping of the heat stress vulnerable zones, shape files of ward-boundary would be acquired. Communication letters will be circulated for the same. It was suggested that the list of the data (time series) required from IMD should be listed down so that specific data can be acquired. This will aid in developing hotspots within the city & periphery, will also help in recording the change or uniformity noticed in the locations of the hotshots. Time series data will be acquired for the past 4- 5 yrs. / 10yrs, with the records of the day and night temperature (Max & Min) for the time series analysis.

3. *Ethical Policy Documentation:*

Both IRADe and IIPH-G/B shared their Policy document. It was suggested to add a one-page brief about the project, which can stand as an introduction about the project and also add a letter of consent (same will be shared by IIPH-B)

4. *Household & Individual Survey:*

The core focus will be the vulnerable sections and the occupational groups which are particularly vulnerable to heat stress like the construction workers, rickshaw pullers, Vendors etc. The HHs will be selected within the hotspots, this will also include construction sites Stratified/ random sampling will be adopted to survey nearly 250-300 HHs in each city. 4 types of Cross Section & Panel surveys will be conducted:

- One time/ Base line HHs survey
- One time/ Base line individual survey (occupational groups)
- Time variant Survey of HHs (one a fortnight)
- Time variant Survey of individuals (one a fortnight)

It was suggested that IIPH-B will take the initiative to develop the survey protocol documents.

5. *Survey Questionnaire/ checklist:*

It was suggested to follow / adopt the NFHS –IIPS Household questionnaire for the base surveys.

The individual survey sheets need to made more precise with codes which could be directly used in data analysis software. It was agreed upon that the Heath and medical status section will be developed by IIPH- G& B and the socio-economic section by IRADe. The questionnaire developed will be reviewed by

a genders specialist and pilot survey will be initiated by the 3rd week of April.

6. Heat Stress Index & Temperature Threshold:

The aspects / indicators required for the threshold are Max. & Min temperature, Humidity level, Rainfall and wind velocity for the last decade / 2 decades. IIPH-B has already been working on developing the Heat Stress Threshold Methodology and will be sharing the manuscript of the same.

7. Constituting Steering Committee:

It was suggested to constitute the Advisory/ Steering committee comprising members from City Municipal Commissioner, Director of NDMA, MD of OSDMA and experts in the field



Team at Discussion

PARTICIPANTS

Dr. Lipika Nanda, Director, Indian Institute of Public Health-Bhubaneswar

Dr. Ambarish Dutta, Associate Professor, Indian Institute of Public Health-Bhubaneswar

Dr. Partha Sarthi Ganguly, Additional Professor, Indian Institute of Public Health-Gandhinagar

Prof. Jyoti Parikh, Executive

Director, IRADe **Mr. Rohit**

Magotra, Assistant Director,

IRADe **Dr. Probal Ghosh**,

Head Modelling Group, IRADe

Prof. Ajit Tyagi, President, Indian Meteorological Society & Senior Advisor IRADe

Mr. Harish Chandra, Senior Advisor IRADe

Ms. Chandra Prabha, Communication

Specialist, IRADe **Mr. Mohit Kumar**,

Senior Research Associate, IRADe **Mr.**

Mohit Gupta, Senior Project

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Ms. Asha Kaushik, Senior Research

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Ananya Mukherjee, Research

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