HEAT AND MORTALITY IN PAKISTAN: A STUDY INTO THE GENDER PERSPECTIVE

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ABSTRACT

Objective: To explore the gender sensitive dimensions of the impacts of heat on mortality in Pakistan using annual time series data from 1972 to 2015 to frame effective health policy and create awareness among masses.

Study Design: Retrospective study.

Place and Duration of Study: The research was carried out at COMSATS Institute of Information Technology and National Defense University Islamabad. Data were collected for the years 1972 to 2015 from world development indicators and Climatic Research unit.

Material and Methods: This is an empirical study. Secondary data was employed for analysis that was collected from world development indicator and climate research unit. Regression was used to assess the relationship between mortality and temperature. Stationary tests were applied to avoid spurious regression. Reliability of results was ensured through different measures of mortality. Some other determinants of human health like trade, remittances, and inflation were also included to overcome confounding factors. Data were entered and analyzed in STATA.

Results: The findings show that temperature and different measures of mortality are strongly and positively linked. However, females are more vulnerable to temperature than males. The vulnerability of females to temperature increases further as the age decreases. This shows that infants, particularly females, are more vulnerable to rising temperature as the coefficient on temperature has larger magnitude in female mortality regressions.

Conclusion: The temperature and mortality are strongly linked and this association strengthens with the decrease in age. The younger the child the more vulnerable to temperature rise. Moreover female children are more exposed to temperature impacts as compare to male children of same age group. In all categories, the regression coefficient is high in case of females and follows the same trend as the age decreases.

Keywords: Gender, Health, Mortality, Temperature.

INTRODUCTION

Global warming has recently sparked new interest in weather-mortality relationship as it is likely to have serious and long-term consequences on human activity[1-3]. The potential health effects of climate change are immense[4,5]. Mortality is an indicator of health that can be affected by temperature rise[6]. Historically mortality has long been known to be seasonal and has been associated with the effects of temperature. Though the mortality is caused by number of socio economic variables, increased temperature has been associated with increased mortality[7]. However, the gender differential of increased temperature impacts on mortality is not well documented in empirical health literature particularly in case of developing countries. It is thus important to identify gender-sensitive effects of changing temperature on different measures of mortality in Pakistan. The reason for selecting Pakistan is the slow decline in mortality rate[8], as compared to other developing countries. Among others one of the reasons for this slow decline in mortality could be rising temperature as Pakistan has been listed one of the most vulnerable country to climate change[9]. The research is expected to be of great importance for policy makers in framing policies in the context of changing climate and protecting children from rise in temperature.

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MATERIAL AND METHODS

This is retrospective study. Mortality and temperature data were collected for the years 1975-2015 from World Development Indicators (WDI) and Climate Research Unit (CRU) respectively. Data for other control variables was also gathered from WDI. Data were selected by non probability convenience sampling. We estimate the regression coefficients to measure the impact of temperature on mortality. To ensure reliability of research and deduce meaningful results different measures of

vector of confounding variables and εi is the usual error term. Ordinary least square method was used to estimate regression coefficients as all variables are stationary at level (table-I). STATA software was used to analyze data.

RESULTS

Descriptive statistics are presented in table-II. Female adult mortality rates have larger variations as compared to their counterpart males. However, female infant mortality shows small variations when compared with male infant mortality numbers. The mean mortality rates are

Table-I: Augmented dickey fuller (ADF) test results.

Variables	Individual effect	Individual effect, Individual linear trend	None
Adult mortality	-6.44* <0.001	-9.33* 0.002	-5.29* <0.001
Male adult mortality	-12.25* 0.001	-7.66* 0.003	-2.15 0.007
Female adult mortality	-10.06* 0.005	-24.34* <0.001	-11.22* 0.003
Infant mortality	-7.13* 0.009	-19.09* <0.001	-1.86* 0.001
Male infant mortality	-11.33* 0.009	-33.77* <0.001	-8.78* 0.001
Female infant mortality	-21.17* 0.003	-16.56* 0.001	-6.76* <0.001
Temperature	-63.33* 0.008	-107.18* 0.003	-9.12* 0.005
Trade	-12.63* <0.001	-23.25* 0.006	-5.60* 0.004
Inflation	-14.01* <0.001	-10.72* 0.002	-2.53 0.001
Remittances	-14.27* 0.007	-9.77* 0.002	-9.87* <0.001

*Show that null hypothesis of the presence of unit root is rejected with 99 percent confidence, *p*-values are in parenthesis.

mortality were employed in the analysis. To overcome confounding factors that can affect mortality, trade, inflation, and remittances were taken into account. The regression takes the following form;

$$Y_i = \propto_i + B_i \text{Temp} + \delta X_i + \varepsilon_i$$

Where *Yi* are the different types of mortality, Temp is the average temperature and *Xi* is the

higher in all categories for male. Very small variations have been observed in temperature that ranges between 22 to 24 Celsius. All the control variables show less volatility over the entire period.

Regression analysis (table-III) shows that all the control variables, trade, inflation and remittances, have their usual sign and are fully

supported by empirical studies[10-13]. Trade and remittances seem to reduce mortality while inflation is positively associated with all types of mortality. Temperature, the variable of interest, has significant positive effect on mortality which means the rising temperature is a major threat to humans particularly female showing their greater vulnerability to climate change.

DISCUSSION

The objective of this research was to use

mortality. On the basis of results derived in this study it is found that females are more vulnerable to rise in temperature as compare to their counterpart in both categories of mortality i.e. adult and infant[14,15]. There could be many reasons for this result: First women constitute the majority of the world's poor and are highly dependent on natural resources for their livelihood that are threatened by climate change[16]. Second women and girls living within male-headed households face unequal intra-

Table-II: Descriptive statistics.

	Mean	Standard Daviation
Adult Morality	40762	320
Male adult mortality	215	25
Female adult mortality	192	36
Infant mortality	144	32
Male infant mortality	9821	66
Female infant mortality	46	11
Tamprature	23	1
Trade	34	3
Inflation	10	6
Remittance	52	1

Number of observation for each variable is 44.

Table-III: Ordinary least squares (OLS) regression results.

Dependent variable	Independent Variables				
	Intercept	Temperature	Trade	Inflation	Remittances
Adult Morality	12.26*	0.40**	-0.12*	0.22*	-0.35**
	<0.001	0.041	<0.001	0.008	0.033
Male adult mortality	-4.56**	0.56*	-0.36*	0.43**	-0.07*
	0.031	<0.001	0.003	0.007	0.005
Female adult mortality	-10.33	0.77***	0.44	0.33**	-0.91*
	0.452	0.089	0.132	0.044	<0.001
Infant mortality	1.23*	0.72**	-0.32*	0.13	0.43
	0.002	0.028	0.005	0.198	0.221
Male infant mortality	2.54**	0.63*	-0.84*	-0.22*	-0.69*
	0.035	0.002	0.003	0.004	0.006
Female infant mortality	-8.23*	0.97**	-0.44**	0.59**	-0.57*
	0.003	0.025	0.043	0.031	0.003

***, **, * Show null hypothesis of the presence of unit root is rejected with 99%, 95% and 90% confidence respectively, *p*-values are in parenthesis.

analytical techniques to unpack the relationship between temperature and mortality in Pakistan considering the gender implications while controlling for other confounding factors like trade, inflation and remittance that can affect

household distribution of power and resources, such as food and property[17,18] and hence more exposed to weather shocks than men. Third Pakistan is a patriarchal society and female children do not get proper attention from parents

and thus suffer to temperature shocks. Finally, mostly general hospitals lack medication facilities to accommodate female children than males. Therefore, women reliable access to reproductive health services can help overcome this conundrum[19].

Our findings are supported by previous empirical literature that concludes that high temperature brings more rains that spread malaria and diarrhea[20]. Extreme events like high temperature can cause cardiovascular diseases[21]. Ozone increases the mortality and hospital admission[22]. In Netherland, it is found that mortality increases with an increase in temperature and vice versa[23].

At the end, it is worth mentioning that our results may not fully capture the impacts of temperature upon mortality and treated as suggestive. For example, long term changes in population characteristics, health behavior like smoking, the frequency of extreme weather conditions in some part of the country may be different from the other reasons. Many other factors like air pollution, health facilities, education and awareness of parents may affect mortality. Therefore, policy implications should be drawn carefully and future research may focus the temperature-mortality nexus by controlling these variables for more meaningful results.

CONCLUSION

The temperature and mortality are strongly linked and this association strengthens with the decrease in age. The younger the child the more vulnerable to temperature rise. Moreover female children are more exposed to temperature impacts as compare to male children of same age group. In all categories, the regression coefficient is high in case of females and follows the same trend as the age decreases.

RECOMMENDATION

The study highlights the gender differential impacts of heat on mortality and suggests that gender and temperature factors need to be focused while framing health policies. Awareness programs on electronic and print media may

significantly help reducing mortality especially of females. In addition, mother education, better infrastructure and healthcare facilities in the most vulnerable regions can mitigate the risk of infant mortality in future.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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