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CLIMATE CHANGE EFFECTS ON THE DISTRIBUTION, PREVALENCE AND TRANSMISSION DYNAMICS OF INFECTIOUS DISEASES IN RURAL SINDH

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ABSTRACT

The current study has been undertaken to take insightful data through the medical experts and affected population of climate change effects in the context of infectious disease distribution, prevalence and transmission dynamics in the rural Sindh province of Pakistan. Therefore; the warmer regions of Rural Sindh were selected for the data collection of the study. The Jacobabad, Shikarpur and Larkana districts were regions for data collection. In-depth interviews were organized to collect the data from the targeted population. 8 in-depth interviews were taken from the medical experts in the respective districts of targeted population, however; 10 in-depth interviews were conducted with the individuals within the affected population of these three districts. The data were analyzed using QDA minor latest version which is convenient for the qualitative data analysis. The findings of the study reveals that the climate change has sever effects on the human health. Due to the warmer weather, rise in temperature is conducive for outbreak of the infectious disease which is inevitable causing life as well as economic loss. According to the medical experts, future will be worst ever in the context of climate change effects and impacts on the human societies in terms of health hazardous if the proper health systems are not applied in the region. The series of floods in this region of Sindh is an eye witness of rapid spread of infectious diseases such as Malaria which recorded high rate of morbidity and mortality in the rural Sindh. Poor infrastructure, improper health facility centers required medical appliances, people's health awareness are the major reasons to prevent the population from the hazardous in future. This study can be a key player in understanding the climate change affects in the rural areas of Sindh from the people perspectives who are health care professionals and affected local population those regions.

Key Words: Climate Change, Health Risks, Infectious Disease, Future Threats.

1.INTRODUCTION

Climate change is a bitter truth of this century we live in which has become a global threat for the earth planet. Not only humans but it has direct and indirect effects and impacts on all living beings on the earth. The present study has been undertaken mainly focusing on the effects of climate change on human health. The study has been carried out in rural Sindh a province which has been severely affected due to the series of climatic hits. According to the Sindh climate change policy document Sindh is declared climate-change-prone province of Pakistan which needs extra efforts and endeavors to safeguard the future climatic losses for the population of rural Sindh.

Pakistan is a country receiving major death toll and illness due to the malaria however; every year one million estimated and 300,000 confirmed cases of malaria are reported. In the region, Pakistan is grouped with the Afghanistan, Somalia and Yemen in terms of the high burden of malarial cases. The prevalence of A. stephensi and A. culicifacies as primary vectors and P. Vivax and P. falciparum are the only reported parasite species in Pakistan which prevail in its seasons. (Aliya Jabeen, 2022).

According to the Sindh climate change policy document the precipitation of Sindh province since 1968-2010 is 160 mm per year. This figure with the deviation suggests the Sindh province is drought-prone part which receives occasional extreme o rainfall causing heavy flooding. This province has seen the long drought series since 1960 to 169, 1971 t 1974, 1985 to 1987 and 1999 to 2002 which brought heavy losses to the crops, livestock soil, and ecosystem. (Sindh, 2022).

Scientific evidences witness that the earth globe is warming at faster rate since the recorded history. Climate change is directly affects the health determinants which in result creating the pressure on prevalent health systems, hence; it is a threat to the progress in health sector mainly in the disaster-prone population of the world. IPCC has declared its very serious consequences in future whereby climate incidence in terms of health risk such as injury, disease and deaths can bring heavy losses due to the frequent temperature extremes, cyclones, storms, floods, droughts, torrential rains and wildfires with the regional variability. It is predicted that over the 50% of mortality will be in Africa by the year 2050 due to the extreme climate change occurrences. (Veronica F. Grasso, 2024).

Climate change with its speedy move has long term effects on human and ecosystem and breeding ground for the vector-borne disease. Rising temperature are conducive for the agricultural pests and disease vectors in the warmer regions.

There are major health determinants which ensure the good health such as economic, social m environmental, political and civic process and systems, however; needlessly to say that all these are vulnerable due to the climate change. The climate is disturbed due to the climate change events which systematically and seriously threatening to the human health because it has sever effects on major social and environmental determinants which ensures the good health. Such as pollution free air quality, clean drinking water, nutritious food, shelter to live in, economic opportunities, social status, healthy behavior, equity, access to the health care and social security. (Veronica F. Grasso, 2024).

1.2 Literature Review

The literature was reviewed using internet sources as usual to collect the relevant data from studies which were undertaken on specifically the topic of this study in the context of global, regional and local level. In Sindh, there have been little work is done on the disease distribution and prevalence, however; majority of population is resided in rural areas with a little number of major health facility centers. The researcher went to collect the data from the medical practitioners available in the catchment areas of this study wherever was convenient to reach and also collected the data from the local people regarding the disease distribution in their areas.

1.2.1 Climate change effects on distribution, prevalence and transmission of infectious disease on global level:

European countries are directly and indirectly climate-sensitive areas which directly and indirectly affected form the climatic hits causing spread of infectious disease potentially epidemic. Climate change creates favorable conditions for these vector-born disease outbreaks like chikungunya, dengue, and West Nile fever and also play role in expansion of these infectious disease geographically of tick vectors that transmit Lyme disease and tick borne encephalitis. Precipitation in extreme level contributes in water-borne outbreaks and long warmer summer seasons contributing in food-borne diseases. (Jan C. Semenza, 2021).

.Climate change events are global health security threats which causing spread of infectious disease. Malaria is one of the infectious diseases including other vector-born disease which is potentially transmitted due to the climate suitability and mosquito vector in Asia, sub-Saharan Africa, and South America. (Ebi, 2022).

In the views of World Health Organization (WHO) after the COVID-19 pandemic, the

climate change may be the global threat to the all societies in 21st century. (WHO, Coronavirus disease (COVID-19): Climate change Report , 2020). Since, it is threatening all aspects of life with the greater health risk assumptions. (WHO, 2018). Increasingly, the greater number of infectious health outcomes are associated with the climate change that are found within European. The infectious transmission is observed as nonlinear which is outcome of weather patterns. (Metcalf CJE, 2017).

Weather patterns are key contributors of the emergence, re-emergence, and spread infectious diseases. (Semenza JC, 2016). Furthermore, their contributing role is visible in survival, reproduction and distribution of diseases pathogens and vectors as well as the transmission and geographical expansion. (Semenza JC, 2016). So far, the transmission of these diseases is dependable on the climate suitability region wise. (Murdock CC, 2016). However, it may increase in other regions for a number of infectious diseases. (Watts N, 2021).

Climate change effects are visible on the human and natural ecosystem which is boosting the vector-borne diseases. Rising temperature triggers the agricultural pests, disease and vectors. (McDermott-Levy R, 2021). Climate change is more conducive and favorable for the spread of infectious diseases such as Lyme disease, water-borne diseases, and mosquito-borne diseases including malaria and dengue fever. (Diner RE, 2021). Climate change is one of the key factors to influence the vector-borne diseases epidemics. (Nooshin Mojahed, 2022).

1.2.2 Vulnerability of Sindh in the context of climate change effects

The projected climate-change related events are likely to affect the health system of the province whereby millions of people mainly those with the low adaptive capacity can be severely affected due to the increase prevalence of diseases and injuries due to the floods, storms, heat waves and droughts. (Sindh, 2022). The floods are predicted in future in Sindh province due to the sea rise level or increased heavy precipitation mainly in coastal areas which may cause the diarrheal and other infectious diseases which hit directly the food consumption ability of the people at wide range in the region. (Sindh, 2022).

Every year, climate change impacts are going to be worst by contributing in vector-borne viral diseases alongside other disease like malaria, in the tropics a temperature zones. The current global warming crises have direct effects on the human health due to the rising temperature which creates heat-stress and vector-born disease. (A, 2017).

The increasing water vapor and formation of ozone on the earth's surface due to the heat waves is connected with the severe health hazardous. The composition of Ozone (03) is of three oxygen atoms in the atmosphere having harmful properties if it is produced on the lower atmosphere of earth. (El-Sayed A, 2020).

1.3 Statement of the Problem

Sindh which is ancient civilization formally known as Indus Valley Civilization for centuries after the exploration, however; it has great ancient history of being a civilization which can be traced back into Mohen Jo Daro in Larkana district. It is assumed that the reason of the destruction of this great ancient civilization (Mohen Jo Daro) is said to be a climatic hits according to some views, however; no any authenticated information is yet received. According to the Sindh climate change policy (2022) document which is a sole property of government of Sindh wherein the climate of Sindh is described as "the Sindh is categorized into three climatic regions: Siro (the upper region, centered on Jacobabad), Wicholo (the middle region, centered on Hyderabad), and Lar (the lower region, centered on Karachi). The thermal equator passes through upper Sindh where the air is generally very dry. Central Sindh's temperatures are generally lower than those of upper Sindh but higher than those of lower Sindh. Dry hot days and cool nights are typical during the summer." (Sindh, 2022).

Sindh province which is second largest province in the context of population next to Punjab has been declared disaster-prone since decades due to the long series of climatic hits. The Sindh climate change policy document narrates its long drought recorded history since 1960 to the 2010 and then a series of climatic hits in the form of inundated rains and devastating floods which brought great losses to the infrastructure, life losses, economic as well as social exclusion. According to the government reports some 33 million homes are

damaged in the last 2022 floods which is irreparable loss. There is future climate change events predicted which could bring great losses to the region.

1.4 Research Objectives:

1. To understand the distribution patterns of infectious disease in rural Sindh in the past decades
2. To estimate the prevalence of infectious in rural Sindh and prevalence rate of in response to the climate change
3. To explore the variation in climate change factors effects on the transmission dynamics of infectious disease in rural Sindh

1.5 Research Questions

1. How climate change influences the distribution patterns of infectious diseases in rural Sindh over the past decade?
2. What are the most prevalent infectious diseases in rural Sindh, and the prevalence rates changed in response to climate change?
3. How variations in temperature, precipitation, and humidity affect the transmission dynamics of infectious diseases in rural Sindh?

1.6 Significance of study

Climate change is a fact of this century which has jolted the entire globe due to its severe consequences on environment and its population. Pakistan has been declared climate-sensitive region which receives series of climatic hits since couple of decades in terms of floods, heavy rains, heat waves and droughts. In the context of health matters, the region of Sindh has severed threats due to the changes in weather patterns evidently in the past decade. The 2022 heavy rains turned it in the devastated region which left 33 millions of households' shelter less with great human losses. Standing water turned to be a host for infectious disease in the region which brought majority of rural population at the brink of death. Cholera, Malaria remained top most diseases in the region which is an evident of climate change impacts. The current study was carried out employing the narrative inquiry whereby targeted populations from the areas were selected for the data collection.

The rural life in Sindh is very toughest with numerous socio-economic problems, however; climate change has fueled it more due to the changes in weather patterns whereby heat waves, unpredictable rainfall patterns have affected the population. It is highly importance to understand the dynamics of the situation from the scientific perspectives. The current study focused on the complex situation in which climate change influences the disease pattern in the region of rural Sindh, Pakistan. After analyzing how changing weather effects the population in terms of spreading the disease, it will provide the future emerging potential health threats in the region. For example, rising warmer weather conditions increase the rainfall which creates ideal breeding conditions for the disease vectors such as mosquitoes which will potentially leads to the higher rate of vector-borne disease n the region. So far, the altered precipitation pattern will affect water quality conditions leading to a rise in waterborne disease.

1.7 Limitations of the study:

The current study despite of its importance in the context of health threats for the population resided in the rural settlements has its limitations. The first thing which comes here is the data availability in the context of health based on historical level. Such inconsistent data itself is a challenge for data reliability and then its analysis to understand the relationship of climate variables and diseases dynamics. The other aspect of the limitation of the study is that the relation between climate change and the transmission of infectious disease involve multiple factors, however; the other major factors such as socio-economic conditions, healthcare facilities, and population density are also crucial factors contributing their role in spreading the infectious disease transmission. The regional variability is one of the most potential factors which make understanding that the effects of climate change vary according to the regional division. Hence; the effects of the lower region may not be same as in the central and northern region of Sindh according to the ecological settings. Hence, the findings of the one climate region cannot be directly applicable to the other region due to the

certain socio-economic and environmental conditions. Although, climate change have direct impact on the spread of infectious diseases but the current study is time-constrained which is its limitation because the climate impacts on infectious disease often unfold over extended period. So far, the long term trends and changes in weather may not be recorded in this study wherein that time period the major shifts in the spread of infectious may occur within that period. Other limitations of the study are the predictive models used for assessing the effects of climate change are also count as limitations. These predictive models heavily rely on the certain assumptions to generalize the complexity of relations between the climate variables and disease transmission. Hence, the future predictions about the disease dynamics may not bring real world outcomes. Other than this the other factors such as poor healthcare structure, inadequate disease surveillance and access issue can be count a significant which may influence the disease outcomes making it complex to assess the climate change impacts.

1.8 Research Gap:

1.8.1 Availability of Longitudinal Data:

The current study lacks longitudinal data which is major research gap in assessing the accurate climate change effects on the transmission of disease. However; there are evidences globally of the climate change impacts on disease transmission but in the context of rural Sindh the specific data on the relationship between climate change variables and diseases dynamics are limited.

1.8.2 Variance in Regional and Local Studies:

Existing studies gives broader regional level data which does not include the locally occurrences of climate change within rural Sindh. The Sindh has diverse climatic and ecological conditions across the region which brings variance in effects and impacts of the climate change events. There is acute need to have the data according to the region-wise to asses and evaluate the effects of the climate change events in the context of disease dynamics. Other than this there is need to have the interdisciplinary approach to conduct the study because the current study is specific on the climate change and health sector only which is insufficient to bring the holistic picture of the effects of climate change. There should be an interdisciplinary approach to combine the climatology, epidemiology, and social sciences to provide a holistic understanding of how climate change affects disease transmission within the regions of Sindh province of Pakistan. Socio-economic factors are major player and transmission of disease from area to area, hence; the current study lack in studying the socio-economic factors of the rural based population. The life style and behaviors of the communities determines the disease prevalence and its transmission. Public health infrastructure is also one of the key factors which can determines the relations between the climate change effects and diseases dynamics in rural areas of Sindh. Poor health infrastructure is key factor to provide the fertile ground for disease prevalence and its transmission which is evidently exiting in rural Sindh.

1.9 Research Methods:

Research methods are scientific ways or systems by which a researcher carries any kind of research. In scientific studies research methods play crucial role to maintain the sanctity of scientific inquiry which ensures the reliability and validity of that study. The present study has been undertaken employing the qualitative research approach to understand the climate change effects on distribution, prevalence and transmission dynamics of infectious diseases in rural areas of Sindh province of Pakistan. This research method is flexible and widely used in qualitative studies to understand the phenomena through peoples lived experience that had lived there in those conditions and occurrences.

1.9.1 Study Setting and Participants:

The universe of this study was northern region of Sindh province of Pakistan whereby Jacobabad, Larkana and Shikarpur were selected for the data collection. These regions are consequently very warmer and in the current conditions due to the climate change as compared to the other regions in the recorded history. Due to rising temperature, the infectious disease could frequently exist and transmit within the regions. The study participants were the main stakeholders: local affected population, healthcare providers and public health officials of these regions who have

lived experienced combating the rising climate change events. This gives a comprehensive view of the infectious disease dynamics in the regions which will be helpful for healthcare professionals and health policy makers to formulate the policies regarding the local regional level demands.

1.9.2 Data Collection Methods:

The data were collected using the in-depth interviews from the medical doctors and local residents of the regions. The local residents were interviewed in order to collect the data regarding the effects of climate change on their health, what is the common infectious disease already prevalent and how these spread. On the other hand, medical professionals were interviewed who served in these regions for longer period of time in the rural regions of the Larkana, Jacobabad and Shikarpur regions respectively.

1.9.3 Sampling:

1.9.3.1 Purposive Sampling

The present study was carried out using the purposive sampling which is non-probability sampling. This type of sampling is flexible and best fit for data collection from the targeted research participants. This sampling require those participants who have had lived experiences of the occurrences of phenomenon of interest.

1.9.3.2 Sampling Size

08 medical health professionals mainly the medical doctors were selected from in-depth interviews from three districts declared warmer in the summer seasons that have had lived experiences of the occurrences. Other than this, 10 local inhabitants of those regions were selected for the in-depth interviews to collect the data regarding the research topic.

1.9.4 Data Analysis

Thematic analysis (TA) provides an opportunity to researcher to see inside the story shared by the interview participants through understanding the patterns for meaning which will obvious for theme development from data sets to address the research and research problems. These themes make a sense to understand the meanings of shared experiences of the research participants.

It is mandatory for a researcher to develop the themes which answer the research questions related to the research topic specifically. In data analysis process, researcher brings the answers of the research questions. (Clark, 2012). **The data were analyzed using the thematic analysis, a qualitative method to identify and to interpret the patterns and themes within the data. This will give a real time analysis about the effects of climate change** on the distribution, prevalence and transmission dynamics of infectious diseases in rural Sindh".

All data were then stored into the computer software program for interpretation. The data were coded to created categories for theme development. The three major categories were created for theme development according to the study demand.

1.10 Findings of the Study

Present the findings of the study related to the effects of climate change on the distribution, prevalence, and transmission dynamics of infectious diseases in rural Sindh.

Research Objectives

1. To understand the distribution patterns of infectious disease in rural Sindh in the past decades

Research Questions

1. How climate change influences the distribution patterns of infectious diseases in rural Sindh over the past decade?

MAJOR THEMES OF THE STUDY

S#	Category	Major Theme	Frequency Rate of the Each Theme
1	Infectious Disease Distribution	1. **(A) Climate Variability and Disease Patterns in Rural Sindh** (B)Distribution of Infectious Diseases in the Rural Sindh	90%
2	Prevalence of Infectious Disease	2. **Prevalence of Infectious Disease and its Effects in the Region**	86%
3	Transmission Dynamics of Infectious Disease	3. Infectious Disease Transmission Dynamics in the Rural Sindh	84%

CATEGORY: 01
Infectious Disease Distribution
THEME 01. (A):
Climate Variability and Disease Patterns in Rural Sindh:
This theme describes the climate change patterns in rural Sindh mainly the northern part of Sindh which is continually faces the devastating effects of the climate change. This theme explores the changing weather patterns that how climate change affects the alternation in weather events such as rainfall , heat waves and how these extreme weather events affects the infectious diseases distribution and transmission dynamics in the rural region of Sindh. The theme describes the seasonal patterns and their correlation with the disease outbreak in the region. Other than this the theme explores that how climate change contributes to the emergence of new infectious diseases and reemergence of previously controlled disease in the rural region of Sindh.

Changing weather patterns in the rural region of Sindh
Temperature Fluctuations
The study investigated how variations in temperature—both increases in average temperatures and extreme temperature events—affect the lifecycle and behavior of disease vectors and the conditions conducive to disease transmission. Warmer temperatures can lead to extended transmission seasons for vector-borne diseases, such as malaria and dengue fever, by enhancing the reproductive rates of mosquitoes in the region at rapid speed.

Precipitation and Humidity Level
Changes patterns in precipitation, including increased rainfall and droughts were recorded for their impact on disease transmission in the region. Increased rainfall can create breeding and fertile grounds for vectors and lead to waterborne diseases, however; droughts may worsen issues related to water scarcity and sanitation, impacting health outcomes.

1. **Seasonal Variability and Disease Dynamics:**

Seasonal Shifts:
The theme describes has how shifting seasons due to climate variability affect the timing and intensity of disease outbreaks. For instance, altered rainfall patterns might shift the peak seasons of vector-borne diseases, leading to unexpected outbreaks during atypical times of the year. Seasonal changes can also affect ecosystems and habitats that are crucial for disease vectors and reservoirs. Understanding how these changes influence ecological balance and, consequently, disease dynamics is vital for predicting future trends.

2. **Re-emergence of Diseases in the Region**

New Disease Patterns: This study has investigated focusing on how climate change leads to the emergence of new infectious diseases in rural Sindh. Changes in climate create new environmental niches that allow previously non-endemic diseases to establish themselves in the region.

Re-emergence of Old Diseases

Similarly, the research will examine how climate variability might contribute to the resurgence of diseases that were once controlled or less prevalent. Factors such as altered vector habitats and disrupted control measures can lead to the re-emergence of diseases.

Excerpts from the interview transcripts in support of themes

"I have been serving in Jacobabad district in remote are at rural health center (RHC) since last 5 years. To me, climate change no doubt has direct effects on the disease pattern but there are other certain factors such as the living style of the population or in other words socio-economic conditions of the population are greatly contributing factors in making the fertile grounds for infectious disease."(Medical Doctor).

"Poor health infrastructure of the health centers and poor living conditions of the population of these areas are key player in spreading the infectious diseases. People are affected due to the poor hygienic conditions, malnutrition are major influencers in making fertile grounds for the pathogens."(Medical Doctor).

"We are uneducated but can understand the disease patterns whereby we receive germs. Contaminated water we use which is obviously making us ill and sick and when we the poor people cannot afford to receive the proper treatment then it bring us at the brink of death."(Case 1).

"I have old memories of heavy rains and floods which were causing various diseases in our villages due to the long time standing water in our homes and surroundings. Such standing water was the major source of disease and mosquitoes which cause malarial outbreak in the villages and we being poor could not afford to treat timely." (Case 2).

"When I was around 15 or 16 year, I am well remembered the heavy rain which made vulnerable us all at that time even we left the village and went to nearby village. When we returned after few days to our native village the standing water was contaminated which brought malaria and other diseases. Then medical camps were installed in nearby village to diagnose and for treatment." (Case 7).

Description of Theme 01.(B)

Distribution of Infectious Diseases in the Rural Sindh

This theme describes the distribution of infectious disease how the climate and environmental changes are affected by the climate change geographical spread and prevalence of various infectious diseases in the warmer regions of rural Sindh. This theme further narrates the regional distribution of infectious disease by its unique ecological and other socio-economic and cultural conditions of the region.

Vector-borne Diseases: Climate change has direct impact on the distribution of vector-borne diseases in rural Sindh by shifting the habitats and patterns of disease vectors such as mosquitoes and ticks. Rising temperature and changing in precipitation are conducive for the vectors mainly in expanding the geographical rang in the region. For example, the warmer weather conditions an increased humidity has higher chances of malarial and dengue fever outbreak in the region.

Waterborne Diseases

Water quality of the area plays key role in water-borne disease in rural Sindh which is causing due to the climate change. Alteration in precipitation patterns and increased flooding and prolonged dry spells contaminate the water quality. This condition is conducive for the spreading of infectious diseases such as typhoid, hepatitis and cholera. Flooded water mainly results in the overflow of contaminated water into the potable sources potentially support the disease transmission in the affected regions. Other diseases such as respiratory and gastrointestinal infections are result of the environmental changes in the rural Sindh. Temperature variance and humidity have direct effects on the prevalence of these diseases by impacting the air quality and the presence of pathogens. For example rising temperature increases the heat related illness and

other disease. The distribution of infectious diseases is influenced by the geographical and socioeconomic factors such as population density, infrastructure and healthcare systems. Inadequate health infrastructure could make those areas more vulnerable due to the infectious disease outbreak.

"The rural Sindh is really disaster-prone where public health is a real time threat for the huge population even though scattered in the region but it at stake due to the rapid distribution of infectious diseases."(Medical Doctor)

"We know but don't have resources to take care of ourselves mainly because Jacobabad has contaminated water which drag us to the illness. "(Case 02)

"In Pakistan equality is a daydream because for rich there are separate education system and health facilities and for poor people there is a separate system. We are desperate having observed such hypocritical attitudes of the government towards rural population."(Case 03)

"Major population in the rural areas less interested in personal hygiene and this is not because they don't want to be healthy rather it is their socio-economic conditions which compel them to live up such a life style which is a breeding ground for many infectious disease. (Medical Doctor).

Category 02
Prevalence of Infectious Disease
THEME 02
Prevalence of Infectious Disease and its Effects in the Region

This theme describes that how climate change affects the frequency and distribution of infectious disease in rural Sindh through analyzing the recorded historical data and current available data in order to identify the trends and future patterns. The themes further explains that how shifts in climate variables correlate with the changes in disease prevalence and incident rate in the region. In this record , historical data supports in understanding that how weather patterns have changes time to time in this region due to the climate change in disease prevalence.

The warmer weather patterns are key player in infectious disease prevalence in these regions. Changing rainfall, rising temperature correlates with the prevalence of vector-borne disease like malaria, dengue and also it triggers in prevalence of waterborne disease like cholera and typhoid.

By examining current data, this theme assesses recent trends in disease occurrence, highlighting areas with emerging outbreaks or shifting disease burdens. Projections based on climate models help anticipate future changes in disease patterns, allowing for the identification of potential hotspots and the development of proactive public health strategies. This comprehensive analysis of prevalence and incidence trends underscores the dynamic relationship between climate change and infectious diseases, emphasizing the need for adaptive measures to manage and mitigate future health impacts in rural Sindh. This theme further elaborates by the assessment of recent trends in disease occurrences of the areas with emerging outbreaks and shifting disease burden. The climate models support in future prediction of disease patterns allow to identify the potential development of proactive public health strategies in the region.

" I have been doing my job here in this region since last decade , I took chance to conduct the health awareness seminars and sessions within the rural communities but such programs also couldn't bring any fruitful results. This is because majority of rural population seek and engaged in their routine activities of earning to feed their families which is hard for them in this era of high inflation." (Medical Doctor).

"Prevalence of infectious disease is correlated with the environmental condition of those regions where warmer temperature fit for the pathogens." (Medical Doctor).

"My observations about the prevalence of infectious in the region of Larkana are this that climate change has greatly contributing the spread and prevalence of infectious disease in the region." (Medical Doctor).

"Contaminated water which is already there in that condition but the climate change has also triggered it further to be more worsening for drinking. Jacobabad is recorded a warmer temperature in this season which has jolted the local life style of people due to the warmer temperature." (Medical Doctor).

"Warmer weather has greatly supported the prevalence of infectious disease in the region but another aspect of its prevalence should be considered as major contributor which is the life

style of local population of rural area which is unhygienic where the children and elders used open defecation." (Medical Doctor).

Category 03
Transmission Dynamics of Infectious Disease in Rural Sindh
Theme 03
Infectious Disease Transmission Dynamics in the Rural Sindh

This theme discusses that how infectious diseases transmit in the region. Rural Sindh is climate-vulnerable region of the Pakistan which has been receiving constant climatic hits. In the context of infectious disease transmission dynamics, climate change has direct effects in the region due to the changes in weather pattern, shifting in precipitation patterns and increased frequency of weather events. Rising temperatures in the region are expanding grounds for the habitat and increase activity of vectors like mosquitoes are higher transmission rates of vector-borne diseases of malaria and dengue. Precipitation changes and flooding water are fertile grounds for the water contamination resources influencing the spread of water borne disease like cholera and typhoid. Due to the disease spread people may prefer migration which also affects the disease transmission patterns in the region.

This theme help us making sense of how changes in pathogen viability and survival, supported by the environmental factors, impact transmission rates. The data on climate variables, vector ecology, pathogen behavior, and human exposure patterns, the theme supports in understanding that climate change modifies the transmission dynamics of infectious diseases, highlighting the need for adaptive public health strategies to address evolving challenges in rural Sindh to prevent further climate change losses.

"Changing weather is definitely contributing in disease transmission from region to region due to the shifting in precipitation and other weather events." (Medical Doctor).

"We do not have proper sanitation facilities in our village, therefore' we mostly face disease attacks of various kinds. We the people of rural areas entirely depend on the agriculture fields or livestock and if both fail then we move to the nearest urban belts in the search of earnings. Disease burden is obvious there due to the unavailable sanitation systems".(Case 4).

1.111 Discussion:

Climate change is a threat visible to all over the world population whereby almost all countries have been receiving climatic hits. Pakistan due to its poor infrastructure in housing (urban settlements) and rural settings including substandard irrigation systems always brings heavy losses for the country. In future natural disasters are inevitable in Pakistan according to the studies which are a clear indicator that there is worst to come if government and policy makers come forward to take serious steps to combat the future gigantic climatic devastations. The current study was a qualitative in nature to make sense of the lived experiences of the health professionals and local affected population about how climate change has geared up the health severity in their regions.

This is fact according to the numerous studies that Sindh province is vital ground for the natural disasters where it can hit severely as previous recorded events are there on record which shows that poor planning in every department by the government has brought this land at the verge of devastation. In the context of health problems rural Sindh is highly sensitive regions among other regions of Pakistan which is at stake due to the health threats. More than 60% population is settled in rural areas where poor health infrastructure, understaffing and other medical facilities are unavailable that is clear sign of government apathy to the rural settings. Climate change affects directly the prevalence, distribution of the infectious disease in the warmer regions.

1.12 Conclusion

Climate change is one the greatest concerns of the world which has geared up the health threats mainly to those regions of the world that comes in the line of natural disasters. Health is one of the sensitive components of human societies which need proper attention by the politicians, policymakers on health systems and implementing agents. Climate change has negative effects on the human life at all which are great concerns of the health professionals. Rural population is suffering greatly due to the

prevalence of infectious disease in the regions where water is contaminated which produce water-borne disease. Changing weather patterns are breeding grounds for infectious disease in the warmer regions of Sindh province of Pakistan where proper health consciousness is required to handle the matter. The current study with its certain limitations is key player in forecasting the future diseases patterns in the warmer regions of Sindh and other provinces of Pakistan.

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