

Mini Review

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Influence of rising temperatures and heat waves on mental health outcomes: An alarming public health concern

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Abstract

Background: An accumulating body of research studies have presented effects of climate change on human health. The current state of climate change supports the notion of elevated incidences of heat waves in future. The understanding of role of increasing temperatures and heat waves on altered mental health conditions stands crucial, in light of wide spectrum of effects warming climate imparts on mental health and well-being status. **Methodology:** Research studies with findings related to increasing temperatures, mental health and behavioural alterations, and psychopathological outcomes are highlighted in this review. Articles were searched using Google Scholar from the year 2005 to 2018 by entering keywords; increasing temperature and mental health, heat waves and mental health, heat waves and behavioural disorders, climate change and mental health, and, global warming and mental health. Studies were also selected from reference lists of the articles emerging out from these keywords provided. Newspaper articles and reports with details of heat waves in Pakistan are also included. **Results:** Extreme heat exposure event is found to result in adverse mental, mood and behavioural consequences; including anxiety, aggression, and violence. Heat waves are found to potentiate risk for hospital admission, also due to mental disorders. Heat-associated mental health alterations may be attributed to compromised thermoregulation, pre-existing mental illness, old age, substance abuse and prescription medications effects, and up-regulation in release of stress hormones. **Conclusion:** Keeping in view the impact of warming climate on mental and behavioural disorders, it appears significantly important to promote research aiming to decipher heat-induced mental health outcomes. In particular, studies are encouraged to be carried out to understand effects of increasing temperatures and heat waves on impaired mental health and psychological well-being state, develop heat-associated mental health mass awareness campaigns, and plan mental health response actions in Pakistan, which currently remain under-represented.

Keywords

Climate Change, Global Warming, Increasing Temperatures, Heat Waves, Mental Health, Behavioural Disorders

Introduction

Several studies have reported influence of climate change on human health (Manning & Clayton, 2018), which is found to play role in disease outbreaks/emergence, poor air quality generation, climate driven disasters enhancement, food insecurity state development, and physical and mental health impairment/alterations (Watts et al.,

2015; McMichael & Lindgren, 2011). Average temperature around the world is considered to be increasing (Hartmann et al., 2013), and the current state of climate change supports the notion of elevated incidences of heat waves in the future (McMichael et al., 2006). Moreover, a recent study has presented that there will be an increase in world's population (48% or



74% versus 30% presently) experiencing severe heat situations ranging over 20 days per year as we move towards end of the century (Mora et al., 2017). The state of elevated temperatures are known to influence physical health, as well as mental health (Padhy et al., 2015).

Increasing temperatures, heat waves and mental health outcomes

Research studies suggest role of increasing temperatures with adverse mental health outcomes (Hsiang et al., 2013). Rising temperatures are found related to elevated interpersonal aggression and interpersonal violence (Hsiang et al., 2013).

Studies have presented relation between increasing temperatures and rise in hospital admissions for mental, mood and behavioural disorders (Trang et al., 2016), due to symptomatic mental disorders, dementia, mood disorders, stress-associated disorders, somatoform disorders, psychological development disorders, schizophrenia, mania, neurotic disorders, self-injury, and intentional injury ((Basu et al., 2017; Wang & Horton, 2015; Chand & Murthy, 2008; Hansen et al., 2008). Heat waves are found to potentiate risk for hospital admission due to mental disorders especially among elderly individuals (senility), men and people from rural communities (Trang et al., 2016; Hansen et al., 2008).

Moreover, a rise in symptomatic illnesses, mental retardation, drug abuse and lowered response of helping behaviour during event of increasing temperatures was observed (Belkin & Kouchaki, 2017; Trang et al., 2016; Antonio Bulbena, 2006).

High temperatures are found to elevate aggression, suicide risk, anxiety, dementia, schizophrenia and depression (Lee et al., 2018; Padhy et al., 2015). Heat-associated mental health consequences may be attributed to altered thermoregulation (Cusack et al., 2011), pre-existing mental illness condition, old age, effects of

substance abuse, prescription medications and upregulation in release of stress hormones (Lee et al., 2018; Dodgen et al., 2016; Simister & Cooper, 2005).

Increasing temperatures and heat waves in Pakistan

With an increase in temperature which is a manifestation of climate change due to global warming (Hartmann et al., 2013), it is expected that heat waves will emerge out more in different parts of the world, including Pakistan (Zahid & Rasul, 2012). In Mohenjo-Daro, Sindh on May 26, 2010, temperature of 53.5 °C (128.3 °F) was recorded (The Guardian, 2010). During June 17-24, 2015, heat wave led to death of over 1200 people in Karachi and during this heat wave period, on June 20, 2015 maximum temperature of 44.8 °C (112.64 °F) was recorded (Chaudhry et al., 2015). In May and June 2018, Pakistan experienced heat wave, which took lives of around 65 people, and temperature of 48.5 °C (119.3 °F) was recorded in Larkana district (Guriro, 2018).

Increasing temperatures, heat waves and, vulnerable populations

Although climate change transduces its effects on everyone, but certain populations remain more susceptible to the impacts of warming climate (Habibi et al., 2016), which highlights potential elevated heat-associated morbidity and mortality especially in these vulnerable populations (Bi et al., 2011). Studies have presented that interaction with severe heat imparts negative effects on health state of mentally ill individuals, elderly population, children, men, indigenous populations, overweight individuals, individuals with low socioeconomic status, and people who are engaged in physical activities during period of heat exposure (Habibi et al., 2016; Li et al., 2015; Ford, 2012; Bi et al., 2011; Khalaj et al., 2010). Moreover, studies have also found relation between demographic



changes and susceptibility to influence of climate change (Dodgen et al., 2016).

Studies have shown that people with chronic diseases (Li et al., 2015), nervous system disease, circulatory system disease, respiratory system disease, neoplasms and renal disease (Khalaj et al., 2010) are susceptible to impact of rising temperatures and heat exposure. These illnesses may pave way to lowered adaptive capability of body to cope with alterations in the

environment and thus impair maintenance of core temperature of the body during warm milieu (Kenny et al., 2010). Studies have shown that mental health of individuals from marginalized communities is more prone to influence of climate change (Manning & Clayton, 2018). Also, mental health of indigenous populations and women is presented to be susceptible to the climate change effects (Manning & Clayton, 2018).

Table 1: Summary of altered mental and behavioural outcomes due to increased temperature/heat exposure/heat waves

Mental and Behavioural Outcomes	Reference(s)
Aggression	(Padhy et al., 2015)
Anxiety	(Lee et al., 2018)
Dementia	(Lee et al., 2018; Hansen et al., 2008)
Depression	(Lee et al., 2018)
Drug abuse	(Antonio Bulbena, 2006)
Intentional injury	(Basu et al., 2017)
Interpersonal aggression	(Hsiang et al., 2013)
Interpersonal violence	(Carleton & Hsiang, 2016; Hsiang et al., 2013)
Low helping behaviour	(Belkin & Kouchaki, 2017)
Mania	(Wang & Horton, 2015; Chand & Murthy, 2008)
Mental retardation	(Trang et al., 2016)
Mood disorders	(Hansen et al., 2008)
Neurotic disorders	(Wang & Horton, 2015; Chand & Murthy, 2008; Hansen et al., 2008)
Psychological development disorders	(Hansen et al., 2008)
Schizophrenia	(Lee et al., 2018; Wang & Horton, 2015; Chand & Murthy, 2008)

Self-injury/Suicide	(Thompson et al., 2018; Basu et al., 2017; Padhy et al., 2015; Lin et al., 2008)
Somatoform disorders	(Hansen et al., 2008)
Stress-associated disorders	(Hansen et al., 2008)
Symptomatic mental disorders	(Hansen et al., 2008)
Violence	(Carleton & Hsiang, 2016; Hsiang et al., 2013)

Recommendations

Rising temperatures and heat waves pose a substantial negative influence on human health (Campbell et al., 2018) and in view of this mass awareness campaigns planning and implementation, health facilities access enhancement, and heat waves-related early warning schemes development are suggested (Bakhsh et al., 2018; Li et al., 2015).

The current gaps in knowledge regarding high temperatures influence on mental health (Thompson et al., 2018) should be filled by carrying out studies that uncover rising temperatures impact on psychological, mental and behavioural outcomes, to contribute to better understanding of their association and help strategize concrete plans for tackling mental health burden in face of predicted increase in heat waves in the future. Moreover, efforts should be made to uncover role of elevating temperatures and heat waves on mental health outcomes of vulnerable populations (Bi et al., 2011).

Conclusion

Increasing temperatures which is a phenomenon of climate change presents threat to physical, as well as mental health. Keeping in view the effects of warming climate on mental health outcomes, it stands important to promote research aiming to decipher environmental heat-induced mental health alterations, to further contribute to build mental health response plans, and reduce heat mediated mental illness-related morbidity and mortality.

Studies are encouraged to be carried out to understand heat induced effects on mental health and psychological well-being, in Pakistan.

Conflict of Interest

None.

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References

- Antonio Bulbena, L. S., Jordi Cunillera. (2006). Psychiatric effects of heat waves. *Psychiatric Services*, 57(10), 15.
- Bakhsh, K., Rauf, S., & Zulfiqar, F. (2018). Adaptation strategies for minimizing heat wave induced morbidity and its determinants. *Sustainable Cities and Society*, 41, 95-103.
- Basu, R., Gavin, L., Pearson, D., Ebisu, K., & Malig, B. (2017). Examining the Association Between Apparent Temperature and Mental Health-Related Emergency Room Visits in California. *American journal of epidemiology*, 187(4), 726-735.
- Belkin, L. Y., & Kouchaki, M. (2017). Too hot to help! Exploring the impact of ambient temperature on helping. *European Journal of Social Psychology*, 47(5), 525-538.



- Bi, P., Williams, S., Loughnan, M., Lloyd, G., Hansen, A., Kjellstrom, T., Dear, K., & Saniotis, A. (2011). The effects of extreme heat on human mortality and morbidity in Australia: implications for public health. *Asia Pacific Journal of Public Health*, 23(2_suppl), 27S-36S.
- Campbell, S., Remenyi, T. A., White, C. J., & Johnston, F. H. (2018). Heatwave and health impact research: A global review. *Health & place*, 53, 210-218.
- Carleton, T. A., & Hsiang, S. M. (2016). Social and economic impacts of climate. *Science*, 353(6304), aad9837.
- Chand, P. K., & Murthy, P. (2008). Climate change and mental health. Paper presented at the Regional Health Forum.
- Chaudhry, Q. Z., Rasul, G., Kamal, A., Ahmad Mangrio, M., & Mahmood, S. (2015). Technical report on Karachi heat wave June 2015. Government of Pakistan Ministry of Climate Change, Ministry of Climate Change, Pakistan. Retrieved from: <http://www.ndma.gov.pk/files/heatwave.pdf>
- Cusack, L., de Crespigny, C., & Athanasos, P. (2011). Heatwaves and their impact on people with alcohol, drug and mental health conditions: a discussion paper on clinical practice considerations. *Journal of advanced nursing*, 67(4), 915-922.
- Dodgen, D., Donato, D., Kelly, N., La Greca, A., Morganstein, J., Reser, J., Ruzek, J., Schweitzer, S., Shimamoto, M., & Tart, K. T. (2016). Ch. 8: Mental health and well-being: US Global Change Research Program, Washington, DC.
- Ford, J. D. (2012). Indigenous health and climate change. *American journal of public health*, 102(7), 1260-1266.
- Guriro, A. (2018). Another 3-day heatwave to hit Karachi from Tuesday: PMD, Daily Times.
- Habibi, P., Momeni, R., & Dehghan, H. (2016). The effect of body weight on heat strain indices in hot and dry climatic conditions. *Jundishapur journal of health sciences (Inpres)*.
- Hansen, A., Bi, P., Nitschke, M., Ryan, P., Pisaniello, D., & Tucker, G. (2008). The effect of heat waves on mental health in a temperate Australian city. *Environmental health perspectives*, 116(10), 1369.
- Hartmann, D., Klein Tank, A., Rusticucci, M., & Alexander, L. (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. S., Charabi, Y., Dentener, FJ, Dlugokencky, EJ, Easterling, DR, Kaplan, A., Soden, BJ, Thorne, PW, Wild, M., and Zhai, PM.
- Hsiang, S. M., Burke, M., & Miguel, E. (2013). Quantifying the influence of climate on human conflict. *Science*, 341(6151), 1235367.
- Kenny, G. P., Yardley, J., Brown, C., Sigal, R. J., & Jay, O. (2010). Heat stress in older individuals and patients with common chronic diseases. *Canadian Medical Association Journal*, 182(10), 1053-1060.
- Khalaj, B., Lloyd, G., Sheppard, V., & Dear, K. (2010). The health impacts of heat waves in five regions of New South Wales, Australia: a case-only analysis. *International archives of occupational and environmental health*, 83(7), 833-842.
- Lee, S., Lee, H., Myung, W., Kim, E. J., & Kim, H. (2018). Mental disease-related emergency admissions attributable to hot temperatures. *Science of The Total Environment*, 616, 688-694.

- Li, M., Gu, S., Bi, P., Yang, J., & Liu, Q. (2015). Heat waves and morbidity: current knowledge and further direction-a comprehensive literature review. *International journal of environmental research and public health*, 12(5), 5256-5283.
- Manning, C., & Clayton, S. (2018). Threats to mental health and wellbeing associated with climate change *Psychology and Climate Change* (pp. 217-244): Elsevier.
- McMichael, A. J., & Lindgren, E. (2011). Climate change: present and future risks to health, and necessary responses. *Journal of internal medicine*, 270(5), 401-413.
- McMichael, A. J., Woodruff, R. E., & Hales, S. (2006). Climate change and human health: present and future risks. *The Lancet*, 367(9513), 859-869.
- Mora, C., Dousset, B., Caldwell, I. R., Powell, F. E., Geronimo, R. C., Bielecki, C. R., Counsell, C. W., Dietrich, B. S., Johnston, E. T., & Louis, L. V. (2017). Global risk of deadly heat. *Nature Climate Change*, 7(7), 501.
- Padhy, S. K., Sarkar, S., Panigrahi, M., & Paul, S. (2015). Mental health effects of climate change. *Indian journal of occupational and environmental medicine*, 19(1), 3.
- Simister, J., & Cooper, C. (2005). Thermal stress in the USA: effects on violence and on employee behaviour. *Stress and Health: Journal of the International Society for the Investigation of Stress*, 21(1), 3-15.
- Temperatures reach record high in Pakistan. (2010). *The Guardian*. Retrieved from: <https://www.theguardian.com/world/2010/jun/01/pakistan-record-temperatures-heatwave>.
- Thompson, R., Hornigold, R., Page, L., & Waite, T. (2018). Associations between high ambient temperatures and heat waves with mental health outcomes: a systematic review. *Public health*, 161, 171-191.
- Trang, P. M., Rocklöv, J., Giang, K. B., Kullgren, G., & Nilsson, M. (2016). Heatwaves and hospital admissions for mental disorders in northern Vietnam. *PloS one*, 11(5), e0155609.
- Wang, H., & Horton, R. (2015). Tackling climate change: the greatest opportunity for global health. *The Lancet*, 386(10006), 1798-1799.
- Watts, N., Adger, W. N., Agnolucci, P., Blackstock, J., Byass, P., Cai, W., Chaytor, S., Colbourn, T., Collins, M., & Cooper, A. (2015). Health and climate change: policy responses to protect public health. *The Lancet*, 386(10006), 1861-1914.
- Zahid, M., & Rasul, G. (2012). Changing trends of thermal extremes in Pakistan. *Climatic change*, 113(3-4), 883-896.