



Knowledge and awareness about high temperature increase the cardiovascular mortality rate

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ABSTRACT

The relation between climatic changes and health is the major concern in the healthcare system; cardiovascular diseases are the leading causes of death worldwide. Both extreme hot and cold temperature can cause deaths associated with cardiovascular diseases. The aim of this study is to analyse the awareness and knowledge on the effect of extreme or high temperature in increased heart-related death rate. A survey with a set of 10 questions was prepared. The questions were administered to 100 participants through google docs by sharing the link. The questionnaire consists of questions related to temperature and heart-related death rate. The study populations were dental students. Majority of the population (i.e.) 91% of the students are aware, and 18% of them aren't aware about the effect of temperature on heart-related deaths. When gender was compared with awareness on extreme or high temperatures in CVD mortality rate, and it was not statistically significant. Hence females were more aware that extreme temperature increases CVD mortality rate than male. Extreme heat and cold temperature have been associated with a higher mortality rate in cardiovascular diseases and conditions like strokes and dysrhythmia. Cardiovascular disease is already the deadliest medical condition and mortality rate related to cardiovascular disorders may triple in extreme heat environments.



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INTRODUCTION

The relationship between climatic changes and health is a significant concern in the healthcare sys-

tem (Cheng *et al.*, 2014). Among the reasons for the deterioration of health and mortality, cardiovascular disease is the leading cause of death worldwide. About 32% of death in women and 27% of death in men worldwide are caused by the impact of climatic conditions combined with cardiovascular diseases. Studies have been found that prolonged extreme heat or cold events, increased mortality and morbidity worldwide due to cardiovascular diseases, respiratory diseases and renal diseases. Myocardial infarction is a cardiovascular disorder. Stem cell therapy, thrombolytic therapy and coronary angioplasty can be used as a treatment for acute myocardial infarction (Renuka and Sethu, 2015). Obesity may increase one's risk for the cardiovascular disorder (Fathima and Preetha, 2016; Baheerati and Devi, 2018; David *et al.*, 2019). Hot

temperature exposure causes physiological changes in the people, like an increase in cholesterol level in the serum (Lin *et al.*, 2011). Heatwaves are attributed to increased mortality rates in patients with cardiovascular conditions and cerebrovascular disorders (Knowlton *et al.*, 2009). Whereas the low-temperature results in stress in the cardiovascular system, which leads to fluctuation of plasma fluid and haematological changes, vasoconstriction, loss of plasma fluid and arterial thrombosis (Keatinge, 1997). Numerous studies have reported increased mortality risk with the variation of daily ambient temperature variation and mortality in cardiovascular patients is characterized by a U or V or J shaped curve (Mcmichael *et al.*, 2008). Time series analysis with long linear regression data analytics shows that there is an association between various levels of temperature and mortality (Curriero, 2002). The commonly used models for mortality by the temperature at given lag consist of polynomial and natural cubic spline curves, combined with the simple linear threshold model. This consists of a linear relationship for temperature below and above threshold and a flat middle section (Armstrong, 2006). The temperature impact and mortality rate varies with population and local geographic to climatic changes in their geographics conditions are different (Gasparrini and Armstrong, 2010). For example, extreme outdoor temperature causes 70,000 deaths in Europe (Ballester *et al.*, 2011) and heat waves and cold spells cause about 1,40,000 deaths in China (Zhou *et al.*, 2014). Extreme Ambient temperature may affect sleep (Ilankizhai and Devi, 2016). Oropharyngeal exercises may reduce snoring while sleeping. (Shruthi and Preetha, 2018). The temperature has an effect on recovery for neonatal jaundice (Harsha *et al.*, 2015).

Previous studies on the effect of the hot temperature and heat waves on cardiovascular morbidity on the human population present a given picture. Within society, the population structure is changing and the percentage of elderly increases due to increased longevity. The extreme heatwaves are predicted to increase in number, and this increases cardiovascular disease-related mortality due to heat in elderly (Orru *et al.*, 2011). The low temperature and high-temperature conditions influence acute myocardial infarction in the general population (Bhaskaran *et al.*, 2009). Studies also showed that cities with a Mediterranean type of climate are susceptible to higher mortality rate due to high temperature, since they are located biographical +hot - spots and undergo some of the strongest effects of changing climate (Paz *et al.*, 2016). In Taiwan, an average ambient temperature

is observed to have influenced cardiovascular diseases (Goldberg *et al.*, 2011). In a Europe based study on the hot and cold temperature effect on mortality indicated that cold temperature effects persisted at legs up to 23 days (Analitis *et al.*, 2008). It is also observed that the majority of death happens due to heatwave effects on the pre-existing cardiovascular disease individuals (Global Change Research Program, 2018). Heatwaves effects which appear due to short time cold spells persisting up to 2 months (Chan *et al.*, 2012). Harmful effects of cold and heat are strongly apparent in CVD's (Yang, 2014). New research on global warming reveals an increasing ambient temperature and its heart-related effect, which is important in public health perspective (Turner *et al.*, 2012). Effect of temperature is based on individual, social, economic and geographic grid factors, and it is different, the heat conditions have a different effect on poor and elderly with medical conditions. Those who are living in big cities are considered vulnerable (Ng *et al.*, 2014). Relationship between mortality and temperature is also dependent on latitude, as per some studies carried out in areas of different latitude (Pascal *et al.*, 2009). A study conducted in Brisbane, Australia showed that the lagged effect on patients with cardiovascular diseases lasted longer for cold temperatures but was shortened for hot temperatures (Yu *et al.*, 2011). Temperature changes may also cause respiratory disorders. Around 300 million people worldwide are affected by asthma (Dave and Preetha, 2016; Renuka and Sethu, 2015). Expiratory rate of children is less than an average person (Timothy *et al.*, 2019). The main aim of this study is to analyse the awareness and knowledge on the effect of extreme or high temperature in increased heart-related death rate.

MATERIALS AND METHODS

Study setting

The pros of this survey are easy and quick to create, and it helps to gather large and significant data. The cons of this survey are the wrong question, or the close nature of the question may lead to inaccurate data. The sampling from this survey is about 100.

Sampling

The sampling method is simple random sampling. The measures that have been taken to minimise sampling bias are survey software participants are randomly selected and avoid asking irrelevant questions. Internal validity depends on the independent variable. External validity is to justify results. A questionnaire with ten questions were prepared and circulated.

Data analysis

Data was collected and analysed using SPSS statistics 19. Descriptive statistic was used to create piecharts representing each variable. The independent variables are skin tone, gender, attitude, personality. The dependent variables are temperature, age, cardiovascular diseases. The type of analysis used here is descriptive analysis.

RESULTS AND DISCUSSION

The survey was conducted among a small scale population. The results were statistically analysed and studied. When asked about the knowledge and awareness on the effect of extreme or high temperature in increased heart-related death rate 58.10% were aware that both extreme temperatures (i.e) hot and cold temperatures could cause death associated with cardiovascular disease whereas 15.25% were not aware of this fact and 26.67% weren't sure about that (Figure 3). When asked about the temperature changes and health-related death rates, the majority of the population (i.e) 91% accepted that it has an effect in health, but 18% fails to accept.

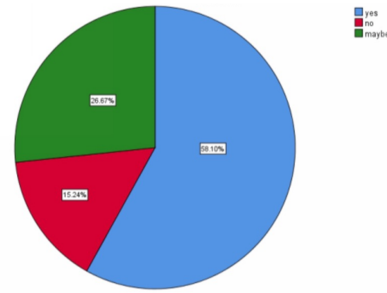


Figure 3: Awareness of the effect of extreme temperature in the cardiovascular mortality rate

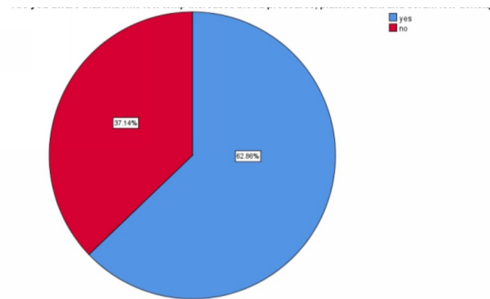


Figure 4: Effect of extremely low temperatures. The majority (62.86%, blue) were aware, but few (37.34%, red) were not aware

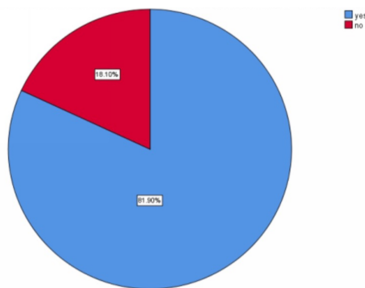


Figure 1: Awareness of the effect of climatic change on health as a significant concern in the healthcare system

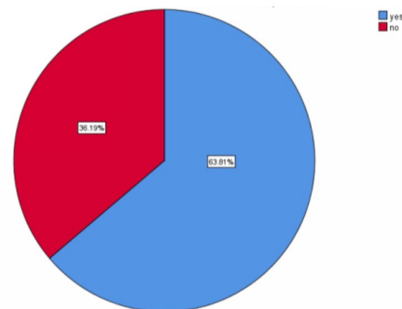


Figure 5: Awareness of mortality rate in optimal temperature

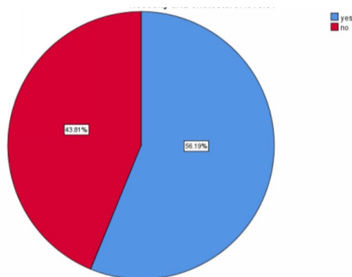


Figure 2: Knowledge of physiological changes caused due to increased temperature

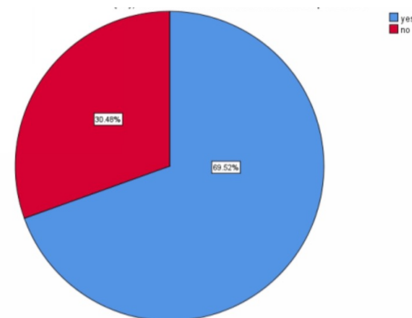


Figure 6: Awareness of the association between increased temperature and cardiovascular disorders

On the question of awareness on the effect of temperature on health, 81.90% of the population were aware, whereas 18.10% weren't (Figure 1). The majority (81.90%, blue) were aware, and few

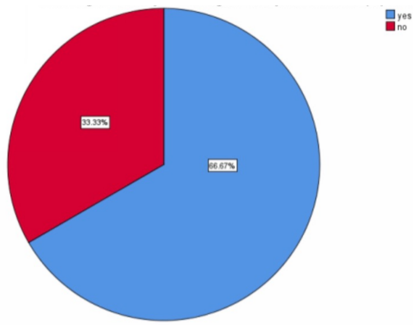


Figure 7: Awareness of the relationship between ambient temperature, air pollution and mortality among the elderly

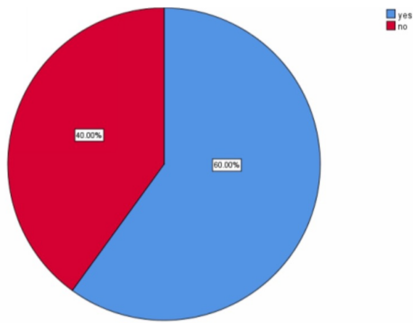


Figure 8: Vulnerability of cardiovascular mortality in traditional hot regions

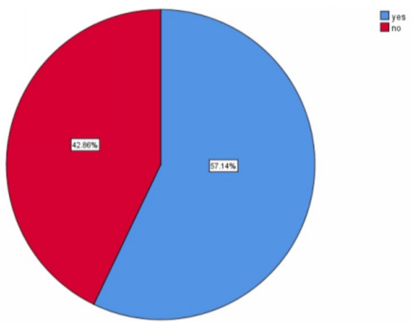


Figure 9: Awareness of the effect of extreme heat on the body and increased cardiovascular mortality rate

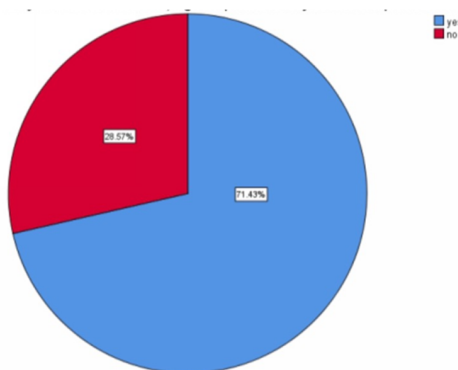


Figure 10: Awareness of extreme or high temperatures in CVD mortality rate

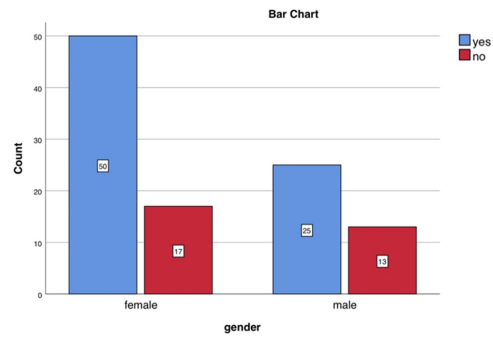


Figure 11: Bar graph represents association between gender and awareness on extreme or high temperatures in CVD mortality rate

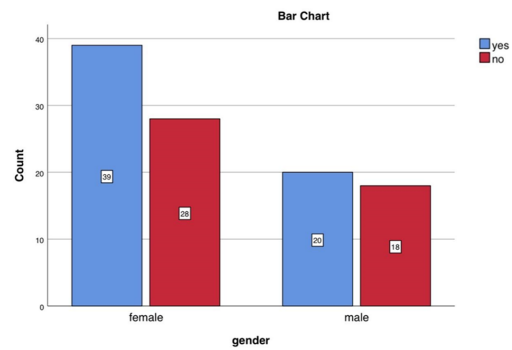


Figure 12: Bar graph represents an association between gender and knowledge on physiological changes caused due to increased temperature

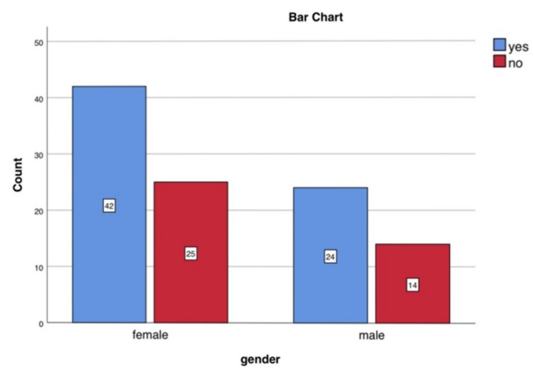


Figure 13: Bar graph represents the association between gender and the effect of extremely low temperatures

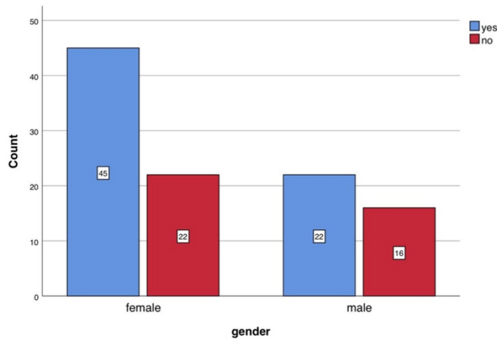


Figure 14: Bar graph represents association between gender and awareness of mortality rate in optimal temperature

(18.10%,red) weren't aware.

56.19% goes along with the fact that increased climatic temperature leads to physiological changes like increased plasma viscosity and cholesterol level, 43.81% doesn't (Figure 2). The majority (56.19%, blue) of the population does have a clear idea about this and few (43.81%, red) don't.

58.10% weren't aware that both extreme temperatures can cause death associated with cardiovascular diseases, whereas 15.25% were not aware of this fact, and 26.67% weren't sure about that (Figure 3). The majority (58.10%, blue) were aware, few (15.24%, red) weren't aware, and some(26.67%, green) weren't sure about that.

62.86% of the population is aware that extreme low temperature increases blood pressure, platelet count and serum, low density; on the other hand, 37.14% aren't (Figure 4).

On the question of awareness on mortality rate is low in optimal temperature, 63.81% said they were aware, and 36.19% said no they weren't aware (Figure 5). Majority population (63.81%, blue) were aware, and some (36.19%, red) were not aware.

When asked about the awareness of cardiovascular diseases including IHD, congestive and myocardial infarction (MI) are associated with increased temperature,63.81% said yes, and 36.19% said no (Figure 6). The majority (69.52%, blue) are aware whereas few (30.48%, red) aren't aware.

When asked about the awareness of ambient temperature air pollution and mortality among the elderly are directly related to each other, 66.67% are aware,33.33% are not aware (Figure 7). The majority (66.67%, blue) were aware, and 33.33% (red)weren't aware.

60% were aware that traditionally hot regions are vulnerable to heat-related deaths, whereas 40% not aware (Figure 8). The majority (60%, blue) are

aware, and few (40%, red) aren't aware.

On the question of extreme heat, effect leads to CVD death, 57.14% said yes, and 42.86% no (Figure 9). The majority (57.14%, blue) of the population were aware, but few (42.86%, red) weren't.

71.43% said yes, that extreme, high related deaths, whereas 28.57% said no (Figure 10). Majority of the population (71.43%, blue) were aware, and few (28.57%, red) weren't aware.

When gender was compared with awareness on extreme or high temperatures in CVD mortality rate, P value obtained was 0.335, and it was not statistically significant (Figure 11). Hence females were more aware that extreme temperature increases CVD mortality rate than male.

When gender was compared with knowledge on physiological changes caused due to increased temperature, P value obtained as 0.477, and it was not statistically significant (Figure 12). Hence females were more aware that increased temperature causes more physiological changes.

Similarly, when gender was compared with the effect of extremely low temperatures, P value obtained was 0.962, and it was not statistically significant (Figure 13). Hence females are more aware of the effect of extremely low temperature.

When gender was compared with awareness of mortality rate in optimal temperature, P value obtained was 0.342, and it was not statistically significant (Figure 14). Hence females are more aware that optimal temperature has a low mortality rate.

A previous study by (Ponjoan *et al.*, 2017) said that cold spells but not heatwaves increased hospitalizations due to cardiovascular diseases. Incidence of cardiovascular hospitalization has increased by 20% during cold spells (Ponjoan *et al.*, 2017; Swathy and Sethu, 2015). In China, cold spells associated with 33% increase in cardiovascular hospital admission was said by (Ma *et al.*, 2011) in his study (Abigail *et al.*, 2019). (Madrigano *et al.*, 2013) found that there was a 36% increase in the USA (Samuel and Devi, 2015). The previous study by (Moghadamnia *et al.*, 2005) conducted that risk of cardiovascular mortality is increased due to cold exposure (Iyer *et al.*, 2019). NAFLD is an increasingly prevalent condition leading to an increased mortality rate (Choudhari and Jothipriya, 2016).

The study was done on a small scale population. It can also be done on a large scale population with more number of questions and with more information about this topic.

Currently, we are yet to discover enough evidence for the relationship between extreme temperature

and cardiovascular problems in south India and Indian sub-continent. A more detailed location-specific study, multi-centre research in some wide range locations on this topic is required.

CONCLUSION

Extreme heat and cold temperature have been associated with a higher mortality rate in cardiovascular diseases and conditions like strokes and dysrhythmia. Cardiovascular disease is already the deadliest medical condition and mortality rate related to cardiovascular disorders may triple in extreme heat environments.

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Conflict of Interest

The author declares that there is no conflict of interest in the present study.

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