ScienSage

Journal of Advanced Scientific Research

Available online through http://www.sciensage.info

ISSN
0976-9595
Research Article

SEASONAL VARIATIONS OF INFANT MORTALITY FOR MAIN DEATH CAUSES IN JAMMU DIVISION, J&K, INDIA

Manjeet Kumar*, V.K. Shivgotra, Himani Nanda

Department of Statistics, University of Jammu, Jammu, Jammu &Kashmir, India

**Corresponding author: manjeetk726@gmail.com*

ABSTRACT

Mortality's seasonal variation has been described all over the world for many death causes. Periodic changes in the weather conditions of temperate countries have been the well recognized risk factors for seasonal mortality but there is no sufficient evidence for this in tropical countries where seasons are not well defined. The aim of this paper is to describe the seasonality of different death causes of infant mortality by using a simple and replicable method. The presence of seasonal variation in several causes of infant mortality was explored with the help of box and whiskers plots. Death causes were selected according to their relevance and data obtained from District hospitals, sub-district hospitals and JMC, Jammu Division, J&K, India for the period January, 2013 to December, 2018. A total of 4700 infant deaths registered during the study period in Jammu Division, J & K out of which 30.3% deaths occurred due to preterm and low birth weight, followed by birth defects (25.3%), SIDS (15.2%), pneumonia (10.1%) and so on. It was observed that there was no significant difference between gender and cause of deaths i.e. gender had no effect on the cause of deaths among infants. Monthly infant deaths showed different median values for different causes. In this study, seasonal variation in infant mortality for several death causes was highlighted to quickly ascertain the presence of seasonality due to different causes which can be very attractive and useful to keep a check on infant mortality in undeveloped countries.

Keywords: Box and whisker plot, Congenital defects, Infant mortality, Preterm and low birth weight, Seasonal variation

1. INTRODUCTION

Infant mortality rate (IMR) is an important indicator of the health of a nation, as it is associated with a variety of factors such as maternal health, quality and access to medical care, socioeconomic conditions, and public health practices [1]. The IMR has been called the most sensitive of all measures of mortality. Infant mortality is the most sensitive index to measure socio-economic development and the quality of life. Infant mortality is a leading public health problem in developing countries. In developed regions, the infant surviving rate is comparatively high, while in less developed regions, the IMR is comparatively high. Hence, the IMR is often viewed as an index which is a reflection of a region's social economics, the level health of a region's population and health services especially those pertaining to maternity and children [2]. Reducing the IMR has a great influence on reducing the mortality rate of the population of a whole country and is regarded as a crucial condition for strengthen improving the chance of the survival and growing up of infants [3]. IMR is an accepted global indicator of health and socioeconomic status of a given population. While neonatal health is found to be dependent on health care services, post neonatal health is dependent largely on environmental factors. A high IMR, therefore, can indicate unmet health needs and unfavorable environmental factors [4].

The infant mortality rate- the probability is expressed as a rate per 1000 live births of a child born in a specified year dying before reaching the age of one has become a prime focus for many researches and public policies. It is often referred to as the infant death rate [5]. The first year of an infant's life is of special importance to ensure its health substructure and improve its life quality. Infant mortality rate (IMR) is an important index to demonstrate social health status and mortality rate [6]. The leading causes of infant mortality are dehydration, congenital malformation, infection, drugs and alcohol, sudden infant death syndrome. Other causes and factors that contribute to infant mortality are prenatal care, mother's marital status, social and income status, poverty, race, smoking and substance abuse, air pollution and environmental

factors [7]. Infant mortality rate has dropped significantly due to recent healthcare and sanitary improvements and high technology medical advances, but continues to remain high in undeveloped countries. Infant mortality rate is commonly included as a part of standard of living evaluations in economics [8].

Seasonality of mortality and, in general, of disease is a well-known phenomenon in many regions and countries worldwide. Although seasonal variations are to some extend driven by seasonal variations in weather, they underlie various non-atmospheric influences. The influence of the different seasons of the year is largely documented and many researchers have studied the characteristically winter peak of several death causes as well as the effect of high temperatures and heat waves on mortality. These influences have fundamentally modified the shape of the seasonal pattern over recent centuries [9]. Periodic changes in the weather conditions such as those that normally occur in temperate countries are well recognized risk factors for seasonal mortality incensement, where extreme weather conditions can be the cause of hundreds of deaths [10]. A variety of statistical techniques have been used to examine the seasonal pattern of health events. In this paper, the seasonal variation of monthly mortality data of infants for 9 death causes in Jammu Division, J&K, during the period 2013-2018 was enumerated thoroughly.

2. MATERIAL AND METHODS

For calculating the seasonal infant mortality, secondary data related to 4700 infant deaths was collected from district hospitals, sub district hospitals and Jammu Municipal Corporation, Jammu Division, J&K for the period of six years *i.e.* from January, 2013 to December, 2018. Descriptive analysis and the association of cause of deaths among infants *w. r. t.* gender were computed by using chi-square test in IBM SPSS software version 24.0.

The simple graphical technique used for describing the structure of seasonal monthly time series was the box and whiskers plot. Box and whiskers plot were used for handling large amount of data in time series, allowing for quick exploration of the series as they provide an insight into the data dispersion and allows comparison for two or more sets. The box and whiskers plot displays the lower whisker *i.e.* minimum score, the first quartile (Q1), the median, the third quartile (Q3), the upper whisker, and the extreme scores called outliers. The box length gives an indication of the sample variability and the line across the box shows where the sample is centered. The position of the box in its whiskers and the position of the line in the box also tell us whether the sample is symmetric or skewed, either to the right or left.

3. RESULTS

Secondary data of 4700 infant deaths was collected from district hospitals, sub-district hospitals and Jammu Municipal Corporation, Jammu Division, J&K for the period of six years *i.e.* from January, 2013 to December, 2018. Table 1 showed the frequency distribution of infant deaths occurred by different causes. The most common cause of death was Preterm and low birth weight (30.3%) followed by Birth defects (25.3%), Sudden infant death syndrome *i.e.* SIDS (15.2%), Pneumonia (10.1%), Infant accident and injuries (6.0%), Respiratory diseases (4.3%), Maternal pregnancy complications (3.6%), other causes (2.9%) and Congenital defects (2.3%) respectively.

Table 1: Frequency distribution of different causes of deaths among infants

Causes of deaths	Frequency	Percent
Birth defects	1188	25.3
Congenital defects	107	2.3
Infant accident and Injuries	280	6.0
Maternal Pregnancy Complications	168	3.6
Other causes	138	2.9
Pneumonia	476	10.1
Preterm and low birth weight	1426	30.3
Respiratory diseases	202	4.3
SIDS	715	15.2
Total	4700	100.0

The association of different causes of deaths among the infants with respect to gender was given in Table 2. It was observed that p=0.925 which is greater than 0.05, it means that gender has no effect on the cause of deaths among infants.

Figure 1 showed the monthly infant deaths due to birth defects during the year 2013-2018. It was observed that monthly infant deaths due to birth defects showed the highest median value in January followed by November and July. The smallest median values occur in the month of June and April. The highest variability was observed in the month of September, February and June and the most consistent data was observed in May. March showed the highest variability along with the presence of outliers.

Table 2: Association of different causes of deaths among infants with respect to gender

Causes of deaths	Males N (%)	Females N (%)	Total N (%)
Birth defects	755 (25.2)	433 (25.5)	1188 (25.3)
Congenital defects	65 (2.2)	42 (2.5)	107 (2.3)
Infant accident and Injuries	182 (6.1)	98 (5.8)	280 (6.0)
Maternal Pregnancy Complications	116 (3.9)	52 (3.1)	168 (3.6)
Other causes	89 (3.0)	49 (2.9)	138 (2.9)
Pneumonia	303 (10.1)	173 (10.2)	476 (10.1)
Preterm and low birth weight	914 (30.5)	512 (30.1)	1426 (30.3)
Respiratory diseases	128 (4.3)	74 (4.4)	202 (4.3)
SIDS	448 (14.9)	267 (15.7)	715 (15.2)

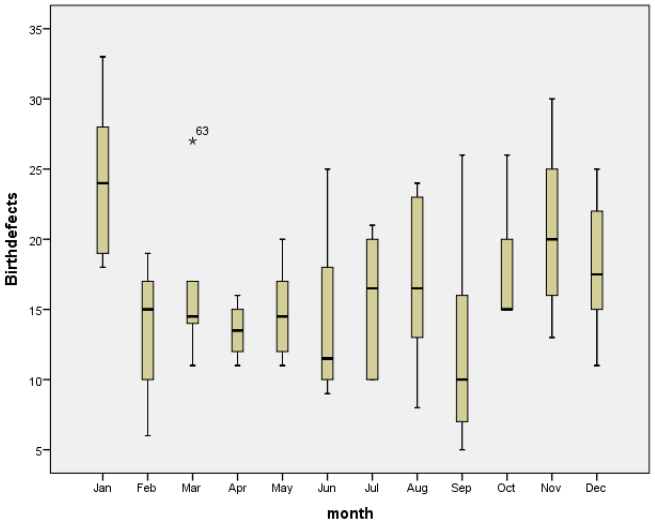

Fig. 1: Monthly infant deaths variability due to birth defects during the period 2013-2018

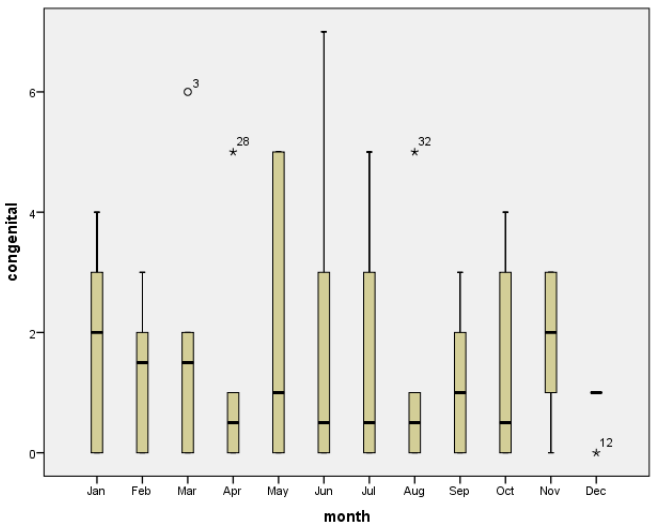

Fig. 2: Monthly infant deaths variability due to congenital diseases during the period 2013-2018

Figure 2 showed the monthly infant deaths due to congenital diseases during the year 2013-2018. It was observed that monthly deaths by congenital diseases showed the highest median values in the month of January followed by November and February. The lowest median values were observed in July followed by April, June and October. The highest variability was observed in the month of June followed by July.

Figure 3 showed the monthly infant deaths due to infant accidents and injuries during the year 2013-2018. It was observed that monthly deaths by infant accidents and injuries showed the highest median values in the month of January followed by March and June. The lowest median values were observed in September followed by May and July. The highest variability was observed in the month of May followed by January and November.

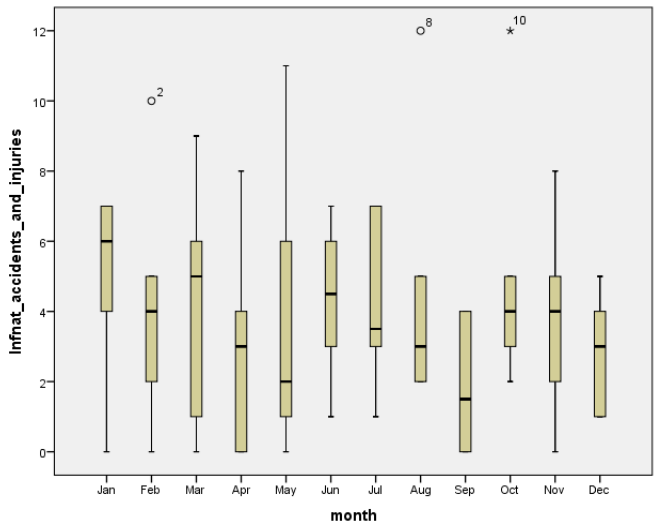

Fig. 3: Monthly infant deaths variability due to infant accidents and injuries during the period 2013-2018

Figure 4 showed the monthly infant deaths due to maternal pregnancy complications during the year 2013-2018. It was observed that monthly deaths by maternal pregnancy complications showed the highest median values in the month of January followed by December and June. The lowest median values were observed in April followed by May and March. The highest variability was observed in the month of January whereas the consistent data was observed in the month of August and February respectively.

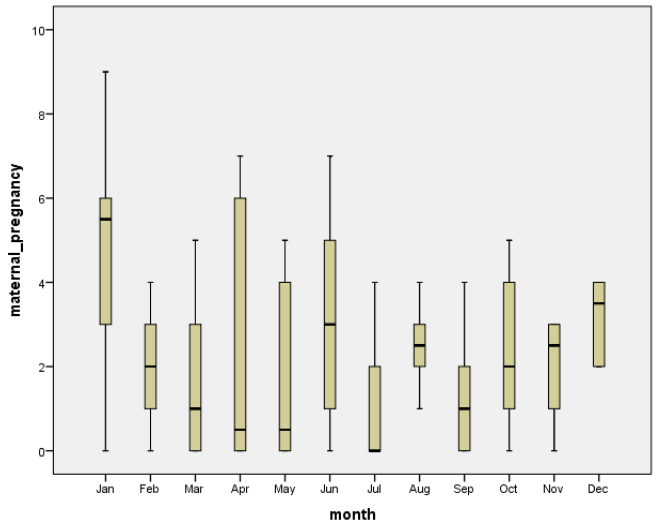

Fig. 4: Monthly infant deaths variability due to maternal pregnancy complications during the period 2013-2018

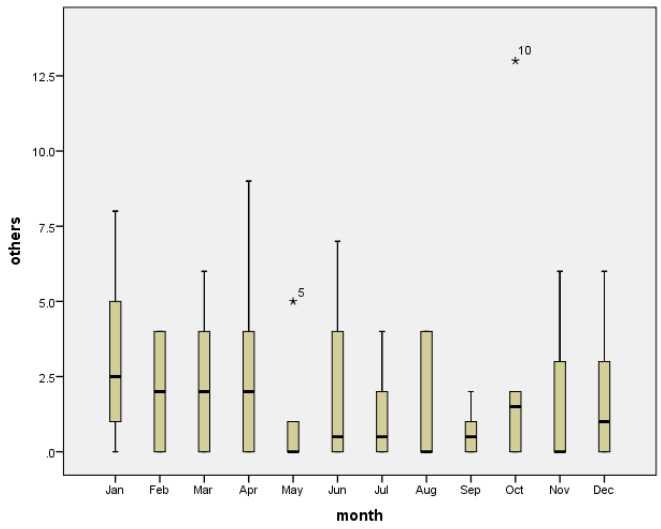

Fig. 5: Monthly infant deaths variability due to other causes during the period 2013-2018

Figure 5 showed the monthly infant deaths due to other causes during the year 2013-2018. It was observed that monthly deaths by other causes showed the highest median values in the month of January followed by February and March. The lowest median values were observed in May followed by June and July. The highest variability was observed in the month of April followed by November and December. Also, the presence of outliers was observed in the month of May and October respectively.

Figure 6 showed the monthly infant deaths due to pneumonia during the year 2013-2018. It was observed that monthly deaths by pneumonia showed the highest median values in the month of May followed by March and February respectively. The lowest median value was observed in July. The highest variability was observed in the month of February followed by April and November. Also, the presence of outliers was observed in the month of March.

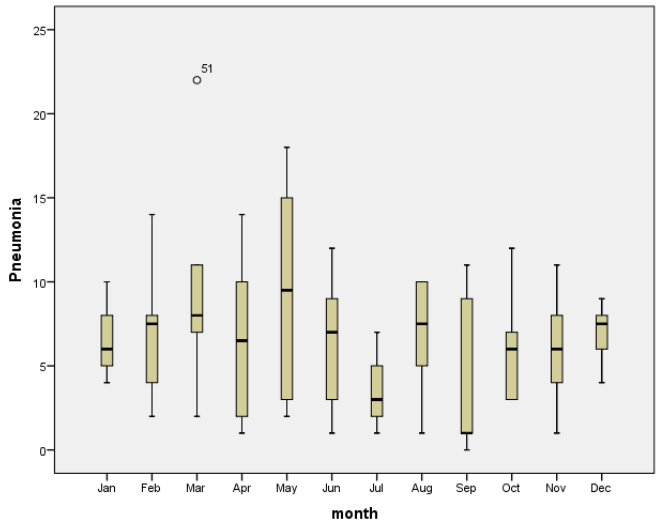

Fig. 6: Monthly infant deaths variability due to Pneumonia during the period 2013-2018

Figure 7 showed the monthly infant deaths due to Preterm and low birth weight during the year 2013-2018. It was observed that monthly deaths by preterm and low birth weight showed the highest median values in the month of January followed by October and November respectively. The lowest median value was observed in September. The highest variability was observed in the month of September followed by December. Data was consistent in the month of August whereas the presence of outliers was observed in the month of April and November respectively.

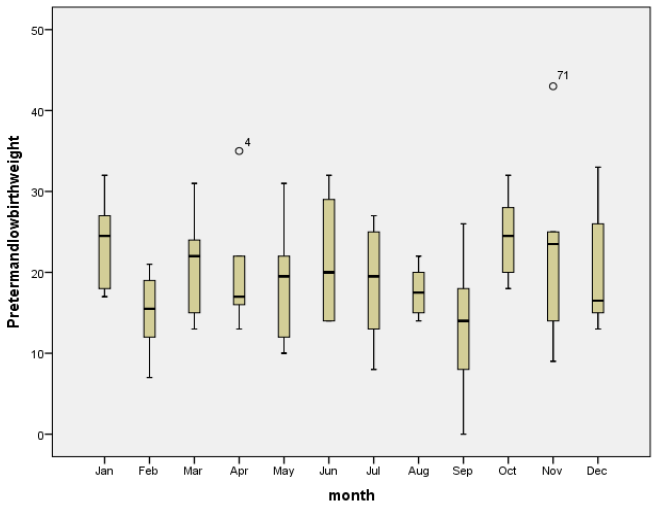

Fig. 7: Monthly infant deaths variability due to Preterm and low birth weight during the period 2013-2018

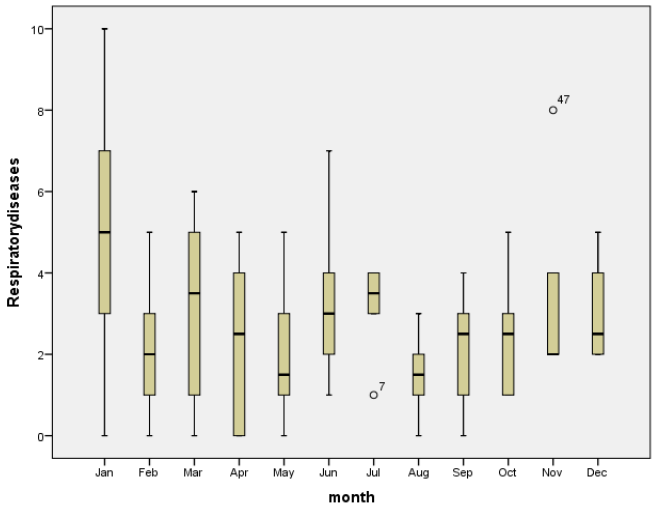

Fig. 8: Monthly infant deaths variability due to respiratory diseases during the period 2013-2018

Figure 8 showed the monthly infant deaths due to respiratory diseases during the year 2013-2018. It was observed that monthly deaths by respiratory diseases showed the highest median values in the month of January followed by March and July respectively. The lowest median value was observed in May. The highest variability was observed in the month of January followed by June. Data was consistent in the month of August whereas the outliers were observed in the month of July and November respectively.

Figure 9 showed the monthly infant deaths due to sudden infant death syndrome (SIDS) during the year 2013-2018. It was observed that monthly deaths by SIDS showed the highest median values in the month of May followed by January. The lowest median value was observed in September followed by February. The highest variability was observed in the month of October followed by March.

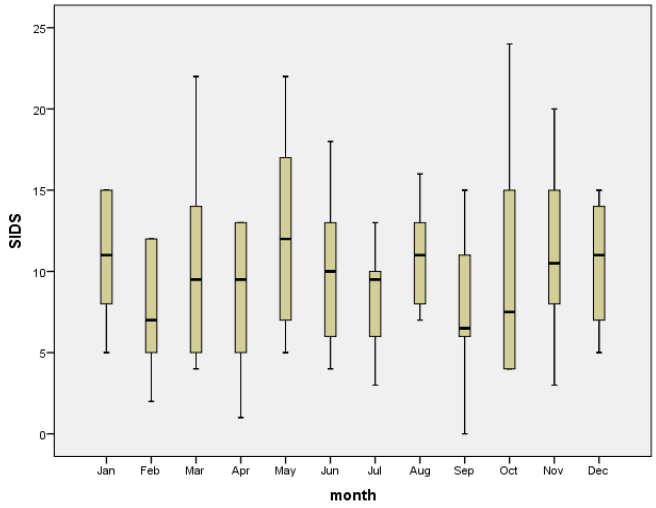

Fig. 9: Monthly infant deaths variability due to sudden infant death syndrome (SIDS) during the period 2013-2018

4. DISCUSSION AND CONCLUSION

In this study, we have identified distinct seasonal variations of mortality, with the shape of the seasonal pattern depending on the cause of death. So, we can say that our study was an attempt to find out the seasonal variations in the causes of death among the infants in Jammu Division from 2013 to 2018 (6 years). Our findings reported that the leading cause of death among the infants was preterm and low birth weight (30.3%) and the monthly data shows that deaths due to preterm and low birth weight increases during the colder months of January and November and decreases during rainy season. Similar findings were reported in a study conducted by Nyari *et al.* [11]. Also, it was reported that the infant deaths due to SIDS (15.2%) showed the peak value in winter months and the lowest deaths occurred in the month of September. Similar pattern was reported by Mitchell *et al.* and many other researchers in their respective studies [12, 13].

The infant deaths due to pneumonia (10.1%) showed the highest deaths in the colder month of January and least deaths in the month of April, which is similar to the results in a study conducted by Farrar *et al.* [14]. Moussa *et al.* and many other researchers [11, 15] reported that the infant deaths due to respiratory diseases (4.3%) displayed the peak values in the winter season and the minimum deaths occurred in the month of April. The results were in contrary to the study conducted by

Gemmell *et al.* [16]. However, the infant deaths due to accidents and injuries (6.0%) shows the highest median value in the month of January followed by March and June and the lowest median value in the month of September followed by May and July which is consistent with the findings of the study conducted by Nyari *et al.* [11] in their respective study.

Our study reported the infant deaths due to birth defects (25.3%) were found to be highest in the month January and November and lowest in the month of June and April, and the consistent mortality was observed in the month of May. Similar findings were reported by Victora *et al.* [17] in their respective study. The infant deaths caused by congenital defects (2.3%) showed its peak in the winter months of January followed by November and February and lowest deaths occurred in autumn months and the similar pattern are reported by Moussa *et al*. [15]. The infant deaths caused by maternal pregnancy complications (3.6%) and due to other causes (2.9%) showed peak values in colder months. The results were similar to the study conducted by Nyari *et al.* [11].

The IMR remains a useful and comparatively inexpensive indicator of population health. If health policy were, as conjectured, going to be unduly influenced by IMR, then one would expect to have observed the effects mostly in those countries with the lowest IMRs. As a significant index to judge the health level and also indirectly reflect the economic development level of a country or a district, the precision of IMR is undoubtedly crucial. The ongoing national programs on decreasing infant and child mortality have been focusing on educating women on increasing age at marriage, age at first birth, and increasing the birth interval between two births.

Some strategies to reduce infant mortality rate would be focusing on modifying the behaviors, lifestyles, and conditions that affect birth outcomes, such as smoking, substance abuse, poor nutrition, lack of prenatal care, medical problems, and chronic illness. Furthermore, a network should form between health care experts and communities to encourage healthy behaviors by pregnant women and parents of infants.

This study demonstrated the importance of considering seasonal impacts on mortality and revealed several target groups and diseases for which the consideration of seasonality seems particularly crucial. We showed that the effect of season or seasonally changing environmental conditions depends on preconditions in a subpopulation or region. Infant and children were affected most by seasonal effects. The consideration of such seasonal effects could help to place public health interventions most effectively. Generally, protection measures against cold or heat among infants or those under hospital care can help to avoid or overcome critical states of health. We emphasize that knowledge on the interaction between seasons, atmosphere, and health is especially necessary in times of climate change so that its possible impacts can be mitigated.

5. ACKNOWLEDGEMENT

We would like to convey our sincere gratitude to BMO and CMO of primary health centres, community health centres, district hospitals and to the director of Jammu Municipal Corporation without whom this data collection could not be completed. Also, we provide our thanks to the staff members of JMC for their timely support.

6. REFERENCES

1. MacDorman MF, Mathews TJ. *NCHS Data Brief*. 2008; **9**:1-9
2. Jimenez J, Romero MI. *Health Aff*, 2007; **26 (2):**458-465.
3. Du B, Zhang Y. *Open J Stat*, 2011; **1:**236-243.
4. Sharifzadeh GR, Namakin K, Mehrjoofard H. *Iran J Pediatr*, 2008; **18 (4):**335-342.
5. Bora JK, Saikia N. *PLoS One,* 2018; **13 (7):**1-15.
6. Singh B. *Indian J Pediatr*, 2006; **74(5)**:454-456.
7. Fadel SA, Pinto CB, Jha P. *The Lancet*, 2019; **393:**1119-1127.
8. Ahmad PJ, Jain S, Wani GA, Shah SBA. *International Journal of Recent Trends in Science and Technology*, 2018: 66-72.
9. McKee M, Sanderson C, Chenet L, Vassin S, et al. *Journal of Public Health and Medicine*, 1998; **20 (3):**268-274.
10. Ishigami A, Hajat S, Kovats RS, Bisanti L, et al. *Environmental Health*, 2008; **7(5):**1-7.
11. Nyari TA, McNaly R. *The Journal of Maternal-field and Neonatal Medicine*, 2019.
12. Mitchell EA, Clements M, Williams SM, Steward AW, et al. *Acta Pediatr*, 1999; **88**:253-258.
13. Malloy MH, Freeman DH. *Arch Pediatr Adolesc Med*, 2004; **158(4):**359-365.
14. Farrar DS, Awasthi S, Fadel SA, Kumar R, Jha, P. *Epidemiology and Global Health*, 2019; **8**:1-23.
15. Moussa MAA, Sayed AM. *Medical Principles and Practice*, 1998; **7:**18-27.
16. Gemmell I, McLoone P, Buddy FA, Dickinson GJ, et al. *Int J Epidemiol*, 2000; **29**:274-279.
17. Victora CG, Vaughan JP, Barros FC. *Revista Paulista de Medicina*, 2001; **119(1):**33-42.