



TASYRGRD BRASM DUST LUNG & INFECTIOUS DISEASES

Mohamad Reza Nazer¹, Hadis Heidari^{*2}, Behrooz Parvaneh³
 Mohammad Darvishi^{*4}

1. *Department of Infectious Diseases, Lorestan University of Medical Sciences, Khorramabad, IRAN*
2. *Master of Arts Lorestan Islamic azad university, Khorramabad, IRAN*
3. *assistant professor, Department of Climatology, Khorramabad Branch, Islamic Azad University, Khorramabad, Iran*
4. *Infectious Diseases and Tropical Medicine Research Center (IDTMRC), AJA University of Medical Sciences, Tehran, IRAN*

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ABSTRACT

In recent years, dust storms in Iran are considered a very familiar word for all people. The issue which has received widespread attention was a trend towards an increase of incidence of this phenomenon in our country. Because of its common frontier and proximity to the deserts of neighboring countries in western provinces, Lorestan experienced an average of more than 100 dusty days and 16 times higher than the global standard in recent years. The dust phenomena have many impacts on health, economics, and transportation of the country. Studies suggest that dust storms lead to increased respiratory illness. Particles size less than or equal to 10 microns' diameter also increase the risk of death in children under 1 years of age, affect the functioning of the lungs and aggravate asthma and cause increased respiratory rate.

Researches reveal that the rate of hospitalized patients' incidence due to pulmonary, respiratory and cardiovascular diseases increases exponentially once the dust phenomenon occurs. Using descriptive statistical method and simple linear regression and correlation relationships, this study analyzes the annual and monthly statistics of dust data of patients with asthma and pulmonary diseases referring at Shohada Ashayer Hospital of Khorramabad during 2004 -2012.

The results show that there is a high correlation (higher than 80%) between two variables of dust with the number of patients with asthma and pulmonary and infectious diseases referring to hospitals and the frequency rate of these two variables during the spring and autumn seasons (63%). The statistics show the impact of dust on the exponential rate of patients with asthma and pulmonary infections referring to hospitals to the hospital.

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Introduction

Climate is one of the most important structural elements of the earth, and there is no doubt that nature and all manifestations of life are affected by climate conditions at a large extent. It is for several years that applied meteorology has faced the problem of air pollution and this knowledge cannot ignore the pollution of the air. Air pollution has been defined as the presence of one or more pollutants such as dust, gases, odors, smoke, vapors in open air with different quantities and characteristics that are detrimental and hazardous to human, plant or animal life, as well as property and disrupt easy life of human. Mortality and human diseases are heavily associated with air patterns in many ways. Weather conditions have an impact on the incidence and spread of contagious diseases such as influenza and various pulmonary infections, including infection of typical organisms such as pneumococcus (2) and non-typical organisms such as Chlamydia pneumoniae (3) to dangerous infections such as tuberculosis (4,5) that have a high prevalence in different regions in Iran and also tuberculosis and allergies such as asthma. The relationship between climate and health is an old issue. The first important book written on climate and health dates back to Hippocrates, the famous physician of ancient Greece, entitled as Air, Water and Locations, and the human reaction to warm winds about 400 years ago. Man is not able to survive at very high or low temperatures. On the other hand, unlike in the past, infections have already been shown to have high levels of resistance to bacteria and do not show a good response to antibiotics

Corresponding Author: Mohammad Darvishi, Infectious Diseases and Tropical Medicine Research Center (IDTMRC), AJA University of Medical Sciences, Tehran, IRAN

(6, 7). Elderly people are exposed to mortality at lower early temperatures. Climate therapy represents a method in which weather conditions are used to treat illnesses. Clean air and low moisture are necessary for the treatment of asthma, bronchitis and infections. However, the rate of new water-borne diseases which is known as "emerging" diseases, such as hepatitis E, is raising (8-10). Contaminated water resources are considered instruments of bioterrorism attacks (11). Moreover, although many other new-born illnesses, including hepatitis B, hepatitis C and Crimean-Congo haemorrhagic fever (CCHF), are not directly transmitted through contaminated air, they may increase the prevalence of these disease due to the role of washing and sanitation dependent on water resources (12-19). Even the use of new technologies, such as mobile phones, will also increase infections in the absence of clean water (20). Besides, the shape of infections has been altered including increasing multiple cases of brucellosis or (brucellosis) with skin symptoms and genital tract in men (21-23), or an increase in the prevalence of Group B streptococcus in the genital female tract (24). Mountains with low altitude have a significant beneficial effect for asthmatic patients. Arabic dusts contain hazardous particles with complex compounds which have the potential to easily penetrate into the depth of lungs and air bags of immune system in the respiratory tract due to their very small size and cause a wide range of pulmonary diseases and respiratory infections. Because of Iran's location in the arid and semi-arid belt of earth, it is repeatedly exposed to different synoptic and local dust systems. In recent years, the geographical location of cities in Iran's western provinces, including Lorestan, such as proximity to the deserts of adjacent countries, has led them to be exposed to multiple dust systems. The dust can be converted into very small particles due to the decomposition of various solid materials that usually can float in the air for some time. The suspended particles of dust in the air may sometimes be visible to the eye or seen through microscope. The presence or absence of moisture along with unstable air is one of the most important conditions for the formation of dust (25). Given the climate changes and the increased number of dust days in recent years, medical statistics indicate the prevalence and severity of respiratory sensitization such as asthma and pulmonary infections. This paper attempts to investigate the relationship between the climatic element of dust and the number of patients with asthma and pulmonary diseases referring at Shohada Ashayer Hospital of Khorramabad. Over the past four decades, dust has been known to occur in vast areas of the world called global dust belt. In Iran, the occurrence of drought and some environmental factors contributed to the occurrence of a dust-borne phenomenon in 2006, which has been escalated in recent years. The presence and lack of moisture are considered the most important conditions of dust besides unstable weather. There must be sufficient water vapor in order for the storm to form, and lack of moisture can trigger thunderstorm development (25). In general, major sources of dust are low land and low rainfall with average annual precipitation less than 250 mm. Due to natural characteristics such as high and mountainous terrain, except for a small part in the provinces of Khuzestan and Ilam, annual precipitation greater than the national annual rainfall and also vegetation cover and pasture that isolate them from arid areas, the western regions of the country are not as a source of dust. Most of these widespread dusts from these regions are trans regional and originate from distant areas. This area was located along the cyclones path and dust collecting systems of the country. 25% of Iran's land area is situated in the dry and desert belts and is under the control of dust storms. The most important sources of dust entering the west are the Syrian Desert, Al-Nofood Desert in the northern Arabian Peninsula and the deserts of southern Iraq and the sub-Saharan Africa have a small contribution [26]. Studies on dust storms in the western regions of Iran during the years of 2005-2009 indicate that the development of a low pressure system in the Middle East and the strengthening of the unstable conditions on the surface of the desert, as well as the coordinated effect of a low-pressure dynamic wave above the atmosphere, provide suitable conditions to transmit dusts to atmosphere of the region. According to research conducted by the University of Khuzestan, these storms lead to the release of chemical, microbial and radioactive elements and rhenium, nickel and lead. Asthma is recognized as a chronic pulmonary disease and respiratory system causing inflammation and contraction of airways that transmits air into the lungs and as a result of these attacks, the person is not able to breathe naturally. Studies show that dust storms lead to increased respiratory illness. Particles equal to or smaller than 10 microns increase risk of death in children under

1 year of old and influence the lungs functioning and aggravate asthma and can cause respiratory symptoms. Also, particles with diameters less than or equal to 2.5 microns pose a serious effect or threat on health and elevates risks for cardiovascular-related and lung cancer mortality. Each 10-microgram per-cubic-meter increase in long-term average PM_{2.5} concentrations was associated with approximately a 4% increased risk of death from all natural causes, a 14% increased risk of death from cardiopulmonary disease, and an 12% increased risk of death from lung cancer. In the last two decades, research has shown that high concentration of calcite particles in dust leads to sneezing and coughing. Silicon dioxide is another element of the covalent dust particles, which the inhalation of free crystalline silica for a long time causes silicosis. Other particles include iron, aluminum, magnesium and ... lead to the formation of kidney stones when used more than 2.5 g of calcium. Iron causes conjunctivitis and retinal inflammation. Short-term inhalation of particles containing aluminum cause coughing and irritation of the lungs. According to the World Health Organization, about 5,000,000 suffer from premature death due to exposure to indoor airborne suspended particles (27). Because of its proximity to vast desert areas, Lorestan province is frequently exposed to severe dust. Lorestan province experienced 100 polluted days in 2009, and also witnessed several weak and severe waves of Arabic dusts in 2010. Moreover in 2011, the province suffered more than 28 days of heavily polluted weather (27). Air pollution in Lorestan province exceeded more than 18 times the air pollution standard limit. Dust phenomenon is one of the most disastrous natural disasters in the arid and semi-arid regions of the world, which can lead to many environmental problems in these areas. In the last three years, the people of Lorestan have lived 300 days out of a year in mist caused by dust (28). Lorestan province, situated in western Iran, covers an area of 28559 square kilometers and accounts for 7.1% of the total area of the country. Lorestan province is located between 46 degrees and 51 minutes to 50 degrees 3 minutes east Longitudes of the Greenwich meridian and 32 degrees 37 minutes to 34 degrees 22 minutes north latitude from the equator (29). In terms of time, data and variables of this research have been selected over a nine-year period, in 2004 -2012. This study aims to determine the amount of dust aerosol impact on the number of patients with asthma referring to the hospital.

Materials and methods

In this research, the required data were firstly prepared from meteorological organization and the database of Shohada Ashayer Hospital of Khorramabad with regard to the research objectives. This study used two types of data including dust and asthma in order to examine and confirm the hypothesis of this research. The first data is the annual average of the climatic dust during 2002-2012 and the second variable is the total annual statistics of patients with asthma referring to Shohada Ashayer Hospital of Khorramabad city during 2004 -2012. Since the purpose of the study was to investigate the impact of dust climatic element on patients admitted to Shohada Ashayer Hospital of Khorramabad city. According to available statistics, data were collected through a library method. Data about the climate element of dust have been extracted by referring to the Meteorological Organization of the province and from the database of this organization as well as the website of Meteorological Organization of the country. Data were classified according to the month and year and the monthly and annual average of these data was calculated and were then entered into the computer. The data were analyzed using SPSS software and inferential statistical methods such as correlation coefficient and regression line equation.

Determination of the relationship of climatic elements of dust with patients with asthma and pulmonary diseases referring to the hospital

In this section, the relationship of dust elements with patients with asthma and pulmonary diseases referring to Shohada Ashayer Hospital of Khorramabad city was analyzed. Statistical analysis was performed using statistical methods such Pearson correlation coefficient, regression line equation, graphs and tables during the statistical period of 2004 – 2012. In order to investigate the relationship between the dust variable with asthma and pulmonary disease, Pearson correlation coefficient formula was utilized. With regard to the normalization of the data, we can say that, in accordance with Table (1), since the ratio of skewness and kurtosis of data is between -2 and +2, one can deduce that the data are normal. It can be observed that the correlation coefficient between the number of dust days and the number of patients with asthma is 0.876 indicating the correlation of these two variables. The

correlation coefficient between two quantitative variables is positive and negative and values close to $1 \pm$ indicate a strong, positive and negative correlation implying that as one variable increases, the other also increases, and as one decreases, the other also decreases. In this table, the P value for the correlation test of the two variables is calculated 0.001. Since this value is less than 0.05, so the null hypothesis of this test can be rejected, and it can be said that these two variables correlate with each other. According to Table (2) and significant levels for asthma and dust variables, the distribution of variables is normal with a strong probability. In the correlation test using Pearson's method and in Table (3), it was shown that the correlation coefficient between two variables is equal to 0.841, which is significant at a level of 0.05. As you can see, the two stars above it indicate that the correlation between the two variables is also meaningful at a level of 0.01, implying that two variables correlated to each other. One of the most important results of this table is the determination coefficient of the model. Determination coefficient is one of the model evaluation tools in regression analysis. The coefficient of determination demonstrates the changes expressed by the model to the total changes and includes the values between 0-1. The closer a determination coefficient to one, the model has a desirable fitness. The determination coefficient shows the linear relationship between x and y. Of two regression models with the same number of independent variables, a model is chosen which has a higher determination coefficient. The significance test of table (6) model, which is a variance analysis is used to test the significance of the regression line. The test statistics formula has been written by relationship (2-4):

This relationship (2-4) tests the significance of regression model. In the last column of this table, the P value reported 0.02, which is smaller than 0.05, indicating that this independent variable can be used to predict the dependent variable. The least squares method is a method for estimating the coefficient of regression. In this method, the sum of regression squares, the sum of squares of errors and the sum of squares have been presented. The greater the total regression sum of squares, the better the model fits data. According to the regression coefficients in the following table, it can be observed that the null hypothesis is not rejected for the regression coefficient. So this coefficient is meaningful. The statistical relation between the two variables of this study may be designed regarding the obtained coefficients. According to the obtained coefficients, the relationship is expressed as: $Y = 40/73 + 1 / 18X$. The

correlation coefficient for the spring season between two quantitative variables is positive and negative and values close to $1 \pm$ indicate a strong, positive and negative correlation implying that as one variable increases, the other also increases, and values close to one represent strong and stable correlations and values close to zero represent that both variables are correlated to each other. Changing one variable does not affect another. According to the P value, it is clear that although both variables are weakly correlated each other, they are not meaningful. Regarding the correlation in summer, Table (9) and the correlation between the two variables studied show that there is no relationship between the two variables and their relationship is not meaningful. In addition, regarding correlation in autumn, according to table (10), as well as the correlation and P value statistic between the two variables, there is no weak relationship between the two variables. In relation to correlation in winter, according to table (11), the correlation and P value statistic between the two variables studied show that correlation is very weak and has no significant level.

Findings

Statistical methods have many applications in determining the correlation and also prediction between different factors. Due to the widespread application of these methods in different disciplines as well as their accuracy, it has been proven that they are at an acceptable level. Therefore, due to the accuracy of the regression methods, the author of this study decided to use of this method according to the purpose of the studies. To do this, after obtaining information on the number of dust days from Lorestan Meteorological Organization and the number of patients referred to the hospital during a 8-year statistical period (2004-2012), the data were first categorized using Excel software and then analyzed using SPSS software. At the beginning, the assumption about the data normalization was tested according to skewness and kurtosis and Shapiro test. Since the range

of skewness and kurtosis of the data was determined to be 0.80 and -0.1, respectively, the probability of normalized data was approved. But in order to ensure more, the Shapiro test was used to prove the normality assumption of data, which its results confirmed it. In the next step, in order to prove the existence of correlation among existing variables, Pearson correlation method was used considering the type of data and its efficiency. The results showed that there is a strong correlation (0.87) between the number of dust days and the number of patients with asthma referring to the hospital. After confirming the existence of a strong and significant correlation between the two variables, linear regression was used. According to the results of simple linear regression model demonstrating the total changes of the model and also linear relationship between two variables of x and T (73.0), we can say that there is a relatively strong and significant relationship between the two variables studied. In addition, based on the significance test of linear regression method as well as the P-value (0.002), it is obvious that this independent variable can be used to predict the dependent variable. The last output of this model is proposed as the regression coefficients. With regard to the obtained coefficients, it can be suggested that there is a statistical relation between the two variables studied and they can be used to estimate another variable. According to the obtained coefficients, the obtained relation can be expressed as $Y = 40/73 + 18/18$.

Discussion and conclusion:

Due to its geographical location as well as vegetation cover and pasture, the western regions of the country (Lorestan) are not as a source of dust. However, in recent years, the occurrence of climate change and successive droughts have significantly contributed to the increasing trend in the presence of dusts in the province. Most of these widespread dusts from these regions are trans regional and originate from distant areas including deserts of Iraq, Syria and Saudi Arabia. This area was located along the cyclones path and dust collecting systems of the country. The results from the first part of the study showed a high correlation (80%) between the two variables of dust days and the number of patients with asthma and pulmonary diseases. According to the statistics, the years with a high number of dusty days corresponded to an increase in the number of patients with asthma and pulmonary disease referring to Shohada Ashayer Hospital of Khorramabad city. The second part of the research investigates the correlation between these two variables in spring, summer, autumn, winter seasons. The results show that there is a higher correlation between dusty days and the number of patients with asthma and pulmonary diseases referring to hospital on spring and autumn seasons than summer and winter ones. However, the amount of statistical significance is found to decrease in two-season seasons with a weaker correlation. Furthermore, in order to clean the environment, human beings depend on nature. Currently, bacteria are beneficial to remove soil and dirty containing dusts (30-31). Also, honey can be helpful in removing highly dangerous infections (32).

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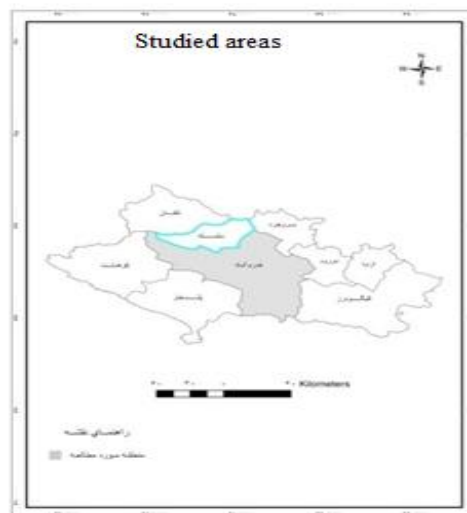


Figure 1

Table 1. The annual number of patients with pulmonary asthma and pulmonary diseases with several days of dusty days during 2004-2012

The number of patients referring with asthma and pulmonary diseases	The number of duty days	Year
32	11	2004
88	31	2005
95	25	2006
69	61	2007
129	81	2008
198	110	2009
152	90	2010
124	50	2011
109	28	2012

Table (2). Testing the Normality of Data Using skewness and kurtosis

Descriptives				
			Statistic	Std. Error
ASTHMA	Mean		110.6667	16.4508
	95% Confidence Interval for Mean	Lower Bound	73.6667	
		Upper Bound	147.6667	
	5% Trimmed Mean		110.1852	
	Median		109.0000	
	Variance		2317.000	
	Std. Deviation		48.13523	
	Minimum		32.00	
	Maximum		198.00	
	Range		166.00	
	Interquartile Range		62.00	717
	Skewness		246	1400
	Kurtosis		561	
DUST	Mean		58.8889	11.835.3
	95% Confidence Interval for Mean	Lower Bound	31.5973	
		Upper Bound	86.1805	
	5% Trimmed Mean		57.3210	
	Median		54.0000	
	Variance		1260.611	
	Std. Deviation		35.50509	
	Minimum		19.00	
	Maximum		127.00	
	Range		108.00	
	Interquartile Range		56.00	
	Skewness		803	717
	Kurtosis		0.17	1.400

Normality test of data using Shapiro-Wilk test

According to Table (2) and significant levels for asthma and dust variables, the distribution of variables is normal with a strong probability.

Table 3. Normality test of data using Shapiro-Wilk test

Data correlation test using Pearson method

Based on the above Table (3), the correlation coefficient between two variables is equal to 0.841, which is significant at a level of 0.05. As you can see, the two stars above it indicate that the correlation between the two variables is also meaningful at a level of 0.01, implying that two variables correlated to each other.

Table (4). Annual data correlation test by Pearson method

Table (5). Correlation coefficient by regression method

		ASTHMA	DUST
Pearson Correlation	ASTHMA	1.000	876
	DUST	876	1.000
Sig. (1-tailed)	ASTHMA	0	001
	DUST	001	0
N	ASTHMA	9	9
	DUST	9	9

Table (6). Model determination Coefficient

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	767 ^a	0.767	734	2482132

Table (7). Meaningfulness test of the model

		ϵ				
Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	14223.314	1	14223.314	23.086	002 ^a
	Residual	4312.686	7	616.098		
	Total	18536.000	8			

Table 8: Estimation of regression coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	40.731	16.743		2.433	45.
	DUST	1.118	247	00.876	4.805	0.002

a. Dependent Variable: ASTHMA

Table 9: correlation test for dust, spring asthma

Correlations			
		ASTHMA.SP	DUST.SP
Pearson Correlation	ASTHMA.SP	1.000	0631
	DUST.SP	0.631	1.000
Sig. (1-tailed)	ASTHMA.SP	.	0.34.
	DUST.SP	0.34	.
N	ASTHMA.SP	9	9
	DUST.SP	9	9

Table 10: correlation test for dust, summer asthma
 Correlations

Correlations			
		ASTHMA.SUM	DUST.SUM
Pearson Correlation	ASTHMA.SUM	1.000	0.547
	DUST.SUM	0.547	1.000
Sig. (1-tailed)	ASTHMA.SUM	0	00.64
	DUST.SUM	0.64.	0
N	ASTHMA.SUM	9	9
	DUST.SUM	9	9

Table 11: correlation test for dust, fall asthma

		ASTHMA.ATU	DUST.ATU
Pearson Correlation	ASTHMA.ATU	1.000	0.637
	DUST.ATU	0.637	1.000
Sig. (1-tailed)	ASTHMA.ATU	0	0.32
	DUST.ATU	0.32	0
N	ASTHMA.ATU	9	9
	DUST.ATU	9	9

Table 12: correlation test for dust, winter asthma

Correlations			
		ASTHMA.WI	DUST.WI
Pearson Correlation	ASTHMA.WI	1.000	0.458
	DUST.WI	458	1.000
Sig. (1-tailed)	ASTHMA.WI	0	0.107
	DUST.WI	107	0
N	ASTHMA.WI	9	9
	DUST.WI	9	9