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Air pollution: A threat to health tourism development in the Islamic Republic of Iran (case study: Ilam city)

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Abstract
Aim. Considering the high capability of Ilam province in the development of health tourism as indicated in its active border crossings with Iraq and the response to the recent epidemic, it was deemed necessary to identify the risks of air pollution on the health of tourists.
Materials and Methods. During 2008-2018, data on five primary air pollutants during 2008-2018 were identified by literature research and by referring to the relevant monitoring organizations. Data analysis was performed by the Full permutation polygon synthetic indicator model, while Excel and MATLAB software were used to display data.
Results. The findings of the study revealed that despite the application of the Land Use Planning Document, average suspended particulate matter of less than 10 microns ranked second after sulphur dioxide (SO_2), in terms of the contribution to air pollution and instability in Ilam City during the 11 years in question (excluding 2008 and 2009).
Conclusions. The link between air pollution and the development of health tourism on the one hand and the emergence of an epidemic on the other has recently necessitated a new concept of health, tourism and welfare in relation to the environment with the aim of achieving a healthy environment for visiting tourists.

Key Words
Air pollution, health tourism, FPPSI method.

Загрязнение воздуха: Угроза развитию оздоровительного туризма в Исламской Республике Иран (на примере города Илам)

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Резюме

Цель. Высокий потенциал провинции Илам в развитии оздоровительного туризма, ее географическое соседство с Ираком и возникновение недавней эпидемии обусловили возможные риски загрязнения природной среды.

Материалы и методы. Данные по пяти основным загрязнителям воздуха за 2008-2018 гг. были собраны методом библиотечного исследования и путем обращения в соответствующие организации. Анализ данных проводился с помощью модели синтетического индикатора многоугольника перестановки, в то время как для отображения данных использовались программы Excel и MATLAB.

Результаты. Результаты исследования показали, что, несмотря на Документ о планировании землепользования, среднее содержание взвешенных твердых частиц менее 10 микрон занимало второе место после диоксида серы (SO_2), с точки зрения вклада в загрязнение воздуха и нестабильности в городе Илам в течение последних 11 рассматриваемых лет (исключая 2008 и 2009 гг.).

Выводы. Связь между загрязнением воздуха и развитием оздоровительного туризма, с одной стороны, и возникновением эпидемии, с другой, выявила необходимость в новой концепции здравоохранения, туризма и благосостояния региона.

Ключевые слова
Загрязнение воздуха, оздоровительный туризм, метод СИМП.

INTRODUCTION

According to the World Health Organization, a person's overall health status has two dimensions, namely physical health and mental health. The latter refers to "a state of well-being in which any person can cope with the normal stresses of life" [1]. Travel with the primary goal of receiving medical treatment and maintaining the well-being of an individual falls within the category of health tourism, which includes various options such as spas, wellness and medicine [2; 3]. As an emerging global phenomenon in the healthcare domain, health tourism has today become the most prominent competitive industry and a lucrative segment of the potential tourism market [4]. Some countries such as India and Thailand have tried capitalising on linking their medical care to health tourism in order to develop their own economies [5].

Over the past few years, the significant role of tourists' perceptions in health tourism development has attracted more attention from researchers [6]. A tourist's perception itself is reflected in the search for a pleasant place to relieve stress [7]. Environmental quality and sustainability serve as essential factors in the decision-making process of tourists, because of their remarkable impact on the competitiveness of tourist destinations [7; 8] and the spatial relationship between diseases. As a result, a low level of environmental quality harms tourism development by creating negative psychological states in visitors, reducing the beauty of natural places, damaging the tourism experience and consequently reducing the demand for tourism [8].

Air pollution adversely affects the development of tourism [9], especially health tourism. As the IPCC's starkly warns [10], air pollution is harmful to the health of all individuals [11; 12] i.e., both residents and tourists. Attracting increasing attention from researchers, air pollution is known as the most significant environmental cause of disease and premature death in today's world [13]. It is also one of the leading causes of death due to ischemic heart disease, strokes, chronic obstructive pulmonary disease, lung cancer and acute lower respiratory tract infection (LRI) [14].

Put differently, exposure to air pollutants is associated with cardiovascular disease, diabetes, metabolic syndrome, neurobehavioral behaviors and reproductive disorders [15]. By definition, air pollution is a complex combination of several types of toxic pollutants [10]. Five primary air pollutants include sulphur dioxide (SO_2), ozone (O_3), suspended particulates less than 10 microns in size, carbon monoxide (CO) and nitrogen dioxide (NO_2). Sulphur dioxide (SO_2) is a toxic and irritant gas that causes acid rain [16], affecting the mucous membranes and respiratory system [17]. Another toxic gaseous pollutant in the atmosphere is tropospheric ozone that has numerous destructive effects on the environment and human health, including reduced lung capacity, sore throats and throat swelling, coughing and heart disease [18]. The level of suspended particulate matter (SPM) constitutes one of the most important indicators of air pollution and is closely connected with the life expectancy rate [19] and the expansion of the respiratory disease matrix. It also has a significant impact on both the climate and people's living environment [20].

The factors causing environmental degradation, especially air pollution, adversely impact not only the health of residents and tourists but also on the decisions they make. However, there exists scarce information on the nature or effects of various environmental factors, especially air pollution, on health tourism as a support industry contributing to improving society and achieving sustainable development. It is also vital to study the effect of non-medical factors such as air pollution when formulating appropriate tourism policies and sustainability issues for health policymakers and managers. The creation of this new conceptual approach, in turn, requires cooperation between designers (architects and planners), physicians, epidemiologists and policymakers in promoting actions and policies aimed at change to in order realise a healthy environment for tourists. Health tourism also constitutes an essential area of policymaking not only in encouraging this industry but also in minimizing its challenges despite the recent epidemic. The reason for this is that some viruses are transmitted through the air, using fine airborne particles as carriers to spread in the environment. Simply put, environmental phenomena such as air pollution can accelerate the spread of viruses such as SARS-CoV-2, and negatively impact on the attraction of tourists. These matters require more appropriate epidemiological research.

One of the general policies adopted by the health system in Iran since 2014 is the reduction of risks and pollution threatening the health based upon valid scientific evidence. Pursuant to these policies, one of the strategic challenges enumerated in the Land Use Planning Document regarding Ilam is the growing trend of the dust storm phenomenon and its pervasive effect on the expansion of dust storm emission sources inside the country. In the same document mentioned above, *Dehloran*, *Mehran*, and *Ilam* cities have been cited as health tourism hub zones [21]. In this regard, this study provides a proposal for the management of the tourism industry following the COVID-19 pandemic that includes the creation of a more sustainable health tourism industry through adopting measures appropriate for the identification of the leading indicators of air pollution. Taking the above into account, the present research seeks to answer the following two questions:

1) Which air pollutant has the greatest impact on the air pollution and instability of Ilam city, and thus is preventing the development of health tourism?

2) Can a level of average aerial particulate matter less than 10 microns- as one of the most critical threats facing the environment – be also regarded as the most significant threat facing the domain of health tourism development?

Ilam city is the capital of Ilam province. The population of this city was 194,030 as per the 2016 Census [22]. It is entirely surrounded by mountain forests with a temperate mountain climate and spring-like weather. Located in the northwest of the Ilam Province, Ilam City is situated at between 33 degrees 21 minutes 30 seconds to 33 degrees 51 minutes 48 seconds north latitude and 45 degrees 41 minutes 7 seconds to 46 degrees 51 minutes 19 seconds east longitude. It has an area of 67,212804 hectares, accounting for 62.10% of the province's total area. It neighbors the towns of Ivan, Sirvan, Chardavol, Darreh Shahr and Mehran and the country of Iraq [23], sharing a 430 km border with Iraq to the north. It extends topographically to the Shenehchir mountain to the north, Shalam mountain to the east, Qala Qiran mountain to the west and to Kabir Kouh mountain to the south [24].

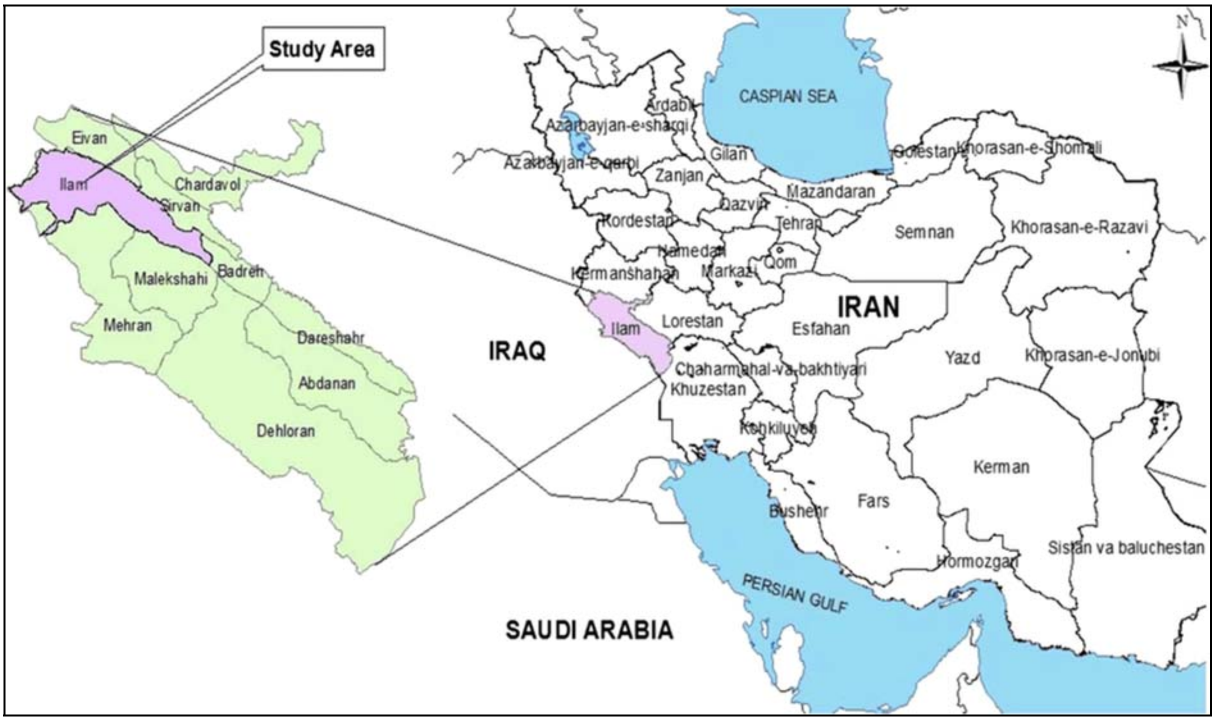

Figure 1. Relative location of Ilam city in Iran geographically
Рисунок 1. Географическое расположение города Илам в Иране

MATERIALS AND METHODS

This research is of applied nature in terms of data consulted. The data were collected through library research and by referring to the relevant monitoring organizations. Data analysis was undertaken according to by the FPPSI model, while Excel and MATLAB software were used to display data. This study examined data relative to the five primary indicators of air pollution, including the average level of carbon monoxide gas (CO), average level of sulphur dioxide (SO_2), average level nitrogen dioxide (NO_2), average level of ozone gas (O_3) and average level of particulate matter of less than 10 microns during 2008-2018.

Table 1. Air pollution indicators studied over the 2008-2018 period
Таблица 1. Показатели загрязнения воздуха, изученные за период 2008-2018 гг.

Indicator Индикатор	**Units** Ед	**Standardised value** Стандартное значение	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
CO	**Ppm** ‰	9	1.5	1.4	1.3	1.4	1.3	1.4	1.4	1.5	1.6	1.7	1.6
SO_2	**Ppm** ‰	0.03	0.0121	0.0161	0.015	0.0141	0.0176	0.0189	0.0201	0.0198	0.0212	0.0223	0.0219
NO_2	**Ppm** ‰	0.053	0.0082	0.0101	0.011	0.093	0.087	0.083	0.094	0.0101	0.0111	0.011	0.0118
O_3	**Ppm** ‰	0.08	0.0141	0.0135	0.018	0.0195	0.0191	0.0188	0.0194	0.0228	0.0241	0.0239	0.0225
PM10	**Ppm** ‰	260	141	177	76	53	126	115	71	58	66	64	70

Source: Environmental *Protection* Agency *of Ilam Province (2018) [25]*
Источник: Агентство по охране окружающей среды провинции Илам (2018) [25]

Description of the model used in the research

In this study, the full permutation polygon synthetic indicator (FPPSI) method was used to evaluate stability. As a model newly developed for assessing sustainable development, FPPSI has not been used in Iran so far. Through considering the values of the upper limit, lower limit, and standardised data in FPPSI, it has a very high power in evaluating and analysing the current status of sustainable development. In this method, the theoretical maximum values of each of the *n* indicators are represented by a polygon of n sides with a radius at each vertex (i.e. distance from the polygon's center). This radius itself is defined by calculating the upper limits of the standardised value for each indicator. Hence, *(n* − 1)!/2 *n*-sided polygons are created in total.

To define the synthetic indicator, the mean of ratios of n-sided polygon's area to the polygon's area is calculated and defined in terms of a normalized value of 1.0 for each indicator.

The process of standardisation can be expressed in the following way:

$$F(X) = a\frac{X+b}{X+c}, \quad a \neq 0, \quad X \geq 0$$

where *F(X)* satisfies the following conditions:

$$f(x)|_{x=L} = -1$$

$$f(x)|_{x=T} = 0$$

$$f(x)|_{x=U} = 1$$

In the above equation, *U*, *L*, and *T* indicate the upper limit, the lower limit and the threshold for parameter *X*, respectively. Thus, we have:

$$f(x) = \frac{(U-L)(U-T)}{(U+L-2T)X + UT + LT - 2LU}$$

Then, the equation can be standardised as follows:

$$Si = \frac{(Ui - Li)(Xi - Ti)}{(Ui + Li - 2Ti)Xi + UiTi + LiTi - 2UiLi}$$

Using *n* indicators, an outer regular polygon of n-sides can be created in which n vertices and the central point represent S_i*=1* and *Si=−1*, respectively. Additionally, the value of the corresponding standardised indicator is defined by the radius from each vertex to the central point.

The threshold values of the indicators meeting S_i =0(X_i = T) are represented by an inner polygon that is situated halfway between the outer polygon and the polygon centre. The values of the standardised indicators that are located inside and outside the inner polygon are negative and lower than their thresholds and positive and higher than their threshold values, respectively (Figure 2).

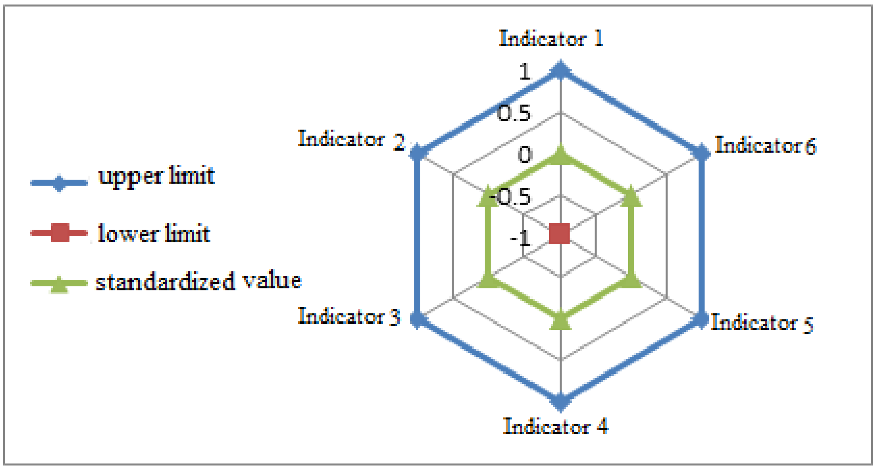

Figure 2. FPPSI Method
Рисунок 2. Метод СИМП

To calculate the number of triangles created by the lines between the central point and the *n* indicators (vertices), the following equation is used:

$$\frac{n(n-1)}{2}$$

In the same vein, the polygon's total area is estimated based on the following equation:

$$0.5\,s\sum_i (S_i+1)(S_j+1)\ln\left(\frac{\pi}{n}\right)$$

where S_i and S_i *+1* are the indicator *i* and the distance from the endpoint of indicator *i* to the central point, respectively. The standardisation interval is equal to *[−1, +1]*.

In this way, *n × (n − 1)!/2 = n!/2* triangles are produced from the number of indicators *(n − 1)!/2*. Their total area is obtained as follows:

$$\left(0.5\sin\left(\frac{\pi}{n}\right)\sum_{i\neq j}(Si+1)(Sj+1)\right) * \frac{n!}{2} * \frac{2}{n(n-1)}$$

To estimate the total areas of the *(n − 1)!/2* regular outer polygons (with a side two units in length), the following equation is used:

$$0.5 \times 4 \times n \times \frac{(n-1)!}{2}$$

Finally, the FPPSI value is calculated as follows:

$$S = \frac{\sum_{i\neq j}^{i,j}(Si+1)(Sj+1)}{2n(n-1)}$$

In this equation, the total of the values of all indicators at a hierarchy's lower level has been represented by *S*. Indicating the value of synthetic indicator; it can also be standardised to reflect the immediately higher level in the hierarchy [26-28].

RESULTS

In this study, the maximum and minimum limits and standards of air pollution indicators were used. In the FPPSI method, the values higher than the standard level indicate less pollution and vice versa. Put differently, the closer the pollution level to -1, the greater pollution will be, and the closer the value of pollution to +1, the lower pollution will be.

As is evident in the results of 2008, the fifth indicator (i.e., suspended particulate matter less than 10 microns) with an average value of *0.375151* had a greater effect than other pollution indicators on the health of residents and tourists and air pollution and instability in Ilam City. After that, sulphur dioxide gas (average value = *0.434545*), ozone gas (average value = *0.5801060*) and carbon monoxide gas (average value=*0.757576*) were ranked from highest to lowest in terms of their level of their contribution to air pollution in Ilam City, respectively. Compared to other pollutants, nitrogen dioxide (NO_2) with an average of 0.7589750 had the least effect on pollution in Ilam City.

In 2009, from among the pollution indicators in question, average particulate matter of less than 10 microns (i.e., 5th indicator) and sulphur dioxide gas had the greatest impact on the health risks of the residents and visitors and the air pollution of Ilam City with a value of *0.250142* and *0.309629*, respectively. The lowest impact levels were of carbon monoxide (CO), ozone (O_3), and nitrogen dioxide (NO_2) with average of *0.772358*, *0.709989*, and *0.573276*, respectively.

Based on Figure 3, in 2010, sulphur dioxide (i.e., indicator No. 2) with an average of *0.338887* had the highest effect on the air pollution and instability of Ilam City. With an average of *0.6326*, suspended particulate matter (i.e., indicator No.5) was found to be the second most significant air pollutant in Ilam City. Ozone gas (i.e., indicator No. 4) with an average of *0.6342* had the same effect as suspended particles. Compared to the five indicators studied, carbon monoxide gas (i.e., indicator No. 1) accounted for the lowest pollution level in the year in question.

In 2011, as far as the effect on the instability and air pollution of Ilam City is concerned, sulphur dioxide (i.e., indicator No.2) with an average of *0.3694*, ozone with an average of *0.6576*, nitrogen with an average of *0.7303* and suspended particles with an average of *0.7353* ranked from the highest to the lowest. Carbon monoxide gas with an average of *0.7723* had the least effect on air pollution and subsequent instability in Ilam City.

In 2012, sulphur dioxide (i.e., indicator No.2) and suspended particles (i.e., indicator No.5) were ranked first and second in terms of effect on air pollution and instability in Ilam City with an average of *0.2679* and *0.43070*, respectively; meanwhile, ozone gas with an average of *0.6506* was more stable than in the years before 2012. Carbon monoxide indicator with an average of *0.7873* and nitrogen dioxide with an average of *0.7458* had the lowest effect on pollution, respectively.

As is evident from Figure 3, in 2013, the sulphur dioxide (i.e., indicator No.2) with an average of *0.23377*, suspended particulates (i.e., indicator No.5) with an average of *0.4728* contributed the most to air pollution and instability in Ilam City, respectively. In terms of the effect on the instability of Ilam city, the next higher positions in the ranking belonged to ozone gas with an average of *0.6506*, nitrogen dioxide with an average of *0.7563* and carbon monoxide with an average of *0.7873*.

In 2014, as in the previous years, sulphur dioxide (i.e., indicator No. 2) with an average of *0.2679* had the top ranking in terms of the effect on instability and air pollution in Ilam. The contribution of suspended particulates (i.e., indicator No. 5) to the air pollution of Ilam city was approximately the same as ozone gas i.e., *0.6544 vs. 0.6558*. However, the former indicator (i.e., suspended particulates matter) showed more stability, decreasing its role in the city's air pollution. Nitrogen dioxide and carbon monoxide were ranked the lowest by the effect on air pollution and instability in Ilam City with an average of *0.7277*and *0.78723*, respectively.

Likewise, considering Figure 3, in 2015, the order of indicators by the effect on the air pollution and instability in Ilam City from the highest to lowest was as follows: sulphur dioxide (i.e., indicator No. 2) with an average of *0.2111*, nitrogen dioxide (NO_2) with an average of *0.7099*, suspended particulates with an average of *0.7124*, ozone gas with an average of *0.7258* and finally, carbon monoxide with an average of *0.75756*.

As per Figure 3, like 2008-2015, in 2016, sulphur dioxide (SO_2) with an average of *0.1773* made the biggest contribution to air instability in Ilam City. Following it, suspended particulates with an average value of *0.6764*, sulphur dioxide with an average of *0.6851*, sulfur monoxide gas with an average of *0.7429* had the greatest effect on air pollution in Ilam, respectively. Ozone gas with an average of *0.7595* had a more stable situation in the year in question and led to less air pollution in Ilam.

In 2017, sulphur dioxide (i.e., indicator No. 2) with an average of *0.152091* contributed the most to the air pollution and instability in Ilam, followed by suspended particles, nitrogen dioxide (NO_2), carbon monoxide and ozone gas with an average of *0.685397, 0.6875667*, *0.7258* and *0.728543*, respectively.

According to Figure 3, in 2018, sulphur dioxide gas (i.e., indicator No. 2) with an average of *0.16117* played the most prominent part in air pollution and instability of Ilam City. After that, suspended particulates with an average of *0.658807*, nitrogen dioxide with an average of *0.668039*, ozone gas with an average of *0.71875* and carbon monoxide with an average of *0.742972* were the next factors having the greatest effect on air and instability in Ilam City, respectively.

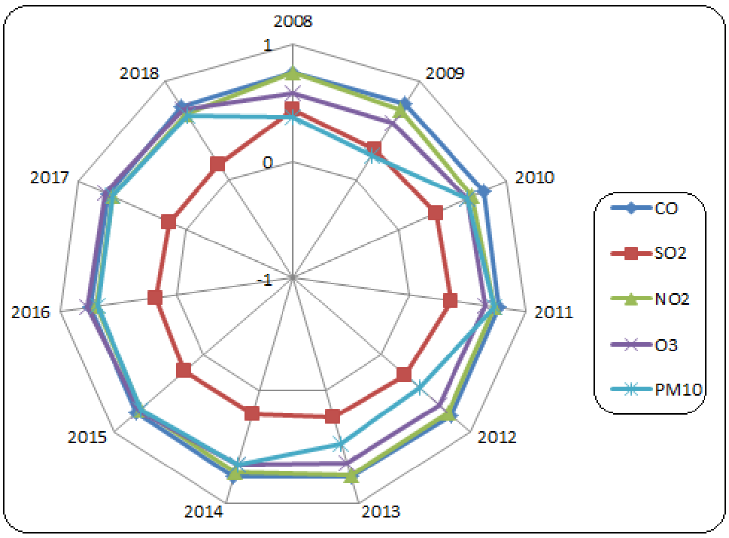

Figure 3. Status of air pollution indicators in Ilam City in 2008-2018
Рисунок 3. Состояние показателей загрязнения воздуха в городе Илам в 2008-2018 годах

As seen in Figure 4 and Table 2, from among five main/leading indicators of air pollution, the average sulphur dioxide content in the air of Ilam City can be considered the most important and primary factor of instability and air pollution in the period under study. As one of the critical environmental pollutants in Iran in recent years, suspended particulates of less than 10 microns were the second-highest pollutant after sulphur dioxide. After these two factors, average ozone gas content contributed the most to air pollution in Ilam City.

Table 2. FPPSI of air pollution indicators in Ilam City in 2008-2018
Таблица 2. FPPSI показателей загрязнения воздуха в городе Илам в 2008-2018 гг.

Average air pollution Среднее значение загрязнения воздуха	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
CO	0.757576	0.772358	0.787321	0.772358	0.787321	0.772358	0.772358	0.75758	0.742972	0.728543	0.742972
SO_2	0.434545	0.309629	0.338887	0.369402	0.267934	0.23377	0.203735	0.21112	0.177384	0.152091	0.16117
NO_2	0.758975	0.709989	0.685105	0.730336	0.74586	0.756339	0.72777	0.70999	0.685105	0.6875667	0.668039
O_3	0.580106	0.573276	0.634221	0.657609	0.650641	0.64557	0.655844	0.72589	0.759511	0.754032	0.71875
PM10	0.375151	0.250142	0.632663	0.735339	0.430702	0.472841	0.654419	0.71244	0.676483	0.685397	0.658807

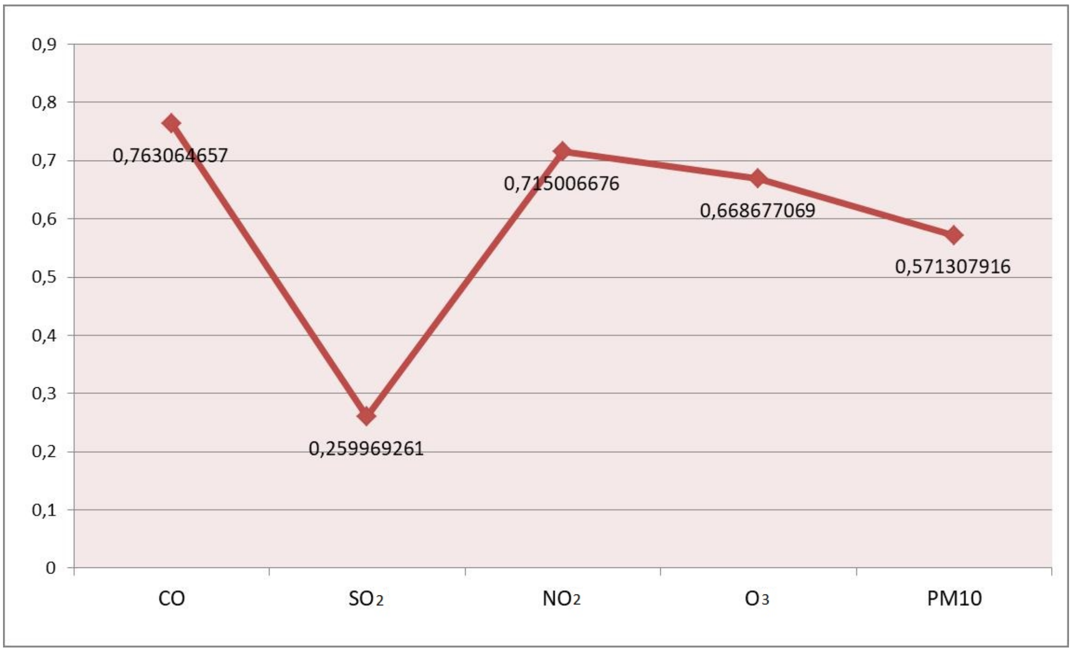

Figure 4. Average FPPSI of air pollution indicators in Ilam City in 2008-2018
Рисунок 4. Средний FPPSI показателей загрязнения воздуха в городе Илам в 2008-2018 гг.

DISCUSSION

Awareness of the natural environment of a given tourist destination, especially air quality as a reference point for health geography, is a newly debated issue. Hence, threat of air pollution and its direct relationship with the increase or decrease in the presence of tourists has intensified the importance of giving due attention to environmental issues of both tourist origin and destination countries when the development of tourism and health tourism is in considered. Severe air pollution has driven international tourists out of China [29] on the one hand and forced Chinese tourists to travel abroad on the other [30]. Thereupon, using a gravitational model in Beijing, they found that air quality has negatively influenced China's inbound tourism remarkably [31]. According to some researchers, environmental phenomena like air pollution have also contributed to the accelerated incidence of viruses such as SARS-CoV-2. Hence, exposure to air pollution is associated with a higher incidence of SARS-CoV-2 and of COVID-19-induced mortality [32].

According to the results obtained from the average of FPPSI of air pollutants during the years studied, as is evident from the standard of some indicators, Ilam's environmental conditions have approached instability during the years in question. This contradicts the goals of *Land Use Planning Document 2020* that has introduced Ilam city as the pole of health tourism development in Ilam province [21]. This problem, in turn, necessitates giving due consideration to the environmental issues by the province's policy-makers and authorities in terms of the type of air pollutant and magnitude of effect on health tourism development.

Based on research results, the effect of sulphur dioxide on environmental instability and air quality of Ilam City in terms of attracting health tourism is higher than other pollutants. This finding was in line with those reported by Seydaei *et al* [27] for the Isfahan metropolis and Hosseini *et al* [28] for the Ahwaz metropolis. These studies differ only in that the levels of instability and diversity of pollutants in the metropolises/big cities of Iran (i.e., Tehran, Ahwaz, and Isfahan) are much higher than in the city of Ilam. Just as air pollution can affect the development of health tourism, so can tourism development affect the quality of air in destination cities. [27-28].

Some researchers have examined the effect of tourism development on air quality, showing that the contribution of tourists' behavior to air pollution cannot be ignored [33]. They claim that 8% of the greenhouse gas emissions worldwide can be attributed to the tourism industry. Thus an increase in the number of tourists by 1% could bring in an increase in the PM10 by 0.45% [34]. Tourism also significantly affects CO_2 emissions. Given the rising trends in environmental pollution in the form of CO_2 emissions, it remains to be seen what solutions developing countries such as Malaysia, Thailand, and Singapore (as emerging economies in this field facing a steady increase in the number of tourists), offer in the future to develop medical tourism [35].

During 2008-2009, the average of particulate matter of less than 10 microns (PM10) had a greater effect on instability and air pollution in Ilam City than other pollution indicators (with an average of *0.375151* vs. *0.250142*, respectively). Overall, during the years 2018-2010, sulphur dioxide (SO_2) gas with an average of 0.*338887, 0.369402*, 0.267934, 0.23377, 0.203735, 0.211115, 0.177384, 0.152091, 0.152091, 0.687567, 0.754032, 0.685397 and 0.152091, respectively, has made a greater contribution to air pollution of Ilam city. With a value of *0.16117*, sulphur dioxide gas (SO_2) had the greatest effect in 2018, creating more instability. In this study, suspended particulate matter was ranked the second, after sulphur dioxide, most important pollutant in Ilam city. This finding was contrary to the Land Use Planning Document that has enumerated an average particulate matter of less than 10 microns as the most crucial threat facing Ilam's environmental domain. In view of the foregoing, one possible future direction of research would be to investigate the effect of these two pollutants, and in particular sulphur dioxide, which is recognized as the most significant pollutant during the recent years to threatening the health of tourists and citizens in Ilam City. The interference of air quality on tourism development has recently come into greater focus in some countries and has entailed important implications for the tourism economy given the recent epidemic. Thus, considering Iran's neighbors requiring medical services, it seems necessary to achieve an integrated understanding of air pollution, tourism and the recent epidemic and explore their interrelationships by adopting a complex strategy for the attraction of health tourists based on air quality.

CONCLUSIONS

Air pollution is recognised as one of the significant environmental concerns and threats facing the health of residents and visitors and, subsequently, health tourism development. Where various regions/areas of equal potential differ in environmental quality, the cleanest region will enjoy higher competitiveness. The present study examined the air pollutants as a threat to health tourism in Ilam over an 11-year period. Given the average FPPSI of contaminants during 2008-2018, the environmental conditions of Ilam City have approached instability in terms of some indicators, with sulphur dioxide making the most significant contribution to the environmental/ecological instability of this city. The novelty of this research is that it is the first time that one of the most important environmental factors, i.e. air pollution has been examined in connection with the development of the health tourism industry in Iran and in one of the high-capability border cities (due to having active border crossings with Iraq) in attracting this category of tourists. Furthermore, according to upstream documents, especially Ilam's Land-use Studies & Planning Document [21], the level of suspended particulates of less than 10 microns (PM10) has been identified as the most serious risk/threat facing the environment of this province. According to the results of this study, the most important threat to the city of Ilam in the field of environment and consequently of health tourism is sulphur dioxide followed by particulate matter of less than 10 microns (PM10). Hence, prior to embarking upon the health tourism development initiatives, planners and policy makers are required to pay special attention to identifying the hazards caused by the unawareness of this pollutant (it has not been considered in the upstream documents) and its subsequent negative effects on the health of residents and tourists, taking into accounting the recent epidemic.

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AUTHOR CONTRIBUTIONS

Somayeh S. Hosseini defined the idea of the study, built its logic, participated in field research, compiled cartographic material and structured the results of the study. Massoud Taghvaei formulated the problem, defined research methods, participated in field research, structured the text of the article in the logic of research and selected bibliographic sources. Eskandar S. Seidaiy participated in field research and structured the text of the article in the logic of research. Yones Gholami structured the text of the article in the logic of research and participated in the production of the graphic material of the article. Zagir V. Ataev performed an analysis of the existing experience and formulated the conclusions of the study. All authors are equally responsible for detecting plagiarism, self-plagiarism and other ethical transgressions.

КРИТЕРИИ АВТОРСТВА

Сомайех С. Хоссейни определил идею исследования, выстроил логику исследования, участвовал в полевых исследованиях, составил картографический материал, структурировал результаты исследования. Масуд Тагвайи сформулировал проблему, определил методы исследования, участвовал в полевых исследованиях, структурировал текст статьи в логике исследования, подбирал библиографические источники. Эскандар С. Сейдайи участвовал в полевых исследованиях, структурировал текст статьи в логике исследования. Йонес Голами структурировал текст статьи в логике исследования, участвовал в изготовлении графического материала статьи. Загир В. Атаев выполнил анализ имеющегося опыта, сформулировал выводы исследования. Все авторы в равной степени несут ответственность при обнаружении плагиата, самоплагиата и других неэтических проблем.

NO CONFLICT OF INTEREST DECLARATION

The authors declare no conflict of interest.

КОНФЛИКТ ИНТЕРЕСОВ

Авторы заявляют об отсутствии конфликта интересов.

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