Evaluation of Climatic Condition Suitability for Elderly Care Industry Development in Prefecture-Level Cities in China

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Abstract: The demand for elderly care in China is growing, and the elderly care industry has great development prospects. Climatic conditions are important factors that affect the health of elderly individuals and the development of the elderly care industry. This study will have important guiding significance for the layout of China’s elderly care industry. This paper utilizes ArcGIS and the spatial fuzzy comprehensive evaluation method to analyze the climatic suitability for the development of the elderly care industry in China’s four municipalities, the Hong Kong, Macao, and Taiwan regions, and 333 prefecture-level administrative regions based on six factors: temperature, humidity, airflow, air pressure, sunshine, and precipitation. In addition, development suggestions are proposed. The results show the following. (1) The areas with highly suitable climatic conditions for the development of the elderly care industry in China are concentrated in the eastern and southern areas of Southwest China and the southern areas of Central and East China, mainly in the Yangtze and Pearl River Basins. Slightly suitable areas are distributed around highly suitable areas, concentrated in the central and southern regions of China. Low-suitability areas are clustered, including an area spanning northern North China and East China, southern Northeast China, and central Northwest China, and there is another cluster in Xinjiang. The non-suitable area resembles a strip extending from Northeast China along the Inner Mongolia Plateau to the Qinghai-Tibet Plateau. (2) In Central and Southwest China, there are 57 prefecture-level administrative units with highly suitable temperature conditions that can develop an elderly care industry for patients with cardiovascular and cerebrovascular diseases. Twenty-eight prefecture-level administrative regions with comprehensively suitable temperature and humidity conditions scattered throughout the country can develop an elderly care industry for elderly patients suffering from rheumatic and respiratory diseases.

Keywords: climatic conditions; elderly care industry; suitability evaluation; prefecture-level city; spatial fuzzy comprehensive evaluation

1. Introduction

The next 30 years will be a critical period for the rapid growth of the elderly population and a drastic rise in demand for elderly care in China [1,2]. By 2030, the number of people over 60 years old in China is predicted to exceed 300 million, and the disposable income of elderly individuals will increase to 5 trillion yuan. By 2050, the proportion of China’s elderly population will exceed 30% [1],
the assets of the elderly care industry will reach 21.95 trillion yuan, and the elderly consumer market will reach 60 trillion yuan [2].

The population is ageing in tandem with the miniaturization of families and a declining birth rate. Moreover, the large-scale demand for quality elderly care exceeds China’s existing elderly care service supply capabilities. It is therefore urgent to carry out structural reforms from the supply side, explore new market-oriented development models for the elderly care industry, and cultivate high-quality elderly care industry bases. Since the Healthy China Strategy was put forward, all regions have been striving to seize development opportunities in the elderly care industry; consequently, the risk of widespread and uncoordinated development is prominent.

Good natural environmental and medical conditions are two important foundations for the development of the elderly care industry. It is necessary for the layout of the elderly care industry to consider the impact of the regional environment on the health of elderly individuals. Among the types of natural environmental conditions, climatic conditions constitute the most important influencing factor with direct or indirect effects on the health status and life span of elderly individuals. Climatic conditions together with other conditions affect the “comfort” of the environment in which elderly individuals live. Good climatic conditions are conducive to the health of elderly individuals, enhance the comfort of living spaces, and heighten the attractiveness of elderly individuals; thus, such conditions are conducive to the development of the elderly care industry.

Existing studies have focused on the relationships between health and the subjective comfort of human settlements and climatic conditions. However, these findings have not been profoundly extended to elderly individuals. To address this shortcoming, this paper first constructs a set of climatic condition suitability evaluation indexes for the development of the elderly care industry, considering the impacts of climate on the health and comfort of elderly individuals. Then, this article carries out a suitability evaluation and ultimately describes the climatic suitability and advantages and disadvantages of the development of the elderly care industry in various regions of China. These findings will have important guiding significance for the reasonable layout and characteristic development of China’s elderly care industry.

Changes in relative humidity affect blood viscosity and the rate of spread of viruses, bacteria, etc., which further affect human health and comfort [3–9]. Elderly people with rheumatoid arthritis are particularly sensitive to temperature, humidity, and air pressure variations, and under the combined influence of strong winds, low temperatures, and high humidity, elderly individuals are particularly susceptible to catching colds. Medical geographers focusing on the geographical distributions of diseases and health in elderly individuals found that the reference value of hemoglobin for elderly individuals increases with an increase in annual sunshine hours and decreases with increases in annual average relative humidity, annual average temperature, and annual precipitation [10–14]. Some scholars studied the peculiarities of the climatic conditions of typical villages whose inhabitants exhibit good longevity and concluded the range of precipitation and sunshine durations that are beneficial to longevity [15,16].

Climatic conditions are also an important influence on the regional human settlement environment. Comfortable human settlement environments formed by good climatic conditions are particularly attractive to the “migratory bird-type” pension group. Domestic and foreign research on the suitability of climatic conditions for human settlements is relatively mature. In the early days, foreign scholars Hundt, Thom, and Werner successively proposed climatic suitability evaluation models, such as effective temperature, comfort index, and wind efficiency index [17,18]. Since then, many domestic and foreign scholars have applied these indexes to evaluate the climatic suitability of local areas [19–21]. Nely Alexandre Marçal comparatively analyzed the environmental thermal comfort conditions of the public squares in two semiarid cities of eastern Brazil (Teixeira and Patos) [22]. Accordingly, national-scale research on the climatic suitability of the human settlement environment is gradually improving in China. In the early 2000s, Li Xueming selected 20 evaluation indexes considering the five aspects of temperature, humidity, wind, sunshine, and severe weather and evaluated the climatic
suitability of human settlements in 29 major Chinese cities by using fuzzy comprehensive evaluation methods [23]. Subsequently, Tang Yan and Yin Wenjuan evaluated the climatic suitability of China [24] and the characteristics of climate comfort in the human settlement environment in mainland China by analyzing the temperature and humidity index, wind efficiency index, and comfort index [25]. In 2019, Zhu Baomei calculated the temperature and humidity index, wind efficiency index, clothing index, and comprehensive index of Dezhou city from 1967 to 2017 based on conventional weather data, including temperature, wind speed, relative humidity, and sunshine, and analyzed its climatic suitability [26]. In recent years, researchers have begun to focus on the impact of a specific climate index on the suitability of human settlements. For example, Negin Nazarian et al. found that thermal stress and thermal discomfort challenge the suitability of urban human settlements [27]. Giuffrida et al. applied big data technology to evaluate people’s perceptions of the weather based on their responses to the weather published in tweets, thereby determining the temperature comfort range in reverse [28]. Gao Xuejie comprehensively considered the effective temperature of the human body’s thermal perception index, which considers the factors of temperature, relative humidity, and wind speed, and predicted the future changes in China’s regional thermal comfort conditions [29].

2. Methods and Data Sources

2.1. Index System Construction

Climatic factors are complex and diverse and mainly include temperature, humidity, solar radiation, wind, air pressure, and precipitation. Each of these factors involves many specific indexes, most of which are closely related to human health and comfort. To ensure a scientific and comprehensive evaluation, the following two aspects were considered: (1) the relationships between various climate factors and the health of elderly individuals and (2) the relationship between climate and human comfort. First, temperature, humidity, air flow (wind), air pressure, sunshine, and precipitation were determined to be closely related to the health and longevity of elderly individuals. Then, combined with the existing evaluation index system of human settlement environment suitability and the climate comfort evaluation index system, specific evaluation indexes were selected according to the impacts of climatic conditions on the health of elderly individuals.

This paper selected 14 meteorological indexes from the above six categories of climatic factors to construct an index system for evaluating the suitability of climatic conditions for the development of the elderly care industry in China (Table 1). When the air pressure was lower than 701 hPa, the weight was set to 1, and when the air pressure was higher than 701 hPa, the weight was set to 0. The remaining indexes used the analytic hierarchy process to determine the weights. First, a hierarchical structure model was built using Yaahp software according to the determined index system. Then, an analytic hierarchy process questionnaire (with a scale divided into nine levels) was created and distributed to 10 experts for scoring (two of these experts were engaged in clinical medical research, two were engaged in Chinese medicine research, two were engaged in human geography research, two were engaged in human settlement environment research, and two were engaged in climate research; all experts had a master’s degree or above and provided deep professional insight into the relationships between the health of elderly individuals, human comfort, and the climatic environment). Second, all of the questionnaires were imported into Yaahp, and the scoring results of each expert appeared in the group decision-making panel. Third, because each expert’s score was considered equally important, the average weight of the expert weight in the group decision-making panel was selected. Finally, the weight of each indicator was obtained using the group decision calculation function based on the data of each expert in the panel.
Table 1. The evaluation index system of climatic suitability for the development of the elderly care industry.

| Target Layer | Standard Layer | Index Layer | Unit | Direction | Weights |
|--------------|----------------|-------------|------|-----------|---------|
|              |                | Number of days when the daily minimum temperature is below 5 °C | Days/year | Reverse | 0.1464 |
|              | Suitability of climatic conditions for the elderly care industry | Number of days with the highest temperature above 30 °C | Days/year | Reverse | 0.0273 |
|              |                | Number of days when the average temperature difference between two adjacent days is less than 5 °C | Days/year | Reverse | 0.0647 |
| Temperature  |                | Annual average temperature | °C | Forward/reverse | 0.1464 |
|              |                | Average temperature in January | °C | Forward/reverse | 0.1464 |
|              |                | Average temperature in July | °C | Forward/reverse | 0.0273 |
| Humidity     |                | Annual average relative humidity | % | Forward/reverse | 0.106 |
|              |                | Number of days in which the annual relative humidity changes by less than 10% | day | Forward | 0.106 |
| Airflow      |                | Annual average wind speed | m/s | Reverse | 0.0542 |
|              |                | Number of days with winds above level 3 in winter and spring | day | Reverse | 0.0542 |
| Air pressure |                | Air pressure | hPa | Forward/reverse | 0/l (note) |
| Sunshine     |                | Annual average sunshine hours | h | Forward/reverse | 0.0469 |
| Precipitation|                | Annual precipitation | mm | Forward/reverse | 0.0469 |

Note: An air pressure lower than 701 hPa is extremely unfavorable for human health, so this is considered an absolute constraint on the development of the elderly care industry.

2.1.1. Temperature Indexes

High- and low-temperature environments are not conducive to the health of elderly individuals. Studies have shown that 15–18 °C is the most beneficial temperature range for human health [30]. The annual average temperature can roughly reflect the comprehensive temperature conditions of a region. Areas with a low annual average temperature exhibit a high incidence of chronic bronchitis, colds, and cardiovascular diseases [17,31–33].

Excessively low temperatures result in significantly increased incidences of stroke, angina pectoris, myocardial infarction, pulmonary heart disease, and arteriosclerosis, as well as related mortality [9,34]. When the monthly average temperature is ≤15 °C, there is a negative linear correlation with monthly respiratory system-related mortality [35]. Studies have shown that the frequency of sudden cardiovascular diseases is the highest in cold winters, and the risk of death in elderly individuals is also the highest [36–40]. The average temperature in January, the coldest month of the year, can reflect the low temperature and coldness to a certain extent [41]. Medical experiments have shown that human physical and mental health will be impaired when the temperature is lower than 5 °C for a long time; hence, the number of days when the minimum daily temperature is lower than 5 °C reflects the frequency of low-temperature weather. In contrast, excessively high temperatures will condense blood, increase the burden on the heart, and easily induce ischemic stroke [30]. According to statistics from the Chinese health department, there is a high incidence of ischemic stroke between June and August each year. The higher the temperature is, the greater the risk. July is the hottest month of the year, and thus, the average temperature in July can reflect hot weather to a certain extent [42]. The number of days in a year with temperatures above 30 °C reflects the frequency of high-temperature weather.

The annual temperature difference is the difference between the highest monthly average temperature and the lowest monthly average temperature in a year, reflecting the seasonal temperature...
balance. For the health of elderly individuals, the temperature difference between winter and summer should not be overly large.

Generally, when the daily average temperature differs by more than 10 °C between two adjacent days, the body’s regulation function cannot adapt to the sudden temperature change [43]. This temperature regulation function in elderly individuals is significantly impaired. Consequently, elderly individuals are more sensitive to temperature changes, and their bodies have difficulty adapting to sudden changes in temperature. An average temperature difference of more than 5 °C between two adjacent days can easily cause physical discomfort, and fluctuating cold and warm conditions can easily result in colds and other diseases. From the perspective of the physiological requirements of elderly individuals, the environmental temperature cannot change much. The average temperature difference between two adjacent days can reflect the temperature change to a certain extent.

2.1.2. Humidity Indexes

The 45–60% relative humidity range is good for human health [8,44,45]. A relative humidity lower than 45% will cause dryness of the skin, throat, and respiratory tract, which can result in respiratory diseases, such as asthma. When the humidity is lower than 30%, bacteria spread more easily, and elderly individuals’ bodily resistance will be weak and vulnerable to bacteria and viruses. In contrast, when the relative humidity is higher than 60%, the heat dissipation capacity of the human body decreases with increasing humidity. When the relative humidity is higher than 70%, due to the large secretion of the pineal gland, the concentrations of adrenaline and thyroxine will be relatively reduced, which will lead to malaise. At a relative humidity above 80%, which is too high, it will be difficult for the human body to dissipate heat, leading to increased body temperature, rapid heartbeat, dizziness, and nausea. Patients with joint pain are particularly sensitive to changes in humidity. When the relative humidity changes by more than 10% in a short time, the frequency of joint pain will increase greatly.

2.1.3. Airflow Indexes

The body of an elderly individual is sensitive to wind [46], especially in winter and spring, and the incidence rate of illness will increase significantly after exposure to wind. Therefore, it is best for elderly individuals if the windy weather in winter and spring is as mild as possible. The annual average wind speed and the number of days with winds above level 3 in winter and spring can effectively reflect the airflow conditions in various places.

2.1.4. Air Pressure Index

The human body is generally able to adapt well to changes in air pressure, but long-term living in an environment with low air pressure is detrimental to the human body [45,47]. Studies have shown that a suitable air pressure for the human body is greater than 526 mmHg or 701 hPa. When the air pressure is too low, the air will be thin, and elderly people are prone to hypoxia.

2.1.5. Sunshine Index

According to the statistics of Changshou township [48,49], an annual average sunshine hour duration between 1400 and 1800 h is conducive to longevity.

2.1.6. Precipitation Index

Too much or too little precipitation is not good for human health [48,49]. Annual precipitation between 1250 mm and 1500 mm is most beneficial to people’s longevity.
2.2. Data sources

The administrative boundary data of prefecture-level cities in China came from the Data Center for Resources and Environmental Sciences of the Chinese Academy of Sciences. The meteorological data were the average values of meteorological data from 613 meteorological stations in China acquired over a period of 10 years (2009–2018).

2.3. Evaluation of Technical Routes

This paper adopted the spatial fuzzy comprehensive evaluation method and used the spatial analysis function of ArcGIS to process the data, including tasks such as reclassification, map algebra calculations, overlay analysis, and the computation of regional statistics. In this way, the membership function of the single factor evaluation index at each grid (point) in the space was determined, after which a multilevel fuzzy comprehensive evaluation was carried out point by point, and finally, the fuzzy evaluation result of the entire study area was obtained. The specific process is outlined as follows:

(1) Data preparation and processing

A geographic database with relevant weather and climate data was constructed, the WGS84 coordinate system was adopted for all the data, and then spatial interpolation was performed on all the data.

(2) Establishing the evaluation index system

The established evaluation index system for the suitability of climatic conditions for the development of the elderly care industry was composed of a single target level, 6 standard levels, and 14 index levels. By defining \( u \) as the index level, there was a collection of climate-influencing factors \( U = \{u_1, u_2, \ldots, u_{14}\} \) for the development of the elderly care industry. That is, a collection of evaluation indexes was formed.

(3) Determining the domain of comment rating

The suitability of each climatic evaluation index was divided into four levels, namely, highly suitable, slightly suitable, suboptimal, and unsuitable, corresponding to \( v_1, v_2, v_3, \) and \( v_4 \), respectively. These levels form the comment level domain \( V = \{v_1, v_2, v_3, v_4\} \), and different grading schemes were adopted for different indexes.

First, the highly suitable threshold value for each index should be determined according to the ranges of the individual indexes when elderly individuals are at their healthiest, the climatic characteristics of areas with good longevity, the classification thresholds of the climatic suitability indexes of human settlements, etc. Then, combined with the existing research and according to the climate indexes in different ranges of human comfort and health, each index in Table 1 was divided into three grades from the most appropriate threshold range to both extremes. The positive and negative values of each indicator outside the most suitable range were divided into three grades. Then, the natural breakpoint method in ArcGIS was employed to classify each index. Combined with the needs of human health and comfort in the existing literature, the threshold value of each level was modified by manually inputting the grade value and modifying the threshold value of each level according to the results. Finally, the classification standard was obtained for each grade of each climate index (Table 2).
Table 2. Classification standards of the climatic condition suitability evaluation indexes for the development of the elderly care industry in China.

| Standard                  | Index                                                                 | Highly Suitable | Slightly Suitable | Low Suitability | Non-Suitable |
|---------------------------|----------------------------------------------------------------------|-----------------|-------------------|-----------------|--------------|
| Temperature               | Number of days when the daily minimum temperature is below 5 °C       | ≤30             | 30–90             | 90–180          | ≥180         |
|                           | Number of days with the highest temperature above 30 °C               | ≤20             | 20–60             | 60–100          | ≥100         |
|                           | Number of days when the average temperature difference between two adjacent days is less than 5 °C | ≥345            | 320–345           | 295–320         | ≤295         |
|                           | Annual average temperature (°C)                                       | 15–18           | 18–20; 13–15      | 8–13; 20–25     | ≤8; ≥25      |
|                           | Average temperature in January (°C)                                   | ≥15             | 4–15              | −5–4            | ≤–5          |
|                           | Average temperature in July (°C)                                      | 15–18           | 18–23; ≤15        | 23–30           | ≥30          |
|                           | Annual range of temperature (°C)                                      | ≤20             | 20–30             | 30–40           | >40          |
| Humidity                  | Annual average relative humidity (%)                                  | 45–60           | 60–70             | 70–80           | ≤45; ≥80     |
|                           | Number of days in which the annual relative humidity changes by less than 10% | >290            | 250–290           | 210–250         | <210         |
| Airflow                   | Annual average wind speed (m/s)                                      | ≤1.8            | 1.8–2.5           | 2.5–3.3         | >3.3         |
|                           | Number of days with winds above level 3 in winter and spring         | ≤10             | 10–20             | 20–40           | >40          |
| Air pressure              | Air pressure (hPa)                                                    | <701            |                   |                 |              |
| Sunshine                  | Annual average sunshine hours (h)                                     | 1400–1800       | 1800–2400         | 2400–2800; 1200–1400 | <1200; >2800 |
| Precipitation             | Annual precipitation (mm)                                            | 1250–1500       | 800–1250; 1500–1700 | 400–800; 1700–1900 | <400; >1900 |

(4) Determining the subordinate layer

The membership level is the membership degree set of each index relative to each evaluation level. This article had 14 indexes and 4 evaluation levels. The air pressure index is binary (either satisfying the threshold or not), so the degree of membership of the subordinate layer of the unsuitable zone is defined as 1, and the degrees of membership of highly suitable, slightly suitable, and low-suitability zones are all 0. In addition, each evaluation index forms four subordination levels relative to the evaluation level, namely, \( r_1 = (G_{11}, G_{12}, G_{13}, G_{14}) \). Taking the positive index as an example, the calculation method is described as follows:

\[
G_{i1,2,3} = \frac{X - p_{i2,3,4}}{\text{MAX} - p_{i2,3,4}},
\]

where \( G_{ij} (i = 1, 2, \ldots, n; j = 1, 2, \ldots, 4) \) is the membership degree of evaluation level \( v_j \) of the \( i \)-th index of each grid, and \( p_{i2}, p_{i3}, \) and \( p_{i4} \) represent the boundary value between the first and second levels, the boundary value between the second and third levels, and the boundary value between the third and fourth levels, respectively.

The first index (the number of days with the lowest temperature below 5 °C) is taken as an example to illustrate the formation of the subordinate layer: first, the membership function was determined, and then the membership degree of each level was calculated according to the membership function; finally, the spatial collection of the membership degree of the grid unit formed four membership layers, which are \( G_{11}, G_{12}, G_{13}, \) and \( G_{14} \) (Figure 1).
(5) Determining the comprehensive subordinate layer

The weighted summation in ArcMap was used to superimpose the affiliation layer of all the indexes of each evaluation level to form a comprehensive subordinate layer in which the evaluation unit belongs to each evaluation level. The spatial fuzzy comprehensive evaluation model became the following expression:

\[ B = A \cdot R = (a_1, a_2, \ldots, a_n) \begin{pmatrix} G_{11} & G_{12} & \cdots & G_{14} \\ G_{21} & G_{22} & \cdots & G_{24} \\ \vdots & \vdots & \ddots & \vdots \\ G_{n1} & G_{n2} & \cdots & G_{n4} \end{pmatrix} = (b_1, b_2, \ldots, b_4), \]

where \( B \) is the comprehensive membership layer, \( A \) is the weight of each factor, \( R \) is the single factor membership layer, and \( G_{ij} (i = 1, 2, \ldots, n; j = 1, 2, \ldots, 4) \) is the membership degree of the evaluation level of the index of each grid. Through calculation, four comprehensive subordinate layers were obtained (Figure 2).

Figure 1. Suitability subordinate layer of the number of days when the minimum temperature is below 5 °C.

Figure 2. Comprehensive subordinate layer for each suitability level.
Based on the comprehensive membership level and using the maximum membership principle, the evaluation level of each grid was determined first, and then the statistics in each district were applied to determine the evaluation level of each evaluation unit (prefecture-level city).

3. Results

Based on the above methods and data, the climatic condition suitability for the development of the elderly care industry was calculated and subdivided into four levels in each of China’s four municipalities (Beijing, Chongqing, Shanghai, and Tianjin), the Hong Kong, Macao, and Taiwan regions, and 333 prefecture-level administrative units. Accordingly, the distributions of the four levels of suitability were obtained for the six factors, namely, temperature, humidity, airflow, air pressure, sunshine, and precipitation, and for the comprehensive climatic suitability for the development of the elderly care industry in China (see Figures 3 and 4). The impacts of climatic conditions on different elderly groups were superimposed to determine the highly suitable areas for the development of the elderly care industry (see Figures 5 and 6).

3.1. Temperature Suitability

The distribution of temperature suitability is shown in Figure 3a. There are 60 prefecture-level administrative units in the highly suitable area. The highest concentration of these units is zonally distributed in the northern part of the Yangtze River Basin, involving 37 prefecture-level administrative units. This result is mainly due to the suitable latitude of this location, the high suitability of the annual average temperature, the relatively small number of days when the minimum temperature is below 5 °C, and the limited annual temperature range. The Yunnan-Guizhou Plateau in the southwest has a high altitude, low latitude, cool summers, few days with high or low temperatures, warm winters, a highly suitable annual average temperature, and low annual and daily temperature differences, all of which are good for elderly human health. The southeast coast and Hainan Island, including the Macao Special Administrative Region and nine prefecture-level administrative units, are located in a low-latitude, low-lying region with no cold weather and a minimum temperature of less than 5 °C on less than 30 days throughout the year; moreover, the average temperature in January is relatively high, the daily temperature range is small throughout the year, and the annual temperature range is less than 20 °C, which means that the overall suitability of the southeast coast and Hainan Island is high.

A total of 82 prefecture-level administrative units are in the slightly suitable area, which is concentrated in South China. This region features many plains and hills and only a few days with the lowest temperature below 5 °C at lower latitudes. The average temperature in January is relatively high, and the temperature fluctuations are small. Generally, the temperature conditions are slightly suitable for the development of the elderly care industry.

The low-suitability areas are mainly distributed in North China, eastern Northwest China, Central China, Northeast China, and the Tarim Basin, accounting for a total of 133 prefecture-level administrative units, which are mainly in the Yellow River Basin. These areas generally are situated at high latitudes and feature low temperatures in winter and high temperatures in summer. The annual temperature difference and the average temperature difference between two adjacent days are relatively large. Overall, these temperature conditions are not suitable for the development of the elderly care industry.

There are 67 prefecture-level administrative units in the non-suitable area, which are mainly in the form of a belt extending from Northeast China along the Inner Mongolia Plateau to the Qinghai-Tibet Plateau. Most of these regions are important ecological barrier areas in China that are situated at high latitudes and feature high altitudes. Many days are characterized by low temperatures, and the annual and daily temperature ranges are very large. The Siberian High produces strong winds in winter. These conditions are generally not conducive to the health of elderly individuals.
There are 75 prefecture-level administrative units in highly suitable humidity area, which are distributed mainly in North China and the eastern part of the Qinghai-Tibet Plateau. The most concentrated area of highly suitable units extends from the Inner Mongolia Plateau and the Loess Plateau to the eastern part of the Qinghai-Tibet Plateau and includes 57 prefecture-level administrative units. This is followed by the eight prefecture-level administrative units located in the northwestern part of the Tarim Basin and near the Junggar Basin. The annual average relative humidity in these areas is generally between 45% and 60%, which is beneficial to the health of elderly individuals.

The units with slightly suitable humidity are distributed around the suitable units, mainly in Northeast China, along a strip extending from the Shandong Peninsula through the southern North China Plain and southwest along the southern Loess Plateau to the Yunnan-Guizhou Plateau. Although the daily relative humidity fluctuates greatly in these areas, the annual average relative humidity is...
relatively suitable. In addition, although the annual average relative humidity in South China has poor suitability, the daily relative humidity fluctuates slightly, and the overall suitability is high.

3.3. Airflow Suitability

The distribution of airflow suitability is shown in Figure 3c. Many units are located in the highly suitable area and are mostly concentrated, including Chongqing and 90 prefecture-level administrative units. The most concentrated area is in Southwest China. This area is blocked by plateau and mountainous terrain and has high vegetation coverage, which effectively reduces the wind speed. The annual average wind speed and the number of windy days in winter and spring are both highly suitable. Another concentrated area encompasses the 20 prefecture-level administrative regions located in Southeast China. In this region, there are few days when the winds exceed the third level in winter and spring, and the annual average wind speed is suitable. The remaining 13 prefecture-level administrative units are scattered in various places.

There are many slightly suitable units, including the Hong Kong Special Administrative Region and 126 prefecture-level administrative units, most of which are scattered between the southwest and southeast suitable areas. The annual average wind speed in these areas is relatively low, but there are more northwesterly winds in winter, which are strong. There are more winds above the third level in winter and spring. Combining the two airflow indexes, these areas are relatively suitable for the development of the elderly care industry.

3.4. Analysis of the Comprehensive Suitability Results

China’s climatic conditions are suitable for the development of the elderly care industry; suitable areas include Taiwan, Chongqing, Shanghai, and 68 prefecture-level administrative units. Slightly suitable areas include the Hong Kong Special Administrative Region, Macau Special Administrative Region, and 112 prefecture-level administrative units. Low-suitability areas include Beijing, Tianjin, and 106 prefecture-level administrative units. Finally, unsuitable areas include a total of 49 prefecture-level administrative units. The spatial distribution of the climatic suitability for the development of the national elderly care industry (Figure 4) is characterized below.

![Figure 4. Comprehensive climatic suitability distribution map for the development of China’s elderly care industry.](image)

Suitable areas are concentrated in Southwest China, the southeastern coastal area of China, and the Yangtze River Basin. Among them, Southwest China has highly suitable areas, including Chongqing and 22 prefecture-level administrative units, mainly due to the superior temperature and airflow conditions in the southwest. This region also has low latitudes, few days with low temperatures, and less extreme high-temperature weather affected by terrain, such as basins and plateaus. The overall suitability of the temperature conditions is high, the airflow conditions are suitable, and the wind chill
index is low, all of which are beneficial to the health of elderly individuals. There are 18 highly suitable prefecture-level administrative units in the southern part of Central China depending on the high suitability of temperature and airflow. Shanghai and 13 prefecture-level administrative units in the southern part of East China are suitable for the development of the elderly care industry due to their highly suitable temperature conditions, relatively non-windy weather, and annual average duration of sunshine hours, which are in line with the characteristics of areas with good longevity. There are 11 highly suitable prefecture-level administrative units in South China, including Sansha, Sanya, and Danzhou on Hainan Island. This finding is mainly due to the absence of low-temperature days throughout the year, small annual and daily temperature ranges, high humidity suitability, and good sunshine conditions. Suitable areas in the northwestern region are scattered in the Huangshui Valley and Aksu region in Xinjiang.

The slightly suitable units are distributed mainly around the highly suitable units. The most concentrated areas are the combined areas of South China, Southwest China, and East China. There are 30 prefecture-level administrative units in South China. Although there are no low-temperature days during the year, this region is greatly affected by high-temperature weather. The temperature is mostly within a suitable range, and the region is characterized by considerable precipitation, high temperatures, high rates of evaporation, and slightly less suitable humidity. In the central part of Southwest China, there are 20 slightly suitable prefecture-level administrative units. The temperature is relatively suitable, and the annual precipitation is slightly lower than that of areas with good longevity. Although the airflow conditions are very suitable, the humidity is mostly suitable or poorly suitable. There are 23 prefecture-level administrative units in the southern part of East China. The precipitation and annual average sunshine hours in this area are slightly less than those in a typical area with good longevity. Although the temperature conditions are suitable, they are restricted by windy weather and high humidity. Hence, southern East China is a slightly suitable area. Approximately 20 prefecture-level administrative units in Ningxia, Mongolia, Shaanxi, and Gansu in the Yellow River Basin are slightly suitable, featuring few days with strong wind, suitable airflow conditions, relatively suitable humidity, and suboptimal rainfall. The 14 prefecture-level cities in Central China are slightly suitable. In Northeast China, the only slightly suitable prefecture-level city is Benxi.

The low-suitability units are the most concentrated, including 41 prefecture-level administrative units in the northern part of East China, 21 prefecture-level administrative units in central and western Northwest China, and 17 prefecture-level administrative units in North China, which are broadly distributed. Due to the high latitudes, low winter temperatures, relatively large annual and daily temperature ranges, and relatively long sunshine hours, the temperature, airflow, precipitation, and sunshine conditions in this area are all sub-optimally suitable. The 12 prefecture-level cities in the northern part of Central China are low-suitability areas. The 12 prefecture-level cities in Northeast China and the 5 prefecture-level administrative units on the southwestern edge of the Qinghai-Tibet Plateau also have poor temperature and precipitation indexes.

The non-suitable areas are mainly distributed in a strip composed of ecological barrier areas throughout Northeast China, the Inner Mongolia Plateau and the Qinghai-Tibet Plateau. Among them, there are 28 prefecture-level administrative units in Northeast China and 15 prefecture-level administrative units in Northwest China, all of which are situated at high latitudes with low temperatures and strong winds; six prefectoral-level administrative units are in the Qinghai-Tibet Plateau and, in addition to low temperatures and strong winds, are also affected by a high altitude. The air pressure atop the plateau is lower than the lower limit of the human body’s tolerance, and thus, these units on the Qinghai-Tibet Plateau are not suitable for the development of the elderly care industry.

3.5. Analysis of the Areas Suitable for Elderly Individuals in Special Elderly Groups

(1) Suitable areas for elderly patients with cardiovascular and cerebrovascular diseases: Epidemiological investigations have shown that the incidence of cardio-cerebrovascular diseases, such as myocardial infarction, cerebral infarction, arteriosclerosis, cerebral hemorrhage, coronary
heart disease, and angina pectoris, increases significantly under low-temperature conditions, and temperatures above 37 °C will cause ischemic stroke [9,30–34,37,42,47,50]. Therefore, elderly people with cardiovascular and cerebrovascular diseases should choose an area based on a high comprehensive climatic suitability and consider the suitability of the temperature conditions and classified climatic suitability (Figure 5). As the temperature in the southern part of the suitable temperature area is high in summer, this region is not suitable for year-round living. Therefore, a special subset of the elderly care industry should be established for patients with cardiovascular and cerebrovascular diseases in the suitable temperature zones of Central and Southwest China.

(2) Suitable areas for elderly care for patients with rheumatic diseases and respiratory diseases: Relevant studies have shown that elderly people with rheumatoid arthritis are particularly sensitive to temperature, humidity, and air pressure extrema [44,45,51]. When the relative humidity change exceeds 10%, the frequency of joint pain will greatly increase. When the temperature drops to 4–10 °C or the humidity is lower than 45%, susceptibility to diseases such as asthma is more likely. Therefore, based on the comprehensive climatic suitability, the analytical results for the temperature suitability and humidity suitability were superimposed to classify the climatic suitability for patients with rheumatic and respiratory diseases. Accordingly, 28 suitable areas with higher temperatures, suitable relative humidity, and small humidity variations (Figure 6) were chosen with a focus on the development of an elderly care industry for patients with rheumatic and respiratory diseases.

Figure 5. Distribution of the suitability for the care of elderly patients with cardiovascular and cerebrovascular diseases.

Figure 6. Distribution of suitability for the care of elderly patients with rheumatic and respiratory diseases.
4. Discussion

The research results in this paper were compared with the existing evaluation results of the climatic suitability of China’s human settlements based on the temperature and humidity index and the wind efficiency index. This comparison revealed that the comprehensive climatically suitable and slightly suitable areas for the development of the elderly care industry are consistent with the overall spatial distributions of highly suitable areas and slightly suitable areas for the human settlement environment in China, and they are all concentrated in southern China, indicating that the results of this study are reliable. In terms of scope, the suitable area for the elderly care industry is smaller than the comfortable residential environment and slightly shifted northward. This also suggests that the elderly care industry has stricter climatic requirements.

Since the climatic suitability of the human settlement environment in China focuses on the subjective comfort of healthy adults, this study focused on factors affecting the physical health of elderly individuals in addition to comfort when selecting evaluation indexes. People in ancient China discovered that human health and lifespan are closely related to climatic conditions, such as temperature, humidity, and wind [9]. Ge Hong of the Jin Dynasty believed that “excessively cold and hot temperatures, strong winds and heavy fog are not good for health.” Modern medical research has shown that elderly individuals’ ability to adapt to changes in climate is significantly weakened relative to younger individuals [46]; consequently, the temperature, humidity, airflow (wind), and air pressure have great impacts on the health of the elderly. In particular, high temperatures, low temperatures, and temperature changes affect the morbidity and mortality of cardiovascular and cerebrovascular diseases in elderly individuals [32–35]. Geographers such as Barrak have also confirmed this fact from the mortality rate of elderly individuals in Kuwait [52]. The research results of medical geography on health and longevity are closely integrated when the evaluation criteria are set.

There are certain differences in the distributions of the comprehensive climate suitable for the elderly care industry and the highly suitable climate for the human settlement environment in China. The latitude is slightly higher, and some coastal areas with high winds and high humidity are not included; because the disease incidence rate and mortality rate for elderly individuals increase in the cold winter season [31–35,41,53], although parts of Northeast China and the Inner Mongolia Plateau are generally suitable areas in evaluations of the human settlement environment and climatic suitability, they are less desirable for elderly care.

Compared with the existing research, the research method in this paper is easy to use, and the research results are more intuitive and visible and thus can provide guidance for the macroscopic layout of the elderly care industry in China, which has good application value. However, due to the complexity and diversity of climatic elements, the index selection, data acquisition, processing and analysis, and weight determination are all relatively complicated processes, and changes in these processes will produce slight deviations in the evaluation results. Future research should further improve the methodology, consider seasonal evaluations, and distinguish the suitability of anti-seasonal summer retirement and winter retirement.

These findings are quite different from the existing research results on the comprehensive suitability of the human settlement environment in China, mainly because a comprehensive suitability evaluation of the human settlement environment also comprehensively considers other natural and human factors. Nevertheless, to carry out a more comprehensive suitability evaluation and better guide the layout of the elderly care industry in China, it is possible to further consider the integration of the topography, vegetation coverage, and distribution of medical institutions that affect the physical health of elderly individuals and the layout of the elderly care industry into the evaluation index system.

Because this article was based only on macroregional evaluations at the city scale, there are still many differences in the suitability of locations within a specific city. It should be noted that since this paper focused mainly on the suitability of climatic conditions, only strict climate indexes were considered in the index selection, whereas air quality indicators reflecting pollution, such as the sulfur dioxide concentration, nitrogen dioxide concentration, and PM$_{2.5}$ concentration, were not
included. However, these factors undoubtedly have important impacts on the suitability of the development of the elderly care industry. In the future, high-resolution (kilometer-scale) data of the climate, atmospheric environment (air quality), transportation convenience, local service facilities (medical conditions), distribution of recreational areas, and cost of living should be considered.

5. Conclusions

This paper established a logical relationship between climatic conditions and the suitability of the development of the elderly care industry in China. The spatial fuzzy comprehensive evaluation method was used to evaluate the suitability of pension industry development in prefecture-level cities in China based on climatic conditions. A total of 68 prefecture-level administrative units are suitable for the development of the elderly care industry in China. The climate in these units is comfortable and conducive to the health of elderly individuals. Therefore, it is necessary to actively determine the layout of the elderly care industry, appropriately expand the scale of the elderly care industry, and open up the elderly care market in other regions. There are 57 prefecture-level administrative units in the suitable temperature zones of Central and Southwest China that can develop the elderly care industry for patients with cardiovascular and cerebrovascular diseases, and there are 28 units with suitable temperature and humidity conditions that can be selected to develop the elderly care industry for patients with rheumatic and respiratory diseases.

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References

1. Office of the National Committee on Aging. China Population Aging Trend Forecasts. Chin. Women’s Mov. 2007, 2, 15–18.
2. Mu, G. Silver-haired economy is a sunrise industry. Global Times 2019. [CrossRef]
3. Ahrens, C.D. Meteorology Today; Brooks/Cole: Sao Paulo, Brazil, 2009.
4. Baughman, A.V.; Arens, E.A. Indoor humidity and human health-part I: Literature review of humidity-influenced indoor pollutants. Ashrae Trans. Res. 1996, 102, 193–211.
5. Lowen, A.C.; Mubareka, S.; Steel, J.; Palese, P. Influenza virus transmission is dependent on relative humidity and temperature. PLoS Pathogen 2007, 3, 1470–1476. [CrossRef]
6. Shaman, J.; Kohn, M. Absolute humidity modulates influenza survival, transmission, and seasonality. Proc. Natl. Acad. Sci. USA 2009, 106, 3243–3248. [CrossRef] [PubMed]
7. Xie, X.; Li, Y.; Chwang AT, Y.; Ho, P.L.; Seto, W.H. How far droplets can move in indoor environments-revisiting the Wells evaporation-falling curve. Indoor Air 2007, 17, 211–225. [CrossRef] [PubMed]
8. Wang, Y.; Zhang, M.; Zhang, L. Theoretical analysis of the impact of high humidity environment on human health. Med. Inf. 2010, 23, 3709–3710.
9. Cui, B. Environment and Health; Chemical Industry Press: Beijing, China, 2012.
10. Liang, Y.; Xiao, Y.; Ren, Z.; Yan, S.; Ge, M. Old female normal hemoglobin reference value of Chinese geographical factors. Archiv Norm. Univ. (Nat. Sci.) 2004, 4, 453–456.
11. Wang, Z.; Liu, Q.; Ge, M. Curve model analysis of normal reference value of hematocrit in presenile men and environmental factors. J. Southwest China Norm. Univ. (Nat. Sci. Ed.) 2004, 3, 429–433.
12. Ge, M. The curve model analysis of reference value of erythrocyte sedimentation rate and altitude in pre-senile women. Chin. Microcirc. 2004, 5, 348.
13. Ge, M.; Xiao, Y.; Liu, K.; Li, X.; Liang, W.; Chen, H. Normal reference value of hemoglobin in presenile men and geographical factors in China. *Geogr. Sci.* 2004, 6, 767–770.

14. Yang, Q.; Zhang, H.; Ge, M.; Liu, Y.; Jiang, H.; Ge, W. Study in elderly men erythrocyte sedimentation rate reference value and geographical relationships based on artificial neural networks. *Geogr. Sci.* 2006, 6, 749–754.

15. Liu, G.; Wang, H.; Wang, Q.; Li, C.; Ye, G.; Tan, C. Comparative analysis of APOE gene polymorphisms between Hubei Zhongxiang and longevity elderly people at home and abroad. *Pract. Geriatr.* 2017, 31, 766–769.

16. Liu, B.; Shen, K.; Liu, H.; Fan, L. Population dynamics and regional distribution of centenarians in China. *Geriatr. Health Care* 2003, 1, 52–53.

17. Xia, L. *Human Biometeorology*; Meteorology Press: Beijing, China, 1986.

18. Werner, H.T. Physiologic Climates of the Conterminous United States: A Bioclimatic Classification Based on Man. *Ann. Assoc. Am. Geogr.* 1966, 56, 141–179.

19. Zhang, J.; Feng, Y. Discussion on the evaluation of climate pleasantness in Guizhou Province. *Tour. Trib.* 1991, 3, 50–53.

20. Sun, G.; Wang, X.; Zhang, X.; Wu, H.; Shen, L. Spatiotemporal characteristics of human comfort BTH Region. *J. Meteorol. Environ.* 2011, 27, 18–23.

21. Wu, J.; Gao, X.; Han, Z.; Xu, Y. Analysis of Yunnan comfort degree changes based on effective temperature index. *Adv. Earth Sci.* 2017, 32, 174–186.

22. Nely, A.M.; Richarde, M.S.; Celso, A.; Joel, S. Analysis of the environmental thermal comfort conditions in public squares in the semiarid region of northeastern Brazil. *Build. Environ.* 2019, 152, 145–159.

23. Li, X.; Liu, J. Comprehensive evaluation of the major climatic factors suitable for urban living environment to live. *Econ. Geogr.* 2003, 5, 656–660.

24. Tang, Y.; Feng, Z.; Yang, Y. Evaluation of climate suitability for human settlements in China based on grid scale. *Resour. Sci.* 2008, 5, 648–653.

25. Yin, W.; Pan, Z.; Pan, Y.; Korea, L.; Wang, J.; Huang, N.; Zhang, Z.; Zhang, J. Research on the characteristics of climate comfort of human settlements in Mainland China. *China Popul. Resour. Environ.* 2018, 28, 5–8.

26. Zhu, B.; Zhou, Q.; Zhu, H.; Sun, W.; Guo, Y.; Wang, X. Climate suitability and change characteristics of human settlement environment in Dezhou City. *Chin. Agric. Sci. Bull.* 2019, 35, 95–100.

27. Negin, N.; Tiffany, S.; Leslie, N. Numerical modeling of outdoor thermal comfort in 3D. *Urban Clim.* 2018, 26, 212–230.

28. Giuffrida, L.; Lokys, H.; Klemm, O. Assessing the effect of weather on human outdoor perception using Twitter. *Int. J. Biometeorol.* 2020, 64, 205–221. [CrossRef]

29. Gao, X.; Wu, J.; Shi, Y.; Wu, J.; Han, Z.; Zhang, D.; Tong, Y.; Li, R.; Xu, Y.; GIORGI, F. Future changes in thermal comfort conditions over China based on multi-RegCM4 simulations. *Atmos. Ocean. Sci. Lett.* 2018, 11, 291–299. [CrossRef]

30. Hu, X. Environmental temperature and human health. *Knauf. Cardiovasc. Dis. Prev. Treat. (Sci. Ed.)* 2011, 11, 54.

31. Chen, R.; Yin, P.; Wang, L.; Liu, C.; Niu, Y.; Wang, W.; Jiang, Y.; Liu, Y.; Liu, J.; Qi, J.; et al. Association between ambient temperature and mortality risk and burden: Time series study in 272 main Chinese cities. *BMJ* 2018, 363. [CrossRef]

32. Ma, W.; Chen, R.; Kan, H. Temperature-related mortality in 17 large Chinese cities: How heat and cold affect mortality in China. *Environ. Res.* 2014, 134, 127–133. [CrossRef]

33. Bunker, A.; Wildenhain, J.; Vandenbergh, A.; Henschke, N.; Rocklöv, J.; Hajat, S.; Sauerborn, R. Effects of air temperature on climate-sensitive mortality and morbidity outcomes in the elderly; a systematic review and meta-analysis of epidemiological evidence. *EBioMedicine* 2016, 6, 258–268. [CrossRef]

34. Monacelli, F.; Aramini, I.; Odetti, P. For debate: The August sun and the December snow. *J. Am. Med Dir. Assoc.* 2010, 11, 449–452. [CrossRef]

35. Lin, H.; Hong, Z.; Hu, H.; Hu, C. Effects of temperature on mortality in the elderly. *Zhejiang J. Prev. Med.* 2016, 28, 230–233.

36. Qu, F.; Xiao, Z. Assessment of the impact of climate change on human health. *Adv. Meteorol. Sci. Technol.* 2019, 9, 34–47.
37. Gerber, Y.; Jacobsen, S.J.; Killian, J.M.; Weston, S.A.; Roger, V.L. Seasonality and daily weather conditions in relation to myocardial infarction and sudden cardiac death in Olmsted County, Minnesota, 1979 to 2002. *J. Am. Coll. Cardiol.*, 2006, 48, 287–292. [CrossRef]

38. Kriszbacher, I.; Bódis, J.; Csoboth, I. The occurrence of acute myocardial infarction in relation to weather conditions. *Int. J. Cardiol.*, 2009, 135, 136–138. [CrossRef]

39. Lee, J.H.; Chae, S.C.; Yang, D.H.; Cho, Y.; Jun, J.E.; Park, W.-H.; Kam, S.; Lee, W.K.; Kim, Y.J.; et al. Influence of weather on daily hospital admissions for acute myocardial infarction (from the Korea Acute Myocardial Infarction Registry). *Int. J. Cardiol.*, 2010, 144, 16–21. [CrossRef]

40. Baker-Blocker, A. Winter weather and cardiovascular mortality in Minneapolis-St. Paul. *Am. J. Public Health*, 1982, 72, 261–265. [CrossRef]

41. Rongjun, A.; Haoci, L.; Zhen, Y.; Tao, Z. Research on the Spatial Differentiation and Influencing Factors of Elderly Population Health—Taking Hubei Province as an Example. *Geogr. Sci. Prog.*, 2017, 36, 1218–1228.

42. Huang, X.; Liao, X.; Xie, M.; Xu, S.; Zhu, Q.; Guangxi Climate Center; Guangxi Meteorological Society. The influence of weather and climate on human health in Guangxi. *Meteorol. Res. Appl.*, 2019, 40, 42–45.

43. Sun, Y.; Wang, J.; Zong, P. Relationship of cardiovascular and cerebrovascular diseases to meteorological conditions and forecast method in Nanjing City. *Meteor. Environ. Res.*, 2013, 4, 25.

44. Li, Z.; He, Z.; Hu, Z. Research progress on climate and health and climate health. *J. Mar. Meteorol.*, 2020, 40, 107–116.

45. Cheng, L. Study on the correlation between the incidence of rheumatoid arthritis and meteorological factors in Beijing. *China Acad. Chin. Med. Sci.*, 2010. Available online: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=2010180467.nh&DbName=CMFD2011 (accessed on 5 November 2020).

46. Xie, R. Research on the Relationship between Environmental Health Preservation and Health; Guangzhou University of Chinese Medicine: Guangdong, China, 2009.

47. Chen, Y.; Chen, X. Series of studies on geographical environment and military health (1) risk factors and preventive measures of high altitude polycythemia. *Chin. Mil. Med. J.*, 2019, 62, 723–727.

48. Cheng, A.; Liang, Y.; Tan, F.; Wei, H. Analysis on the Climate and Environment Characteristics of Longevity Township in Bama. *Meteorol. Res. Appl.*, 2010, 31, 50–52.

49. Ou, T. Research on the Spatiotemporal Evolution and Influencing Factors of Longevity Level in the Lower Yangtze River Provinces. *Huazhong Norm. Univ.*, 2015. Available online: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=1015444330.nh&DbName=CMFD2016 (accessed on 5 November 2020).

50. Song, X.; Wang, S.; Hu, Y.; Le, M.; Zhang, T.; Liu, Y.; Tian, J.; Shang, K. Effects of temperature on incidence rate and mortality of diseases. The 34th Annual Meeting of China Meteorological Society S15 climate and environmental change and human health sub collection. *China Meteorol. Soc.*, 2017. Available online: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=ZGQX201709015035&DbName=CPFD2017 (accessed on 5 November 2020).

51. Wiebe, P.; Rasker, R.; Johannes, J. Weather effects in rheumatoid arthritis: From controversy to consensus. A review. *J. Rheumatol.*, 2004, 31, 1327–1334.

52. Barrak, A.; Ahmed, F.; Haitham, K.; Mohammad, A.; Janvier, G.; Ali, A.; Petros, K.; Mary, A.F. Extreme temperatures and mortality in Kuwait: Who is vulnerable. *Sci. Total Environ.*, 2020. [CrossRef]

53. Gasparrini, A.; Guo, Y.; Hashizume, M.; Lavigne, E.; Zanobetti, A.; Schwartz, J.; Tobias, A.; Tong, S.; Rocklov, J.; Forsberg, B.; et al. Mortality risk attributable to high and low ambient temperature: A multicountry observational study. *Lancet*, 2015, 386, 369–375. [CrossRef]

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