

The Influence of Meteorological Factors on Airport Satisfaction

-- A Case Study of Lanzhou Zhongchuan Airport

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Abstract: With the development of social economy, the passenger throughput of China's civil aviation industry is also increasing year by year, although the development prospect is broad, but in reality there are still many problems. In the process of flight operation, there are many unfavourable factors interfering with the airline management or the airport side, which lead to the negative impact of travellers' recognition or satisfaction of airlines and airports decreasing. This paper explores the relationship between meteorological factors and airport satisfaction, establishes a model, and uses literature analysis, questionnaire survey, data analysis, and Vosviewer software to deeply analyse the research hotspots in the field of flight delays and satisfaction, meteorological factors, the mediating role of anxiety, and the moderating role of satisfaction, and the results of the analysis show that Lanzhou Zhongchuan Airport needs to alleviate flight delays and passengers' satisfaction by providing fine-tuned The results show that Lanzhou Zhongchuan Airport needs to alleviate the anxiety of delayed passengers by providing refined remedial measures, and realistically safeguard the passengers' own interests, so as to further enhance passengers' airport satisfaction and travelling intentions.

Keywords: Meteorological factors; Airport satisfaction; Anxiety; Travel willingness.

1. Introduction

With the rapid development of the civil aviation industry in recent years, air travel has become the first choice for many passengers, and while civil aviation provides travel services to passengers, flight delays often caused by various factors have brought a lot of trouble to people, which has seriously affected passengers' willingness to travel and their satisfaction with the airport^[1]. This paper will analyze and study the relationship between passengers' waiting anxiety and airport satisfaction after flight delay caused by meteorological factors, and provide realistic suggestions with high credibility for Lanzhou Zhongchuan Airport.

In recent years, a number of scholars have done a lot of research work in the field of flight delay and satisfaction, including Algarin Ballesteros Jose A. and Hitchens Nathan M. While studying the specific meteorological factors that cause flight delays and cancellations during the winter in the Midwest of the United States, a classification scheme was developed and each flight was classified according to the meteorological factors that may have caused its delay, and it was found that visibility was the main meteorological factor affecting Midwest airports, and snowstorms were the main cause of flight cancellations^[2]; Jiang Yu, Yuan Qi, Hu Zhitao, Wu Weiwei, and Gu Xin proposed a spatio-temporal map roll based on meteorological factors (MSTGCN) airport delay prediction model when studying meteorological factors and airport delays, and added a meteorological feature extraction module to predict airport delay time, which weather characteristics can be further explored in future research that will have a significant impact on the delay prediction results^[3]. When studying meteorological factors and flight delays, Wang Kai explored other factors that affect airport departure

delays under weather conditions, and used the GBRT algorithm to build a prediction model for airport departure delays, which can accurately predict the number of departure flight delays at airports in the next hour, which provides a certain reference for the improvement of airport satisfaction^[4]; Zhang Xiaoyu and Zhang Haoling analyzed the current situation of domestic flight delays and the causes of flight delays, and found that force majeure weather factors have an important impact on flight operations^[5]. However, most of the relevant studies in the existing field tend to be qualitative overview, and lack a systematic and comprehensive quantitative analysis of the entire field. In order to sort out the research status in the field of flight delay and satisfaction and conduct a comprehensive and systematic analysis of the existing research, this paper uses the methods of bibliometrics and questionnaire survey, and will conduct follow-up research based on the main line of meteorological factors affecting airport satisfaction, starting from four variables: meteorological factors, passenger psychology (anxiety), airport satisfaction, and travel intention^[6].

2. Theoretical Framework and Hypothesis Development

This study mainly explores the variable relationship between meteorological factors and airport satisfaction, expounds the influence of meteorological factors on airport satisfaction, the mediating effect of anxiety and satisfaction on anxiety and travel intention, and refers to the influence of catering takeaway customer satisfaction on customer loyalty written by Su Bowen, Zhao Shuping and Hu Qiliang: the influence model of youth catering takeaway customer satisfaction on customer loyalty formulated with customer

trust as the moderating variable, and according to the variable relationship between meteorological factors and airport satisfaction, A theoretical model was developed [7]. This model is specifically manifested in the fact that when passengers are in the environment of flight delay due to meteorological factors, they will produce corresponding anxiety and reduce their satisfaction with the airport, and with the emergence of passenger anxiety, passengers will reduce their satisfaction with the airport, but by providing high-quality services and refined security measures, passengers' anxiety may be well released, and their satisfaction with the airport will also be well improved.

2.1. The impact of meteorological factors on airport satisfaction

With the development of society and the increasing improvement of people's living standards, people's economic activities and travel modes have become diversified, which has promoted the rapid development of the transportation industry. In recent years, airplanes have gradually become a means of transportation for people to choose to travel, providing a more convenient and comfortable flight experience for the masses of people, but there are also many problems, such as the safety of aircraft flights, abnormal flights, meteorological factors and other emergencies, which have become a hot spot of everyone's concern. Domestic scholars have done a lot of research on meteorological factors, including: the analysis of the causes of flight delays, including the following four points, such as weather factors, flow control factors, aircraft mechanical failure factors, and passenger and airport factors, among which it is found that the delay of flights that cannot take off on time due to weather reasons is very frequent [8]. In the discussion on the relationship between the anxiety of passengers, the positive impact of flight delay is more obvious, because passengers have planned their own itinerary before carrying out boarding behavior, and flight delay directly affects the planning of passengers, so in this case, airlines should understand the negative psychology of passengers, empathize, and dredge passengers from the two perspectives of positive psychological dominance and negative psychological dominance. Flight delays caused by meteorological factors are conducive to better promoting the airport to change its service mode, increase the types of services, improve the security system, and better meet the requirements of passengers to a certain extent. In view of this, starting from the independent variable of meteorological factors, this paper defines the impact of airport satisfaction as the delay of flights due to meteorological factors, which affects airport satisfaction, and puts forward the following hypotheses:

H1: Flight delays caused by meteorological factors have a significant positive impact on the anxiety of passengers.

2.2. The mediating role of anxiety

Wu Youping (2022) believes that various "psychological unexpected events" (such as flight delays, flight turbulence, and loss of luggage) are often the triggers of passengers' anxiety, and in addition, high trait anxiety will also affect the individual's interpretation and processing function, making individuals more inclined to make negative and threatening explanations for vague information in reality [9]. Anxiety has a partial mediating effect between meteorological factors and airport satisfaction, and anxiety as a mediating variable has a direct impact on airport satisfaction. Therefore, the following

hypotheses are proposed:

H2: Anxiety plays a mediating role in the relationship between meteorological factors and airport satisfaction.

H3: Anxiety positively affects passengers' willingness to travel.

2.3. The moderating effect of satisfaction

Satisfaction is a de-psychological state that refers to a person's subjective evaluation of the quality of a relationship. Satisfaction is a mental state of mind that measures "satisfaction" in numbers [10]. Customer satisfaction is the state of perception formed by the customer by comparing the perceived effect of a product or service with his expectations. Gronroos (1984) argues that service quality is the result of the comparison of the level of customer expectation of service with the level of perception of service performance. It can be seen that there is a close relationship between the two. Service quality focuses on the relationship between customers and service providers, while customer satisfaction is the subjective impression of customers on the services they enjoy, which is more subjective, and the uncertainty of service quality and the unpredictability of customer satisfaction are also the reasons for the variability of services [11]. The satisfaction referred to in this article refers to the satisfaction of passengers with Lanzhou Zhongchuan Airport, and when meteorological factors affect the flight delay, passengers will have a lot of emotions, thus reducing their satisfaction with the airport. On the contrary, through correct and effective measures to appease, the effect will become very different, passengers will improve their satisfaction with the airport, and the satisfaction index has increased significantly, which will drive the continuous rise of tourists' willingness to travel, and attract a large number of "repeat customers" for Lanzhou Zhongchuan Airport.

Based on the above discussion, hypotheses are proposed:

H4: Satisfaction can positively affect the relationship between passengers' anxiety and travel intention, that is, the higher the satisfaction of passengers with the airport, the stronger the passengers' willingness to travel.

H5: Satisfaction can negatively moderate the relationship between passengers' anxiety and travel intention, that is, the lower the passenger's satisfaction with the airport, the stronger the passenger's willingness to travel.

In summary, a theoretical model of the study is obtained (Figure 1)

3. Research Design

3.1. Questionnaire design

The questionnaire consists of two parts: the first part is the personal information of tourists; The second part is the main part of the questionnaire, with a total of 16 items. Based on the four dimensions of meteorological factors, anxiety, information feedback, and airport satisfaction, the questions were set up by type, that is, how meteorological factors caused flight delays, how flight delays caused passengers to feel anxious, and how anxiety affected airport satisfaction and passengers' willingness to travel. Through many exchanges and communication with expert teachers, the questionnaire was revised several times according to the relevant suggestions, the setting of options and question types was expanded, and the current situation between meteorological factors and airport satisfaction was investigated.

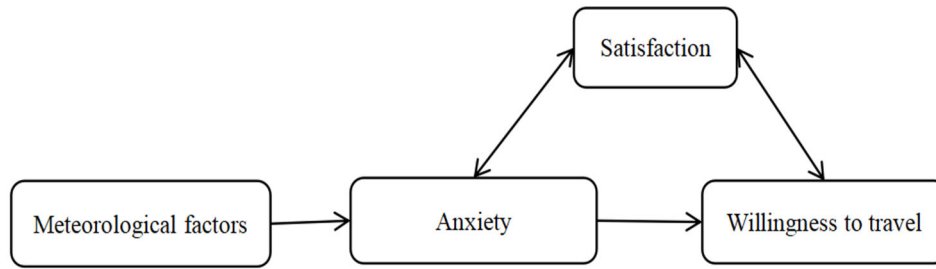


Figure 1. Theoretical model is studied

3.2. Investigation methods

The survey mainly targeted young and middle-aged social groups in Gansu Province, and asked them to fill in the questionnaire to understand the current situation of the two-way impact of flight delays caused by meteorological factors on airport satisfaction. The questionnaire involves a variety of groups, and multi-level sampling can ensure the representativeness of the survey data results, which is sufficient to ensure the quality of questionnaire analysis and recovery, and can comprehensively understand the current situation that flight delays caused by meteorological factors

have a two-way impact on airport satisfaction. A total of 350 electronic questionnaires were distributed in this questionnaire survey, 350 were recovered, and 243 invalid questionnaires were excluded (the proportion of passengers who experienced flight delays due to meteorological factors was low), and a total of 107 valid questionnaires were obtained, with an effective questionnaire rate of 30.57%.

4. Data Analysis

4.1. The co-occurrence of domestic and foreign research keywords

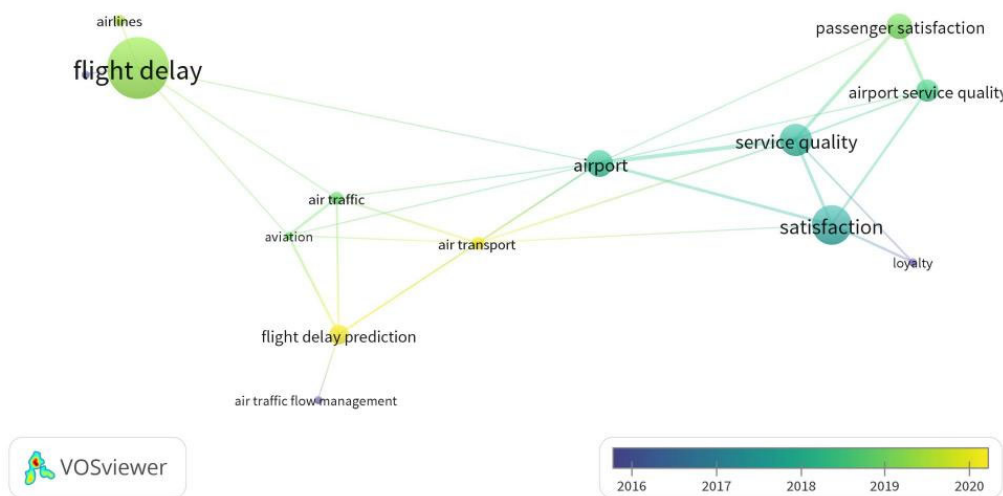


Figure 2. Keyword co-occurrence map

Based on the bibliometric analysis method, this paper uses the bibliometric tools VOSviewer and CNKI literature retrieval report to co-present 581 domestic and foreign related literature in the field of flight delay and satisfaction, and looks forward to future research directions^[12]. From the figure, it can be seen that the frequency of flight delays, satisfaction, delay prediction, and service quality is relatively high, and it also gives a good research direction for the future development of civil aviation.

4.2. Questionnaire reliability analysis

In order to ensure the reliability of the questionnaire, the reliability test of the survey data was carried out by using the questionnaire star. Firstly, the α coefficient is analyzed, if this value is higher than 0.8, it means that the reliability is high,

and if the value is between 0.7~0.8, it means that the reliability is good. If this value is between 0.6~0.7, it means that the reliability is acceptable. If this value is less than 0.6, the reliability is poor^[13]. After testing, the Cronbach's alpha coefficient of the reliability statistics obtained from the table was α 0.796, indicating that the data obtained from the questionnaire survey had good credibility and strong scientific and credible data.

Table 1. Cronbach reliability analysis

Number of items	Sample size	Cronbach α coefficients
17	107	0.796

4.3. Questionnaire validity analysis

In order to ensure the reasonableness of the questionnaire

research items, the validity test analysis of the survey data was carried out by using the questionnaire star, and the KMO value was first analyzed. If this value is higher than 0.8, it means that the research data is very suitable for extracting information (the validity is good from the side), and if this value is between 0.7~0.8, it means that the research data is suitable for extracting information (the validity is better from the side). If this value is between 0.6~0.7, it means that the research data is more suitable for extracting information (the validity is generally reflected from the side), and if this value is less than 0.6, it means that the data is not suitable for extracting information (the validity is generally reflected from the side); Validity analysis requires a Bartlett test (corresponding to a p-value of less than 0.05) [14]. After the KMO and Bartlett tests were validated for validity, it can be seen from Table 4-2 that the KMO value is 0.894, the KMO value is greater than 0.8, and the p-value is less than 0.05, so the study data is very suitable for extracting information (the validity is very good from the side).

Table 2. Cronbach validity analysis

KMO value	p-value
0.894	0.00

4.4. Analysis of the results of questionnaire demographic information

As can be seen from Table 4-3, 60.75% of women and 39.25% of men are women. 45.79% of the sample were "20-30 years old", 37.38% of the sample were under 20 years old, and the proportion of 31-40 years old and over 40 years old was relatively equal. In the education level sample, 82.24% will choose "undergraduate/junior college", which shows that the proportion of education level in this survey is relatively high. In terms of occupation, there are relatively many "full-time students" in the sample, accounting for 67.29%. In terms of the geographical distribution of the survey groups, most of the samples were "outside Lanzhou City and within Gansu Province", accounting for 47.66%, and the proportion of groups in the province was relatively large.

Table 3. Demographic statistics (N=107)

Name	Options	Frequency	Percentage (%)
Gender	Woman	65	60.75
	Man	42	39.25
Age	20-30 years old	49	45.79
	Under 20 years of age	40	37.38
	31-40 years old	9	8.41
	Over 40 years old	9	8.41
	Other	3	2.80
Educational attainment	Undergraduate/Junior College	88	82.24
	Master's degree or above	12	11.21
	High school and below	4	3.74
	Professionals (e.g. accountants, lawyers, architects, healthcare professionals, journalists, etc.)	1	0.93
	human resources	2	1.87
	Full-time students	72	67.29
	Other	8	7.48
Occupation	Customer service staff	1	0.93
	Marketing/PR staff	1	0.93
	Production staff	2	1.87
	Administrative/logistical staff	1	0.93
	Financial/Auditor	2	1.87
	Salespeople	5	4.67
	In Lanzhou City	29	27.10
Region	Outside Lanzhou City, in Gansu Province	51	47.66
	Outside Gansu Province	27	25.23

4.5. Regression analysis

Table 4. Linear regression analysis results (N=107)

Item	Regression coefficients
Constant	-0.989** (-28.332)
Independent Variable (Meteorological Factors)	0.666** (58.367)
Sample size	107
R ²	0.972
Adjust R ²	0.972
F-number	F (1,98)=3406.727,p=0.000

Dependent variable: Willingness to travel
 * p<0.05 ** p<0.01 The t-value is inside the parentheses

The following conclusions can be drawn from regression analysis:
 When the model is tested by F, it is found that the model

passes the F test (F=3406.727, p=0.000<0.05), which indicates that the model construction is meaningful.

4.6. Relevant analysis

By sorting out the questionnaire data and model, the regression analysis of this paper is as follows:

Table 5. Pearson correlation analysis

Item	Item	Mediation variables
Argument	Correlation coefficient	0.968**
	p-value	0.000

* p<0.05 ** p<0.01

Through correlation analysis of independent variables and mediating variables, there is a positive correlation between them, indicating that flight delays caused by meteorological

factors have a significant positive impact on the anxiety of passengers, and the occurrence of meteorological factors will lead to anxiety of passengers, that is, the hypothesis H1 is true.

Through the correlation analysis of the mediating variables and the moderating variables, the correlation coefficient was high, and the two showed a positive correlation, indicating that anxiety would positively affect airport satisfaction, and there was a positive correlation between meteorological factors and anxiety, indicating that the mediating effect of anxiety was obvious, that is, the hypothesis H2 was true.

Table 6. Pearson correlation analysis

Item	Item	Adjust variables
Mediation variables	Correlation coefficient	0.704**
	p-value	0.000

* p<0.05 ** p<0.01

Table 7. Pearson correlation analysis

Item	Item	Dependent variable
Mediation variables	Correlation coefficient	0.704**
	p-value	0.000

* p<0.05 ** p<0.01

Through correlation analysis of the mediating variable and the dependent variable, there is a positive correlation between the two, indicating that anxiety will positively affect passengers' travel intention, that is, hypothetical condition H3 is true.

Table 8. Pearson correlation analysis

Item	Item	Dependent variable
Adjust variables	Correlation coefficient	0.980**
	p-value	0.000

* p<0.05 ** p<0.01

Through the correlation analysis of the moderating variable and the dependent variable, the correlation coefficient was high, and the two showed a positive correlation, indicating that the higher the satisfaction, the stronger the traveler's willingness to travel. And if the hypothesis H2 is true, satisfaction can moderate anxiety and travel intention, that is, the assumptions H4 and H5 are true.

Flight delays caused by meteorological factors have a significant negative impact on the alleviation of passengers' anxiety, so the provision of emergency remedial services will alleviate passengers' anxiety in a timely manner, increase their willingness to travel, and have a more significant mediating effect [15].

5. Finding and Discussion

5.1. Finding

Through data analysis, we can draw the following conclusions:

The overall service of Lanzhou Zhongchuan Airport has been recognized by most passengers, indicating that the overall satisfaction with Lanzhou Zhongchuan Airport is high, and they will choose Lanzhou Zhongchuan Airport as the transit station or starting point for travel again, with a relatively high willingness to travel.

H1 analysis: When the flight is running, the flight delay

caused by meteorological factors has a significant positive impact on the anxiety of passengers, because when the flight delay occurs, the passengers themselves will become restless, anxious and restless, and will correspondingly have excessive behaviors, resulting in a series of complaints about Lanzhou Zhongchuan Airport, resulting in stereotypes, and the overall image of the airport will be reduced.

H2-H3 analysis: This paper adds a mediating variable between meteorological factors and airport satisfaction, anxiety, and uses anxiety to regulate the relationship between the two, when meteorological factors affect flight delays, passengers will have anxiety, and when the anxiety is not properly alleviated or released, passengers will have a positive impact on the airport, resulting in a decrease in airport satisfaction. Flight delays caused by meteorological factors have a significant negative impact on the alleviation of passengers' anxiety, so the provision of emergency remedial services will alleviate passengers' anxiety in a timely manner, increase their willingness to travel, and have a more significant mediating effect [16]. When the flight is delayed, the airport can take relevant emergency remedial service measures to stop the passenger's own interests in a timely manner, so that the passenger can get a certain degree of satisfaction physiologically and psychologically, although there will be corresponding negative emotions to affect the airport or the airline, but this is temporary; When passengers' vital interests are protected or concerned by others, their impression will be deepened, and with the blessing of time, passengers will deepen their recognition and satisfaction with the airport, forming a positive impact on the airport [17].

H4-H5 analysis: the level of satisfaction and the strength of travel intention are a pair of positive correlations, which affect and restrict each other, and when the satisfaction factor is higher, the stronger the traveler's willingness to travel; When the satisfaction factor is lower, the traveler's willingness to travel is weaker.

Summary: Satisfaction needs to be maintained from multiple aspects, and airports should pay attention to the psychological and physiological reactions of passengers to prevent excessive behaviors when flights are delayed, which will affect the normal operation of flights [18]. In the event of a flight delay or corresponding emergency, it is necessary to take appropriate remedial measures in a timely manner to alleviate passengers' emotions and convey the corresponding flight dynamic change information and weather conditions on the day or in the coming week to passengers in a timely manner, so as to ensure that passengers are aware of this information when purchasing tickets and protect passengers' right to know [19].

5.2. Discussion

This paper mainly discusses the relationship between meteorological factors and airport satisfaction, and provides theoretical support for improving the satisfaction and passenger flow of Lanzhou Zhongchuan Airport. The study aims to guide Lanzhou Zhongchuan Airport to form an efficient flight delay remediation mechanism, so as to further improve passengers' satisfaction with the airport and their willingness to travel.

Flight delays can be affected by different factors, and in the event of flight delays or other emergencies, airports should pay the most attention to the real psychological needs of passengers, and provide corresponding services according to the needs of passengers to resolve conflicts is the fundamental

way to alleviate passengers' dissatisfaction [20]. Starting from the psychological needs of passengers, passengers from the security checkpoint queue waiting, security check, waiting at the waiting gate, boarding, waiting for take-off, this series of process passengers' emotions are fluctuating, long-term waiting has made passengers gradually lose patience, become more and more impatient, passengers' emotional fluctuations are proportional to the importance of their own itinerary, dissatisfaction is followed by boredom, and the negative impact of impatience will make passengers have the illusion of prolonging the delay time, impatience, dissatisfaction, If the crew does not take remedial services to guide and comfort the passengers, it is very easy for the passengers to lose control of their emotions and have friction with the crew, resulting in a series of unsafe incidents and a negative impact on the reputation of the airline [21].

Therefore, when a flight delay occurs, the airline or the airport should take corresponding remedial services in a timely manner, so that passengers can be satisfied in both physical and psychological aspects, so as to better improve passengers' satisfaction with the airport and their willingness to travel.

6. Countermeasures and Suggestions

China's civil aviation industry is currently facing the current situation of expanding claims for the rights and interests of domestic and foreign passengers after flight delays, as well as frequent mass incidents at airports. Therefore, when delays cannot be completely avoided, how to let passengers truly understand the relevant information, and make the post-delay services and compensation timely, in place and transparent, is the key to changing the status quo and gaining the understanding and satisfaction of passengers.

6.1. Refined transmission of flight delay information

In the event of flight delays, the airport should send the specific information of the flight on the same day through the contact information reserved by the passengers, and carefully inform the passengers of the specific time when the flight will resume operation, so as to facilitate the passengers to make changes or wait for a short time, so as not to bring unnecessary trouble to the passengers. When transmitting information, it is necessary to ensure that the notice is in place, the main body is clear, if you encounter special passengers such as the elderly, the weak, the sick, the disabled, the pregnant, the left-behind children, and the first-time passengers, the airport should take corresponding measures, such as: do a good job of medical examination, reserve comfortable seats for the middle-aged and elderly, call relatives or provide a suitable place to rest, issue a warm guide card, etc.

6.2. Remedial services for flight delays shall be provided in a timely manner

Establish a sound emergency service mechanism for flight delays, which can give passengers the best psychological comfort when the flight is delayed, so that passengers can really feel the warmth brought to them by the airport and feel the taste of home, for example: carriers should provide meals or accommodation services to alternate passengers or delayed passengers, help them change to the nearest flight to prevent the interests of passengers from being damaged, bring corresponding benefits to passengers stranded at the airport

(follow-up air tickets, in-flight meal discounts, etc.), and regulate the negative emotions of passengers through remedial services. This further enhances passenger satisfaction and willingness to travel.

6.3. "Follow-up service" after the event, and comprehensively optimize and improve the service quality of Lanzhou Zhongchuan Airport

Do a good job in the "tracking service" after the flight delay, establish a sound after-service mechanism, and ensure the thoroughness and comprehensiveness of the service; In addition, it is also necessary to establish a precise index evaluation system to summarize and sort out the suggestions put forward by passengers, carefully analyze the shortcomings, find the shortcomings, and formulate correct solutions to ensure the optimization of passenger satisfaction.

6.4. Provide targeted service measures according to seasonal changes

Lanzhou Zhongchuan Airport is located in the northwest inland, the seasonal changes are obvious, and each season has meteorological factors that affect the flight flight, so it is necessary to provide special services for seasonal changes. While informing passengers of flight information, passengers should also be informed of the weather conditions in the coming week in advance, and passengers should be reminded to bring clothes suitable for weather changes, so that passengers can travel selectively.

7. Conclusion

Based on meteorological factors, this study constructed a conduction model of the dynamic change of airport satisfaction caused by flight delays caused by meteorological factors at Lanzhou Zhongchuan Airport, and distributed questionnaires to passengers, and analyzed them with the help of questionnaire stars, and explored the relationship between meteorological factors, anxiety, airport satisfaction, and travel intention, and drew the following conclusions:

Flight delays caused by meteorological factors have a significant positive impact on the anxiety of passengers.

Anxiety has a certain mediating role between meteorological factors and airport satisfaction.

There is an obvious positive correlation between airport satisfaction and passengers' travel intention, and when the relationship between anxiety and travel intention becomes more obvious, the mediating variable of satisfaction has a better effect and a stronger effect.

Satisfaction can positively affect passengers' anxiety due to flight delays, the higher the satisfaction, the more complete the anxiety regulation mechanism, the faster the adjustment rate, and the stronger the willingness to travel; On the contrary, satisfaction can negatively regulate passengers' anxiety due to flight delays, and the lower the satisfaction, the more passengers distrust Lanzhou Zhongchuan Airport, and the relevant program facilities are obviously insufficient, and they can improve satisfaction and enhance passengers' willingness to travel by providing refined services.

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