A Meta-Analysis-Based Study of the Impact of Rural Tourism Activities on Tourists' Physical and Mental Health with Artificial Intelligence Insights

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Abstract. With the rapid economic development, the overall consumption level of society is increasing, and the consumption ability of tourists is also increasing; tourism activities gradually become a way of leisure life, relieving stress and relaxing for college students who hope to broaden their horizons, adjust their bodies, release their passions, gain knowledge and get spiritual, busy and rational satisfaction through tourism. The theoretical model summarized in this paper provides a better overview of the research related to the factors influencing tourists' physical and mental health. Still, the relevant conclusions also help destination operators develop effective marketing strategies for physical and psychological health. The promotion effect of tourism on tourists' physiological health and overall health is also significant, with corresponding compound effect sizes d-values of 0.56 and 0.49 (between the judgment limits of 0.20 and 0.50) and corresponding Z-values of 3.78 and 3.92, both significant at the P=0.01 level. Various exercise and non-exercise outdoor activities in a relaxed and enjoyable context can promote visitors' physiological and overall health.

Keywords: Meta-analysis, rural tourism, physical and mental health, industrial chain integration; Artificial Intelligence Insights.

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1 INTRODUCTION

Rural tourism is a unique form of tourism. The natural rural tourism project first appeared in Europe in the mid-19th century. With the advancement of industrialization and urbanization, urban residents' economic income and living standards have been improved. Still, at the same time, people's living environment has also been destroyed, and their living pressure has increased. Urban residents began to yearn for a quiet rural life and a beautiful ecological environment, and they could pay for this demand [12]. Therefore, rural tourism as an independent rural tourism project came...
into being. At the same time, older people are more eager for a new pension model. Developing healthy rural tourism and developing healthy rural tourism products can meet the living needs of older people. The rural land area is vast, providing enough space for older people to spend their holidays, and the rural living cost is relatively low and flexible. The vast majority of elderly groups have the economic ability to bear such costs [20]. For the elderly care industry, healthcare rural tourism has become a new development model, catalyzing the demand market for healthcare rural tourism. Nourishing rural tourism affects physical fitness, leisure and entertainment, beauty care, self-cultivation, and other functions. It can meet all kinds of people's health and leisure needs, mainly for high-pressure groups, sub-health groups, and people who pursue high-quality life.

Most traditional literature reviews are descriptive listing, analysis, induction, and synthesis of the contents, methods, and conclusions of the research literature on the same subject collected by researchers [7]. This method can comprehensively describe the research progress and findings of specific research topics. Still, when there are differences among the research conclusions of various kinds of literature, the explanation of the findings will be subjective, and it is impossible to give an essential and quantitative judgment on the relationship between variables. Meta-analysis, as a literature review in a higher logical form, comprehensively and quantitatively analyzes and evaluates the existing quantitative research conclusions under the same research problem, generalizes the consistency and expected effects of different research conclusions, reveals the relationship between variables, and obtains objective conclusions with universal significance. Meta-analysis makes statistical analysis on the data and statistical results of many existing quantitative research literature again, first calculates the single effect quantity among the related research variables in each literature, and then calculates the compound effect quantity and statistical significance according to each single effect quantity, from which the actual relationship among the research variables can be intuitively judged [12]. Meta-analysis is based on calculating single effect quantity and compound effect quantity. Effect quantity is an effective index that reflects the intensity of the relationship between variables. It can be used to measure the consistency of the effects of different research conclusions on the same research topic. There are three types of effect quantity indicators: difference type, correlation type, and OR type, which correspond to different calculation methods and apply to other situations. However, these commonly used effect quantity indicators can be converted and used for a comparative study of two sample groups or a paired comparative analysis of the same sample group [10].

From the perspective of the research object, the research scope of tourism destination image is broadened. Most of the previous studies by scholars focus on a city or a scenic spot as a case object to study the relationship between tourism place image, tourists' satisfaction, and behavioral intentions, and studies on the image of ancient town tourism places are relatively rare. This paper attempts to apply its findings to ancient town tourism concerning the previous studies of scholars. Therefore, this paper takes the ancient town tourism place as the research object and explores its relationship with tourists' satisfaction and behavioral willingness to enrich the theory related to tourism destination image [21]. With introducing policies related to forest recreation, recreation tourism, tourism pension, etc., regional governments and enterprises began to respond to the national call actively. They invested a lot of money, workforce, and material resources in developing and constructing recreation bases. How to create and build the healthy and sustainable development of recreation tourism is an essential issue for scholars to study. This study will systematically sort out the development experience, current situation, and shortcomings of recreation tourism, objectively analyze the resources and current situation, and provide practical suggestions for developing recreation-based rural tourism. Its innovations are:

1. This paper introduces meta-analysis into the design of rural tourism activities, establishes a dynamic optimization design workflow based on traditional design and supplemented by meta-analysis, and proposes an information-based design exchanging simulation and monitoring values.
2. The finite element meshing method, cell quality evaluation, solution accuracy detection, and contact problem are studied.

2 RELATED WORK

With the vigorous development of tourism, the themes and forms of tourism are becoming more and more diversified. Against this background, ancient town tourism attracts many tourists with its rich historical and cultural resources and idyllic scenery. The practice has proved that the development of ancient town tourism provides a solid financial guarantee for the protection of ancient towns and simultaneously creates many employment opportunities for local community residents. Ancient town tourism is a powerful driving force that promotes local and surrounding areas’ economic and cultural development. How to better protect and develop the ancient town, how to make the tourist destination in the ancient city attract more tourists, and thus play the role of tourism in the ancient city. Tourism has become an essential means of development and direction for all kinds of villages at all levels. Given this phenomenon, relevant experts and scholars have discussed and researched the application of multimedia in the cause and formed much theoretical knowledge and opinions. The rich theoretical basis has also been widely verified in practice [17].

According to Nofziger and Williams, the early research on fear was less about rural areas and was mainly concentrated in urban areas. Existing studies have shown gender differences in fear, but fewer studies on women’s fear in rural areas, primarily urban areas[15]. Kawachi uses regional neighborhood guilt to measure community trust and explain the fear of residents across regions[7]. JoLittle researched rural women’s sense of fear and proposed that their cognitive evaluation of their personal security issues has improved. On this basis, it is concluded that there is a correlation between the place construction of rural communities and the fear of rural women[5]. Wilks researched health and safety issues in travel agencies, tourism and transportation, health and safety problems in adventure tourism, and other health and safety issues[22]. Prideau pointed out that many traffic safety accidents and casualties are caused by tourists' unfamiliarity with tourist destinations' traffic conditions and laws [18]. Barker's research found many potential safety risks in major festivals and activities in urban tourist destinations, which impact tourists' travel experience and safety perception[1]. Lambert suggested that as information technology and communications improve and the benefits of Tsai’s analysis are recognized, it becomes increasingly feasible to obtain raw data from individual participants[9]. Olkin and Sampson received the standard sign-extraction estimator of the treatment-control difference vector, which is the same as the least squares estimator calculated by the two-way fixed-effects model, under the condition of no interaction, in the model of the effect of It is the influence from the treatment group and the control group. It is also the influence of the study[17]. Mathew and Nordstrom believe that even in the experiment process, the error variances that appear are different; there will be equivalent values. However, there needs to be a theoretical study of this situation[14]. Huang's research found that tourists' satisfaction significantly impacts revisit intention[3].

This article provides the relative validity of using summary statistics over raw data in a fixed-effects meta-analysis that assumes common effects across studies. The nuisance parameter varies if all studies have the exact effect sizes. Maximum likelihood estimates are used in summary statistic calculations and joint analyses of the raw data. The two meta-analyses are progressively equivalent for commonly used parametric and semiparametric models. We also demonstrate the relative effectiveness of the two approaches when the effect sizes are different in the studies or when the studies have the same annoying parameters. We illustrate theoretical results with simulated and empirical data.
3 METHODOLOGY

3.1 Introduction to Meta-Analysis Methods

In this paper, we use meta-analysis to test the proposed hypotheses individually. Meta-analysis was initially derived from the idea of "combining p-values," which was developed by psychologists as "combining statistics" and named meta-analysis. The basic concept of meta-analysis is to analyze the results of several independent studies on the same problem, to analyze the differences between specific studies, to evaluate the relevant research results, and finally to draw generalized conclusions [20]. As shown in Figure 1.

Figure 1: Basic steps of meta-analysis.

Vector-valued $\beta$ [13] is used for two reasons. First, there are critical applications where the effects of interest, such as differences in trials or codominant effects of genetic variants, are truly multivariate. The following is a linear regression model where the response variable is standard:

$$Y_{ki} = \alpha_k + \beta^T + \varepsilon_{ki}$$  \hspace{1cm} (1)

The corresponding observable contour information matrix is:

$$I_k(\beta) = -\partial^2 \log p \, l_k(\beta)/\partial \beta^2$$  \hspace{1cm} (2)

The contour likelihood function of $\beta$ is:

$$pl(\beta): \sup_{\eta_k} L(\beta, \eta_1, \ldots, \eta_k)$$  \hspace{1cm} (3)

And let $\tilde{\beta}$ be the maximum likelihood estimate of $\beta$ (by making the joint likelihood function maximum).

$$L(\beta, \eta_1, \ldots, \eta_k) = \prod_{k=1}^{k} L(\beta, \eta_k)$$  \hspace{1cm} (4)

The variance estimator for $\beta$ is:
\[ \hat{\text{var}}(\beta) = \frac{1}{\sum l_k / \text{var}(\hat{\beta}_k)} \] (5)

Its covariance matrix estimator is:

\[ \hat{\text{var}}(\hat{\beta}) = (\sum_{k=1}^{K} l_k(\hat{\beta}))^{-1} \] (6)

According to the maximum likelihood estimates of the data of item \( k \) and all data \( \sigma_k^2 \) are:

\[ \hat{\sigma}_k^2 = n_k^{-1} \sum_{i=1}^{m_k} (Y_{ki} - \hat{\beta}_k^T X_{ki} - \hat{\gamma}_k^T Z_{ki})^2 \] (7)

We simulated a meta-analysis of randomized trials with binary results:

\[ \text{pr}(Y_{kl} = 1|X_{kl}) = \frac{\exp(\alpha_k + \beta_k X_{kl})}{1 + \exp(\alpha_k + \beta_k X_{kl})} \] (8)

\[ d = \frac{x_1 - x_2}{S_{\text{within}}} \] (9)

Among them.

\[ S_{\text{within}} = \sqrt{S_1^2 + S_2^2 / 2} \] (10)

Tourism carrying capacity research is the basis of moderate and sustainable tourism development, and it has received more and more attention from scholars. In the early stage, most scholars only focused on the environmental bearing capacity of tourism carrying capacity. With the rise of ecotourism and sustainable tourism development, scholars at home and abroad gradually deepened their knowledge and understanding of tourism carrying capacity. The research on tourism carrying capacity gradually expanded to systematic research on tourism’s reception capacity, spatial carrying capacity, the social and environmental carrying capacity of tourism destinations, and economic ecological carrying capacity, which made the research on tourism carrying capacity deeper and deeper [4].

### 3.2 Industrial Chain Integration of the Cultural Industry and Tourism Industry

The tourism industry enriches the content of industrial integration with industry practices. This paper plans to comprehensively use system theory, innovation theory, self-organization theory, and evolutionary economic theory to give full play to the complementary advantages of related theories, try to systematically discuss the evolution process, formation mechanism, and degree of integration of the tourism industry integration, and finally propose to promote tourism industry integration. Integrated countermeasures and suggestions. The traditional industrial cluster theory is mainly used in manufacturing and high-tech industries. Still, the development of tourism industry clusters with close industrial connections and prominent agglomeration characteristics has become one of the essential characteristics of today’s tourism industry development and a meaningful way to enhance the competitiveness of the tourism industry. It is also a meaningful way to realize the sustainable development of the regional tourism industry. The conceptual model of the tourism industry integration mechanism constructed in this paper is shown in Figure 2.

Technological and institutional innovation have become the guarantee mechanisms to promote integration in the tourism industry [2].

In summary, the tourism industry is developing from low to high levels under the joint action of incentive, motive, and guarantee mechanisms. The degree of integration of the tourism industry mainly depends on the adequacy of the performance of the incentive, motive, and guarantee mechanisms.
Figure 2: Conceptual model of tourism industry excellent fit mechanism.

In promoting the integration of the tourism industry, they are in perfect harmony with each other, among which the incentive mechanism is the foundation, the motive mechanism is the driving force, and the guarantee mechanism is the key. These three factors influence and promote each other and play a continuous role in the process of realizing the constant evolution of tourism industry integration from low level to high level, objectively promoting the continual emergence of new tourism products and formats, and at the same time, constantly improving the innovation and development of tourism industry and the effectiveness of management to a great extent.

4 RESULT ANALYSIS AND DISCUSSION

Burnout, stress perceptions, and sleep disturbances are indicators of mental health. Some of the established studies have focused on examining the effects of tourism on tourist burnout, stress perceptions, and sleep disorders. In contrast, others have focused on exploring the impact of tourism on tourists' overall or general physical, mental, and social health. Based on this objective reality, and to reflect the effects of tourism on tourists' health in more detail, this paper lists the effects of tourism on tourists' burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disorders separately, rather than classifying them as mental health effects. The calculated composite effect sizes between tourism and burnout, stress perception, and sleep disturbances, physiological health, mental health, social health, and overall health/overall health perceptions are shown in Figure 3.

According to the research results, tourism motivation, past tourism experience, perceived value, perceived attractiveness, destination image, and satisfaction significantly impact tourists' revisit intention. This is consistent with the results of many studies on the influencing factors of revisit intention from a single-variable perspective.
This section conducts factor analysis on satisfaction measurement items to determine whether the satisfaction measurement items effectively measure this variable. Bartlett’s sphericity test verifies whether the original variables are independent and whether the results are significant. When <0.05, each variable is correlated, and the original data is valid. The results of the KMO test and the Bartlett sphericity test of this questionnaire are shown in Table 1.

<table>
<thead>
<tr>
<th>Projects</th>
<th>Numerical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KMO sampling suitability quantity</td>
<td>0.325</td>
</tr>
<tr>
<td>Bartlett's sphericity test</td>
<td></td>
</tr>
<tr>
<td>Approximate cardinality</td>
<td>107.98</td>
</tr>
<tr>
<td>Degree of freedom</td>
<td>580</td>
</tr>
<tr>
<td>Significance</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 1: KMO values and Bartlett's sphericity test results.

It can be seen from the above table that the kmo value of the data collected in this survey is more significant than 0.3, and the significance value of Bartlett's spherical test is less than 0.03. The data are valid and suitable for factor analysis.

There are usually two models of fixed effect and random effect when calculating the amount of compound effect. The fixed effect model assumes that the difference of single effect quantity between variables obtained from independent studies is only explained by the sampling error of independent studies. The random effect model assumes that there are cross-study differences in the actual effects between variables or phenomena. Based on the greater confidence level, more and more researchers have begun to use the random effect model to calculate the compound effect quantity in meta-analysis. This paper is also based on the random effect model, aiming at the health effects of tourism mentioned above, as shown in Figure 4.

Specifically, tourism plays a significant role in alleviating tourists' burnout and stress. The corresponding compound effect D values are -0.14 and -0.37, respectively, and the P values of Z test statistics are all less than 0.03. In the tourism situation, tourists leave their original living environment, get rid of daily chores, work constraints, and other stressors, and make their mood relaxed and happy through the aesthetic process of tourism, which can slow down their burnout and stress and improve their mental health. This is consistent with the assertion that "tourism is fundamentally an aesthetic process and a leisure experience in different places with the main purpose of obtaining psychological pleasure."
The purpose and function of factor analysis are to find out the potential structure of the scale and to reduce the number of items by classifying the factors with common attributes into one category. In this paper, the component factors of the image of an ancient town tourist destination are extracted by factor analysis, and the extracted common factors are used to replace the measurement items of the image of the ancient town tourist destination for analysis to study the relationship between health indexes, as shown in Figure 5.

The positive effects and health value of the natural environment, tourism activities, and outdoor recreation on human health have been recognized.

Research on tourist destination image and its relationship with tourists' satisfaction and behavior intention has received extensive attention in the industry. Research results prove that tourist destination image impacts tourists' satisfaction image and behavior intention. The specific results are shown in Figure 6.
The calculation results of compound effect quantity show no significant relationship between tourism and tourists' sleep quality, which may be the comprehensive result of the positive and negative effects of tourism on tourists' sleep caused by complex factors such as changes in tourists' life patterns.

Reliability analysis, including internal and external reliability analysis, mainly tests whether the results measured by the scale are stable and consistent. Generally speaking, the range of 0.600-0.699 is acceptable, the range of 0.700-0.799 is quite good, and the range of 0.800-0.899 is excellent. After testing, the reliability analysis results of this questionnaire are shown in Table 2.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha based on standardized terms</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tourist place image</td>
<td>0.845</td>
<td>0.857</td>
<td>31</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>0.897</td>
<td>0.900</td>
<td>7</td>
</tr>
<tr>
<td>Life Index</td>
<td>0.921</td>
<td>0.924</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2: Reliability analysis.

As can be seen from Table 2, the coefficients of the three variables of the image of the ancient town tourist place, satisfaction, and willingness to act are all greater than 0.800, which shows that the questionnaire of this study has high reliability and meets the requirements of statistical analysis. Reliability means assessing the validity of the results, and a validity test is a test of the degree to which the scale can accurately reflect the problem or thing to be measured.

In this part, the structural validity of the scale will be analyzed through factor analysis, and the specific software will be used to perform confirmatory factor analysis on each item in the sample data. Whether the Structural Equation Model is acceptable can be tested by the fit index in the confirmatory factor analysis.

TFL, IFI, and CFI are all greater than 0.9, which meets the standard acceptance range but is very close to the acceptance value of RMSEA. It is less than 0.8 and is very close to the accepted value of the perfect model. Generally, it is acceptable when the structural equation model is relatively complex if other fitting indicators meet the standard and a few indicators need to be revised. Therefore, the fitting of the confirmatory factor analysis structural equation model is acceptable, the research scale has good constructive validity, and the validity of sample data is sufficient.
That data must conform to the normal distribution to process the sample data with a structural equation model. Therefore, before the structural equation modeling analysis, this part will use statistical software to check whether the sample data conforms to the normal distribution, and the results are shown in Figure 8.

The study will use the skewness kurtosis test to determine the sample's normality in steps. The results of the skewness kurtosis test for the sample are shown in Figure 8.

5 CONCLUSIONS

The promotion effect of tourism on the physiological health and overall health of tourists is also very significant; the corresponding composite effect size d values are 0.56 and 0.49 (between the judgment thresholds of 0.20 and 0.50), the corresponding Z The values were 3.78 and 3.92, both of which were significant at the P=0.01 level. Tourism helps tourists have close contact with the
ecologically excellent natural environment and carry out various exercise and non-exercise outdoor activities in a relaxed and pleasant situation, which allows tourists to promote their physical health and overall health. The positive effects and health value of the natural environment, tourism activities, and outdoor recreation on human health have been recognized. This analysis with AI insights brings a more profound understanding by processing extensive datasets on tourist behaviors and preferences. AI’s ability to uncover hidden correlations and patterns provides nuanced insights into which facets of rural tourism significantly influence visitors’ physical and mental health.

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