Research on urgency classification of emergency supplies based on combined method

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Abstract

When a sudden disaster occurs, it is necessary to carry out emergency rescue work in a timely manner, especially when emergency resources are limited and emergency transportation capacity is constrained, it is important to quantify and classify the urgency of the material needs of each disaster-stricken point, so as to improve the efficiency of emergency rescue. First, it comprehensively analyses the factors that affect the urgency of the disaster-affected site's demand, and establishes the evaluation of the urgency of the disaster-affected site's demand from three aspects: environment, population and material demand. The index system uses the group decision-making relative entropy aggregation model (REM) and entropy method to determine the weights, and proposes to evaluate the demand urgency classification based on the Gray Relational -TOPSIS method; and analyses the relevant data from the Wenchuan earthquake, and obtains ten demand urgency coefficient and ranking of the most severely-hit areas, among which Wenchuan, the epicenter has the highest urgency, followed by Mianzhu and Beichuan. The analysis results are basically consistent with the official government evaluation results. Therefore, this paper can provide a reference method for emergency rescue urgency research.

Keywords: emergency supplies; demand urgency classification; REM; the entropy method; improved TOPSIS method

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1. Introduction

In recent years, many large-scale public emergencies have occurred in China, including natural disasters, accident disasters and public health events, which have brought great life and health injuries and economic losses to the society and the people. Therefore, emergency rescue of disaster-stricken people is needed, in which the transfer and transportation of emergency materials is the key link in the rescue process. However, emergency materials are often faced with practical constraints such as limited total amount of materials, scattered demand points and valuable rescue time. Therefore, it is urgent to grade the urgency of emergency material demand at the disaster-stricken points and determine the distribution plan according to the priority of the disaster-stricken points, so as to maximize the rescue effect, reduce the rescue response time and make full use of emergency materials, improve the handling capacity of emergency rescue materials.

In terms of emergency material demand urgency classification, Zhu Huagui [1] analyzed the emergency demand structure of the victims in different periods after the disaster and constructed the evolution evaluation factor set of the emergency demand structure of the victims. Zhang Yinghui [2] proposed the dynamic hierarchical evaluation process of emergency material demand, constructed the hierarchical matter-element model of demand, and gave the extension fuzzy comprehensive evaluation method based on correlation function. Wang Zhile [3] divided the whole process of emergency management into seven stages and three links, and classified the demand for emergency materials by using the basic principle of analytic hierarchy process (AHP). Many scholars have also done some research on the classified calculation of emergency material demand urgency. Gao Hongni[4] quantified the collected disaster information into disaster factors by using the improved expert scoring method, and established a multi-objective material scheduling model on this basis. Tan Wenjing [5] proposed the calculation method of evidence conflict distribution weight and improved evidence synthesis rules as the basis for constructing fuzzy evaluation matrix. Zou Zhiyun [6] used accelerated genetic algorithm to solve the nonlinear optimization analytic hierarchy process problem with expert credibility; Yao Enting[7] established a demand urgency classification model based on BP neural network. Wang Lifang [8] used the method of combination weighting to determine the weight value of subjective and objective indicators. Guan [9] established a cooperative decision-making system for emergency relief material dispatching, and used entropy weight TOPSIS method to measure the emergency degree of disaster areas. Wang Jing [10] proposed the classification method of emergency material demand urgency and the calculation method of emergency material demand urgency based on fuzzy comprehensive evaluation. Yang Zheng [11] constructed the evaluation index system of material demand urgency by using analytic hierarchy process. Gao Tianyu [12] used the idea of material modularization for reference to calculate the urgency of grouping materials.

The purpose of the research on the urgency of emergency material demand is mainly to solve the problems of emergency material path planning or allocation center location in the next step. However, presently most of the existing studies on the calculation and classification of emergency material demand urgency are focused on the systematization specialization. There are few research results on refined demand urgency. Therefore, this paper comprehensively considers the information of the main decision-making factors of the disaster-stricken points, determines the combined weight coefficient of each index through the combination of entropy method and group decision-making relative entropy aggregation model (REM), and uses the basic idea of grey relational analysis to improve TOPSIS method to establish the emergency material demand urgency classification model of the disaster-stricken points. The model is applied to the verification of the classification of emergency material demand urgency at the main disaster-stricken points in Sichuan Province in the 2008 Wenchuan earthquake, and the research method of emergency demand urgency is given, so as to provide a basis for the next emergency rescue.

2. Analysis on Influencing Factors of demand urgency at affected points

Based on the existing research results, this paper divides the influencing factors of demand urgency of disaster-stricken points into fuzzy type and exact type.

(1) Affected area refer to the area affected by natural disasters.

(2) Epicenter intensity refers to the intensity of the epicenter area. The higher the epicenter intensity, the greater the scope affected, the more affected and injured people, and the higher the urgency of emergency materials [13].

(3) The damage level of buildings. The higher the damage level of buildings in the disaster area, the more serious the disaster, and the higher the urgency of material demand. Since it is impossible to accurately assess the damage level of buildings in disaster areas, the damage degree of buildings is divided into five levels through language variables, and the scores of 2, 4, 6, 8 and 10 are given, as shown in Tab 1. Since it is difficult to obtain the data on the damage degree of buildings, different scores will be given according to the proportion of full and half inverted households in the disaster affected villages and towns [14].

(4) Road damage degree: the greater the damage degree of the roads in the disaster area, it indicates that the disaster situation is more serious. The evaluation criteria are the same as that in Tab 1.

Tab 1. Damage Classification of Buildings and Roads

Damage level of building/ Road damage degree	Affected percentage （%）	Grade	Score
Intact	0-20	one	2
Minor damage	20-40	two	4
Moderate damage	40-60	three	6
Serious damage	60-80	four	8
Complete damage	80-100	five	10

(5) Number of victims refers to the number of people lost due to natural disasters. The number of people affected is a direct factor affecting the demand for emergency materials.

(6) Number of injured refers to the number of people injured by natural disasters. The larger the number of injured people, the more demand for medical and health materials, and the higher the urgency of the corresponding demand for emergency materials.

(7) Affected population ratio refers to the ratio of the affected population in the affected area to the total population in the jurisdiction.

(8) Material demand refers to the total demand for various materials at the disaster site.

(9) Demand gap rate refers to the ratio of material demand at the disaster site to the sum of material demand and existing materials. The greater the demand gap rate, the higher the degree of urgency.

The premise of grading the demand urgency of disaster-stricken points is to clarify the influencing factors of demand urgency of disaster-stricken points. Through a comprehensive analysis of the relevant factors affecting the demand urgency of the disaster-stricken areas, it is classified mainly from three aspects: environmental factors, demographic factors and material demand. See Tab 2 for details.

Tab 2. Impact Indicators of Demand Urgency At Affected Points

Primary index	Secondary index	Indicator type
Environmental factor	Affected area	Exact type
	Epicenter intensity	Exact type
	Damage level of building	Fuzzy type

	Road damage degree	Fuzziness
Demographic factors	Number of victims	Exact type
	Number of injured	Exact type
	Affected population ratio	Exact type
Material factors	Material demand	Exact type
	Demand gap rate	Exact type

3. Determination of index weight and evaluation method

3.1. Determination of comprehensive weight

3.1.1 Determination of subjective weight by REM

The relative entropy aggregation model (REM) of group decision-making is a subjective weight weighting method for evaluating and making decisions on multiple objectives. This method simplifies the operation steps and overcomes the shortcomings of the characteristic root method of group decision-making. Give the group decision matrix $\mathrm{H}=\left(h_{ij}\right)_{m\times n}$.(h_{ij} is the scoring value of the expert i on the evaluated target j . The scoring system is usually 10 points $(i=1,2,\cdots m, j=1,2,\cdots n)$ .Transform group decision matrix into normalized decision matrix $\mathrm{K}=\left(k_{ij}\right)_{m\times n}$. Then get the group preference vector $\alpha=\left(\alpha_1,\alpha_2,\cdots,\alpha_n\right)^T$ .The calculation formulas are shown in formula.

$$k_{ij}=h_{ij}/\sum_{j=1}^{n}h_{ij} \qquad \alpha_j=\prod_{i=1}^{m}\left(k_{ij}\right)^{\lambda_j}\Bigg)\sum_{j=1}^{n}\prod_{i=1}^{m}\left(k_{ij}\right)^{\lambda_j} \tag{1}$$

Among them, λ_j is the decision weight of expert s_j . $\lambda_j=\dfrac{1}{m}$, means there is no difference between experts, and they are weighted equally. Then $\alpha=\left(\alpha_1,\alpha_2,\cdots,\alpha_n\right)^T$ is the subjective weight of each evaluation index.

3.1.2 Determination of objective weight by the entropy method

In information theory, the amount of uncertainty can be measured by entropy. The greater the entropy, the stronger the uncertainty. Through this characteristic, the dispersion of the index can be measured by entropy. The greater the entropy, the greater the impact of the index on decision-making. The entropy method can fully reflect the change degree of the evaluation index and objectively reflect the attributes of the evaluation index. The specific calculation steps are as follows.

Step 1: determine the decision matrix and standardize the matrix.

This paper studies nine indicators of emergency measures in disaster areas, indicating by $C=\left\{C_j,1,2\ldots 9\right\}$. C_1 is the area of the affected area; C_2 is the epicenter intensity; C_3 is the damage degree of the building; C_4 is the degree of road damage; C_5 is number of victims; C_6 is the number of injured; C_7 is ratio of affected population; C_8 is material demand; C_9 is the demand gap rate. There are n evaluation objects and m evaluation indicators. The initial value of the attribute j of evaluation object i is x_{ij} . The above evaluation indexes constitute the decision evaluation matrix V of demand urgency of disaster-stricken points.

$$V=\begin{vmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{vmatrix} \quad (2)$$

Different index data often have different dimensions and magnitudes, which not be directly compared or calculated. Standardization for matrix V can solve the problem of dimension, which can be processed in SPSSAU .

$r_{ij}^{'}$ is the standard value of the evaluation index j of the evaluation object i . For indicators with different attributes, if the data direction is inconsistent, it needs to be processed in advance, usually forward or reverse. If there is a reverse index in the data, then the function "reverse" needs to be used to process. For positive indicators and negative indicators standard them as follow formula 4.

$$r_{ij}^{'}=\begin{cases} \dfrac{x_{ij}-\min_j x_{ij}}{\max_j x_{ij}-\min_j x_{ij}} & ,x_{j\max}\neq x_{j\min} \\ 1 & ,x_{j\max}=x_{j\min} \end{cases} \qquad r_{ij}^{'}=\begin{cases} \dfrac{\max_j x_{ij}-x_{ij}}{\max_j x_{ij}-\min_j x_{ij}} & ,x_{j\max}\neq x_{j\min} \\ 1 & ,x_{j\max}=x_{j\min} \end{cases} \quad (3)$$

Based on the above formula, the processed index will have a zero value, which does not comply with the calculation process of the entropy method. Therefore, after standardization, the index with a value of 0 will be no negative translated. If a column (or an index) data is less than or equal to 0. Then add a 'translation value' to the column of data at the same time (the value is the absolute value of the minimum value of a column of data +0.01). Then that all the data are greater than 0, so as to meet the requirements of the algorithm.
Matrix R can be obtained after standardization:

$$R=\begin{vmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{vmatrix} \quad (4)$$

Step 2: use H_j represents the entropy of the index j , representing the disorder degree of the material system.

$$H_j=-k\sum_{i=1}^{m} p_{ij}\ln p_{ij} \quad (5)$$

Among them, $p_{ij}=\dfrac{r_{ij}}{\sum_{i=1}^{n} r_{ij}}$, p_{ij} indicates the contribution of the disaster i affected point under indicator j .When

$p_{ij}=0$, $p_{ij}\ln p_{ij}=0$. k is a constant, $k=\dfrac{1}{\ln n}$, the constraint is $0\le H_j\le 1$.

Step 3: calculate the redundancy g_j of information entropy in the evaluation index and the index weight K_j .

$$g_j=1-H_j \qquad K_j=\frac{g_j}{\sum_{j=1}^{m} g_j} \quad (6)$$

The weight comprehensively determined based on REM and the entropy method. Among them, θ represents the weight, and $0<\theta<1$.

$$W_J=\theta\alpha+(1-\theta)K_j \quad (7)$$

3.2. Demand urgency classification based on Grey Relational Analysis -TOPSIS evaluation method

The classification and evaluation methods of urgency mainly include fuzzy comprehensive evaluation method, TOPSIS method, function relationship quantification method, cluster analysis method, etc. In this paper, the grey relational analysis method and TOPSIS method are used to comprehensively determine the index weight based on REM and the entropy method. The classification model of demand urgency of disaster-stricken points is constructed, and the relative closeness is calculated by using the grey relational between disaster-stricken points and positive and negative ideal solutions. Ranking of demand urgency of disaster affected points.

Step 1: determine the weighted gauge matrix Z.

$$Z=RW_J=\begin{vmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{vmatrix}\begin{vmatrix} W_{J1} & 0 & \cdots & 0 \\ 0 & W_{J2} & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & W_{Jn} \end{vmatrix}=\begin{vmatrix} z_{11} & z_{12} & \cdots & z_{1m} \\ z_{21} & z_{22} & \cdots & z_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ z_{n1} & z_{n2} & \cdots & z_{nm} \end{vmatrix} \quad (8)$$

Step 2: determine the positive and negative ideal solutions Z^+ 、 Z^- of the weighted gauge matrix.

$$Z^+=\left\{\max_j z_{11},\ldots\max_j z_{im}\right\}=\left\{Z_1^+,\ldots Z_m^+\right\}(i=1,2\ldots n) \quad (9)$$

$$Z^-=\left\{\min_j z_{i1},\ldots\min_j z_{im}\right\}=\left\{Z_1^-,\ldots Z_m^-\right\}(i=1,2\ldots n) \quad (10)$$

Step 3: calculate the grey relational degree from the disaster point to the positive and negative ideal solution respectively.

$$\theta_{ij}^+=\frac{\min_i\min_j\left|Z_j^+-z_{ij}\right|+\rho\max_i\max_j\left|Z_j^+-z_{ij}\right|}{\left|Z_j^+-z_{ij}\right|+\rho\max_i\max_j\left|Z_j^+-z_{ij}\right|} \quad (11)$$

$$\theta_{ij}^-=\frac{\min_i\min_j\left|Z_j^--z_{ij}\right|+\rho\max_i\max_j\left|Z_j^--z_{ij}\right|}{\left|Z_j^--z_{ij}\right|+\rho\max_j\max_j\left|Z_j^--z_{ij}\right|} \quad (12)$$

Among them, ρ is the resolution coefficient, $\rho\in[0,1]$. The purpose is to reduce the influence of extreme values on the calculation results, this paper takes $\rho=0.5$. The grey relational analysis is carried out for evaluation items and data, and the positive ideal solution Z^+ is taken as the reference value, θ^+ and θ^- are the grey relation matrix of each disaster point and positive and negative ideal solutions.

$$\theta^+=\begin{vmatrix} \theta_{11}^+ & \theta_{12}^+ & \cdots & \theta_{1m}^+ \\ \theta_{21}^+ & \theta_{22}^+ & \cdots & \theta_{2m}^+ \\ \vdots & \vdots & \vdots & \vdots \\ \theta_{n1}^+ & \theta_{n2}^+ & \cdots & \theta_{nm}^+ \end{vmatrix} \qquad \theta^-=\begin{vmatrix} \theta_{11}^- & \theta_{12}^- & \cdots & \theta_{1m}^- \\ \theta_{21}^- & \theta_{22}^- & \cdots & \theta_{2m}^- \\ \vdots & \vdots & \vdots & \vdots \\ \theta_{n1}^- & \theta_{n2}^- & \cdots & \theta_{nm}^- \end{vmatrix} \quad (13)$$

Therefore, the correlation degree between the disaster point and the rational positive, or negative ideal solution is:

$$s_i^+ = \frac{1}{n}\sum_{j=1}^{n}\theta_{ij}^+ \qquad s_i^- = \frac{1}{n}\sum_{j=1}^{n}\theta_{ij}^- \tag{14}$$

Step 4: the relative closeness of grey relational between each affected point and the ideal solution.

$$ss_i = \frac{s_i^-}{s_i^+ + s_i^-}, 1 \le i \le n \tag{20}$$

Among them, $1 \le ss_i \le \mathrm{n}$, ss_i is the quantitative value of demand urgency at the disaster-stricken point. The greater the value of ss_i , the higher the demand urgency of the affected point. In this way. Through the quantification of the demand urgency, the grading results of the demand urgency of each affected point can be obtained, so as to determine the emergency rescue situation of the whole affected area.

4. Case analysis

4.1 Disaster point data

The area severely damaged by the 5 •12 Wenchuan earthquake is about 500000 square kilometers, including 10 counties (cities) in the extremely severe disaster area, 41 counties (cities) in the relatively severe disaster area and 186 counties (cities) in the general disaster area. As of September 25, 2008, the 5 • 12 Wenchuan earthquake has killed 69227 people, left 17923 missing, injured 374643 people in varying degrees, lost 1993.03 million people lost homes, and affected a total population of 46.256 million. Taking the material transportation of Wenchuan earthquake as an example, this paper analyzes the demand urgency of 10 disaster-stricken areas in the extremely severe disaster areas, including Wenchuan, Maoxian and Beichuan, Anxian, Pingwu, Mianzhu, Shifang, Dujiangyan, Pengzhou and Qingchuan. The data listed in tab 3 are mainly from the official reports of the Ministry of civil affairs of China, the Seismological Bureau and the occurrence of the disaster. Some of the data are predicted and estimated through the objective data such as population and geography of the region [15], and solved by SPSSAU.

The evaluation indexes of each disaster affected point in the table are used $C = \{C_j, 1, 2 \ldots 9\}$ express, C_1 is the area of the affected area, C_2 is the epicenter intensity, C_3 is the damage degree of the building, C_4 is the degree of road damage, C_5 for the number of people affected, C_6 for the number of injured, C_7 ratio of affected population, C_8 for material demand, C_9 is the demand gap rate.

Tab 3. Disaster Situation Data Of 10 Extremely Severe Disaster Areas

Disaster site	C1	C2	C3	C4	C5	C6	C7	C8	C9
Wenchuan	4083	8.89	10	10	58454	34583	55.15	923.37	64.72
Beichuan	2869	9.16	8	8	26361	9693	17.12	258.8	54.2
Mianzhu	1245	9.14	8	6	47864	36468	9.32	973.7	66.45
Shifang	863	8.68	6	6	38133	31990	8.81	854.13	52.19
Qingchuan	3269	8.74	6	6	20272	15453	8.24	412.6	28.23
Maoxian	4075	7.91	6	4	12452	8183	11.64	218.49	34.56
Anxian	1404	8.89	4	4	15047	13476	3.43	359.81	36.12

dujiangyan	1280	9.13	4	4	7457	4388	1.22	117.16	27.61
Pingwu	2720	8.15	4	4	33691	32145	18.08	858.27	45.88
Pengzhou	1420	8.53	4	4	6722	5770	0.86	154.06	31.94

4.2 Determination of index weight by combination weighting

The process of determining the subjective weight according to the relative entropy aggregation model formula (REM) of group decision-making is as follows.

Five experts are selected to score the evaluation indicators of the affected areas to obtain the group decision-making table. The scoring system is usually 10 points, as shown in tab 4.

Tab 4. Group Decision Table

Expert serial number	C1	C2	C3	C4	C5	C6	C7	C8	C9
Expert 1	8	8	8	8	9	9	5	7	9
Expert 2	7	8	8	7	9	9	6	8	7
Expert 3	9	9	7	5	7	8	7	6	8
Expert 4	6	8	9	8	7	9	7	8	9
Expert 5	6	7	9	6	8	9	5	8	6

Based on the relative entropy aggregation model of group decision-making, the subjective weight of evaluation index can be obtained:

$$\alpha = (0.105029, 0.117837, 0.120646, 0.09891, 0.117467, 0.129889, 0.087663, 0.108659, 0.1139)$$

The process of determining objective weight by entropy method is as follows. Firstly build decision matrix V and R. Therefore, the index weight is: $K_j = (0.1229, 0.1711, 0.0890, 0.0751, 0.0924, 0.1407, 0.0605, 0.1344, 0.1138)$

The article takes $\theta = 0.3$, the weight is comprehensively determined based on AHP and entropy method is:

$$W_J = (0.1229, 0.1711, 0.089, 0.0751, 0.0924, 0.1407, 0.0605, 0.1344, 0.1138)$$

4.3 Determine the weighted normalized matrix Z and the positive and negative ideal solutions

The weighted gauge matrix Z.

$$Z = \begin{bmatrix} 0.0012 & 0.037 & 0.0009 & 0.0008 & 0.0009 & 0.0083 & 0.0006 & 0.0079 & 0.0051 \\ 0.0463 & 0.0017 & 0.0297 & 0.025 & 0.0573 & 0.1175 & 0.0424 & 0.1122 & 0.0359 \\ 0.1083 & 0.0027 & 0.0297 & 0.0501 & 0.0189 & 0.0014 & 0.0511 & 0.0013 & 0.0011 \\ 0.1229 & 0.0657 & 0.0593 & 0.0501 & 0.0363 & 0.0196 & 0.0517 & 0.0188 & 0.0418 \\ 0.0311 & 0.0575 & 0.0593 & 0.0501 & 0.0682 & 0.0922 & 0.0523 & 0.088 & 0.112 \\ 0.0003 & 0.1711 & 0.0593 & 0.0751 & 0.0821 & 0.1241 & 0.0485 & 0.1185 & 0.0935 \\ 0.1023 & 0.037 & 0.089 & 0.0751 & 0.0775 & 0.1009 & 0.0577 & 0.0963 & 0.0889 \\ 0.107 & 0.0041 & 0.089 & 0.0751 & 0.091 & 0.1407 & 0.0601 & 0.1344 & 0.1138 \\ 0.052 & 0.1382 & 0.089 & 0.0751 & 0.0442 & 0.019 & 0.0413 & 0.0181 & 0.0603 \\ 0.1017 & 0.0862 & 0.089 & 0.0751 & 0.0924 & 0.1347 & 0.0605 & 0.1286 & 0.1011 \end{bmatrix}$$

The positive and negative ideal solutions Z_j^+, Z_j^- of the weighted gauge matrix Z:

$$Z_j^+ = (0.123, 0.171, 0.089, 0.075, 0.092, 0.141, 0.061, 0.134, 0.114)$$

$$Z_j^- = (0, 0.002, 0.001, 0.001, 0.001, 0.001, 0.001, 0.001, 0.001)$$

The grey relational degree θ^+ 、 θ^- from the disaster point to the positive and negative ideal solution is calculated respectively.

Therefore, the correlation degree S_i^+ between the disaster point and the rational solution is:

$$s_i^+ = (0.4572, 0.6336, 0.5754, 0.6487, 0.7077, 0.8221, 0.7942, 0.9052, 0.6843, 0.892)$$

The correlation degree S_i^- between the affected point and the negative ideal solution is :

$$s_i^- = (0.9434, 0.6671, 0.8064, 0.6509, 0.5721, 0.5459, 0.5253, 0.5233, 0.6234, 0.4768)$$

The demand urgency ss_i at the affected point:

$$ss_i = (0.6736, 0.5129, 0.5836, 0.5009, 0.447, 0.399, 0.3981, 0.3663, 0.4767, 0.3483)$$

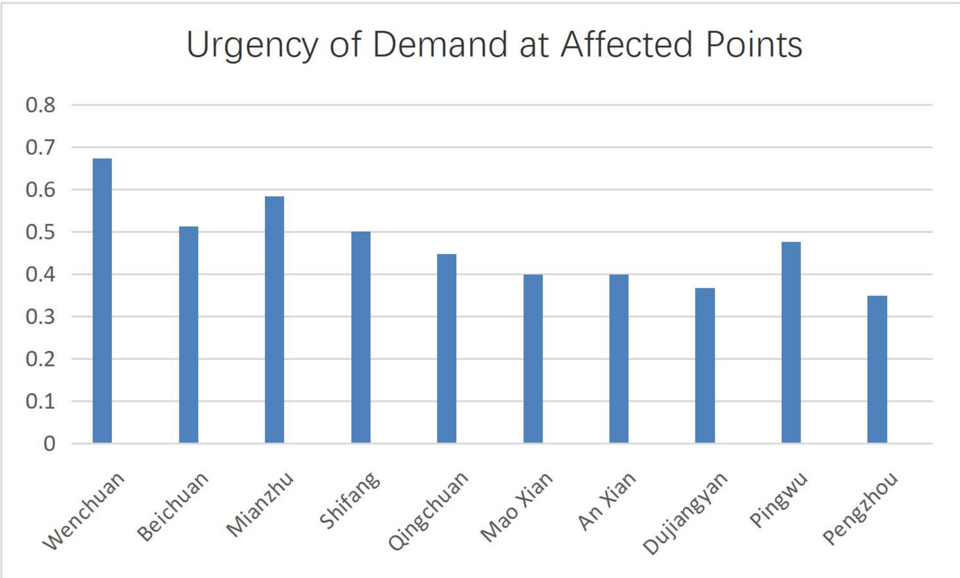

Fig. 1 Comparison of Demand Urgency at Disaster Affected Points

It can be seen from Fig 1 that the severe demand urgency of the extremely severe disaster areas is Wenchuan, Mianzhu, Beichuan, Shifang, Pingwu , Qingchuan , Anxian, Maoxian , Pengzhou and Dujiangyan . The greater the demand urgency, the higher the response level of rescue material distribution. Wenchuan has the highest degree of urgency in the earthquake, followed by Mianzhu and Beichuan , Maoxian , Anxian and Dujiangyan . There is a small gap with the urgency of Pengzhou , and the analysis results are basically consistent with the national results on Issuing the disaster scope assessment of Wenchuan earthquake.

5. Conclusion

In order to scientifically quantify the demand urgency of the affected points, timely supply emergency materials to the disaster areas with high demand urgency, analyze the earthquake disaster with the most serious harm among the major sudden natural disasters, comprehensively consider the factors affecting the demand urgency of the affected points, and construct the demand urgency model of the affected points from three aspects: environmental factors, demographic factors and material demand. Urgency evaluation index system; then, REM and entropy method are used to determine the index weight; finally, the grey relational TOPSIS evaluation method is proposed to analyze the ten extremely severe disaster areas of Wenchuan earthquake, and the demand urgency coefficient of each disaster point is obtained to ensure that the disaster points with high demand urgency can be met first, so as to maximize the effectiveness of emergency rescue.

Although the model has certain universality, it fails to take into account all the actual situations in emergency rescue. Therefore, in future research, the method should be improved to make it more in line with the actual situation.

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