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Retraction

Retracted: Analysis of Human Reliability in Fever Clinics during the Epidemic Based on the DEMATEL Method

Journal of Electrical and Computer Engineering

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Journal of Electrical and Computer Engineering has retracted the article titled "Analysis of Human Reliability in Fever Clinics during the Epidemic Based on the DEMATEL Method" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Editorial Board.

References

[1] A. Lin and X. Chen, "Analysis of Human Reliability in Fever Clinics during the Epidemic Based on the DEMATEL Method," *Journal of Electrical and Computer Engineering*, vol. 2022, Article ID 2351648, 7 pages, 2022.
[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

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Research Article

Analysis of Human Reliability in Fever Clinics during the Epidemic Based on the DEMATEL Method

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Objective. To explore the method and process of human reliability analysis in epidemic prevention and control system in the complex environment of fever clinics. *Methods*. Based on the actual situation in the fever clinic of a level A tertiary hospital in Wenzhou, factors that affect clinical safety are sorted out. The Delphi method is used when evaluating the interrelationship among the contributing factors, and then, the DEMATEL method is used to further sort it out to build an impact model. Finally, the data of the experimental model are analyzed, and the impact of factors on human reliability is summarized. *Results*. Through the data analysis of 23 factors in the fever clinic of the hospital, the impact, prominence, and relation of each factor are confirmed. It is concluded that layout design, disinfection, and isolation setting and on-the-job training are the core factors impacting the operation of the fever clinic. *Conclusion*. Conducting a human factor reliability analysis with the help of the DEMATEL method can quantitatively describe the influence and interrelationship of human factors in epidemic prevention and control system and effectively promote the safety enhancement of fever clinics.

1. Introduction

With the normalization of the prevention and control of the coronavirus pneumonia epidemic in China, fever clinics and reserved observation rooms need to be standardized in general hospitals at the secondary level and above in accordance with the joint prevention and control mechanism of the State Council to cope with the spread of the epidemic in local areas [1]. The scientific design and effective operation of fever clinics is an important part of the current epidemic prevention and control and is closely related to the establishment of the overall prevention and control system [2, 3].

The specific design of fever clinics is related to the actual situation of the hospital where they are located, and human factors play a decisive role in their safe and reliable use. Human error is also an important cause of nosocomial infections, and improving the reliability of human factors is a guarantee for lowering the risk of infections occurring within the hospital [4, 5]. There are great differences in the design of fever clinics in different hospitals, and the establishment and improvement of its safety is largely based on the empirical guidance of personnel, and the evaluation method is concise and intuitive. However, it is impossible to comprehensively assess the overall state of and the potential dangers in the safety system [6]. This study combines the method of expert evaluation with quantitative analysis, in order to accurately quantify the reliability of fever outpatients, and uses data indicators to evaluate various risk factors, so as to scientifically and comprehensively improve the operation safety of fever clinics [7, 8]. Decision-making trial and evaluation laboratory (DEMATEL) was proposed by A. Gabus and E. Fontela at the Geneva Conference to cope with complex and difficult problems in real scenarios, which uses graph theory and matrix tools to analyze system security [9]. DEMATEL is used in complex work scenarios focusing on human factors to improve system reliability, eliminate potential hazards, and offer guidance for the improvement of project procedures [10–12]. Unlike the currently widely used interpretative structural modeling (ISM) method, which focuses on revealing the qualitative

Table 1: Factors affecting the reliability of fever clinics.

Types	Factors	Codes
Architectural planning	Location independence	F1
	Zoning and layout	F2
Equipment and facilities	Medical equipment	F3
	Independent air conditioning	F4
	Ventilation equipment	F5
	Disinfection and isolation design	F6
	Information technology equipment	F7
Staffing	Allocation of doctors	F8
	Allocation of nurses	F9
	Induction training	F10
Operation management	Service guidance	F11
	Close inspection of patients	F12
	24-hour consultation	F13
	Closed-loop management of patients	F14
	Reporting of suspicious cases	F15
	Transfer of suspected or confirmed cases	F16
	Environmental cleaning and disinfection	F17
	Waste disposal	F18
Staff protection	Standard prevention	F19
	Personal protective equipment	F20
	Reasonable selection of protective equipment	F21
	Proper donning and doffing of protective equipment	F22
	Staff health monitoring	F23

structural forms within a system, it can effectively quantify the influence of constituents in a large and complex system and the degree of interaction with other constituents [13]. The DEMATEL method is used in a wide range of fields such as construction management of nuclear power plant facilities, assessment of mechanical engineering, and analysis of the development of sustainable energy industries [14–16]. Based on the existing studies, we sort out and summarize the factors affecting the reliability of the operation system of fever clinics through expert discussion, surveys, and field research [17, 18]. The DEMATEL method is introduced to construct the human factors reliability analysis model, so as to identify key influencing factors [19]. Correlations among the factors are analyzed to assess the specific status of the system safety in fever clinics and to provide quantitative reference for the establishment and improvement of system reliability in fever clinics [20]. This study demonstrates a method to enhance the ability of medical institutions to respond to infectious diseases through theoretical analysis without resorting to additional applied equipment. It has positive implications for exploring the level of medical safety and protection enhancement in global epidemics.

2. Factors Affecting the Reliability of Fever Clinics

The fever clinic of a level A tertiary hospital in Wenzhou was selected as the research object for the study and analysis. After the review of policy documents and research papers on epidemic prevention and control and field research by the authors of this study, 23 influencing factors related to the safety in the fever clinic system were summarized, which can systematically and comprehensively reflect the procedure for medical treatment in fever clinics in hospitals [21–24].

The influencing factors are divided into five categories: architectural planning, equipment and facilities, staffing, operation management, and medical staff protection, as shown in Table 1.

3. Establishment of the DEMATEL Model for Fever Clinics

3.1. Establishment of Relation Matrix Based on Expert Evaluation. To analyze the overall system with the DEMATEL method, it is necessary to confirm the relationship between the influencing factors first. Due to the existence of certain ambiguity in human linguistic descriptions, precise measurement of the factors is impossible.

In this study, a 5-level scale is used to measure the impact of the influencing factors, and different levels of impact are graded as 0, 1, 2, 3, and 4, respectively, as shown in Table 2.

Four experts were invited to assess the relationship between the 23 influencing factors with the Delphi method, and the factor relationship diagram is shown in Figure 1.

3.2. Establishment of Comprehensive Influence Matrix. The direct influence matrix M is established according to the relationship diagram. Based on the normalized results of the matrix M, the canonical influence matrix N is established, which is calculated as [25]

$$N = \left(\frac{aij}{\text{Max var}}\right)_{n\times n}. \quad (1)$$

Table 2: Expert evaluation scale.

Linguistic description	No impact	Low impact	Moderate impact	High impact	Extreme impact
Scale	0	1	2	3	4

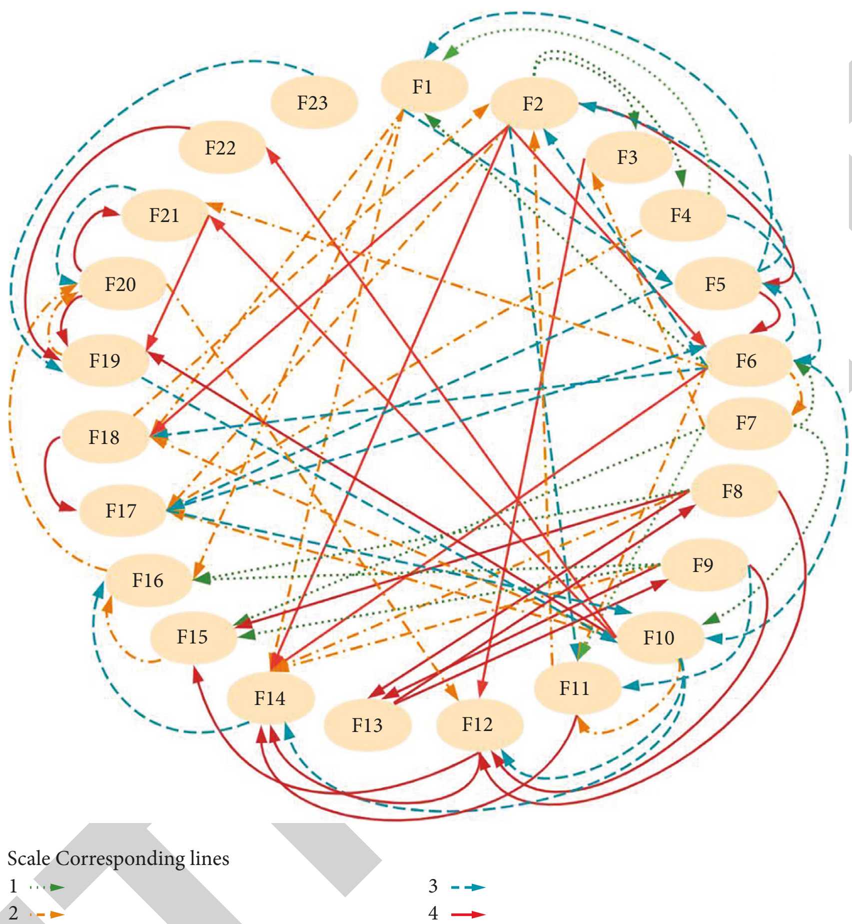

Figure 1: Relation diagram.

Both direct and indirect relations can be found among the influencing factors, and the factors are superimposed on each other to establish a comprehensive influence matrix T, which was calculated as [17]

$$T = \left(N + N^2 + N^3 + \ldots + N^k\right) = \sum_{k=1}^{\infty} N^k \longrightarrow T = N(I - N)^{-1}, \tag{2}$$

where I is the unit matrix and $(I - N)^{-1}$ is the inverse matrix of $(I - N)$.

3.3. Calculation of Relation between Human Factors. The impact degree D and the degree of being impacted C are calculated, according to the value of t_{ij} in the comprehensive influence matrix T and the comprehensive influence degree of factor i on factor j, as shown in equations (3) and (4) [26].

The degree of impact reflects the comprehensive influence of elements of each row in the matrix T on all other elements. The sum of the values of each row of the matrix T is the comprehensive influence degree of each row's elements on the rest of the elements, and the set is denoted as D:

$$D = \left(D_1, D_2, D_3, \ldots, D_n\right), \tag{3}$$

where $D_i = \sum_{j=1}^{n} tij$, $(i = 1, 2, 3, \ldots, n)$

The degree of being impacted reflects the comprehensive influence of elements of each column in the matrix T from all other elements. The sum of the values of each column of the matrix T is the comprehensive influence degree of each column's elements on the rest of the elements, and the set is denoted as C:

$$C = (C1, C2, C3, \ldots, Cn), \tag{4}$$

where $C_i = \sum_{j=1}^{n} tij$, $(i = 1, 2, 3, \cdots, n)$.

3.4. Calculation of Centrality and Causality. Centrality and causality are calculated based on the impact degree and the degree of being impacted, as shown in equations (5) and (6) [18]. In addition, identification of factors'

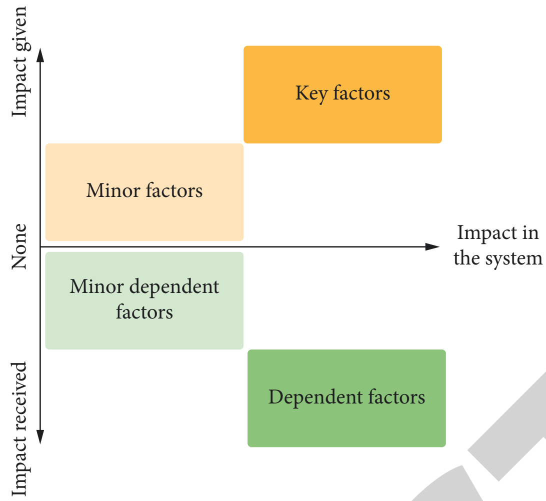

Figure 2: Interactions and importance of factors in the system.

$$M=\begin{bmatrix}
0&0&0&0&3&0&0&0&0&0&0&0&0&2&0&2&0&2&0&0&0&0&0\\
0&0&1&1&4&4&0&0&0&0&3&0&0&4&0&0&2&4&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&4&0&0&0&0&0&0&0&0&0&0&0\\
1&0&0&0&0&3&0&0&0&0&0&0&0&0&0&0&2&0&0&0&0&0&0\\
3&3&0&0&0&4&0&0&0&0&0&0&0&0&0&0&3&0&0&0&0&0&0\\
1&3&0&0&3&0&2&0&0&3&2&0&0&4&0&0&0&3&0&0&2&0&0\\
0&0&2&0&0&1&0&0&0&1&1&0&0&0&1&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&4&4&2&4&1&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&3&4&4&2&1&1&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&2&3&0&3&0&0&2&2&4&0&4&4&0\\
0&2&0&0&0&0&0&0&0&0&0&0&0&4&0&0&0&0&0&0&0&0&0\\
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0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&4&3&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&4&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&0&3&0&0&0&0
\end{bmatrix}$$

Figure 3: Relation matrix M.

interaction and importance based on centrality and causality is shown in Figure 2.

Centrality, also known as prominence in related studies, indicates the force of the factor's impact in the system and is a quantitative indicator of the factor's importance. The greater the relevance of a factor in the system, the higher the centrality of the factor. The greater the centrality value, the greater the influence of the factor on the overall system. The centrality of factor i is obtained by adding the degree of impact and the degree of being impacted, which is denoted as Mi:

$$Mi = Di + Ci. \tag{5}$$

Causality reflects the degree of the causal attribute of a factor in the system, and there are positive and negative values of causality. When the causality of a factor is positive, the factor is called the cause factor, and the higher the causality value, the stronger the influence of the factor on other factors. When the causality of a factor is negative, the factor is referred to as the result factor, and the higher the absolute value of the causality, the stronger the impact of other factors on the factor. The causality of factor i is obtained by subtracting the degree of impact and the degree of being impacted, which is denoted as Ri:

$$Ri = Di - Ci. \tag{6}$$

3.5. DEMATEL Model Results. Based on the results of expert evaluation, the degree of interaction between human factors in fever clinics is quantified, and the relationship matrix N is established according to the coding order of the 23 factors, as shown in Figure 3.

Table 3: Impact degree, degree of being impacted, centrality degree, causality degree, and weights.

Codes	Impact degree	Degree of being impacted	Centrality	Causality	Weights
*F*1	0.601	0.343	0.944	0.258	0.032
*F*2	1.744	0.775	2.519	0.969	0.085
*F*3	0.229	0.171	0.4	0.058	0.013
*F*4	0.576	0.074	0.65	0.502	0.022
*F*5	1.251	0.715	1.965	0.536	0.066
*F*6	1.735	1.006	2.742	0.729	0.092
*F*7	0.422	0.167	0.589	0.255	0.02
*F*8	0.823	0.235	1.058	0.588	0.036
*F*9	0.863	0.235	1.098	0.628	0.037
*F*10	1.416	0.857	2.273	0.559	0.076
*F*11	0.419	0.747	1.166	−0.328	0.039
*F*12	0.373	0.97	1.343	−0.597	0.045
*F*13	0.614	0.412	1.026	0.202	0.034
*F*14	0.142	1.8	1.941	−1.658	0.065
*F*15	0.094	0.634	0.729	−0.54	0.024
*F*16	0.133	0.701	0.834	−0.568	0.028
*F*17	1.013	0.936	1.949	0.077	0.065
*F*18	0.564	0.975	1.539	−0.411	0.052
*F*19	0.435	1.527	1.961	−1.092	0.066
*F*20	0.593	0.57	1.163	0.023	0.039
*F*21	0.438	0.738	1.177	−0.3	0.039
*F*22	0.239	0.31	0.549	−0.071	0.018
*F*23	0.179	0	0.179	0.179	0.006

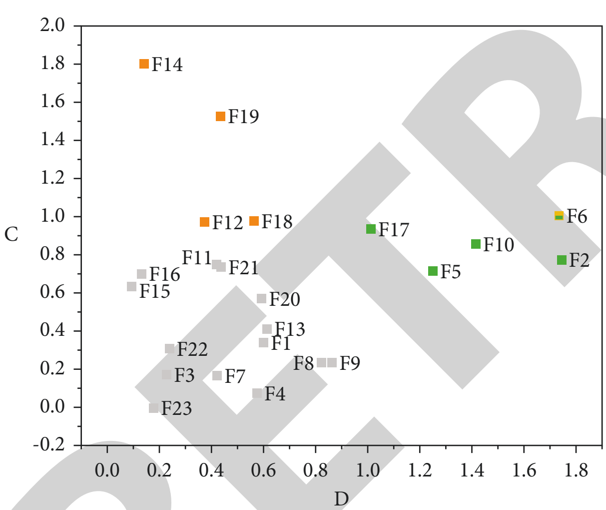

Figure 4: Diagram of impact degree and degree of being impacted.

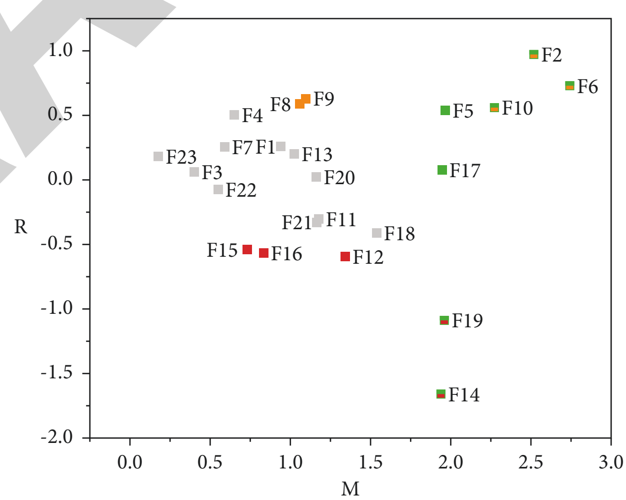

Figure 5: Centrality-causality diagram.

The direct matrix M is normalized to obtain the integrated impact matrix T. Based on the matrix T, the impact degree D, degree of being impacted C, centrality M, causality R, and centrality weights of fever clinic human factors are calculated, as shown in Table 3.

With the degree of impact as the horizontal coordinate and the degree of being impacted as the vertical coordinate, a diagram of impact on and from other factors can be obtained, as shown in Figure 4.

With centrality as the horizontal coordinate and causality as the vertical coordinate, a centrality-causality diagram can be obtained, as shown in Figure 5.

As can be seen in Figure 3, the top five factors with highest degree of impact are zoning and layout F2, disinfection and isolation design F6, induction training F10, ventilation equipment F5, and environmental cleaning and disinfection F17. The top five factors with highest degree of being impacted are closed-loop management of patients F14, standard prevention F19, disinfection and isolation design F6, waste disposal F18, and close inspection of patients F12.

As can be seen in Figure 4, three factors, disinfection and isolation design F6, zoning and layout F2, and induction training F10 have the highest centrality, while four factors, ventilation equipment F5, standard prevention F19, environmental cleaning and disinfection F17, and closed-loop management of patients F14 are similar in centrality and are significantly higher compared to the remaining factors. As far as causality is concerned, the top five cause factors are zoning and layout F2, disinfection and isolation design F6, allocation of nurses F9, allocation of doctors F8, and induction training F10; the top five result factors (absolute values)are closed-loop management of patients F14, standard prevention F19, close inspection of patients F12, transfer of suspected or confirmed cases F16, and reporting of suspicious cases F15.

4. Discussion

Human factors play a vital role in the safe operation of fever clinics. The DEMATEL method is used to analyze human factors in complex environments, and the graph theory and matrix algorithm results quantitatively demonstrate the reliability of human factors in fever clinics. By analyzing the logical and influential relations between various human factors, the degree of mutual impact between factors is precisely calculated. Centrality and causality of each factor are further clarified based on impact degree and the degree of being impacted, so as to examine the risk factors and their degree of impact in the safety of the fever clinic system and provide data support and theoretical basis for the enhancement of the existing medical environment and the establishment of the safety system.

In this study, 23 main factors involved in epidemic prevention are sorted out in the analysis of human reliability in the fever clinic of a level A tertiary hospital in Wenzhou. In the model, the elements of closed-loop management of patients, standard prevention, and close inspection of patients are most affected by other factors, and all three have the least negative values among the result factors so that their safety reliability is known to be highly reliable on other related factors. If there are potential problems in the closed-loop management of patients, standard prevention, and close inspection of patients, we need to start with improving other factors with high influence, such as zoning and layout, disinfection and isolation design, induction training, ventilation equipment, and environmental cleaning and disinfection. High-weighted factors have a large impact on the human-caused reliability of fever clinics and are most critical to the establishment of system safety. The core of construction and supervision of fever clinics should revolve around three high-weighted core factors, zoning and layout, disinfection and isolation design, and induction training and focus on ventilation equipment, standard prevention, environmental cleaning and disinfection, and closed-loop management of patients on this basis. The complex system has a wide range of influencing factors, and targeted construction and improvement can quickly and effectively improve the safety and reliability of the fever clinic system.

5. Conclusion

In the epidemic prevention and control of fever clinics, many human factors can affect the system safety in the complex environment where human and environmental facilities work in collaboration. Data modeling of human factors reliability based on the DEMATEL method can clarify the relation between influencing factors and quantify the prominence of factors in system reliability assessment.

The establishment and application of this research model can provide novel insight into the analysis process and offer references to the prevention and control of the new coronary pneumonia epidemics in hospitals. First, human operations and allocations involved in epidemic prevention and control can be organized and summarized in the form of multiple factors. The situation in fever clinics can be clarified into different elements to reflect the working condition of the overall system. Large-scale operational scenarios are broken into specific factor items to specify the epidemic prevention and control program and to systemize the work scientifically. Second, the expert evaluation method can be used to assess the relation between different factors. Evaluative opinions are collected from several experts and are then aggregated. A multilevel scale is adopted during expert evaluation to assess factors, which can avoid ambiguity, partialness, and linguistic description lack of directivity and get a unified and clear assessment result. Third, the DEMATEL method can establish a human factor reliability evaluation model based on the assessment results from expert evaluation, quantitatively show the degree of influence of each factor in the security system, and measure with precise values the importance of the factor in the system and its relation with other factors. Fourth, the results of the DEMATEL model can offer insightful guidance for the establishment, improvement, and monitoring of fever clinics. Taking the fever clinic in this study as an example, 23 aspects are involved in and complicate the working environment. Identifying the core elements with high prominence and the associated risk factors can effectively promote epidemic prevention and control in an integrated manner, improve system reliability, and avoid wasting human and material resources.

In the future, the approach to the analysis of the risks in medical safety can be improved. The extraction and relationship assessment of risk factors in the system will be the next research focus. In addition, multiple analysis methods can be introduced to work together with this experimental method to reveal the safety situation in the overall system more comprehensively.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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