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Developing a Scale to Measure Doctor-Patient Relationshi Risks: A Patient's Perspective

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Research Article

Keywords: Doctor-patient relationship, relationship risks, Scale, Patient, Pratt's D Matrix

Posted Date: March 8th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8721925/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Doctor-patient relationship risks persist, threatening the safety of healthcare workers and hindering the healthy development of the healthcare industry. Developing a scale to measure doctor-patient relationship risks is a crucial step in advancing the governance of doctor-patient relationship risk.

Methods

Data were collected by using this study's 24-item preliminary version of the Doctor-Patient Relationship Risk Measurement Scale. Item Response Theory (IRT) and Pratt's D Matrix analysis were employed to study the reliability and validity of the scale.

Results

This research developed and tested a measurement scale for doctor-patient relationship risks; the final version comprises three factors and consists of 18 items. The overall Cronbach's α coefficient of the scale is 0.851, with individual Cronbach's α values for the three factors being 0.766, 0.783, and 0.827, respectively. The 18-item scale meets the basic requirements for scale development, with structural validity, discriminant validity, and convergent validity all reaching acceptable thresholds.

Conclusion

The proposed Doctor-Patient Relationship Risk Scale demonstrates good reliability and validity. Each item is scored using a 5-point Likert scale, and items A9, A10, A11, A17, A18, and A19 are reverse-scored. The total score of the scale is 90 points, and a higher score indicates greater risk in the doctor-patient relationship.

Introduction

According to data from the Supreme People's Court of China, in 2024, there were 12,857 medical malpractice liability disputes nationwide, averaging 35 cases per day. This represents a 77.29% increase compared to 2021. Thus, the effectiveness of qualitative management in mitigating doctor-patient relationship risks demonstrates a delayed response, and the expected outcomes in fostering a harmonious development of these relationships have not been fully realised. It is urgent to dynamically grasp the perception data of the doctor-patient relationship, develop a doctor-patient relationship risk measurement scale, and implement quantitative management of doctor-patient relationship risk.

Literature Review

The risk in a doctor-patient relationship primarily arises when the medical services provided by healthcare professionals fail to fully meet the expectations and needs of patients. The manifestation of an unharmonious doctor-patient relationship is a specific outcome of this issue. Currently, some doctors choose not to disclose the specific details of risk incidents to patients[1], although a few medical workers believe that promptly disclosing the complete details of the risk incident to the patient and their family, and sincerely apologising to them, can prevent the recurrence of similar risk incidents[2]. (Hereafter, we use the term "patient" to refer to both the patient and their family members involved in the medical care.) Furthermore, studies have shown that patients tend to expect doctors to clearly identify the errors or flaws that occur in medical accidents[3]. By helping the patient understand an incident's details and its specific impact on medical care, doctors are forced to confront the seriousness of the mistake and offer sincere apologies[4]. This approach helps healthcare professionals learn from errors or deficiencies, preventing the recurrence of similar incidents[5], and it also aids in enhancing the understanding of patients, while facilitating the formulation of appropriate treatment decisions. This can alleviate the escalation of conflicts within the doctor-patient relationship. The aforementioned studies indicate that effective doctor-patient communication can influence the level of understanding patients have regarding treatment outcomes, as well as the trajectory of doctor-patient relationship risks. Therefore, Hypothesis 1 is proposed.

Hypothesis 1

The risk level of the doctor-patient relationship correlates with the quality of doctor-patient communication.

Trust is of paramount importance in the healthcare industry, as it plays a critical role in bridging the inherent vulnerability, uncertainty, and unpredictability involved in disease treatment processes[6]. Research has confirmed that trust between healthcare providers and patients significantly impacts the quality of the doctor-patient relationship[7]. A high level of trust between doctors and patients can enhance patient adherence, improve the quality of healthcare services, and contribute to better treatment outcomes, thereby reducing the risks associated with doctor-patient interactions[8]. This aligns with previous research concluding that "the trust crisis is the direct cause of the risks in doctor-patient relationships."[9] Therefore, Hypothesis 2 is proposed.

Hypothesis 2

The risk level of the doctor-patient relationship correlates with the level of doctor-patient trust.

Studies have shown that the expectations of doctors' behaviour can affect the treatment outcome of patients' diseases, and it also influences patients' compliance. This can be conveyed through subtle changes in their emotions and expressions[10]. From the perspective of patients and their families, the patient's compliance is not only influenced by the emotions expressed by the doctor but also depends on their own participation in the decision-making process regarding the treatment of the disease, which in turn affects the treatment outcome and the quality of the doctor-patient relationship[8]. Heinrich's Law tells us that the occurrence of risk in the doctor-patient relationship is not an isolated event. Although the harm may occur suddenly, it is the result of a series of events. Despite seeming sudden, its essence follows certain patterns[11]. Sewell pointed out that the occurrence of risks in the doctor-patient relationship is not caused solely by the outcome of "treatment failure" (disease outcome) but rather is triggered by the negative perceptions formed by the patient during the entire treatment process[12]. Based on this, it is reasonable to conjecture that if the treatment plan for the disease is decided jointly by the doctor and the patient (including the patient's family), then their right to informed consent will be effectively protected. At the same time, the doctor's empathy will also prove that the patient's emotions are receiving attention[13], which may change the patient's negative perceptions. Moreover, the patient's understanding of the disease outcome (the uncertainty of disease treatment) will become clearer[14], possibly reducing the risk level of the doctor-patient relationship. Therefore, Hypotheses 3, 4, and 5 are proposed.

Hypothesis 3

The risk level of a doctor-patient relationship correlates with the level of emotional connection.

Hypothesis 4

The risk level of a doctor-patient relationship correlates with the degree of decision-making participation.

Hypothesis 5

The risk level of a doctor-patient relationship correlates with the disease prognosis.

Evidence suggests that both doctors and patients exhibit distinct risk preferences in medical treatment[15]. When these preferences conflict, treatment plans may deviate from optimal solutions[15], which could be attributed to defensive healthcare behaviours[16,17]. Doctors develop risk preferences based on clinical experience to mitigate doctor-patient relationship risks. Similarly, it is reasonable to believe that patients' process perception of medical services and disease outcome, combined with their own risk experience, colour their risk behaviour preferences to safeguard their own health rights and potential economic interests, so Hypotheses 6 and 7 are proposed.

Hypothesis 6

The risk level of the doctor-patient relationship correlates with the risk experiences of patients and their families.

Hypothesis 7

There is a correlation between the risk level of the doctor-patient relationship and the behavioural intentions of patients and their family members.

Based on the above assumptions, combined with the theory of scale development and the theory of project management, the development process of the doctor-patient relationship risk measurement scale is as shown in **Fig. 1**[18].

Figure 1

Research Methods

Data Collection

This study constructed the item pool of the novel doctor-patient relationship risk measurement scale based on the analysis of real cases of doctor-patient relationship risks. The structure variables of the scale were initially determined through expert consultation, and the item settings were optimised. The preliminary scale of the doctor-patient relationship risk measurement with 24 items was established. The 24-item version of the doctor-patient relationship risk measurement scale was used to collect public perception data. The data collection was conducted through both online and offline methods. The online questionnaire was collected through Wenjuanxing (an online survey platform), and the samples covered all of China based on IP addresses. The offline collection was carried out in two cities and one county in Anhui Province. Overall, in this sample collection, the participants covered a wide range and had good representativeness. The database was established using EpiData 3.1 software, and data were entered and cleaned.

Analysis Method

Using SPSS 21.0 software, we conducted Pearson correlation analysis on the 24 items of the preliminary scale. Eigenvalues greater than 1 were extracted through maximum likelihood estimation and the Promax rotation method[19]. The derived pattern coefficients, structure coefficients, and communal coefficients were used to construct a Pratt's D matrix[1], where the D-value integrates pattern and structural factor information to partition each item's communality (proportion of variance shared with other items) into nonoverlapping components attributable to individual factors. Specifically, Pratt's D measures the proportion of an item's communality (shared variance) within each factor. A higher D-value indicates a greater contribution of the item's communality to its respective factor, reflecting stronger factor importance. To optimise item reduction, we evaluated item correlations: For items with inter-

item correlation coefficients r > 0.7, their Pratt's D values were calculated separately. Items with low Pratt's D values and those exhibiting communalities below 0.4 were eliminated[19,20], ultimately constructing the final Pratt's D matrix.

The selected items underwent validity and reliability analysis. The Cronbach α's coefficient was used to assess internal consistency reliability[21], with values closer to 1 indicating better internal consistency and higher homogeneity reliability. Validity assessment included structural validity, discriminant validity, and convergent validity. Structural validity was examined through exploratory factor analysis and confirmatory factor analysis. Confirmatory factor analysis was conducted using AMOS23.0 software, employing maximum likelihood estimation. The fit indices used in this study included χ^2/df, RMSEA, GFI, IFI, and CFI. Discriminant validity was evaluated through confirmatory factor analysis[21,22,23].

Result

A total of 519 samples were collected in this survey. After eliminating 30 invalid questionnaires, 489 valid questionnaires were obtained, with an effective rate of 94.2%. We marked the questionnaires alternately using the sequence of inputting them (1 and 2). The 245 questionnaires marked as "1" were used for the exploratory factor analysis and Pratt matrix analysis of the scale, while the 244 questionnaires marked as "2" were used for confirmatory factor analysis. According to the relevant theories of scale development, the collected data from the participants meet the actual needs of scale development.

Screening of items

First, a Pearson correlation analysis was conducted on the 24 items of the preliminary scale. The results are presented in Table 1.

Table 1 Binary correlation analysis of the items

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A
A1	1														
A2	-.084	1													
A3	.337***	-.123	1												
A4	.321***	-.124	.470***	1											
A5	.366***	-.127*	.383***	.483***	1										
A6	.152*	-.422***	.062	.045	.101	1									
A7	.352***	-.165**	.512***	.516***	.457***	.086	1								
A8	.341***	-.151*	.535***	.487***	.633***	.107	.675***	1							
A9	.206***	-.257***	.210***	.203***	.368***	.242***	.234***	.385***	1						
A10	.357***	-.286***	.273***	.220***	.337***	.281***	.235***	.311***	.447***	1					
A11	.369***	-.300***	.239***	.155*	.326***	.342***	.205***	.323***	.500***	.677***	1				
A12	.343***	-.207***	.394***	.358***	.392***	.228***	.443***	.502***	.262***	.241***	.266***	1			
A13	.344***	-.204***	.398***	.448***	.403***	.206***	.518***	.530***	.193**	.167**	.266***	.571***	1		
A14	.179**	-.226***	.137*	.145*	.136*	.309***	.259***	.210***	.318***	.344***	.360***	.232***	.273***	1	
A15	.278***	-.247***	.284***	.269***	.449***	.245***	.389***	.399***	.202**	.163*	.160*	.371***	.427***	.227***	1
A16	.301***	-.178**	.404***	.398***	.343***	.192**	.400***	.431***	.157*	.206***	.170**	.381***	.405***	.181**	.4
A17	-.203***	.134*	-.457***	-.323***	-.315***	-.112	-.468***	-.524***	-.197**	-.160*	-.219***	-.404***	-.521***	-.163*	-.2
A18	.301***	-.156*	.095	.180**	.292***	.136*	.157*	.176**	.364***	.444***	.376***	.232***	.173**	.337***	.1
A19	.196**	-.229***	-.011	.066	.200**	.249***	.056	.101	.281***	.345***	.255***	.132*	.176**	.241***	.1
A20	.190**	-.073	.331***	.335***	.290***	-.011	.465***	.352***	.153*	.040	-.039	.239***	.366***	.219***	.3
A21	.199**	-.012	.239***	.269***	.307***	.060	.317***	.305***	.187**	.169**	.103	.256***	.275***	.157*	.2
A22	.259***	-.182**	.306***	.342***	.516***	.140*	.445***	.521***	.300***	.171**	.200**	.452***	.551***	.243***	.4
A23	.212***	-.138*	.238***	.292***	.347***	.132*	.371***	.317***	.153*	.065	.083	.308***	.467***	.146*	.3
A24	.081	-.103	.205***	.068	.263***	.062	.165**	.327***	.125	.024	-.004	.252***	.241***	.084	.2

□□*P□0.05□**P□0.01□***P□0.001.

As can be seen from Table 1, the absolute value of the correlation coefficient between all items is less than 0.7. According to previous research conclusions[24,25,26], "if the absolute value of the correlation coefficient exceeds 0.7, there may be a multicollinearity problem; If the absolute value of the correlation coefficient is more than 0.8, it is necessary to further calculate the variance inflation factor (VIF). If the VIF value is greater than 10, it indicates that there is serious multicollinearity." The correlation between the items selected in this study shows good performance.

To further ensure the applicability of the selected items, the critical value or rule related to scale development is used to screen effective items. The specific rules are as follows[18]: (1) When the public value of a project is lower than 0.4, it is considered that the common factor does not fully capture the information of the variable and should be deleted; (2) When the item load crosses two or more factors, the item should be deleted; (3) When a factor contains only one or two items, the number of factors should be adjusted.

Details of the screening process are shown in Table 2.

Table 2
Item screening process

Item	First round	Second round (Factor contains 2 items)		Third round (A15 spans 3 factors, and the current factor contains 2 items after deletion)			Fourth round	Project screening
	C	The value of C before adjustment	The value of C after adjustment	The value of C before deleting A15	The value of C after deleting A15	The value of C after adjustment	C	
A1	.397							×
A2	.551	.536	.494	.548	.570	.269		×
A3	.579	.580	.577	.576	.573	.560	.558	√
A4	.514	.513	.508	.491	.496	.460	.457	√
A5	.600	.611	.540	.556	.573	.487	.510	√
A6	.657	.674	.606	.654	.675	.288		×
A7	.630	.632	.615	.619	.619	.613	.610	√
A8	.702	.728	.714	.717	.719	.693	.698	√
A9	.460	.496	.496	.501	.494	.461	.486	√
A10	.692	.696	.689	.678	.669	.627	.666	√
A11	.696	.694	.673	.660	.655	.650	.655	√
A12	.492	.490	.484	.481	.485	.459	.455	√
A13	.578	.581	.581	.590	.597	.546	.548	√
A14	.427	.425	.351					×
A15	.495	.502	.475	.459				×
A16	.490	.491	.482	.471	.443	.406	.408	√
A17	.524	.523	.521	.516	.538	.511	.517	√
A18	.700	.692	.561	.597	.613	.501	.593	√
A19	.615	.611	.551	.585	.584	.581	.586	√
A20	.797	.797	.698	.708	.712	.709	.706	√
A21	.651	.649	.585	.582	.582	.576	.571	√
A22	.708	.706	.705	.707	.715	.709	.710	√
A23	.588	.594	.593	.459	.621	.588	.596	√
A24	.642	.646	.260					×
Note: C is the public value (C<.4 indicates a question should be eliminated.)								

Based on the above screening process, A1, A2, A6, A14, A15, and A24 were removed, leaving 18 items for exploratory factor analysis.

Exploratory factor analysis (EFA)

The KMO and Bartlett's Test of Sphericity were carried out on the selected 18 items of the preliminary questionnaire. The KMO value was 0.880, and the Bartlett's sphericity test reached a significant level ($p < 0.001$). The total variance interpretation rate is shown in Table 3, indicating that the data of this study are suitable for EFA.

Table 3
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
1	6.544	36.353	36.353		6.544	36.353	36.353
2	2.279	12.662	49.015		2.279	12.662	49.015
3	1.507	8.372	57.386		1.507	8.372	57.386
4	.960	5.333	62.719				
5	.863	4.796	67.515				
6	.771	4.281	71.797				
7	.641	3.560	75.356				
8	.591	3.281	78.638				
9	.561	3.117	81.754				
10	.521	2.893	84.647				
11	.488	2.714	87.361				
12	.461	2.563	89.924				
13	.446	2.476	92.400				
14	.352	1.957	94.357				
15	.290	1.610	95.967				
16	.258	1.435	97.402				
17	.250	1.386	98.788				
18	.218	1.212	100.000				

Figure 2

EFA extracted three common factors with eigenvalues greater than 1. The fragmentation diagram of the number of components is shown in Fig. 2.

As can be seen from Fig. 2, it is appropriate to divide the doctor-patient relationship risk measurement scale into three factors. To further clarify the classification of factors, the contribution of the scale items, and the corresponding quantitative relationship, this study uses the method of Pratt matrix analysis to determine the structure of the risk measurement scale of the doctor-patient relationship.

Pratt Matrix Analysis

To clarify the structure of the doctor-patient relationship risk measurement

scale, the Pratt matrix was constructed based on the results of exploratory factor

analysis, as shown in Table 4.

Table 4
Risk measurement scale for doctor-patient relationship: Pratt Matrix D

Item	P			S			C	D		
	F1	F2	F3	F1	F2	F3	-	F1	F2	F3
A3	0.815	-0.061	-0.122	0.737	0.208	0.24	0.558	1.076	-0.023	-0.052
A8	0.788	0.095	0.017	0.831	0.386	0.401	0.698	0.938	0.053	0.010
A17	-0.728	0.141	-0.062	-0.706	-0.138	-0.366	0.517	0.994	-0.038	0.044
A7	0.727	-0.049	0.134	0.771	0.246	0.457	0.61	0.919	-0.020	0.100
A4	0.651	-0.008	0.056	0.674	0.241	0.354	0.457	0.960	-0.004	0.043
A16	0.632	-0.042	0.042	0.637	0.198	0.324	0.408	0.987	-0.020	0.033
A13	0.588	0.015	0.246	0.707	0.284	0.52	0.548	0.759	0.008	0.233
A12	0.588	0.118	0.068	0.662	0.347	0.365	0.455	0.856	0.090	0.055
A5	0.476	0.285	0.146	0.646	0.491	0.428	0.51	0.603	0.274	0.123
A18	-0.195	0.793	0.126	0.151	0.75	0.214	0.593	-0.050	1.003	0.045
A10	0.183	0.771	-0.218	0.363	0.789	0.039	0.666	0.100	0.913	-0.013
A11	0.256	0.729	-0.293	0.387	0.757	-0.012	0.655	0.151	0.843	0.005
A19	-0.412	0.729	0.349	0.014	0.657	0.323	0.586	-0.010	0.817	0.192
A9	0.131	0.641	-0.008	0.361	0.687	0.196	0.486	0.097	0.906	-0.003
A20	0.091	-0.128	0.818	0.421	0.088	0.831	0.706	0.054	-0.016	0.963
A21	0.03	0.004	0.741	0.372	0.18	0.755	0.571	0.020	0.001	0.980
A23	0.078		0.733	0.416	0.193	0.769	0.596	0.054	0.000	0.946
A22	0.229	0.082	0.684	0.574	0.319	0.808	0.71	0.185	0.037	0.778

As shown in Table 4, the final version of the questionnaire covers a total of 18 items and three factors. Among them, factor F1 covers nine items including A3, A4, A5, A7, A8, A12, A13, A16, and A17; factor F2 covers five items including A9, A18, A19, A10, and A11; and factor F3 covers A20, A21, A22, and A23. The cumulative contribution rate of the scale is 57.386%, which meets the basic requirements for scale development.

Reliability Evaluation

We further examined the total Cronbach α coefficient of the 18 items of the scale, obtaining a Cronbach α coefficient of 0.851 for the doctor-patient relationship risk measurement scale. The Cronbach α coefficients within the three factors were 0.766, 0.783, and 0.827, respectively, which meet the basic requirements for scale development[25,26].

Confirmatory Factor Analysis (CFA)

(1) Structure Validity

The structural equation model of the scale was constructed using structural variance. The evaluation indicators include the chi-square degree of freedom ratio (χ^2/df), the approximate root mean square error (RMSEA), the goodness-of-fit index (GFI), the incremental fit index (IFI), and the comparative fit index (CFI). The analysis results of the above evaluation indicators of the doctor-patient relationship risk measurement scale in this study were $\chi^2/df = 2.740$, RMSEA = 0.085, GFI = 0.854, IFI = 0.843, CFI = 0.841. The P value of the fitting model was 0.000. According to the structural validity standards for scale development[25], these results indicate that the fitting validity of the structural model of this scale meets the requirements. The structural equation model is shown in Fig. 3.

Figure 3

(2) Discriminant validity and convergent validity

Further analysis revealed the load coefficient and convergent validity of the doctor-patient relationship risk measurement scale. Detailed information is presented in Table 5.

Table 5
Risk measurement scale for doctor-patient relationship: Load factor and convergent validity

Route	Estimate	Convergent validity		
		CR	AVE	Square root of AVE
A3 ⇓ F1	− .590	.814	.3322	.576
A4 ⇓ F1	− .402			
A5 ⇓ F1	− .548			
A7 ⇓ F1	− .567			
A8 ⇓ F1	− .650			
A12 ⇓ F1	− .706			
A13 ⇓ F1	− .579			
A16 ⇓ F1	− .469			
A17 ⇓ F1	.618			
A9 ⇓ F2	.539	.7332	.3787	.615
A10 ⇓ F2	.816			
A11 ⇓ F2	.803			
A18 ⇓ F2	.367			
A19 ⇓ F2	.397			
A20 ⇓ F3	.667	.8098	.5194	.721
A21 ⇓ F3	.739			
A22 ⇓ F3	.846			
A23 ⇓ F3	.609			

As can be seen from Table 5, except for the standardised load coefficients of A18 and A19, all of the values are greater than 0.4. Moreover, all the measurements are significant at the 0.001 level, so it can be concluded that the degree of aggregation between the factors and the measurement items meets the requirements for scale development.

Further analysis revealed the Pearson correlation coefficients among the factors of the doctor-patient relationship risk measurement scale, as well as the square root values of the average variance extraction values (AVEs), as shown in Table 6.

Table 6
Risk measurement scale for doctor-patient relationship: Pearson correlation coefficient and AVE square root value

Factor	F1	F2	F3
F1	.576		
F2	.416**	.615	
F3	.475**	0.308**	.721

Note: The numbers in the shaded area represent the square root of the average variance extracted (AVE); ** indicates that the p-value is less than 0.01.

It can be seen that factors F1, F2, and F3 have significant correlations ($p < 0.01$), and the correlation coefficients are all smaller than the square root of the corresponding AVE, indicating that the latent variables have certain correlations with each other, and they also have certain distinctions[26,27]. Moreover, the composite reliability (CR) value is greater than 0.7, which further shows that the scale proposed in this study has good overall reliability[25,26].

Discussion of Factors and Their Meaning

As long as sufficient information is extracted, the scale should truly reflect the factors affecting the doctor-patient relationship risk and provide a sufficient data guarantee for the successful development of the doctor-patient relationship risk measurement scale. In this study, the normative scale development process ensures the rationality of the research results. On the basis of making full use of the real risk data and information of the doctor-patient relationship to extract the risk inducers, this study carried out expert consultation. Survey results using the preliminary 24-item version of the doctor-patient relationship risk measurement scale were analysed to determine the content validity, which provided a good working foundation for follow-up reliability and validity research. Analysis of these results indicated three factors.

The first factor, F1, obtained by this study includes nine items. Item A3 (“The time of consultation is too short; you cannot fully express your concerns”) and item A4 (“You think the medical record writing is not standard or has defects”) respectively capture the information of doctor-patient relationship risks from two risk points of language communication and written communication. From the perspective of medical practice, items A5 (“You suspect doctors

recommended tests/drugs for financial gain"), A7 ("You suspect hospitals concealed medical errors"), and A8 ("You suspect excessive treatment or insufficient care") capture information about trust erosion caused by inadequate doctor-patient communication. Integrating these into the doctor-patient communication framework is appropriate. Although the quantitative analysis results adjusted the item ownership domain of the qualitative analysis results, it essentially optimised the scale's structure.

Items A12 ("Doctors occasionally show impatience or an urgent attitude") and A13 ("Your reasonable needs are not respected") capture information about the lack of empathy between doctors and patients caused by insufficient communication between doctors and patients from the perspective of the medical process and can also be included in the doctor-patient communication system. Item A16 ("You think the informed consent process is a formality") considers the decision-making participation in disease treatment to extract the risk of lack of decision-making participation by patients and their families. Patients sign an informed consent form to uphold their rights to be informed about their medical condition, to make decisions regarding treatment options, and to agree to the implementation of the chosen treatment plan. This approval needs to be achieved through the process of doctor-patient communication. Therefore, A16 is attributed to the doctor-patient communication factor.

From the perspective of communication classification, informed consent is a specific operation point of written communication. As an outcome variable in the process of disease diagnosis and treatment, A17 ("You agree to accept the gap between medical results and treatment expectations") is directly affected by the quality of doctor-patient communication. Full doctor-patient communication enables patients and their families to clearly understand the disease diagnosis and treatment process, as well as the existing treatment risks, which enhances the transparency of medical treatment and increases trust between doctors and patients. Low-quality doctor-patient communication, on the other hand, increases the concerns of patients and their families, making them more sceptical about the treatment process. This is consistent with the previous research results that "effective doctor-patient communication can improve the rate of patients' return to the clinic and increase doctor-patient trust"[28]. In conclusion, the risk level of the doctor-patient relationship is related to the quality of doctor-patient communication, which confirms Hypothesis 1. Although the quantitative analysis results adjusted the attribution domain of A16 in the qualitative analysis results, this was only to optimise the structure of the scale, and it also confirms Hypothesis 4.

The second factor, F2, obtained from this study consists of five items. Item A9 ("You fully trust your doctor") captures information about the risks in the doctor-patient relationship from the perspective of trust crises. Results obtained using these items of the 18 items doctor-patient relationship risk scale demonstrate a correlation between the level of doctor-patient relationship risk and the trust between doctors and patients, confirming Hypothesis 2. Items A10 ("If the waiting time is too long, the doctor will provide you with appropriate emotional communication based on the psychological anxiety caused by waiting") and A11 ("The doctor will promptly notice your anxiety and offer comfort") capture the information on doctor-patient relationship risks from the perspective of doctor-patient empathy. Items A10 and A11, as measurement components of the doctor-patient relationship risk scale, can demonstrate a correlation between the level of doctor-patient relationship risk and the level of emotional connection, so responses to these items can be used to confirm Hypothesis 3.

Items A18 ("You think that doctors' actions can be accepted by patients and their families if they appropriately explain medical accidents") and A19 ("You think that there is a risk of sudden death in any disease treatment") considers the outcome variables of disease treatment and extract the risks of disease prognosis from the perspectives of patients. These items combine with the dual factors of emotion and trust to form a new dimension, that the items are acceptable in factor **F2**. One of the reasons for accepting bad outcomes might be a high level of trust between doctors and patients, which likely leads to a better response at the level of empathy between doctors and patients. An empathetic relationship helps patients and their families believe that the outcome of disease treatment is the inevitable result of the disease's own development. This is consistent with the research results of Sewell, who stated that "risk events in the doctor-patient relationship are not solely caused by the failure of treatment (disease outcome), but are triggered by the negative perceptions formed by the treatment process for patients/families"[12]. Another reason for accepting bad outcomes is that the empathy of doctors can also bring attention to the emotions of patients and family members[13], which may change the negative perceptions formed by the patient (including the patient's family). The patient's understanding of the disease outcome (uncertainty of disease treatment) will also be clear[14], thereby reducing the risk level of the doctor-patient relationship. Although the quantitative analysis results adjusted the attribution domain of A18 and A19 in the qualitative analysis results, this was only to optimise the structure of the scale, and it also confirms Hypothesis 5.

The third factor, F3, obtained in this study includes four items. Items A20 ("You have experienced a doctor-patient dispute") and A21 ("You have had a relative/friend involved in a doctor-patient dispute") capture the information of doctor-patient relationship risk from the perspective of risk experience. The inclusion of these items in the doctor-patient relationship risk scale can show that the doctor-patient relationship risk level is related to the risk experience of patients and their family members, which can be used to confirm hypotheses like Hypothesis 6. Items A22 ("You want to complain about your doctor") and A23 ("In an emotional situation, you have the impulse to hit your doctor") capture information about subject behaviour risk willingness from the perspective of a medical relationship risk situation. The inclusion of these two items in the doctor-patient relationship risk scale can show that the doctor-patient relationship risk level is related to the behaviour intention of patients and their family members, so answers to these items can confirm Hypothesis 6.

Conclusion

The final version of this study's novel doctor-patient relationship risk scale consists of three factors, encompassing a total of 18 items. The factors can be named based on the risk measurement points and measurement perspectives, combined with the names given to the three factors by the measurement content itself. Factor F1 is "doctor-patient communication" (nine items), F2 is "emotions and trust" (five items), and F3 is "experience and willingness" (four items). The Cronbach α coefficient of the doctor-patient relationship risk scale is 0.851, and the Cronbach α coefficients of the three factors are 0.766, 0.783, and 0.827, respectively. The items are rated on five-point Likert scales, and items A9, A10, A11, A17, A18, and A19 are scored inversely. The total score of the scale is 90 points. The higher the score, the greater the risk in the doctor-patient relationship.

Declarations

Ethics approval

All experimental protocols were approved by the ethics committee of Anhui Medical University (No.83230353) .

Consent for publication

Not applicable

Clinical Trial Number

Not applicable

Competing interests

The authors declare that they have no competing interests

Funding

This work was supported in part by the NSFC Center for Basic Science Project (No.72188101), This work was supported in part by the Natural Science Foundation of China (No.72374005), the Natural Science Foundation for the Higher Education Institutions of Anhui Province of China (No. 2023AH050561), the Quality Engineering for research projects of the Anhui Department of Education(2022sx067), Cultivation Programme for Young and Middle-aged Excellent Teachers in Anhui Province(YQZD2023021).

Author Contribution

JJS, LPZand LL designed this study(substantial contributions to the conception). YND, CJS and WJL collected data. JJS, LPZand LL extracted and analyzed data, interpretation of data for the work. JJS and LPZ provided guidance for statistical analysis and provided financial support. They agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy. JJS, LPZand LL wrote the manuscript. JJS, LPZ, YND, CJS, WJLand LL reviewed the manuscript.

Data Availability

The data used and/or analyzed during the current study is available from the corresponding author on reasonable request.

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Figures

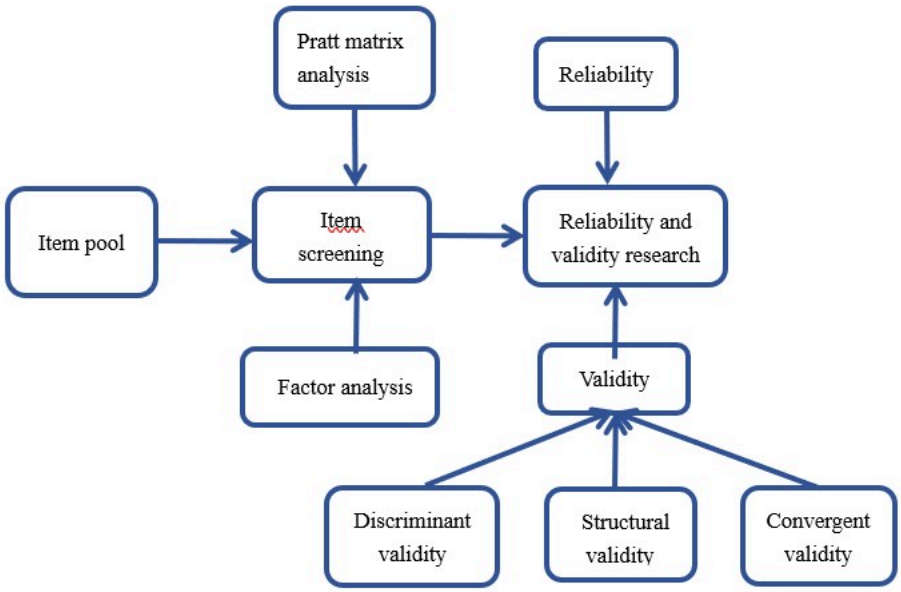


Figure 1

Development process of doctor-patient relationship risk measurement scale[18]

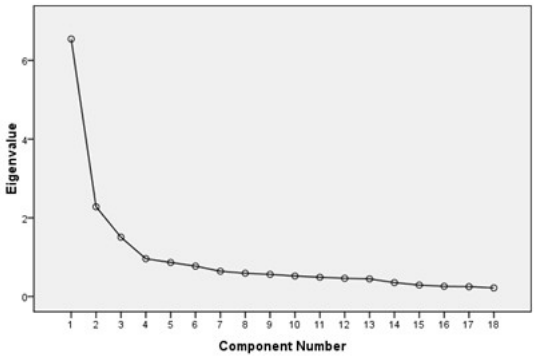


Figure 2

Scree plot of the number of components

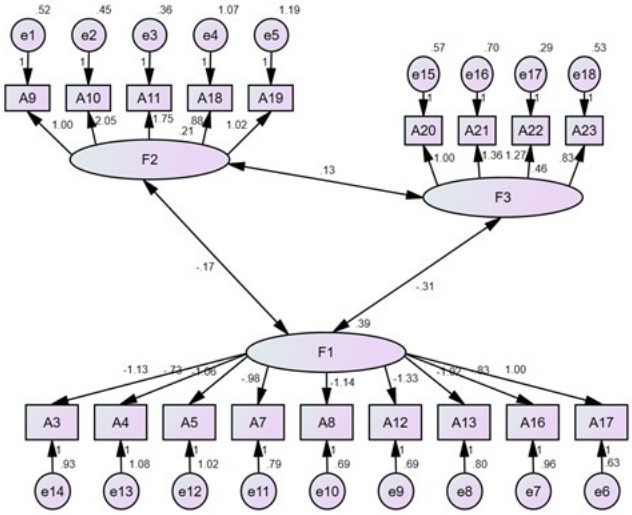


Figure 3

Risk measurement scale for doctor-patient relationship: Structural model