Applied & Educational Psychology (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/appep.2025.060320
ISSN 2523-5842 Vol. 6 Num. 3

Establishment of a Risk Perception Scenario Library for Nursing Staff and Assessment of the Reliability and Validity of Its Images

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Keywords: Nursing Staff; Risk Perception; Scenario Library; Pleasantness; Arousal Level; Threat Level; Reliability; Validity

Abstract: To preliminarily establish a risk perception scenario library for nursing staff and test its reliability and validity, so as to provide reliable training materials for subsequent risk perception regulation training of nursing staff. This study took thirty-six nursing staff screened out pictures from 196 pictures. The pictures with a dimension recognition degree of more than 80% and an average score of the perceived risk intensity greater than 4 points were selected. Eleven experts carried out two rounds of screening, scoring the pictures in terms of the degree of dimension matching, the perceived risk intensity, and whether they could be included in the risk perception scenario library. Finally, the reliability and validity of the pictures were evaluated. As shown in the results,thirty-one pictures were screened out to form the risk perception scenario library for nursing staff. The Cronbach'sα coefficients of the pictures in terms of pleasantness, threat level, and arousal level were 0.995, 0.991, and 0.987 respectively; the content validity index of the pictures was 0.886,and the test-retest reliability was 0.760 and the split-half reliability was 0.900; there was a negative correlation between the ratings of pleasantness and threat level in the picture library ($r = -0.32$, $P < 0.001$); a positive correlation between arousal level and threat level in the picture library ($r=0.65$, $P<0.001$).the scatter plot showed that when the rating of pleasantness was low, the rating of threat level was at a high level, and when the rating of pleasantness was high, the rating of threat level would decrease accordingly and the higher the threat level score, the higher the arousal level score of the pictures.The results of the study prove that the preliminary evaluation of the risk perception scenario library for nursing staff is good, which can provide reliable materials for subsequent risk perception regulation training of nursing staff.

1. Introduction

Risk perception refers to the individual's perception and understanding of various objective risks

in the outside world, and emphasizes the influence of experience acquired by intuitive judgment and subjective perception on cognition [1]. The risk perception of nursing staff refers to the subjective perception and cognition of crisis events in their working environment [2], and the level of risk perception has a moderating effect on the occurrence of risk behaviors in clinical work of nursing staff [3-4].

In clinical nursing, the level of risk perception of nursing staff has an important impact on the quality of work and patient safety. People with a high level of risk perception often show excessive sensitivity to risk events and are prone to strong emotional reactions, which not only lead to negative emotions such as anxiety and stress [5], but also may lead to somatization symptoms and irrational behavior, thereby affecting work efficiency and quality of care [6]. On the contrary, nurses with low risk perception level may lack the necessary alertness to potential risks, and it is difficult to identify and effectively prevent the occurrence of risk events in time. This significant difference in risk perception level not only impairs the physical and mental health of nursing staff, but also increases the probability of adverse events in patients, which poses a potential threat to medical safety.

Attentional bias training, also known as attention bias modification training (ABMT), uses a pre-set processing mode to directly manipulate the individual's attentional bias through the task situation. After stable and repeated training, individuals can effectively form a stable attention preference, so that individuals gradually form an automatic processing process for relevant information [7]. A large number of studies have shown that attentional bias training can effectively train anxiety disorders [8-12], substance addiction [13-16] and so on. At present, cognitive therapy and psychological lectures are routinely used in risk perception regulation training, which takes a long time and requires high intervention from the practitioners, and the training effect is difficult to quantify. Therefore, it may be a more effective way to explore risk perception regulation through attentional bias training. At present, there is no standardized and standardized situational picture library for risk perception attentional bias training of nurses. The purpose of this study is to construct a risk perception situation database for nursing staff through their daily work and life situations, and to evaluate its reliability and validity, so as to provide standardized materials for follow-up risk adjustment training for nursing staff.

2. Objects and Methods

The context database of this study includes three parts: the live-action context, the comic context, and the web-collected context. Situational pictures are based on the dimensions and items of the Risk Perception Scale for Nurses (Zhang Xinwei, 2016), including personal safety risk, physical function risk, time risk, organizational risk, occupational exposure risk and psychosocial risk, including 196 pictures, which are clear in content and do not involve other people's copyright. The picture quality of the network collection version is clear, which can accurately reflect the daily work situation of nursing. This study evaluates the dimensions of pictures and the perception of strong risks through the open recruitment process of front-line nursing staff.

After that, the pictures were screened again through expert inquiry, and the picture dimensions and the perceived risk intensity level of the pictures were evaluated respectively.Whether the pictures retained after two rounds of screening could be included in the risk perception situation database of nursing staff and the degree of dimension matching were evaluated by the same expert, and finally the risk perception situation database of nursing staff was formed.

2.1 Situational Material Collection

Situational materials are divided into three parts, including the live-action version of the situation,

the comic version of the situation, and the network collection version of the situation. 1) Live version of the situation. According to the risk perception scale of nursing staff, the daily work content of front-line nursing staff in a hospital in Jiaxing City was selected to shoot. With informed consent, more than 150 pictures were taken around the content of the scale, 136 of which were valid. The content of the pictures was clear and did not involve copyright or other people's privacy. 2) Comic version of the situation. According to the six dimensions of the risk perception scale of nursing staff, a total of 38 pictures were drawn, which were clear and could intuitively describe the situation of nursing work. 3) Network collection version situation. The search engine and app commonly used in China, such as Baidu Pictures and Weibo, were used to search with the keywords of "nursing staff", "risk perception" and "nursing risk", and 22 ambiguous situational pictures were eliminated.

2.2 Context Picture Matching Degree Screening

2.2.1 Personnel selection

The questionnaire was distributed to the front-line nurses by convenient sampling using the questionnaire star platform, and the questionnaire link was released from August 29, 2024 to September 13, 2024, and the questionnaire was sent to the working WeChat group of nurses QR Code. Inclusion criteria: 1) having nurse's professional qualification certificate; 2) being engaged in clinical nursing work; 3) working time ≥ 1 year; 4) voluntary participation in this study. Exclusion criteria: 1) refusal to participate in the study; 2) nursing staff for advanced study and practice; 3) patients with severe visual impairment. In the first round of screening, 40 nurses were recruited to fill in the questionnaire, and 41 questionnaires were actually recovered, and 36 valid questionnaires were finally obtained, with an effective recovery rate of 87.8%. Among them, there were 2 males and 34 females; hospital grade: 31 in tertiary hospital, 2 in secondary hospital, 3 in community health clinic; education level: 31 in undergraduate and above, 5 in junior college; Professional titles: 6 nurses, 16 chief nurses, 14 chief nurses and above. The map reading ability of the above personnel is normal.

2.2.2 Evaluation method

Situational pictures are presented in the form of questionnaire stars, which includes two parts: the first part is the general information questionnaire of nursing staff, including gender, working years, professional titles, departments, educational background, etc. The second part is the situational picture evaluation, which requires the nursing staff to judge the dimensions of each picture and whether the picture makes people perceive a strong risk, using a five-point scale, 1 point means no perceived risk, 5 points means perceived a strong risk. Questionnaires with a total browsing time of < 1000 seconds are considered invalid.

2.3 Expert assessment

2.3.1 Personnel selection

An expert team composed of associate professors and experts from the nursing department of a medical college and front-line clinical nurses demonstrated the pictures after preliminary screening. Inclusion criteria: 1) 35 to 60 years old; 2) nursing research or clinical nursing; 3) ≥ 10 years of working experience in this field. Exclusion criteria: 1) Patients with severe visual impairment; 2) Unable to work normally during leave/sick leave. A total of 11 experts were selected. Among the 11 experts, there are 9 people with deputy senior titles and above, who have worked for more than 10

years, and are familiar with the work flow of nursing staff, the level of risk perception of nursing staff, and the quality of nursing work, so as to ensure the accuracy of the assessment.

2.3.2 One round evaluation method of experts

Through expert inquiry, each expert is invited to judge the picture dimensions, including personal safety risk dimension, physical function risk dimension, occupational exposure risk dimension, psychosocial risk dimension, organizational risk dimension, time risk dimension and seven options that can not be determined. Secondly, the perceived risk intensity of the picture was scored according to the scoring standard of 1 to 5 grades, 5 points indicated that people perceived strong risk, and 1 point indicated that people did not perceive risk.

2.3.3 Criteria for one-round screening of images by experts

1) Picture dimension judgment: Keep the pictures with more than 80% expert recognition of the same dimension, and delete the remaining pictures. 2) The pictures with the average perceived risk intensity score of more than 4 points were retained, and the rest were deleted.

2.3.4 Expert second-round evaluation method

The same experts were selected to score the dimensional matching degree of the remaining pictures according to the scoring criteria of 1 to 5, with 1 indicating very unmatched and 5 indicating very matched. Whether the remaining pictures could be included in the risk perception situation database of nursing staff was scored according to the scoring standard of grade 1 to grade 4, with a score of 1 indicating that they could not be included, and a score of 4 indicating that they could be included.

2.3.5 Criteria for the second round of expert image screening

1) Dimension matching degree: The dimension matching degree of each picture is equal to or greater than 4 points, and the remaining pictures are deleted. 2) Whether to be included in the situation database: If the score of more than 80% of the experts for each picture is greater than or equal to 3, the picture can be included in the risk perception situation database of nursing staff, and the rest of the pictures will be deleted.

2.4 Assessment of front-line nursing staff

2.4.1 Personnel selection

The convenience sampling method was used to distribute the network questionnaire to the front-line nurses through the questionnaire star platform, and the questionnaire link release time was from August 29, 2024 to September 13, 2024, and the questionnaire was sent to the working WeChat group of nurses QR Code. Inclusion criteria: 1) having nurse's professional qualification certificate; 2) being engaged in clinical nursing work; 3) working time ≥1 year; 4) voluntary participation in this study. Exclusion criteria: 1) refusing to participate in the study; 2) nursing staff for advanced study and practice; 3) Patients with severe visual impairment.

2.4.2 Evaluation criteria for nursing staff

The pictures are presented by the questionnaire star online software. The questionnaire includes two aspects: the first part is the general demographic data of volunteer nurses, including gender, age,

educational level, department, hospital level, visual acuity, etc. The second part is the evaluation of the pictures. The browsing time of each picture is controlled by the nurses themselves. They try to avoid thinking about the pictures for a long time. Each volunteer is required to score the three dimensions of pleasure, threat and arousal of each picture, using the hundred-mark system. Pleasure indicates the degree of unpleasantness and pleasantness. The higher the degree of pleasantness, the closer the score is to 100. The more unpleasant, the closer the score is to 0. Interesting, pleasing, satisfying and hopeful represent pleasure, while bad mood, disgust, sadness, fear and anger represent unhappiness. Threatening means safe to unsafe. It means that seeing this picture makes people feel safe or threatened. 0 means safe, calm, and not alert. 100 means extremely unsafe, alert, and dangerous. The degree of arousal indicates that you are not excited to the degree of excitement, which means that you feel excited or not energetic when you see the picture. The closer the score is to 100, the higher the degree of excitement is, that is, bright, sensitive, stimulating and exciting. The closer the score is to 0, the less excited you are, which means that you are not energetic, dull and sleepy.

2.5 Statistical methods

All data were processed by SPSS 22.0 software, using descriptive statistics, Pearson correlation analysis, scatter plot analysis, Cronbach's α coefficient consistency analysis.

3. Results

3.1 Picture screening results

3.1.1 Results of the first round of screening for nursing staff

The 196 pictures collected were screened by 36 front-line nurses, and the dimension matching was based on the risk perception dimension of nurses in previous studies [19], and the risk perception intensity was evaluated by 1-5 grades (1 not perceived risk to 5 perceived strong risk); 78 pictures with the same dimension judgment degree less than 80% [23] were deleted; A total of 12 pictures with an average score of perceived risk intensity < 4 were deleted. Homogeneity analysis was performed on the remaining 106 images. The images with highly consistent content in the same dimension of the same scene were sorted according to their scores, and the images with lower scores were deleted, totaling 27 images. Finally, 79 images were left, and the perceived risk intensity score of the images was (4.19 ± 0.30). See Table 1 for the remaining pictures of each dimension after scoring and screening by the nursing staff.

Table 1: Basic Information of Remaining Images of Each Dimension

Dimension	Number of pictures remaining
Personal safety risk	33
Physical function risk	15
Occupational exposure risk	10
Psychosocial risk	4
Time risk	17

3.1.2 Results of the second round of expert screening

Eleven experts screened the remaining 79 pictures, and 24 pictures with the same dimension judgment degree less than 80% were deleted. A total of 20 pictures with perceived risk intensity < 4 [23] were deleted, and 35 pictures were left. Among them, there are 22 live-action pictures, 4 online

collection pictures and 9 cartoon drawings, and the perceived risk intensity score of the pictures is (4.21 ± 0.44).

3.1.3 Results of the third round of expert screening

The remaining 35 pictures after the second round of screening were re-evaluated and analyzed by 11 same experts, and more than 80% of the experts scored more than 4 points for 35 pictures. In view of whether the picture can be included in the score of the risk perception context database, more than 80% of the experts scored less than 3 points for one picture, which was deleted, and the remaining 34 pictures. According to the experts' opinions on revision, 31 pictures were finally determined to be included in the final context-informed database of nurses' risk perception after eliminating some differences and not restoring the pictures (such as ambiguous situation, special identity and other factors).

3.1.4 Results of the fourth round of screening for nursing staff

A total of 82 volunteer nurses screened 31 pictures of risk situations, and analyzed the three dimensions of pleasure, arousal and threat of 31 pictures. The score of pleasure was (24.90 ± 34.75), the score of arousal was (84 ± 30.68), and the score of threat was (83.37 ± 26.35). The scores of each dimension are shown in Table 2 below.

Table 2: Pleasure, arousal and threat of each dimension

Dimension category	Pleasure	Threat level	Awakening degree
Personal Safety Risk Dimension	23.83	88.08	88.02
Physical function risk dimension	25.26	83.27	83.46
Occupational exposure risk dimension	24.11	83.38	83.87
Psychosocial risk dimension	25.17	82.91	84.07
Time risk dimension	25.71	80.72	81.97
Overall	24.90±34.75	84±30.68	83.37±26.35

3.2 Reliability and validity of situational content

3.2.1 Stability of contextual content

Ten of the 35 images were randomly selected as quality control images, and the dimensional judgment of the images was used as the evaluation index of consistency to judge whether the judgment of the evaluator was stable in the evaluation process, that is, the test-retest reliability. According to the percentage of the consistent pictures in the two dimensions, we can judge the influence of the error caused by time on the stability of the questionnaire judgment. The results showed that the stability of dimensional judgment was greater than 0. 6, and the mean and standard deviation were (0. 76 ± 0.12), which indicated that the evaluators were serious in the evaluation process and the evaluation results were reliable.

3.2.2 Situational content reliability

The coefficients of internal consistency Cronbach's (α) of pleasure, threat and arousal were 0.995, 0.991 and 0.987, respectively, and the internal consistency of the whole picture library in the three dimensions was greater than 0.90. The split-half reliability of the overall questionnaire score was 0. 900, which indicated that the split-half reliability of the evaluation was reliable and could be used as a reference in Table 3.

Table 3: Internal consistency alpha coefficient of pleasure, arousal and threat

Dimension category	Pleasure	Awakening degree	Threat level
Personal Safety Risk Dimension	0.987	0.612	0.956
Physical function risk dimension	0.987	0.958	0.958
Occupational exposure risk dimension	0.986	0.950	0.965
Psychosocial risk dimension	0.951	0.886	0.883
Time risk dimension	0.986	0.967	0.983
Overall	0.995	0.987	0.991

3.2.3 Situational content validity

After two rounds of expert screening, the dimension judgment of 35 selected pictures and whether they could be included in the risk perception situation database of nursing staff were scored, of which 31 pictures were scored more than 3 points by more than 80% of experts, the content validity index (CVI) was 0.886, greater than 0.8, the content validity of the pictures was good, and the correlation analysis was carried out according to the dimensions of the selected pictures. The score results of construct validity are shown in Table 4, and the selected pictures are shown in Figure 1.

Table 4: Construct validity scores

		Personal Safety Risk Dimension	Physical function risk dimension	Psychosocial risk dimension	Time risk dimension	Occupational exposure risk dimension
Personal safety risk	r	1	.910**	.354	.547	.619*
	Sig. (Two-tailed)		<.001	.286	.082	.042
Physical function risk	r	.910**	1	.413	.396	.440
	Sig. (Two-tailed)	<.001		.207	.228	.175
Psychosocial risk	r	.354	.413	1	.692*	.693*
	Sig. (Two-tailed)	.286	.207		.018	.018
Time risk	r	.547	.396	.692*	1	.818**
	Sig. (Two-tailed)	.082	.228	.018		.002
Occupational exposure risk	r	.619*	.440	.693*	.818**	1
	Sig. (Two-tailed)	.042	.175	.018	.002	

Figure 1: Examples of selected pictures

3.2.4 Correlation between pleasantness and threat of situational content

Pearson correlation analysis was used to analyze the correlation of pleasure, threat and arousal. According to the results, it was found that there was a negative correlation between pleasure and threat ($R = -0.32$, $P < 0.001$). In order to show the correlation between pleasure and threat more intuitively, the data were drawn as a scatter plot. The distribution trend of the data is displayed more intuitively. It can be seen from the data in the figure that the score data of the picture is scattered.

However, when the pleasure score is low, the threat score is mostly at a high level. When the pleasure score is high, the threat score will also decrease.The results are shown in Figure 2.

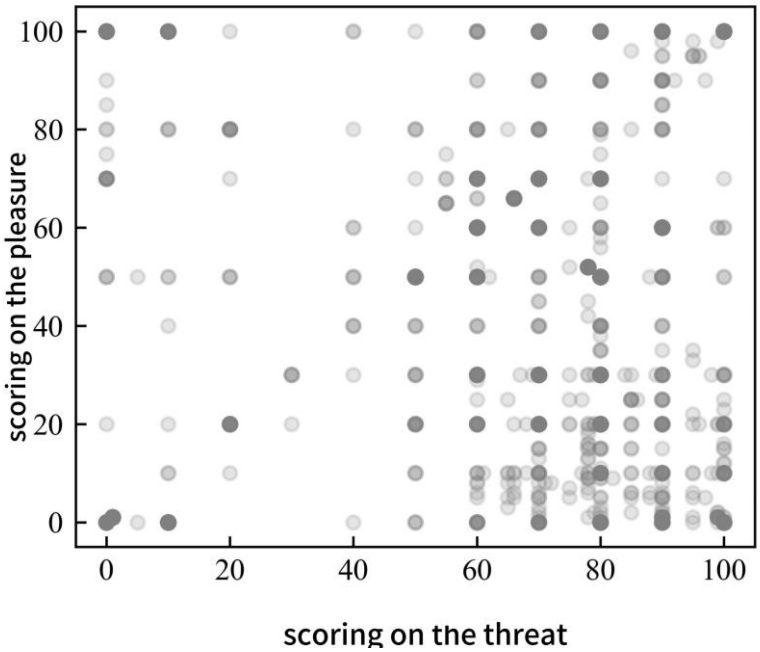

Figure 2: Scatter plot of pleasure and threat scores

3.2.5 Correlation between situational content arousal and threat

Pearson correlation analysis showed that there was a strong positive correlation between arousal and threat ($R = 0.65$, $P < 0.001$), and the scatter plot visualization results showed in Figure 3 that when the threat score increased, the arousal score also increased, indicating that in the pictures included in the perceived risk context database, The potential or obvious risks of more pictures pose a threat to the intuitive perception of nursing staff and can activate the physiological arousal state of individuals, and the greater the threat of pictures, the higher the arousal degree of nursing staff.

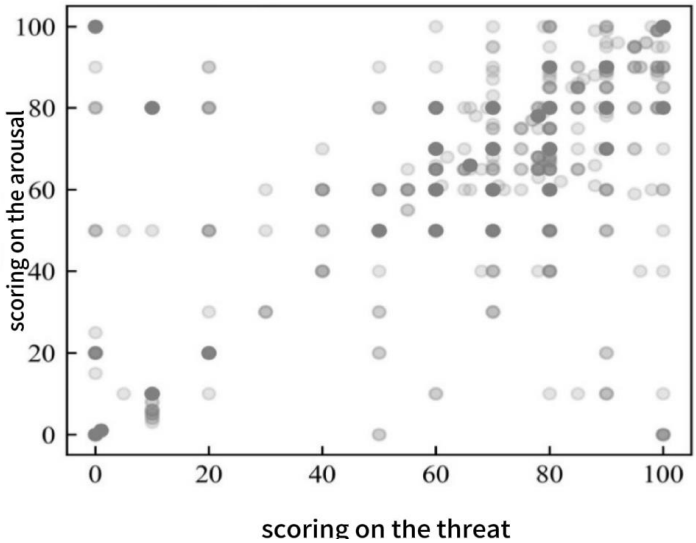

Figure 3: Scatter plot of arousal and threat scores

4. Discussion

4.1 The picture library of nurses' risk perception situation has good reliability and validity

The influencing factors of nurses' risk perception level include personal, family, working environment and other influencing factors. In clinical work, nurses' excessive attention to the risk situation clues in their work and life is an important factor leading to the increase of their risk perception level. It is the premise of risk perception level adjustment training to establish the knowledge base of risk perception of nurses. In this study, the materials were screened and evaluated by nursing experts and front-line nurses, and the situational materials were comprehensively evaluated from the perspectives of front-line clinical nursing management, nursing and psychological work, and the evaluation results were in line with the requirements of scientificity and objectivity. After two rounds of screening, the validity index of the picture library is 0.886, which is greater than 0.8, indicating that the picture library has good content validity. Quality control pictures were randomly selected in the screening, and the dimension judgment of the pictures was selected as the test-retest reliability analysis index to analyze the internal consistency of the pictures. The test-retest reliability of the total questionnaire was 0.76, and the split-half reliability of the total table was 0.900, which had good measurement characteristics. At the same time, this study uses the hundred-mark system to score, so that the score can be more accurately close to the psychological assessment of the evaluator. The Cronbach's of each dimension was greater than 0. 9, indicating that the stability of the dimension was good and the reliability of the evaluation was reliable.

4.2 The picture library of nursing staff's risk perception situation has a good emotional induction effect

The results of this study show that there is a certain degree of negative correlation between the pleasure score and the threat score in the study of nursing groups. This finding strongly confirms that the pictures used in this study can trigger common emotional experiences and feelings in the nursing community. When the pleasure score is low, the threat score is high, which is in line with the law of human emotions. When an individual captures threatening stimuli from the displayed pictures, based on the principles of cognitive neuroscience, the limbic system of the brain will be activated rapidly, especially the amygdala and other key brain areas, which will trigger the stress response of the hypothalamus-pituitary-adrenal (HPA) axis. Negative emotional States such as tension and anxiety are more likely to be induced and aroused [20], which makes the individual's inner sense of security system based on self-efficacy and environmental control shaken and weakened to varying degrees.

The results show that there is a strong positive correlation between the scores of arousal and threat, which indicates that the situational pictures of the risk perception situation database constructed in this paper can have an immediate impact on the individual's arousal level through the visual dimension. It conforms to the theory of optimal arousal (Optimal Arousal Theory) proposed by Berlyne (1971). In this theory, it is proposed that external stimuli can affect the individual's arousal level through direct sensory input in the sensory dimension [21]. At the same time, threatening stimuli have a higher ability to capture attention. When threatening stimuli appear, the amygdala and other brain areas in the brain are highly sensitive to threatening stimuli. The amygdala will be activated in the early stage of threatening stimuli, and then guide the attention system to process these stimuli more deeply [22], which affects the perception and evaluation of threatening stimuli and further affects the individual's trend-avoidance behavior. This also explains from the perspective of neural mechanism that individuals in this paper have a stronger level of

arousal for pictures with higher threat.

4.3 The picture library of risk perception situation of nursing staff has good practicability

Studies have confirmed that the level of risk perception of nursing staff has a certain degree of influence on the occurrence of nursing risk events and the physical and mental health of nursing staff [24], so it is very important to adjust the risk perception of nursing staff to a reasonable level. Because of the limitation of attentional resources, individuals will selectively allocate attentional resources to some or some stimuli compared with neutral stimuli when facing a variety of stimuli, resulting in attentional bias [18]. Neuroimaging has shown that attentional bias is related to the activity of threatening stimuli in the brain. In clinical nursing, the degree of attention allocation for nursing risk situations will affect the quality of nursing and their physical and mental health to a certain extent, and attentional bias training is to guide nurses to remove their attention from the cue stimulation of risk situations and turn to neutral stimulation through long-term repetitive exercises, so as to reduce the cognition of negative stimulation.

The contextual database of nurses' perception of risk constructed in this paper can be used as training materials for nurses' perception of risk adjustment by focusing on nurses themselves and their working environment, restoring realistic scenes and events in the form of pictures, with rich and clear content and strong practicability. The results of the study were based on Zhang Xinwei's [19] risk perception questionnaire for nursing staff. The results of the questionnaire showed that the nursing staff had a weak risk perception of the "organizational" risk dimension in the process of evaluation, which may be due to the emergence of the organizational risk dimension, such as "the aging of facilities leads to potential risks." In the process of nursing work, the same dimension items will be regarded as other risk dimensions by nurses for various other potential reasons, so the risk score and dimension judgment are not sensitive. This is consistent with the research of Shao Xiaoqin [17] et al. (2024), so only five dimensions of risk situation pictures are included in the subsequent screening evaluation, which ensures the scientificity and accuracy of the image library dimension screening. Based on the above analysis and research results, the risk perception scenario database of nursing staff contains five risk dimensions and three types of material pictures, which can be used as the training materials of nursing staff's attention bias in the future, and regularly carry out risk perception adjustment training to ensure that the risk perception of nursing staff is at a controllable and reasonable level, effectively prevent the occurrence of nursing risk events and ensure the physical and mental health of nursing staff.

5. Conclusion

The preliminary establishment of the risk perception situation database of nursing staff has important practical significance for stabilizing the risk perception level of nursing staff, providing a scientific tool for reasonably avoiding the occupational risk of nursing staff and improving the quality of clinical nursing, and improving the quality of nursing risk management in hospitals.

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