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ARTICLE

Construction of a Competency Evaluation Indicator System for Specialist Nurses in Liver Transplantation: A Delphi Study

Dan Gao[1,2], Lili Ma[3,*], Beihua Xi[2], Yanling Wang[2], Yi Bao[2]

[1]School of Nursing, Tongji University School of Medicine, Shanghai, China
[2]Department of Liver Transplantation, Ruijin Hospital-Shanghai Jiao Tong University School of Medicine, Shanghai, China
[3]Nursing Department, Shanghai East Hospital, Shanghai, China
*Correspondence: Math_223243@163.com (Lili Ma)

Abstract

Aims/Background Liver transplantation specialist nurses provide comprehensive and safe care for liver transplant patients, which requires them to have a wide range of competencies. However, at present, there is no comprehensive understanding of the competency of liver transplantation specialist nurses in China, and there is a lack of comprehensive evaluation indicators. The purpose of this study was to construct a competency evaluation indicator system for specialist nurses in liver transplantation.

Methods Utilizing the "Iceberg model" of competency, the indicator system for evaluating the competency of liver transplant specialist nurses was developed through literature review, semi-structured interviews, and two rounds of Delphi expert consultation.

Results Twenty nursing and medical experts in liver transplantation were consulted over two rounds. The effective response rates for the expert consultation questionnaires were 90.91% and 100.00% for the first and second rounds, respectively. The coefficient of expert judgment was 0.920, the coefficient of familiarity was 0.880, and the authority coefficient was 0.900. The value range of the coefficient of variation in the second round was 0.00–0.16, both <0.25, indicating that the degree of coordination of expert opinions was high. The final competency evaluation index system for liver transplant specialist nurses encompassed 6 primary indicators, 17 secondary indicators, and 59 tertiary indicators, including professional knowledge, professional skills, social role, self-concept, personality quality, and motivation.

Conclusion The developed competency evaluation indicator system for liver transplant specialist nurses possesses scientific validity and reliability, offering a reference for the training and assessment of liver transplant specialist nurses.

Key words: liver transplantation; specialist nurse; competency; evaluation indicator system; Delphi method

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Introduction

In recent years, liver diseases have emerged as a significant global health issue, with an increasing disease burden. Over two million people die annually from major liver diseases such as acute hepatitis, cirrhosis, and liver cancer, comprising roughly 4% of all worldwide deaths (Xiao et al, 2019a). Liver transplantation is acknowledged as the sole effective treatment for various end-stage liver diseases.

Since the development of liver transplantation, more than 100,000 liver transplantation procedures have been carried out worldwide (Jadlowiec and Taner, 2016). This surgical procedure, which involves replacing a diseased liver with a healthy one, is essential for saving lives and enhancing the quality of life in patients with end-stage liver diseases (Maynard, 2019; Gruttadauria et al, 2010). The complexity and trauma involved in liver transplant surgery, coupled with the rising demands of patients, reduced hospital stays, and the increased intricacy of nursing care, require that liver transplant specialist nurses possess distinct professional skills, knowledge, attitudes, and values. These qualities are essential for protecting, promoting, and optimizing the health and capabilities of transplant recipients (Negreiros et al, 2017). As integral members of the multidisciplinary liver transplant team, the competency levels of specialist nurses are vital in delivering safe and high-quality care to patients (Negreiros et al, 2017). Current research on the competencies of critical care nurses (Zhang et al, 2020), diabetes specialist nurses (Xing et al, 2019), and infectious disease specialist nurses (Wu et al, 2021) is quite developed. In the aspect of liver transplantation nursing, the role of nurses in the field of liver transplantation has been studied, but the specific competence of nurses is not clear (Chaney et al, 2016). In China, some hospitals have started relevant training programs for transplant specialist nurses, the levels of these programs vary, and a unified evaluation system is lacking (Xiao et al, 2019b; Guo et al, 2015). Evaluations often concentrate on explicit factors like theoretical knowledge and practical skills, while overlooking implicit factors such as responsibility, values, and motivation. This underestimation can significantly influence the performance of nursing management staff, leading to evaluations that are not sufficiently scientific and thorough (Wang et al, 2022). Competency in the field of nursing refers to the knowledge, skills and attitude that a nurse must possess in clinical nursing work and demonstrate superior job performance (Wu et al, 2021). Research based on the competency model has generated new inspirations for nursing managers on how to better manage employees. However, a review of the literature indicates limited research on the job competency of liver transplant specialist nurses. Thus, this study, based on the competency "Iceberg model" and considering the real needs of liver transplant specialist nursing roles, constructs a competency evaluation indicator system for liver transplant specialist nurses. This system, developed through literature review, semi-structured interviews, the Delphi method, and the Analytic Hierarchy Process (AHP) (Ezzat and Hamoud, 2016), aims to serve as a reference for the training and evaluation of liver transplant specialist nurses.

Methods

Design

The Competency "Iceberg model" was used as the theoretical framework. An initial draft of the competency evaluation indicator system for specialist nurses in liver transplantation was developed through a literature review and semi-structured interviews. A Delphi expert consultation questionnaire was then designed based

on this draft. Through two rounds of Delphi expert consultations, we gathered opinions and suggestions from experts to achieve consensus. Lastly, the AHP was applied to determine the weight of each indicator.

Construction of the Competency Evaluation Indicator System for Specialist Nurses in Liver Transplantation

A research team was formed, consisting of a Deputy Director of Nursing (Master's degree), two Head Nurses from the Liver Transplantation Department (Master's degrees), and three Specialist Nurses in Liver Transplantation (two with Master's degrees and one with a Bachelor's degree), all having considerable experience in clinical nursing and management in liver transplantation. Keywords including "Liver Transplantation", "Specialist Nurse", "Competency", "Job Competency", and "Competency Characteristics" were used to search databases such as Chinese National Knowledge Infrastructure (CNKI), Wan Fang, China Biology Medicine (CBM), PubMed, Medline, and Web of Science. We reviewed literature to gather, organize, and analyze information related to the competencies of specialist nursing positions. Purposive sampling was employed to select specialist nurses, nursing managers, and clinical doctors from three top-tier hospitals in Shanghai for interviews. The sample size was determined when thematic saturation was reached. The final sample comprised 13 specialist nurses, 5 nursing managers, and 4 liver transplant doctors. The interviews focused on their understanding and views on the job requirements, work content, and necessary knowledge, skills, and personal traits for specialist nurses in liver transplantation. Interviews were recorded, and non-verbal actions were carefully noted. Post interviews, the materials were transcribed into a Word document for analysis and organization. We identified the competency elements required for specialist nurses in liver transplantation by combining the literature review results and employing the competency "Iceberg model" as a guide. This process yielded the initial draft of the competency evaluation indicator system, including 6 primary indicators, 17 secondary indicators, and 67 tertiary indicators.

Delphi Process

Expert Selection

Delphi survey is a feedback anonymous inquiry method, which can ensure that the experts won't discuss or exchange views. Therefore, it is regarded as an effective method to set goals (Black et al, 2018). In this study, both the academic authority and the extensive practical experience of the experts were considered, to ensure they could offer constructive suggestions and opinions from various perspectives. The selection criteria included: (1) involvement in clinical nursing and nursing management, and medical expertise in liver transplantation; (2) over 10 years of work experience with a solid theoretical background; (3) holding a mid-level or higher technical title; (4) possessing at least an undergraduate degree; (5) maintaining a rigorous academic attitude and a high academic level in liver transplantation; and demonstrating high enthusiasm and willingness to support this research.

Preparation of the Expert Consultation Questionnaire

The expert consultation questionnaire consisted of four sections: (1) A letter to experts, briefly explaining the research background, objectives, and significance. (2) The indicator consultation form, the main part of the questionnaire. The initial competency evaluation indicator covering 6 primary, 17 secondary, and 67 tertiary indicators was transformed into an indicator consultation form. Participants were asked to rate each competency on a 5-point Likert-type scale ranging from "1 = very unimportant" to "5 = very important" to express how much the participants thought the nurse should demonstrate these abilities. (3) Expert basic information, including age, education, title, position, years of work, etc. (4) Expert judgment basis and familiarity level, including self-assessment of familiarity and judgment basis. Familiarity levels were categorized into five grades (very familiar, relatively familiar, moderately familiar, somewhat unfamiliar, unfamiliar), with corresponding coefficients (1.0, 0.8, 0.6, 0.4, 0.2). Judgment basis categories included theoretical knowledge, practical experience, reference to domestic and international materials, and subjective feeling, each with different degrees of influence: theoretical knowledge (0.3, 0.2, 0.1), practical experience (0.5, 0.4, 0.3), reference materials (0.1, 0.1, 0.1), subjective feeling (0.1, 0.1, 0.1).

Implementation of Expert Consultation

In the period of October–November 2022, two rounds of expert consultations were carried out. Initially, the research team contacted the experts by telephone and, following their consent, sent the expert consultation forms via email with a two-week response deadline. Based on the experts' feedback and team discussions, the indicators were revised and refined. A summary of opinions from the first round and feedback were included in the second-round questionnaire, which also incorporated new items suggested by experts, to further gather their opinions. The criteria for indicator selection in both rounds were an average importance score >3.5 and a coefficient of variation (CV) ≤ 0.25.

Statistical Methods

Data collected in this study were entered into Excel 2019 (Microsoft Excel 2019, Redmond, WA, USA) and analyzed using SPSS 25.0 (IBM-SPSS Statistics, Chicago, IL, USA). Descriptive statistics were used to analyze basic information about the experts, including age, years of professional experience, and educational background. The reliability of the consultation results was assessed using measures of expert engagement, expert authority, concentration of expert opinions, and coordination of expert viewpoints. The AHP was utilized to determine the weight values of the indicators. This was done through methodology multicriteria evaluation using Saaty's AHP (Ajakaye et al, 2017). AHP is a multi-criteria decision method that uses hierarchical structures to represent a problem and makes decisions based on priority scales. Judgement matrices were constructed and consistency tests were conducted to ultimately establish the weight values of each indicator.

Table 1. General information of the experts (n = 20).

Category	Subcategory	Number	Percentage (%)
Age	35–40 Years	5	25.00
	41–45 Years	8	40.00
	46–50 Years	5	25.00
	51–55 Years	2	10.00
Education	Bachelor's Degree	9	45.00
	Master's Degree	7	35.00
	Doctoral Degree	4	20.00
Professional Title	Intermediate	9	45.00
	Associate Senior	9	45.00
	Senior	2	10.00
Years of Professional Experience	10–15 Years	7	35.00
	16–20 Years	9	45.00
	>20 Years	4	20.00
Field of Work	Liver Transplant Nursing Experts	14	70.00
	Liver Transplant Medical Experts	6	30.00

Results

Basic Information of the Experts

In the expert consultation, 14 participants (70.00%) were specialists in liver transplant nursing, whereas 6 (30.00%) were medical experts in liver transplantation. Their ages ranged from 36 to 53 years, with a mean age of 43.80 ± 4.66 years. Professional experience varied from 10 to 31 years, averaging 17.80 ± 5.81 years. In terms of educational qualifications, 9 experts (45.00%) held Bachelor's degrees, 7 (35.00%) had Master's degrees, and 4 (20.00%) possessed Doctoral degrees (Table 1).

Expert Engagement Coefficient

Expert engagement was gauged by the response rate to the questionnaire, reflecting the experts' interest in, and support for, the study. The study included two rounds of expert consultations. In the first round, 22 questionnaires were distributed and 20 valid responses were obtained, resulting in a response rate of 90.91%. In the second round, 20 questionnaires were issued and all 20 valid responses were received, achieving a response rate of 100%. In the first round, 11 experts (55%) provided suggestions for modifying the indicators, whereas in the second round, 7 experts (35%) made suggestions.

Degree of Expert Authority

The reliability of Delphi expert consultation results is closely related to the authority coefficient of experts and the degree of coordination concentration of experts. It is generally believed that the authority coefficient of experts is >0.7, the coordination coefficient is about 0.5, and the variation coefficient is less than 0.25,

which means that the reliability of experts is high (Diamond et al, 2014). In this study, the coefficient for expert judgment basis was 0.920, the familiarity coefficient was 0.880, and the authority coefficient was 0.900.

Coordination Degree of Expert Opinions

The degree of coordination, or dispersion, of expert opinions is indicated by the CV. A lower CV value signifies less divergence in experts' evaluations of an indicator, denoting a higher degree of coordination among experts. In this study's first round, the CV values for experts' importance assignments to the indicators ranged from 0.05 to 0.37. In the second round, the CV values ranged from 0.00 to 0.16. All indicators in the second round had CV values <0.25, suggesting a high level of coordination in expert opinions and lending credibility to the evaluation results.

Competency Evaluation Indicator System for Specialist Nurses in Liver Transplantation

Following two rounds of Delphi expert consultations in this study, the research team made several modifications based on indicator selection criteria and expert feedback. After the first round, 5 indicators were removed, 5 were merged, 3 were added, and 8 were revised. Following the second round, the team modified 4 additional indicators. In this round, the CV for all indicators was <0.25, and the average importance assignment for each indicator was >3.5, aligning with the standards for the indicators. After deliberations and incorporating expert opinions, textual adjustments were made to the corresponding indicators. Consequently, a competency evaluation indicator system for liver transplant specialist nurses was finalized, including 6 primary indicators, 17 secondary indicators, and 59 tertiary indicators. The AHP was employed to determine the weight values for each indicator, creating judgment matrices based on the average importance assignments from the second round of expert consultation, followed by a consistency check. The maximum eigenvalue (λ_{max}), Consistency Index (CI), and Consistency Ratio (CR) were calculated. The CR <0.1 was considered a reasonable weight distribution (Nie and Wang, 2024). The present study found that the weight values for the primary indicators of specialist knowledge, specialist skills, social role, self-concept, personality traits, and motivation were 0.3006, 0.2240, 0.1683, 0.1346, 0.0730, and 0.0995, respectively. Specialist knowledge had the highest weight, followed by specialist skills. Among the secondary indicators, specialist nursing skills had the highest weight (0.1680), and within the tertiary indicators, routine care during the liver transplant perioperative period had the highest weight (0.0916). The CR values for all judgment matrices were <0.1, meeting the consistency test requirements and indicating a reasonable distribution of weights among the indicators (Table 2).

Table 2. Competency evaluation system and weight values for liver transplantation specialist nurses.

Indicator	Importance Mean Score ($\bar{x} \pm s$)	Coefficient of Variation	Intra-Layer Weight	Composite Weight
1. Specialized Knowledge	4.93 ± 0.25	0.05	0.3006	0.3006
1.1 Medical Specialty Knowledge	4.80 ± 0.41	0.08	0.2975	0.0894
1.1.1 Knowledge of Liver Anatomy, Physiology, and Pathology	4.73 ± 0.59	0.12	0.1733	0.0155
1.1.2 Liver Transplantation Knowledge, e.g., Surgical Methods, Immune Rejection Symptoms and Management	4.86 ± 0.35	0.07	0.2699	0.0241
1.1.3 Pharmacology of Common Liver Transplant Drugs, e.g., Immunosuppressants, Antivirals	4.93 ± 0.25	0.05	0.3554	0.0318
1.1.4 Knowledge of Common Liver Transplant Lab Values and Clinical Significance	4.53 ± 0.64	0.14	0.1151	0.0103
1.1.5 Knowledge Related to Common Diagnostic and Therapeutic Techniques in Liver Transplantation	4.60 ± 0.50	0.11	0.0864	0.0077
1.2 Specialty Nursing Knowledge	4.93 ± 0.25	0.05	0.4575	0.1375
1.2.1 Perioperative Nursing Care in Liver Transplantation	5.00	0.00	0.6667	0.0916
1.2.2 Clinical Manifestations and Nursing Care of Complications Related to Liver Transplantation	4.93 ± 0.25	0.05	0.3333	0.0458
1.3 Critical Care Knowledge	4.73 ± 0.45	0.09	0.1850	0.0556
1.3.1 Hemodynamic Monitoring Knowledge	4.73 ± 0.59	0.12	0.1212	0.0067
1.3.2 Neurological System Monitoring Knowledge	4.60 ± 0.53	0.13	0.0742	0.0041
1.3.3 Respiratory System Monitoring Knowledge	4.93 ± 0.25	0.05	0.2551	0.0141
1.3.4 Renal Function Monitoring Knowledge	4.80 ± 0.25	0.05	0.1732	0.0096
1.3.5 Digestive System Monitoring Knowledge	4.93 ± 0.25	0.05	0.2551	0.0141
1.3.6 Endocrine and Glucose Metabolism Monitoring Knowledge	4.73 ± 0.59	0.12	0.1212	0.0067
1.4 Professional-Related Knowledge	4.53 ± 0.64	0.14	0.1050	0.0315
1.4.1 Knowledge of Hospital Infection Prevention and Control	4.80 ± 0.41	0.08	0.3639	0.0114
1.4.2 Ethics in Organ Transplantation	4.53 ± 0.51	0.11	0.1083	0.0034
1.4.3 Legal Knowledge Related to Organ Transplantation	4.60 ± 0.50	0.11	0.1819	0.0057
1.4.4 Nursing Psychology Knowledge	4.73 ± 0.59	0.12	0.2375	0.0074
1.4.5 Professional English Knowledge	4.53 ± 0.51	0.11	0.1083	0.0034

Table 2. Continued.

Indicator	Importance Mean Score ($\bar{x} \pm s$)	Coefficient of Variation	Intra-Layer Weight	Composite Weight
2. Specialized Skills	4.89 ± 0.35	0.07	0.2240	0.2240
2.1 Specialized Nursing Skills	5.00	0.00	0.7500	0.1680
2.1.1 Airway Management and Ventilator Monitoring in Liver Transplant Patients	4.73 ± 0.46	0.09	0.1564	0.0262
2.1.2 Pain Assessment and Nursing in Liver Transplant Patients	4.73 ± 0.59	0.12	0.1564	0.0262
2.1.3 Care of Multiple Catheters Post Liver Transplant Surgery	4.93 ± 0.25	0.05	0.2778	0.0466
2.1.4 Fluid Balance Management During the Perioperative Period of Liver Transplantation	4.60 ± 0.50	0.11	0.0918	0.0154
2.1.5 Rapid Recovery Nursing After Liver Transplant Surgery	4.73 ± 0.59	0.12	0.1564	0.0262
2.1.6 Nutritional Assessment and Supportive Nursing for Liver Transplant Patients	4.60 ± 0.50	0.11	0.0918	0.0154
2.1.7 Assisting and Nursing in Artificial Liver Support Therapy	4.53 ± 0.51	0.11	0.0692	0.0116
2.2 Emergency Nursing Skills	4.53 ± 0.74	0.16	0.2500	0.0560
2.2.1 Emergency Nursing for Critical Changes in Liver Transplant Patients, e.g., Upper Gastrointestinal Bleeding, Hepatic Encephalopathy	4.86 ± 0.35	0.07	0.5390	0.0301
2.2.2 General Emergency Nursing Skills, e.g., CPR, Defibrillation	4.73 ± 0.45	0.09	0.2973	0.0166
2.2.3 Use and Maintenance of Emergency Equipment	4.60 ± 0.51	0.11	0.1638	0.0917
3. Social Role	4.80 ± 0.41	0.08	0.1683	0.1683
3.1 Health Education Ability	4.86 ± 0.35	0.07	0.3513	0.0591
3.1.1 Timeliness in Health Education	4.82 ± 0.38	0.16	0.3928	0.0232
3.1.2 Resources and Methods in Health Education	4.73 ± 0.45	0.09	0.2036	0.0120
3.1.3 Health Education Ability for Liver Transplant Patients	4.80 ± 0.41	0.08	0.2803	0.0165
3.1.4 Guidance Ability for Family Members	4.60 ± 0.50	0.11	0.1232	0.0072
3.2 Interpersonal Communication Skills	4.80 ± 0.41	0.08	0.2658	0.0447
3.2.1 Communication Skills	4.93 ± 0.25	0.05	0.4905	0.0219
3.2.2 Cooperation Skills	4.80 ± 0.41	0.08	0.3119	0.0139
3.2.3 Coordination Skills	4.73 ± 0.45	0.09	0.1976	0.0088
3.3 Critical Thinking Ability	4.73 ± 0.45	0.09	0.1893	0.0318
3.3.1 Assessment Ability	4.53 ± 0.51	0.11	0.2167	0.0068

Table 2. Continued.

Indicator	Importance Mean Score ($\bar{x} \pm s$)	Coefficient of Variation	Intra-Layer Weight	Composite Weight
3.3.2 Analytical and Judgment Skills	4.40 ± 0.63	0.14	0.1500	0.0047
3.3.3 Clinical Decision-Making Ability	4.60 ± 0.63	0.13	0.3000	0.0095
3.4 Management Skills	4.46 ± 0.64	0.14	0.1078	0.0181
3.4.1 Quality Management in Liver Transplant Nursing	4.80 ± 0.41	0.08	0.6667	0.0120
3.4.2 Long-Term Follow-Up Management of Liver Transplant Patients	4.60 ± 0.63	0.13	0.3333	0.0060
3.5 Nursing Education Ability	4.53 ± 0.64	0.14	0.0858	0.0144
3.5.1 Teaching Rounds Ability	4.60 ± 0.50	0.11	0.2500	0.0036
3.5.2 Hands-On Teaching Skills	4.80 ± 0.41	0.08	0.5000	0.0072
3.5.3 Theoretical Teaching Ability	4.60 ± 0.63	0.13	0.2500	0.0036
4. Self-Concept	4.73 ± 0.45	0.09	0.1346	0.1346
4.1 Professional Attitude	4.73 ± 0.45	0.08	0.5000	0.0673
4.1.1 Dedication	4.86 ± 0.35	0.07	0.2002	0.0135
4.1.2 Attention to Detail	4.93 ± 0.25	0.05	0.3290	0.0221
4.1.3 Service Consciousness	4.93 ± 0.25	0.05	0.3290	0.0221
4.1.4 Rigorous Work Ethic	4.80 ± 0.41	0.08	0.1418	0.0095
4.2 Value System	4.73 ± 0.45	0.09	0.5000	0.0673
4.2.1 Equality	4.53 ± 0.64	0.14	0.1976	0.0133
4.2.2 Respect for Life	4.73 ± 0.45	0.09	0.4905	0.0330
4.2.3 Caring for Others	4.66 ± 0.48	0.10	0.3199	0.0209
5. Personality Traits	4.60 ± 0.63	0.13	0.0730	0.0730
5.1 Personal Characteristics	4.80 ± 0.45	0.09	0.5000	0.0365
5.1.1 Responsibility	4.80 ± 0.32	0.06	0.5000	0.0182
5.1.2 Integrity	4.80 ± 0.35	0.07	0.5000	0.0182
5.2 Self-Adaptation	4.60 ± 0.50	0.11	0.5000	0.0365
5.2.1 Stress Coping	4.66 ± 0.48	0.10	0.2500	0.0091
5.2.2 Emotional Control	4.86 ± 0.35	0.07	0.5000	0.0182
5.2.3 Self-Motivation	4.66 ± 0.48	0.10	0.2500	0.0091

Table 2. Continued.

Indicator	Importance Mean Score ($\bar{x} \pm s$)	Coefficient of Variation	Intra-Layer Weight	Composite Weight
6. Motivation	4.66 ± 0.48	0.10	0.0995	0.0995
6.1 Self-Directed Learning Ability	4.66 ± 0.48	0.10	0.6667	0.0663
6.1.1 Seeking and Utilizing Learning Resources	4.66 ± 0.48	0.10	0.3333	0.0221
6.1.2 Ability to Self-Learn and Acquire Knowledge and Skills	4.73 ± 0.59	0.12	0.6667	0.0442
6.2 Professional Development Ability	4.60 ± 0.51	0.11	0.3333	0.0331
6.2.1 Research Skills	4.73 ± 0.45	0.09	0.7500	0.0248
6.2.2 Innovation Skills	4.33 ± 0.61	0.14	0.2500	0.0082

Discussion

Analysis of the Scientific and Reliability of Competency Evaluation Indicator System for Liver Transplantation Specialist Nurses

This study, grounded in the competency "Iceberg model", initially developed an evaluation indicator pool (index) for the competency of liver transplantation specialist nurses through literature review and semi-structured interviews. During the Delphi expert consultation phase, to enhance the scientific rigor and representativeness of the indicators, 20 medical and nursing experts from Grade III Class A hospitals in Shanghai, Zhejiang Province, and Jiangsu Province specializing in liver transplantation were invited. The invited experts all have rich experience in liver transplantation treatment and nursing, and can deeply express the competencies required for liver transplantation specialist nurses. In the Delphi expert consultation session, the experts were asked to fill in their opinions on the content of the evaluation index anonymously. The researchers sorted out and summarized the opinions of all the experts, modified the content of the evaluation index, and then solicited the opinions of the experts again. According to the opinions of experts, the evaluation system was finally revised and refined. The questionnaire recovery rate was high, and the expert authority coefficient was also high, indicating that the experts had high enthusiasm and high authority. Additionally, the CVs for the second round of indicators were all <0.25, indicating consistent expert opinions and reliable consultation results. Moreover, this study used the AHP to establish the weights of each indicator. The CR values of the judgment matrices for each level of indicators were all <0.1, meeting the consistency test requirements. This suggests that the judgment matrices were consistent, and the weighting was reasonable. In this study, the analytic hierarchy process is combined with Delphi method, and the subjective judgment of experts is quantified, which makes up the defect of Delphi method that the weight prediction is contradictory with the actual situation due to human subjectivity, and improves the accuracy and effectiveness of the evaluation results (Wei et al, 2022).

Content Analysis of the Competency Evaluation Indicator System for Liver Transplantation Specialist Nurses

Based on the "Iceberg model", this study constructed a competency evaluation indicator system and explored a series of knowledge, skills, social roles, and personal traits essential for liver transplantation specialist nurses. The competency "Iceberg model" is one of the classic competency models (Spencer et al, 1994), which compares competency to an iceberg floating in the water. The iceberg part of knowledge and skills above the water surface belongs to explicit competency. Most parts of the iceberg, including social roles, self-concepts, traits, and motivations, lurk below the surface. These are invisible traits that are key predictors of individual job performance. The evaluation index constructed in this study includes six primary indicators (specialized knowledge, specialized skills, social role, self-concept, personality traits, and motivation), 17 secondary indicators, and 59 tertiary indicators. This comprehensive system encapsulates both explicit and implicit competencies required for liver transplantation specialist nurses.

Specialized Knowledge

Specialized knowledge is fundamental for liver transplantation specialist nurses, underpinning their ability to provide exceptional care (Russell, 2014). This study assigned the highest weight to specialized knowledge, at 0.3006. This category encompasses medical specialized knowledge, nursing specialized knowledge, and monitoring knowledge. Acquiring this knowledge is essential for these nurses to safely and effectively carry out clinical tasks in liver transplantation. As Negreiros et al (2020) suggest, liver transplant nurses need a wide range of knowledge to handle the complex scenarios encountered at various stages of liver transplantation. As primary caregivers for liver transplant patients, who often have limited disease-related knowledge, these nurses should provide information on medication, psychology, self-monitoring of conditions, and infection prevention (Mendes and Galvão, 2008). For example, understanding the administration, side effects, and precautions of immunosuppressants is critical for maintaining the quality of transplanted livers. Liver transplantation specialist nurses use their theoretical knowledge to inform nursing practices, aiding patients and their families in understanding liver transplantation more thoroughly, thus facilitating patient recovery.

Specialized Skills

Specialized skills are professional competencies developed through ongoing learning and training, and are vital for nurses to perform their duties effectively. In this study, the weight assigned to specialized skills was 0.2240, ranking second after specialized knowledge. As key members of the multidisciplinary liver transplantation team, liver transplantation specialist nurses deliver safe and distinctive care at all stages of liver transplantation, particularly focusing on immediate postoperative care. The intensive tasks performed by these nurses during this phase require advanced nursing skills (Negreiros et al, 2020).

Neubeck et al (2016) emphasize that proficient operational abilities are crucial in reducing patient morbidity and mortality. Liver transplantation surgery is intricate, often involving multiple complications and critically ill patients, necessitating not only routine nursing proficiency but also expertise in emergency nursing skills.

Social Role

The social role refers to the identity and associated functions and capabilities that come with a job position. In this study, the social role of liver transplantation specialist nurses encompasses abilities in health education, interpersonal communication, judgmental thinking, management, and teaching. The weight for the social role was 0.1683, with health education ability having the highest weight among its secondary indicators at 0.0591. McAfee (2012) highlights that health education ability is a key competency for liver transplantation specialist nurses. It aids in enhancing postoperative recovery, encouraging patient adherence to treatment, and improving self-care awareness. This ability is also crucial for motivating family members in home care and adapting to new lifestyles. Nurses' involvement in health education is essential throughout the patient journey, from hospital admission to discharge and subsequent home care. As liver transplantation and nursing

care continue to advance, liver transplantation specialist nurses are expected to fulfill multiple roles and possess diverse skills to provide top-tier care to patients.

Self-Concept

Self-concept encompasses an individual's perception of their own existence, including attitudes, emotions, and values, shaped through personal experiences, self-reflection, and workplace feedback. Within the competency "Iceberg model", self-concept is an implicit competency, lying beneath the surface. This study assigned a weight of 0.1346 to self-concept. Experts regard it as a crucial competency for liver transplantation specialized nurses. A strong professional attitude and appropriate values enable these nurses to deliver superior patient care and adeptly manage the complexities and dynamism of clinical nursing with sufficient internal motivation.

Personality Traits

Personality traits are stable behavioral responses shaped by an individual's physiological or psychological characteristics and their work environment. These traits also represent implicit competencies. In this study, the weight for personality traits was 0.0730, covering aspects like responsibility, integrity, stress coping, and emotional control. Responsibility and integrity are vital for liver transplantation specialist nurses. They must proactively fulfill their duties and be accountable to patients, adhering to institutional policies and operational standards, even when unsupervised. The challenging nature of liver transplantation nursing often involves considerable mental stress, necessitating strong self-regulation abilities in nurses. The capacity to manage stress, quickly adjust negative emotions, and maintain a positive, optimistic attitude is essential for effectively serving patients.

Motivation

Motivation, viewed as an implicit competency, is the internal drive necessary for individuals in a job position to satisfy various needs. In this study, motivation was weighted at 0.0995, encompassing self-directed learning ability and professional development capability. With ongoing advancements in liver transplantation, specialist nurses must possess a strong capability for autonomous learning. This includes seeking learning resources, staying abreast of the latest knowledge, and acquiring relevant professional skills to expand their knowledge base. Under professional development capability, secondary indicators are research ability and innovation capacity. In the developmental area of transplant care, more research is needed aimed at improving patient outcomes and reducing resource utilization (Coleman et al, 2015). Liver transplantation specialist nurses can apply findings from research and innovation to clinical practice, thereby enhancing nursing quality and advancing the field of liver transplantation (Mendes et al, 2012). It is essential to continuously promote internal motivations in these nurses, stimulating their external actions and promoting their ongoing development and progress.

Practicality and Feasibility Analysis of the Competency Evaluation Indicator System for Liver Transplantation Specialist Nurses

Nurses, as the most direct and frequent contacts during the treatment of patients, are closely related to the safety of patients. High quality nursing plays an important role in ensuring patient safety and promoting patient recovery (McNatt and Easom, 2000). This necessitates higher competency levels in liver transplantation specialist nurses. The development and cultivation of such nurses are crucial for the growth of the liver transplantation nursing field. Although existing study has devised evaluation systems for the core competencies of these nurses (Lei et al, 2018), it has not specifically concentrated on job competency. In this context, job competency refers to the correct combination and application of knowledge, attitudes and skills required by nurses in specific work to improve the quality of work (González García et al, 2022).

The competency evaluation indicator system developed in this study aligns with the actual job competency requirements in liver transplantation clinical nursing, offering practical value at various levels. From a nursing management perspective, this system can serve as a basis for setting evaluation and training standards, providing objective criteria for the training and assessment of liver transplantation specialized nurses. For the nurses themselves, the system offers a reference to assess their strengths and areas needing improvement, aiding in enhancing their capabilities. From the patient's viewpoint, the establishment of this system can lead to improved nursing quality, consequently aiding patient recovery. Therefore, the indicator system presented in this study demonstrates significant practical utility.

For feasibility, the index system includes explicit and implicit competence of specialist nurses in liver transplantation, and knowledge and skills belong to explicit competence, which can be easily acquired and improved through training. Nursing managers can take the entries corresponding to the specialized knowledge of the indicator system as the basis to set up theoretical knowledge training and assessment contents. In terms of specialized skills, nursing managers can set up corresponding evaluation standards, and conduct training and assessment for specialized nurses in clinical practice. For the implicit competency in the system, such as social role, self-concept, motivation and trait, nursing managers can set corresponding scenarios to explore and evaluate the hidden competency of liver transplant nurses by situational simulation, so as to improve the comprehensive post competency of specialist nurses in liver transplantation.

Conclusion

Through literature review, semi-structured interviews, and two rounds of expert consultations, this study has effectively developed a competency evaluation indicator system for liver transplantation specialized nurse positions. This system comprises six primary indicators, 17 secondary indicators, and 59 tertiary indicators. Utilizing the AHP, the study determines the weight of each indicator, offering a valuable reference for the training of liver transplantation specialist nurses in current contexts. As the project progresses, further data will be collected for the

reliability and validity assessment of the indicator system. Continuous revisions and enhancements will be made to improve the overall evaluation system.

This study has certain limitations. Firstly, the interviewees were exclusively from Shanghai, potentially overlooking diverse perspectives from other provinces and cities, which might result in a skewed outcome. Additionally, the experts consulted were confined to Shanghai City, Zhejiang and Jiangsu Provinces, meaning their opinions may not fully represent the entire range of views across different regions. Furthermore, the developed evaluation indicator system remains theoretical and requires additional research to validate its practical application.

Key Points

- Liver transplantation nursing is a complex and specialized nursing discipline designed to provide optimal care for liver transplant patients to meet the delicate health needs of patients and their families.
- Liver transplantation specialist nurses are core members of the multidisciplinary liver transplant team and their competence is critical to providing safe and effective nursing practices and interventions for patients.
- Based on the competency "Iceberg model", the post competency evaluation indicator system of liver transplantation specialist nurses was constructed through literature review, semi-structured interview, the Delphi method, and the AHP, and the explicit and implicit competency of liver transplantation nurses was defined.
- The competency evaluation system for liver transplantation specialist nurses can clarify acceptable levels of clinical skills and knowledge and allow for the measurement of a nurse's competence, which can be used in practice to highlight strengths and areas for improvement and support ongoing professional development.

Availability of Data and Materials

Data supporting the results reported in the article can be found in the tables included in this paper.

Author Contributions

DG and LM designed the research. DG, BX and YW performed the research. DG, BX and YB collected and analyzed data. DG wrote the article. LM directed the implementation of the entire study and reviewed the article. All authors contributed to important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

All the participants were provided with written and verbal information about the content and gave written informed consent to participate. The experts' re-

sponses were protected throughout the Delphi consultations, and the participants had the right to refuse to answer questions or withdraw from the study whenever they wanted to. This study is a pure investigation study and does not involve patient privacy and rights or ethical issues, nor will it have adverse effects on the research subjects. According to local policy of the National Health Ethical Review of Biomedical Research Involving Humans , no ethical approval is required.

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Conflict of Interest

The authors declare no conflict of interest.

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