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*Article*

# Research on the Identification of High-Potential Nursing Talents for Intelligent elderly Care Based on Multi-Benchmarking Selection and Competitive Analysis

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**Abstract:** The intelligent elderly care model places new demands on the skills of aging caregivers. The identification and development of forward-thinking, high-potential nursing talent is essential for advancing the intelligent elderly care sector. Multi-benchmarking selection and competitive analysis is used to evaluate and identify nursing personnel in the rehabilitation treatment center of a hospital in Hefei City. Using proxy evaluation and democratic evaluation model, three types of benchmarks such as single item benchmark, individual benchmark and group benchmark were identified and selected, and the professional nursing team was constructed based on the evaluation results. Different from the traditional other-directed evaluation, multi-benchmarking selection and competitive analysis is self-directed evaluation, this method is more conducive to the identification of high-potential and digital nursing talents by intelligent elderly service organizations, and facilitates the formation of professional nursing teams with complementary strengths and cross-fertilization, so as to satisfy the diversified and multi-level needs of the elderly for intelligent elderly services.

**Keywords:** intelligent elderly care; high potential; nursing talents; multi-benchmarking selection; competitive analysis

## 1. Introduction

The China Research Center on Aging's report highlights that, as of the end of 2022, the demographic aged 60 and above in China has reached 280 million. Within this group, approximately 44 million elderly individuals are either disabled or semi-disabled, necessitating a range of medical and long-term care services. Furthermore, Ministry of Civil Affairs statistics reveal that, by the close of 2021, there was a demand for 6 million eldercare caregivers. However, the current workforce in this sector numbers only 500,000. Challenges plaguing this field include inadequate service capacity, an aging workforce, gender disparities, and insufficient professionalization.

The intelligent elderly care model utilizes cutting-edge information technology and intelligent devices to enhance the convenience and efficiency of services and support for older adults. This model is crucial for tackling the challenges posed by significant population aging. It necessitates a transformation in the roles, locations, content, methodologies, and priorities of elderly care professionals, thereby elevating the requirements for their skill sets. These professionals must possess a robust foundation in elderly care theory and practical skills, in addition to proficiency in technologies like artificial intelligence, the Internet of Things, and big data, to cater to the demands of intelligent elderly care environments. Consequently, the identification and development of forward-thinking, high-potential nursing talent is essential for advancing the intelligent elderly care sector.

A multitude of talent evaluation methodologies exists, including the Analytic Hierarchy Process, Fuzzy Comprehensive Evaluation, Grey Relational Analysis, Neural Network Method, TOPSIS

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Method, and Bow-Tie Model Network Analysis. While each method emphasizes different aspects, they universally apply evaluator-based value judgments, assigning subjective weights to a consistent set of indicators for assessing candidates. This evaluative strategy, though apt for broad talent identification and addressing deficiencies, exhibits constraints in recognizing and capitalizing on unique strengths or the distinct potential of individuals. It particularly fails to acknowledge unique capabilities, such as exceptional potential or digital proficiency, in fields like nursing, leading to the uniformity and insufficient distinction in identifying high-potential talents. Zhao Xinan et al. (2008) introduced the Competitive Advantage Evaluation Method, focusing on the discernment of object advantages. This approach aims to fully honor the uniqueness of subjects and pinpoint individuals' comparative strengths within a group[1].

Benchmarking management, a process pivotal for enterprises to identify shortcomings, emulate best practices, and foster self-improvement, is essential for securing competitive advantages. Within talent evaluation, Yang Kai et al. (2017) integrated benchmarking management with competitive advantage analysis to introduce a multi-benchmark selection and competitive analysis approach. This method focuses on the hierarchical indicators of the evaluated group, pinpointing individual variance and strengths from the perspective most advantageous to the individual. It establishes proxy and democratic evaluation models to identify three benchmark types: individual, and group benchmarks, thereby expanding the range of selectable benchmarks from previous achievements and underscoring the benefits of self-directed evaluation[2]. In contrast to other-directed evaluations, this multi-benchmark selection method proves more effective in the assessment of high-potential nursing talent.

High-potential nursing talents are crucial for the advancement of intelligent elderly care. While their core values might currently be implicit, timely differentiation and selection are essential for effective talent management. This study aims to evaluate such talents through a multi-benchmarking selection and competitive evaluation approach, using the nursing staff at a rehabilitation center as a case study. By defining the characteristics of high-potential talents in intelligent elderly care and establishing an evaluation index system, the paper seeks to provide methodological support for identifying and nurturing these talents. This, in turn, will facilitate talent development that aligns with the innovative evolution of elderly care services.

## 2. Methods

### *2.1. Definition and Selection of Evaluation Indicators for High-Potential Nursing Talents in Intelligent Elderly Care*

Intelligent elderly care, also known as the Comprehensive Intelligent Elderly Care System, was pioneered by the Life Trust Foundation in the UK. It encompasses a collaborative approach via IoT platforms, integrating efforts from governments, communities, and medical institutions to ensure the elderly can access high-quality life regardless of time or location constraints. This model, attracting significant interest, emphasizes the need for elderly nursing professionals to possess core competencies such as specialized skills, information technology proficiency, interdisciplinary thinking, and humanistic care. The industry demands professional, multifaceted talents adept in modern information technology and geriatric medical care.

The academic discourse extensively explores high potential from diverse perspectives, with consensus on its multifaceted nature. Scholars emphasize its link to individuals' intrinsic motivation and willingness, highlighting the capacity for swift and continuous development. High potential is characterized by consistent high performance and the capability to handle expanding responsibilities[3-4]. The requirements for high-potential individuals vary across roles, influenced significantly by organizational contexts. The identification of high-potential traits is provisional, subject to discovery or obscurity. Such potential is dynamic, adaptable under specific conditions, and necessitates social acknowledgment for recognition. Importantly, it encompasses the potential for growth, evolving with environmental shifts and occupational demands[5].

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This paper posits that high-potential nursing talents in the intelligent elderly care model are characterized by a foundational understanding of elderly services and management, coupled with essential skills in elder care and common disease management. Additionally, these individuals exhibit the capacity to leverage emerging technologies such as IoT, cloud computing, big data, and intelligent hardware to deliver comprehensive, connected, and intelligent elderly care services. They must fulfill existing competency requirements like a strong sense of responsibility, empathy, patience, dedication, clinical and geriatric nursing skills, assessment, intervention, and interpersonal communication. In the context of intelligent elderly care, proficiency in utilizing smart technologies, interdisciplinary learning, and resource sharing is imperative. The evaluation index system proposed for identifying these talents incorporates universal talent assessment indicators, specific criteria reflecting the unique demands and work characteristics of the intelligent elderly care sector, and guidelines for nurturing digital-savvy, high-potential talents. This system is structured around three levels and four dimensions, as shown in Table 1, based on a thorough literature review.

**Table 1.** High-Potential Intelligent Elderly Care Nursing Talent Competence Quality Evaluation Indicator System.

| First-Level Indicator | Second-Level Indicator | Third-Level Indicator | Literature sources |
|---|---|---|---|
| Competence Quality of High-Potential Nursing Talent for Intelligent Elderly Care | Basic Quality($Y_1$) | Sense of Responsibility, Love, Patience($X_{11}$) | Ni Wei, 2019[6]; Bouda et al. 2022[7] |
| | | Clinical Nursing Ability($X_{12}$) | |
| | | Geriatric Nursing Specialty Skills($X_{13}$) | |
| | | Assessment and Intervention Ability($X_{14}$) | |
| | High Potential($Y_2$) | Interdisciplinary Thinking Ability($X_{21}$) | Yan Zhang, 2018[8]; Xu Ruiyang et al, 2020[1]; Hu Xiaomeng, 2022[9] |
| | | Critical Thinking and Research Ability($X_{22}$) | |
| | | Learning and Supplementing New Core Competencies($X_{23}$) | |
| | Digitalization($Y_3$) | Digital Mindset($X_{31}$) | Shiyin Zhou, 2018[10]; Zhou Li, 2022[11] |
| | | Information Technology Application Ability($X_{32}$) | |
| | Influence($Y_4$) | Communication, Interpersonal Skills($X_{41}$) | Xu Ruiyang et al, 2020[1]; Xu Qingyu, 2022[12] |
| | | Educational Guidance Ability($X_{42}$) | |

*2.2. Data Collection and Processing*

This study examines a rehabilitation treatment center in Hefei city, employing field interviews and surveys within the nursing department and selecting a sample of 20 nursing staff. Data encompassing nursing performance, work capacity, and attitude were collected through assessments, peer reviews, and evaluations by department heads or specialty directors. Quantitative metrics such as workload and work efficiency were normalized using Model (1) and transformed into capability scores, as detailed in Table 2.

$$Z_{ik}^{'} = \frac{Z_{ik} - \min Z_k}{\max Z_k - \min Z_k} \quad (2)$$

In this context, $Z_{ik}'$ represents the standardized value of the evaluation $Z_i$ on the (k)th indicator, while $Z_{ik}$ is the actual value of the evaluation $Z_i$ on the (k)th indicator. $minZ_k$ and $maxZ_k$ respectively represent the minimum and maximum values of all evaluation objects on the (k)th indicator. Through standardization, the impact of different dimensions of evaluation indicators can be eliminated, ensuring that the standardized data falls within the range of 0 to 1.

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**Table 2.** Competence Quality Evaluation Indicators of 20 Nursing Staff for Intelligent Elderly Care and Their Original Data.

| Third-Level Indicator | 1# | 2# | 3# | 4# | 5# | 6# | 7# | 8# | 9# | 10# | … | 19# | 20# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $X_{11}$ | 0.85 | 0.81 | 0.8 | 0.94 | 0.89 | 0.72 | 0.85 | 0.93 | 0.86 | 0.85 | … | 0.88 | 0.85 |
| $X_{12}$ | 0.79 | 0.75 | 0.73 | 0.88 | 0.84 | 0.83 | 0.88 | 0.76 | 0.83 | 0.79 | … | 0.97 | 0.95 |
| $X_{13}$ | 0.83 | 0.73 | 0.86 | 0.84 | 0.93 | 0.66 | 0.97 | 0.81 | 0.88 | 0.83 | … | 0.95 | 0.85 |
| $X_{14}$ | 0.84 | 0.88 | 0.79 | 0.87 | 0.86 | 0.71 | 0.94 | 0.88 | 0.82 | 0.84 | … | 0.86 | 0.81 |
| $X_{21}$ | 0.83 | 0.93 | 0.76 | 0.96 | 0.81 | 0.76 | 0.9 | 0.93 | 0.81 | 0.83 | … | 0.78 | 0.78 |
| $X_{22}$ | 0.97 | 0.95 | 0.83 | 0.96 | 0.87 | 0.61 | 0.83 | 0.81 | 0.76 | 0.97 | … | 0.71 | 0.82 |
| $X_{23}$ | 0.87 | 0.97 | 0.91 | 0.97 | 0.75 | 0.6 | 0.9 | 0.83 | 0.72 | 0.87 | … | 0.73 | 0.86 |
| $X_{31}$ | 0.85 | 0.96 | 0.82 | 0.95 | 0.95 | 0.58 | 0.92 | 0.83 | 0.82 | 0.85 | … | 0.82 | 0.79 |
| $X_{32}$ | 0.98 | 0.98 | 0.72 | 0.86 | 0.87 | 0.64 | 0.94 | 0.78 | 0.74 | 0.98 | … | 0.61 | 0.79 |
| $X_{41}$ | 0.88 | 0.76 | 0.77 | 0.97 | 0.83 | 0.72 | 0.94 | 0.78 | 0.7 | 0.88 | … | 0.89 | 0.89 |
| $X_{42}$ | 0.93 | 0.85 | 0.78 | 0.86 | 0.6 | 0.65 | 0.87 | 0.77 | 0.84 | 0.93 | … | 0.85 | 0.76 |

## 3. Results and Discussion

### *3.1. Identification of Individual Advantage Characteristics of High-Potential Nursing Talents for Intelligent Elderly Care and Single-Item Benchmark Selection*

#### 3.1.1. Identification of Individual Advantage Characteristics

The individual advantage characteristics of high-potential intelligent elderly care nursing talents represent the specific ways in which individual strengths are manifested. Specifically, it refers to the presence of a particular indicator weight structure for a given evaluation object, which confers an individual advantage. If such an indicator weight structure exists, it is a concrete expression of the individual advantage characteristics of the evaluation object. This paper adopts the ideal point utility model function to identify individual advantage characteristics. Assuming that there are (n) members being evaluated, their evaluation data is represented by an indicator system constituted by an (p)-dimensional vector indicator. The standardized indicator value vector for member (i) is denoted as $x_i = (x_{i1}, x_{i2}, \ldots, x_{ip})^T$, then the common model for evaluating the direction of these (n) members is expressed as a weighted 2-norm to represent the distance function:

$$d^2(x_i, x^*) = \sum_{j=1}^{p} w_j{}^2 (x_j{}^* - x_{ij})^2 \quad (2)$$

In this model, the weighted vector $w_i = (w_{i1}, w_{i2}, \ldots, w_{ip})^T$ represents the value parameter vector, and $x^*$ represents the ideal point selected by the organization. The text adopts an extended ideal point approach, where the actual best value of each indicator is increased by 10% to use 110% of the actual best value as the ideal point. This approach is intended to encourage individuals to strive towards the ideal state. According to Model (2), the smaller the (d) distance, the closer it is to the ideal point, indicating that the evaluation object is better. From the perspective that best facilitates the display of the evaluation object's advantages, the indicator weight coefficients that reflect the value of the evaluation object to the greatest extent are the optimal solution of Model (3).

$$mind_i^2(x_i, x^*) = \sum_{j=1}^{p} w_{ij}^2 (x_j{}^* - x_{ij})^2 \quad (3)$$

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$$s.t.\sum_{j=1}^{p} w_{ij} = 1$$

$$w_{ij} \geq 0, j = 1,2,\cdots,p; i = 1,2,\cdots,n$$

To find the optimal solution for Model (3), which is based on the data of all evaluated individuals, the resulting weights for individual advantage characteristics are objective. To achieve this, we construct a Lagrange function for the solution, which can be represented as follows:

$$\omega_{ij}^{*} = \frac{\lambda^{*}}{[x_i^{*} - x_{ij}]^2}, \quad i = 1,2,\cdots,n \quad j = 1,2,\cdots,m \tag{4}$$

Where:

$$\lambda^{*} = \frac{1}{\sum_{j=1}^{m} \frac{1}{[x_i^{*} - x_{ij}]^2}}$$

By iterating over all members, we can obtain the value parameter vector of advantage characteristics for each member, $w_i = (w_{i1}, w_{i2}, \ldots, w_{ip})^T$, and form a set of value parameters for the advantage characteristics of organizational members, denoted as $\{w_i^{*} \mid i = 1,2,\cdots,n\}$. This set represents the collection of all individual advantage characteristic value parameters across the organization. For example, Table 3 could showcase the value parameters of individual advantage characteristics for tertiary indicators.

**Table 3.** Third-Level Indicator Individual Advantage Characteristic Value Parameters.

| Second-Level Indicator | Third-Level Indicator | Intelligent Elderly Care Nursing Staff | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1# | 2# | 3# | 4# | 5# | 6# | 7# | 8# | 9# | 10# | … | 19# | 20# |
| $Y_1$ | $X_{11}$ | 0.29 | 0.25 | 0.24 | 0.42 | 0.25 | 0.21 | 0.12 | 0.46 | 0.27 | 0.47 | … | 0.15 | 0.18 |
| | $X_{12}$ | 0.19 | 0.17 | 0.16 | 0.22 | 0.17 | 0.42 | 0.15 | 0.11 | 0.21 | 0.22 | … | 0.42 | 0.5 |
| | $X_{13}$ | 0.25 | 0.15 | 0.38 | 0.16 | 0.39 | 0.16 | 0.44 | 0.16 | 0.32 | 0.13 | … | 0.31 | 0.18 |
| | $X_{14}$ | 0.27 | 0.43 | 0.23 | 0.2 | 0.19 | 0.2 | 0.29 | 0.27 | 0.2 | 0.18 | … | 0.12 | 0.13 |
| $Y_2$ | $X_{21}$ | 0.15 | 0.25 | 0.17 | 0.32 | 0.31 | 0.51 | 0.39 | 0.57 | 0.43 | 0.33 | … | 0.41 | 0.24 |
| | $X_{22}$ | 0.64 | 0.32 | 0.27 | 0.32 | 0.49 | 0.25 | 0.22 | 0.2 | 0.31 | 0.39 | … | 0.28 | 0.32 |
| | $X_{23}$ | 0.21 | 0.43 | 0.55 | 0.37 | 0.21 | 0.24 | 0.39 | 0.23 | 0.25 | 0.28 | … | 0.31 | 0.44 |
| $Y_3$ | $X_{31}$ | 0.19 | 0.42 | 0.65 | 0.72 | 0.7 | 0.44 | 0.44 | 0.58 | 0.62 | 0.64 | … | 0.75 | 0.5 |
| | $X_{32}$ | 0.81 | 0.58 | 0.35 | 0.28 | 0.3 | 0.56 | 0.56 | 0.42 | 0.38 | 0.36 | … | 0.25 | 0.5 |
| $Y_4$ | $X_{41}$ | 0.37 | 0.35 | 0.48 | 0.77 | 0.77 | 0.58 | 0.67 | 0.52 | 0.3 | 0.37 | … | 0.59 | 0.72 |
| | $X_{42}$ | 0.63 | 0.65 | 0.52 | 0.23 | 0.23 | 0.42 | 0.33 | 0.48 | 0.7 | 0.63 | … | 0.41 | 0.28 |

If the evaluation system for the subject is hierarchically structured, the valuation of higher-level elements can be derived using the aforementioned model. This process involves the iterative application of the ideal point utility model method to establish the optimal weighting for each layer. For details on the individual advantage characteristic values of the secondary indicators, refer to Table 4.

**Table 4.** Second-Level Indicator Individual Advantage Characteristic Value Parameters.

| Second-Level Indicator | Intelligent Elderly Care Nursing Staff | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1# | 2# | 3# | 4# | 5# | 6# | 7# | 8# | 9# | 10# | … | 19# | 20# |
| $Y_1$ | 0.04 | 0.02 | 0.23 | 0.07 | 0.26 | 0.38 | 0.34 | 0.36 | 0.41 | 0.81 | … | 0.72 | 0.47 |
| $Y_2$ | 0.23 | 0.26 | 0.43 | 0.56 | 0.10 | 0.23 | 0.12 | 0.39 | 0.17 | 0.02 | … | 0.04 | 0.17 |
| $Y_3$ | 0.59 | 0.70 | 0.18 | 0.13 | 0.57 | 0.15 | 0.32 | 0.15 | 0.20 | 0.03 | … | 0.05 | 0.12 |
| $Y_4$ | 0.15 | 0.02 | 0.16 | 0.24 | 0.06 | 0.24 | 0.22 | 0.11 | 0.22 | 0.14 | … | 0.18 | 0.24 |

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3.1.2. Single-Benchmark Selection

According to the multi-benchmark selection and competitive evaluation method designed under the hierarchical structure and in conjunction with the Pareto Principle (80/20 rule), it is agreed that within the individual advantage weight, if the individual advantage weight of the evaluated individual satisfies $0.8 \le w_i \le 1$, then it is considered that the individual has a significant comparative advantage within the group; if the individual advantage weight is the maximum among the indicator values at that level, and satisfies $w_i < 0.8$, then it is considered to have a relative comparative advantage.

Utilizing sample object 1# as an illustrative case amid extensive data, we observe the allocation of weights for secondary indicators in high-potential nursing talents for intelligent elderly care: basic qualities (0.04), high potential (0.23), digitalization (0.59), and influence (0.15), as detailed in Table 4. Digitalization emerges as the predominant strength, signifying a pronounced comparative advantage. Delving into tertiary indicators, information technology application ability within digitalization stands out with a weight of 0.81, showcasing a significant comparative edge. Meanwhile, critical thinking and research ability under high potential, and educational guidance ability within influence indicators, both exhibit weights of 0.64 and 0.63 respectively, indicating relative comparative advantages.

Applying the indicator weights from sample 1# to evaluate the 20-nursing staff will naturally favor sample 1#, illustrating that these weights uniquely represent its distinct advantages. Consequently, adopting the specific indicator weight structures for other samples will similarly highlight their unique strengths.

*3.2. Individual Proxy Evaluation of High-Potential Nursing Talent for Intelligent Elderly Care and Individual Benchmark Selection*

3.2.1. Individual Proxy Evaluation

The individual proxy evaluation based on the ideal point utility model is grounded on the individual advantage characteristic identification model (3). By solving for the individual advantage characteristic vecto $w_i^* = (w_{i1}^*, w_{i2}^*, \cdots, w_{ip}^*)^T$ through equation (4) and then inserting it into equation (5) as the value parameter vector, one can obtain the individual proxy evaluation opinion of one individual towards another, detailed as follows:

$$y_{\omega_i}(x_k, x_i^*) = \sqrt{\sum_{j=1}^{m} \omega_{ij}^{*2} \left| x_j^* - x_{kj}^* \right|^2}, \quad i,k = 1,2,\cdots,n \tag{5}$$

When arranging the evaluation results of an individual towards all individuals in ascending order according to the ascending criterion, the smaller the calculation result, the higher the individual's evaluation of them. To realize the hierarchical structure under individual proxy evaluation results, based on the proxy evaluation results of the h+1 level towards the h level obtained through equation (5), by combining these proxy evaluation results with their corresponding optimal weight vector, one can obtain the proxy evaluation results of the h+1 level towards the h level, detailed as follows:

$$z_{\mu_i}(x_t, x_i^*) = \sqrt{\sum_{t=1}^{k} \mu_{it}^{*2} y_{it}^{\ 2}}, \quad i = 1,2,\cdots,n; t = 1,2,\cdots,k \tag{6}$$

Using models (5) and (6) to evaluate the sample nursing staff, that is, evaluating all participating sample nursing staff based on the individual advantage characteristics of each evaluator, the results are shown in Table 5.

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**Table 5.** Individual Proxy Evaluation Ranking of High-Potential Nursing Talent for Intelligent Elderly Care.

| Sort | *1#* | *2#* | *3#* | *4#* | *5#* | *6#* | *7#* | *8#* | *9#* | *10#* | … | *19#* | *20#* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1st* | 1# | 4# | 4# | 4# | 4# | 4# | 7# | 4# | 4# | 4# | … | 4# | 4# |
| *2nd* | 4# | 7# | 7# | 7# | 7# | 7# | 4# | 7# | 7# | 7# | … | 7# | 7# |
| *3rd* | 7# | 1# | 1# | 1# | 1# | 1# | 1# | 2# | 1# | 1# | … | 1# | 1# |
| *4th* | 2# | 2# | 2# | 2# | 2# | 2# | 2# | 1# | 2# | 2# | … | 2# | 2# |
| *5th* | 5# | 8# | 5# | 5# | 5# | 5# | 5# | 8# | 8# | 8# | … | 5# | 20# |
| *6th* | 20# | 20# | 20# | 20# | 20# | 20# | 20# | 5# | 5# | 10# | … | 20# | 5# |
| *7th* | 11# | 5# | 11# | 11# | 11# | 8# | 11# | 10# | 12# | 5# | … | 19# | 11# |
| *8th* | 8# | 10# | 8# | 8# | 19# | 11# | 8# | 11# | 10# | 20# | … | 12# | 19# |
| *9th* | 10# | 11# | 19# | 19# | 8# | 12# | 19# | 20# | 19# | 12# | … | 10# | 8# |
| *10th* | 17# | 12# | 10# | 10# | 12# | 10# | 15# | 12# | 20# | 11# | … | 8# | 10# |
| *...* | … | … | … | … | … | … | … | … | … | … | … | … | … |
| *19th* | 16# | 16# | 16# | 16# | 16# | 6# | 6# | 6# | 16# | 16# | … | 16# | 16# |
| *20th* | 6# | 6# | 6# | 6# | 6# | 16# | 16# | 16# | 6# | 6# | … | 6# | 6# |

3.2.2. Individual Benchmark Selection

Individual selection or benchmarking involves enabling the evaluated individual to obtain the highest evaluation scores (weight coefficients) under widely recognized evaluation indicators and methodologies. Thus, individual selection utilizes the personalized advantages of the evaluated individuals as value parameters to conduct evaluations and selections among all other evaluated individuals, determining whether they possess distinct advantages. If an evaluated individual outranks others, it suggests that the individual has a comparative advantage; conversely, if the individual is ranked lower, it signals a lack of advantage. Ultimately, by adopting the most favorable perspective of the individual—namely, evaluating others based on the individual's most advantageous value parameters—evaluated individuals are inclined to more readily accept the evaluation results.

From Table 5, it can be observed that the second column ranks the 20 sample nursing staff based on the weight angle most favorable to sample 1#, with 1# ranking first, followed by 4#, 7#, 2#…6#. Similarly, the third column ranks the samples based on the weight angle most favorable to sample 2#, with 4# ranking first, followed by 7#, 1#, 2#...6#; this pattern continues for the remaining samples. According to empirical practices, during the individual proxy evaluation of high-potential nursing talents for intelligent elderly care, those ranked in the top 3 and possessing a frequency of no less than 40% are deemed benchmarks. Should benchmark selection be conducted among 20 sample personnel, the rule mandates that those ranked in the top 3 appear at least 8 times according to frequency. According to the statistics from Table 5, samples 4#, 7#, and 1# are identified as first, second, and third, with frequencies of 20, 20, and 18, respectively, thus fulfilling the requirements for individual benchmark selection.

Following the single benchmark selection for high potential nursing staff, sample 4# is ranked first, having appeared 19 times, and sample 7# is ranked second, having appeared 10 times, thereby fulfilling the individual single benchmark requirements. Sample 1# is ranked third, having appeared only once, which fails to meet the benchmark experience requirements. Similarly, for the digitalization single benchmark selection, sample 2# is ranked first, having appeared 20 times, and sample 7# is ranked second, having appeared 17 times, thereby fulfilling the individual single benchmark requirements. Sample 1# is ranked third, having appeared 4 times, which fails to meet

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the benchmark experience requirements. Selections for other single benchmarks are conducted in a similar manner.

### *3.3. Democratic Proxy Evaluation of High-Potential Nursing Talent for Intelligent Elderly Care and Group Benchmark Identification*

#### 3.3.1. Democratic Proxy Evaluation

Democratic proxy evaluation fairly considers the opinions of each individual within the group, summarizing all evaluation results obtained by each individual to achieve democratization and fairness in evaluation opinions. Therefore, the determination of value parameters for democratic proxy evaluation and the evaluation ranking results are objective. A common practice is to directly synthesize each individual's proxy evaluation opinions, meaning that when evaluating an object, the evaluation opinion is the weighted sum of each individual's proxy opinions.

$$h(x_k)=\frac{1}{n}\sum_{i=1}^{n}y_{\omega_i}(x_k,x_i^*)=\frac{1}{n}\sum_{i=1}^{n}\sqrt{\sum_{j=1}^{m}\omega_{ij}^{*2}\left|x_j^*-x_{kj}^*\right|^2},\ \ i,k=1,2,\cdots,n \tag{7}$$

Through iterating over all evaluated individuals, the results derived from equation (7) are organized in ascending order, with lower values being more desirable. Table 6 displays the results and ranking of the democratic proxy evaluation aimed at identifying high-potential nursing talents for intelligent elderly care.

**Table 6.** Democratic Proxy Evaluation Results of High-Potential Nursing Talent for Intelligent Elderly Care and Ranking.

| | 1# | 2# | 3# | 4# | 5# | 6# | 7# | 8# | 9# | 10# | … | 19# | 20# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1# | 0.94 | 0.95 | 0.91 | 0.92 | 0.92 | 0.89 | 0.9 | 0.9 | 0.89 | 0.85 | … | 0.86 | 0.88 |
| 2# | 0.94 | 0.96 | 0.9 | 0.91 | 0.92 | 0.87 | 0.88 | 0.89 | 0.87 | 0.83 | … | 0.83 | 0.86 |
| 3# | 0.8 | 0.81 | 0.82 | 0.83 | 0.8 | 0.81 | 0.8 | 0.82 | 0.81 | 0.81 | … | 0.8 | 0.81 |
| 4# | 0.94 | 0.94 | 0.94 | 0.95 | 0.92 | 0.93 | 0.92 | 0.93 | 0.92 | 0.91 | … | 0.91 | 0.92 |
| 5# | 0.88 | 0.9 | 0.85 | 0.83 | 0.9 | 0.86 | 0.87 | 0.86 | 0.86 | 0.88 | … | 0.87 | 0.86 |
| 6# | 0.65 | 0.64 | 0.69 | 0.68 | 0.66 | 0.7 | 0.69 | 0.7 | 0.7 | 0.74 | … | 0.73 | 0.71 |
| 7# | 0.92 | 0.92 | 0.91 | 0.9 | 0.93 | 0.92 | 0.92 | 0.91 | 0.92 | 0.93 | … | 0.93 | 0.92 |
| 8# | 0.82 | 0.83 | 0.85 | 0.85 | 0.83 | 0.84 | 0.83 | 0.86 | 0.84 | 0.86 | … | 0.86 | 0.85 |
| 9# | 0.79 | 0.79 | 0.8 | 0.79 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.84 | … | 0.84 | 0.82 |
| 10# | 0.77 | 0.74 | 0.81 | 0.78 | 0.8 | 0.85 | 0.84 | 0.83 | 0.86 | 0.93 | … | 0.92 | 0.87 |
| … | … | … | … | … | … | … | … | … | … | … | … | … | … |
| 19# | 0.79 | 0.77 | 0.81 | 0.79 | 0.82 | 0.85 | 0.85 | 0.83 | 0.86 | 0.92 | … | 0.91 | 0.87 |
| 20# | 0.81 | 0.8 | 0.84 | 0.83 | 0.83 | 0.85 | 0.84 | 0.85 | 0.85 | 0.89 | … | 0.88 | 0.86 |
| D-Proxy Evaluation | 0.90 | 0.88 | 0.81 | 0.93 | 0.86 | 0.70 | 0.92 | 0.84 | 0.81 | 0.85 | | 0.85 | 0.85 |
| Ranking | 3 | 4 | 16 | 1 | 5 | 20 | 2 | 10 | 15 | 9 | | 8 | 6 |

The democratic evaluation of high-potential nursing talents for intelligent elderly care, utilizing multi-benchmark selection and competitive analysis, not only provides an overall view of the priority ranking of sample personnel, as illustrated in Table 6, but also discloses the evaluation results and their rankings for each sample personnel across every indicator. For instance, this is demonstrated by the secondary indicators, as depicted in Table 7.

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**Table 7.** Second-Level Single Item Indicator Ranking of Democratic Proxy Evaluation.

| Sort | Basic Quality | High Potential | Digitalization | Influence |
|---|---|---|---|---|
| *1st* | 10# | 4# | 2# | 4# |
| *2nd* | 19# | 2# | 7# | 7# |
| *3rd* | 7# | 1# | 5# | 1# |
| *4th* | 4# | 7# | 4# | 11# |
| *5th* | 13# | 8# | 1# | 10# |
| *6th* | 5# | 3# | 8# | 19# |
| *7th* | 20# | 20# | 12# | 12# |
| *8th* | 15# | 15# | 11# | 20# |
| *9th* | 14# | 17# | 20# | 15# |
| *10th* | 12# | 5# | 9# | 2# |
| … | … | … | … | … |

3.3.2. Group Benchmark Identification

The group benchmark, founded on individual selection, is predicated upon advantage weights. Should a benchmark-evaluated individual appear frequently, this suggests that the individual is widely considered outstanding by the group, establishing a solid democratic foundation for the selection to identify the benchmark representing the group. As depicted in Table 6, the evaluation results at this stage merge both individual and group opinions, rendering it more democratic and persuasive, with the priority ranking of the 20 sample nursing staff listed as 4#, 7#, 1#, 2#, 5# ... 6#.

In the democratic proxy evaluation of high-potential nursing talents for intelligent elderly care, the number of benchmarks may be established based on management needs, including identifying the top three ranked evaluated individuals as benchmarks. The same selection rules are applicable to single indicator democratic proxy evaluations. For instance, the top three rankings for the high potential indicator include 4#, 2#, 1#; meanwhile, for the digitalization indicator, the top three comprise 2#, 7#, 5#.

3.3.3. Selection of High-Potential Nursing Talent Team Members and Team Building

Nursing work necessitates both individual skills and team collaboration. To achieve the goal of team formation, cluster analysis is utilized to identify combinations of individuals with similar strengths within the evaluated group. Therefore, following the identification of individual strength characteristics, cluster analysis is employed to identify and group individuals with similar strengths, forming clusters. This process facilitates the identification and utilization of complementary strengths among team members.[13] Thus, through cluster analysis, the group's strength characteristics are refined, providing a solid analytical foundation for team building.

Python programming was employed to conduct clustering analysis on the strength characteristics of 20 nursing personnel samples. The inter-class distance was determined using the sum of squared deviations, and the distance between sample points was computed using the Euclidean squared distance. The corresponding clustering results can be found in Table 8.

**Table 8.** Cluster Results and Centroids of Each Cluster.

| Category | Sample Members | Cluster Centroid |
|---|---|---|
| A | (4#，5#，10#，11#，14#，16#) | (0.572, 0.168, 0.178, 0.082, 0.252, 0.429, 0.319, 0.674, 0.326, 0.737, 0.263) |
| B | (3#，6#，7#，8#，9#，12#，15#，17#，18#，19#，20#) | (0.237, 0.309, 0.317, 0.137, 0.432, 0.22 , 0.348, 0.579, |

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| | | |
|---|---|---|
| | | 0.421, 0.59 , 0.41) |
| C | (1#，2#，13#) | (0.248, 0.125, 0.222, 0.405, 0.077, 0.633, 0.289, 0.238, 0.762, 0.277, 0.723) |

The cluster analysis of the 20 samples yielded three distinct categories. The analysis revealed that Category A demonstrated superior performance in basic quality, Category B was notable for its high potential, and Category C excelled in digitalization. For any given category k (where k=1,2,3) containing r members, the associated weight coefficient for category k is denoted as $w_k^* = \frac{1}{r}\left(\sum_{i=1}^{r}\omega_{i_1}^*\right)\left(\sum_{i=1}^{r}\omega_{i_2}^*\right)\cdots\left(\sum_{i=1}^{r}\omega_{i_m}^*\right)$. This weight coefficient was then applied to evaluate each of the 20 samples.

$$y_{\omega_k^*}\left(x_t, x_k^*\right) = \sqrt{\sum_{j=1}^{m}\omega_k^{*2}\left|x_j^* - x_{ij}\right|^2}, t = 1, 2, \ldots, n \tag{1}$$

Within the formula, a smaller value of $y_{w_k}^*(x_t, x_k^*)$ indicates superior performance. By organizing the outcomes of the 20 samples in ascending order based on this criterion, we ascertain the ranking of the members within the k-th category group. This method is uniformly applied to evaluate and rank the member in the remaining two category groups, with the findings presented in Table 9.

**Table 9.** Cluster Evaluation Ranking.

| Ranking | Category A | Category B | Category C |
|---|---|---|---|
| *1st* | 7# | 4# | 4# |
| *2nd* | 4# | 1# | 7# |
| *3rd* | 10# | 7# | 1# |
| *4th* | 5# | 2# | 11# |
| *5th* | 1# | 5# | 2# |
| *6th* | 19# | 8# | 10# |
| *7th* | 20# | 20# | 20# |
| *8th* | 2# | 11# | 19# |
| *9th* | 8# | 12# | 12# |
| *10th* | 11# | 19# | 5# |
| *…* | … | … | … |
| *19th* | 6# | 16# | 16# |
| *20th* | 16# | 6# | 6# |

In alignment with the principle of complementary advantages, it is feasible to assemble teams that exhibit a balanced mix of capabilities and qualities. Tailoring to the exigencies of managerial tasks, select individuals distinguished by their exceptional skills and attributes from varied categories can be amalgamated to establish exemplary benchmark teams, which excel across all dimensions. For illustration, leveraging the rankings, the individuals placed in the top three positions—identified as 7#, 4#, and 1#—who were mentioned 3, 3, and 2 times respectively, are prime candidates for constituting a leadership team. Furthermore, utilizing these selections as a foundation, it is possible to devise a specialized professional nursing benchmark team. Subsequently, employing the principle of complementary advantages, additional personnel can be organized into respective nursing service teams.

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## 4. Conclusion and Implications

Based on relevant literature, this paper constructs a multi-dimensional evaluation index system including high potential and digitalization according to the competence quality of high-potential talents for intelligent elderly care. Taking the nursing staff of a hospital's rehabilitation treatment center as a representative case, the multi-benchmark selection coupled with competitive analysis is applied to identify high-potential nursing talents for intelligent elderly care. This methodology delineates three categories of benchmarks: single-item, individual, and group, thereby offering a comprehensive evaluative lens. Additionally, through cluster analysis focused on the comparative advantages of benchmark nursing talents, the research fosters the formation of nursing teams characterized by their complementary strengths and interdisciplinary synergy. The case study elucidates that the adoption of multi-benchmark selection and competitive analysis transcends the conventional performance-oriented talent view, ushering in a progressive future-oriented talent view that accentuates individual competencies. This paradigm shift holds profound implications for the augmentation of elderly nursing talent pools and the enhancement of intelligent elderly care service quality.

The advent of the intelligent elderly care model emerges as a pivotal solution to mitigate the challenges posed by an aging population, emphasizing the criticality of identifying and nurturing high-potential nursing talents in intelligent elderly care as a cornerstone in addressing these issues. This novel paradigm necessitates geriatric care professionals to exhibit elevated core competencies, including empathy, specialized skill sets, proficiency in information technology, and interdisciplinary cognitive capabilities. Derived from the implementation of the multi-benchmark selection and competitive analysis methodology, this study advocates for a tripartite approach:

It is imperative to delineate industry or enterprise-specific standards for the professional skills of high-potential talents. A precise understanding of the core competencies essential for nursing staff within the innovative intelligent elderly care service framework is fundamental. This understanding serves as the linchpin for efficacious management strategies encompassing the selection, training, and deployment of high-potential intelligent elderly care nursing talents.

Institutions offering intelligent elderly care services are encouraged to employ scientific methodologies for nursing talent identification. This involves a paradigm shift from conventional other-directed assessment models, which utilize a uniform weighting coefficient, to self-directed assessment models that fully acknowledge individual capabilities and advocate for the democratization of evaluation perspectives. Such a transition facilitates the identification of specialized nursing talents, including those with high potential and digital competencies.

Benchmark management constitutes a strategic mechanism for organizations to secure a competitive edge. By embracing multi-benchmark selection, intelligent elderly care service providers can establish a spectrum of individualized benchmarks. This foundation enables the creation of professional nursing teams characterized by synergistic competencies, thereby catering to the varied and complex intelligent elderly care needs of the aging populace.

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