Types and Characteristics of Self-Management among Rural Pregnant Women Based on Cluster Analysis: Postprint

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Abstract

Background Rural pregnant women exhibit relatively low levels of self-management with notable individual differences, warranting further subgroup classification based on their self-management behavioral characteristics. Objective To analyze the typology and characteristics of rural pregnant women from a self-management perspective, thereby providing evidence for developing targeted management strategies. Methods From January to August 2023, a convenience sample of 470 rural pregnant women was recruited from Suihua and Daqing in Heilongjiang Province, and Changchun in Jilin Province. Participants were surveyed using a general information questionnaire, Pregnant Women's Self-Management Scale, General Self-Efficacy Scale, Intrinsic Motivation Scale, and Pregnancy Health Knowledge Scale. Classification was performed using cluster analysis in SPSS 25.0, and general characteristics were compared across different types. Results The total self-management behavior score of the surveyed rural pregnant women was (70.2$±$16.4). Optimal clustering revealed four distinct types: Type I Low-Cognition Non-Participation (n=119, 25.32%), Type II Guided Cooperation (n=138, 29.36%), Type III Supervised Guidance (n=88, 18.72%), and Type IV Active Participation (n=125, 26.60%). Statistically significant differences were observed among the four types regarding education level, occupation, annual income, gravidity, gestational age, planned pregnancy status, chronic disease history, and pregnancy complications ($P<0.05$). Comparisons of self-management dimension scores revealed significant differences in compliance behavior and fetal monitoring behavior management ($P<0.05$). Conclusion The four self-management types of rural pregnant women identified through cluster analysis exhibit substantial heterogeneity. Targeted interventions may be developed based on these typologies to enhance self-management capabilities and optimize prenatal care services for rural pregnant women.

Full Text

Classification Study of Self-management Types among Pregnant Women in Rural Areas Based on Cluster Analysis

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Abstract

Background: In rural areas, the self-management levels of pregnant women not only remain generally low but also vary significantly among individuals, thereby necessitating a detailed investigation into their behavioral patterns to facilitate their classification into distinct groups.

Objective: This analysis explores the types and characteristics of self-management among pregnant women in rural areas to provide references for devising targeted management strategies.

Methods: From January to August 2023, a convenience sampling method was employed to select 470 rural pregnant women from Suihua City and Daqing City in Heilongjiang Province, and Changchun City in Jilin Province. Surveys were conducted using a general data questionnaire, a self-management scale for pregnant women, a general self-efficacy scale, an internal motivation scale, and a prenatal care knowledge scale. Cluster analysis was performed using SPSS 25.0 to classify the subjects into different types based on their self-management traits and compare their general characteristics.

Results: It was found that the total score for self-management behaviors among the surveyed rural pregnant women stood at (70.2$±$16.4). Four distinct types were identified through optimal clustering: Type I, characterized by low awareness non-participants (25.32%, n=119); Type II, those who engage through guided cooperation (29.36%, n=138); Type III, those under supervised directive (18.72%, n=88); and Type IV, proactive participants (26.60%, n=125). Noteworthy are the significant statistical differences that emerged across such variables as educational backgrounds, occupations, annual incomes, number of pregnan-

cies, gestational weeks, whether pregnancies were planned, histories of chronic diseases, and complications during pregnancy among the four types (P<0.05). Furthermore, the comparison of scores across different self-management dimensions revealed significant statistical differences, with adherence to medical advice scoring the highest and fetal monitoring behavior scoring the lowest (P<0.05).

Conclusion: The four types of self-management among rural pregnant women identified through cluster analysis exhibit significant heterogeneity. Tailored intervention measures can be developed based on these types to further enhance self-management capabilities and optimize prenatal care services.

Key words: Pregnant women; Self-management; Pregnancy management; Rural; Cluster analysis

1. Introduction

With socioeconomic development and increasingly comprehensive national basic public health service policies, maternal and child health levels in China have improved substantially. However, compared with the expanding coverage of prenatal care, the participation rate in standardized prenatal care has risen slowly, with rural areas lagging far behind the average. Problems such as abandoning examinations, reducing examination frequency, and missing inspection items occur frequently. The primary reason for this phenomenon is the neglect of pregnant women's principal role in prenatal care, the underestimation of self-management's important function in prenatal health services, and the failure to fully realize their sense of responsibility.

Since the implementation of China's universal three-child policy, the number of pregnant women has surged. Compared with urban areas, rural regions face constraints in terms of the pregnant population base, geographical span, allocation of maternal health resources, and medical development levels, resulting in a serious imbalance between medical staff and pregnant women [1]. Consequently, personalized prenatal care services are difficult to implement in rural areas, and maternal health needs remain unmet. If rural pregnant women could be classified into different groups according to their self-management levels and then provided with targeted group-matched management models, this would be of great significance for conserving medical and health resources, improving resource utilization efficiency, and alleviating pressure on higher-level medical institutions.

Bandura [2] proposed self-efficacy theory in 1977 to explain the causes of motivation in specific situations. For pregnant women, their self-management behaviors are closely related to their self-efficacy [3-5], and their direct personal experience—namely, knowledge of prenatal care—constitutes the most important factor affecting their self-efficacy. This will directly influence pregnant women's self-management behavioral motivation and ultimately affect their self-

management behaviors [6-7]. Therefore, based on Bandura's self-efficacy theory, this study conducted cluster grouping using rural pregnant women's characteristics in prenatal care knowledge, motivation, and self-efficacy to identify and explore types of self-management behaviors. Through cluster grouping, we can achieve classification based on key elements and interrelationships of prenatal care self-management behaviors among rural women, overcoming the subjectivity of classification based on empirical rules to some extent, and providing empirical evidence for characterizing groups through the segmentation of rural pregnant women based on self-management behavior patterns.

2. Subjects and Methods

2.1 Study Subjects

From January to August 2023, we employed a convenience sampling method to select rural pregnant women from villages under the jurisdiction of Anda City in Suihua City, Heilongjiang Province; Honggang District in Daqing City, Heilongjiang Province; and Erdao District in Changchun City, Jilin Province as survey participants. Recruitment was conducted through outreach clinics and tours by higher-level maternal and child health institutions and during the process of establishing medical records.

Inclusion criteria: (1) Pregnant women; (2) Rural permanent residents with residence time $\geq$ 2 years; (3) Aged 15-49 years; (4) Possessing basic reading and comprehension abilities; (5) Voluntary participation with signed informed consent.

Exclusion criteria: (1) Individuals with intellectual disabilities, mental illness, language barriers, or other conditions preventing cooperation; (2) Those who refused to participate in this survey.

A total of 481 questionnaires were distributed, and 470 valid questionnaires were recovered, yielding an effective response rate of 97.71%.

2.2 Research Instruments

2.2.1 General Information Questionnaire Based on a preliminary literature review, we developed a general information questionnaire for rural pregnant women, consisting of three parts: demographic characteristics, pregnancy characteristics, and clinical disease characteristics.

2.2.2 Pregnant Women's Self-Management Scale The Pregnant Women's Self-Management Scale was developed by Li Jinzhi et al. [8] in 2013 to assess pregnant women's self-management levels. The scale comprises four dimensions: daily life behavior management, fetal monitoring behavior management, adherence to medical advice, and self-protection behavior management. Each item is scored from 1 to 5 points, with total scores ranging from 25 to

125. Higher scores indicate stronger self-management abilities. The Cronbach's α coefficient for this scale is 0.926.

2.2.3 General Self-Efficacy Scale (GSES) The GSES was developed by Schwarzer and translated into Chinese by Wang Caikang [9] in 2001. The scale contains 10 items, with scores from 1 to 4 representing "completely incorrect" to "completely correct." Higher scores indicate better self-efficacy. The Cronbach's α coefficient for this scale is 0.87.

2.2.4 Internal Motivation Scale The Internal Motivation Scale was developed by Van Yperen and Hagedoorn and translated by Lin Lirong [10]. The scale includes three dimensions with 12 items: internal motivation to understand the activity, internal motivation to complete the activity, and internal motivation to enhance experience. Items are scored from 1 ("strongly disagree") to 5 ("strongly agree"), with total scores ranging from 12 to 60. Higher scores indicate stronger internal motivation. The Cronbach's α coefficient for this scale is 0.974.

2.2.5 Prenatal Care Knowledge Scale The Prenatal Care Knowledge Scale was developed by Zhang Kai et al. [11] and covers aspects such as dangerous symptoms during pregnancy, home self-monitoring, and hospitalization preparation. Scores are assigned based on correct answers (1 point for correct, 0 for incorrect). The scale contains 11 positively scored items and 8 reverse-scored items, with a total possible score of 19. The Cronbach's α coefficient for this scale is 0.791.

2.3 Data Collection Method

The researcher provided unified training to two surveyors, requiring them to strictly screen participants according to inclusion criteria before data collection and obtain signed informed consent. Surveyors explained the purpose and significance of the study in detail to participants and guided them in completing the questionnaires. After collection, surveyors immediately checked for missing or unclear responses and supplemented them promptly.

2.4 Statistical Methods

SPSS 25.0 software was used for statistical analysis. Normally distributed measurement data were expressed as ($\bar{x}\pm s$), while non-normally distributed measurement data were expressed as M(P25, P75). Count data were expressed as frequency and percentage for descriptive statistics. Two Step Cluster (TSC) analysis was employed to determine the optimal number of clusters, followed by K-means cluster analysis for classification. The chi-square test was used to compare general characteristics among different types of pregnant women, while one-way ANOVA and non-parametric tests were used to compare self-management scores. $P<0.05$ was considered statistically significant.

3. Results

3.1 Cluster Analysis and Typology of Self-Management among Rural Pregnant Women

Based on Bandura's self-efficacy theory and cluster analysis results, rural pregnant women were divided into four subgroups (Figure 1 [Figure 1: see original paper]).

- **Type I: Low Awareness Non-Participants** (n=119, 25.32%): Rural pregnant women lacking prenatal care knowledge reserves, which prevents the activation of self-management efficacy and consequently fails to generate internal motivation for self-management behavior change.
- **Type II: Guided Cooperation** (n=138, 29.36%): Rural pregnant women who possess certain prenatal care knowledge but have low self-efficacy, preventing them from transforming acquired knowledge into correct subjective assessments and subsequently making appropriate pregnancy-related decisions.
- **Type III: Supervised Directive** (n=88, 18.72%): Rural pregnant women with adequate prenatal care knowledge and good self-management efficacy but lacking internal motivation to participate in their own prenatal care management.
- **Type IV: Proactive Participants** (n=125, 26.60%): Rural pregnant women with good prenatal care knowledge, self-efficacy, and strong internal motivation for self-management behaviors.

No statistically significant differences were found in the total self-management scale scores, daily life behavior management dimension, or self-protection behavior dimension among the four types of rural pregnant women ($P>0.05$). However, statistically significant differences were observed in fetal monitoring behavior management and adherence to medical advice dimensions ($P<0.05$), as shown in Table 1 .

Significant statistical differences were found among the four types of rural pregnant women in terms of education level, employment status, annual income, number of pregnancies, gestational weeks, whether pregnancy was planned, history of chronic diseases, and pregnancy complications ($P<0.05$), as shown in Table 2 .

4. Discussion

4.1 High Heterogeneity Among Self-Management Types in Rural Pregnant Women

As the principal participants in prenatal care, pregnant women are the primary responsible parties for self-management during pregnancy, and their personal factors directly influence final medical decisions. Good self-management capabilities during pregnancy are crucial for maintaining maternal and infant health

[12]. This study shows that rural pregnant women's self-management can be classified into four types with high heterogeneity among them.

Bandura's self-efficacy theory posits that self-efficacy is an individual's subjective assessment of their ability to complete certain tasks, which directly affects behavioral motivation and subsequently influences final behavioral decisions. The formation and change of self-efficacy are influenced by multiple information sources, among which personal direct experience has the greatest impact. Knowledge serves as personal direct experience that forms and transforms the foundation of pregnancy self-management behaviors, can stimulate pregnant women's self-efficacy, and self-efficacy is the internal driving force generating behavioral motivation. Based on Bandura's self-efficacy theory, rural pregnant women were divided into four types: Type I Low Awareness Non-Participants, Type II Guided Cooperation, Type III Supervised Directive, and Type IV Proactive Participants. This demonstrates that self-management capabilities among rural pregnant women still have room for improvement and exhibit group differences. Healthcare professionals can play different roles—educator, collaborator, guide, supervisor, and facilitator—according to different self-management types, address their self-management shortcomings, stabilize their strengths, provide targeted group interventions, enrich prenatal knowledge reserves, improve self-efficacy, fully mobilize rural pregnant women's internal motivation to participate in prenatal care self-management, and thereby enhance overall self-management capabilities.

4.2 Analysis of Self-Management Types and Characteristics of Rural Pregnant Women

4.2.1 Type I: Low Awareness Non-Participants In this study, nearly one-quarter (n=119, 25.32%) of pregnant women belonged to the low awareness non-participant type, with an average self-management score of (69.7$±$17.2). These pregnant women primarily exhibited lack of prenatal care knowledge, low self-efficacy, and absence of internal motivation. This group consisted mainly of rural pregnant women with low education levels (junior high school or below, 55.5%) and low family income (annual income <100,000 yuan, 88.2%). Previous studies have shown that education level and economic status are important influencing factors of pregnant women's self-management capabilities. Lower education and economic levels affect women's access to pregnancy knowledge and the participation rate and utilization degree of prenatal care services, resulting in low self-efficacy and insufficient internal drive [13-15]. For this type of rural pregnant women, healthcare professionals should fully play the role of educator, focusing on imparting prenatal care knowledge and training self-help skills to promote mastery of perinatal care, disease prevention, and emotional counseling, thereby improving their prenatal care literacy and self-efficacy levels, stimulating their self-management behavioral motivation, and subsequently improving their current self-management behaviors.

4.2.2 Type II: Guided Cooperation In this study, 29.36% of pregnant women belonged to the guided cooperation type, with an average self-management score of (70.6$±$14.6). These pregnant women possessed certain prenatal care knowledge but could not transform acquired knowledge into correct subjective assessments. Characteristics of this group included higher education levels (college/associate degree or above, 45.0%), planned pregnancies (78.2%), and absence of pregnancy complications (95.7%). For this type of rural pregnant women, healthcare professionals should fully play the role of guide, focusing on strengthening prenatal care knowledge and consolidating prenatal care operation skills. On one hand, intensive education should address common pregnancy problems and misconceptions, such as "obesity during pregnancy is normal," "no medication should be taken during pregnancy," "sexual activity should be completely avoided during pregnancy," and "ultrasound examinations are harmful to the fetus." On the other hand, self-monitoring skills for prenatal care and identification of danger signs should be reinforced to improve these pregnant women's ability to make correct subjective assessments of their acquired prenatal care knowledge and skills, thereby maximizing their self-management behavioral motivation and improving self-management levels.

4.2.3 Type III: Supervised Directive In this study, 18.72% of pregnant women belonged to the supervised directive type, with an average self-management score of (68.3$±$18.0). These pregnant women had good prenatal care knowledge and self-efficacy but insufficient internal motivation for self-management behaviors, affecting their compliance with standardized prenatal care participation. Characteristics of this group included mainly natural conception (97.7%), having medical insurance (90.9%), absence of pregnancy complications (94.3%), absence of genetic disease history (98.9%), and absence of chronic disease history (98.9%). For this population, healthcare professionals should fully play the roles of supervisor and facilitator, focusing on conducting prenatal care warning education and positive guidance. They should provide positive guidance to rural pregnant women, fully mobilize family members to strengthen external supervision, and conduct in-depth prenatal care warning education about the dangers of gestational hypertension to mothers and infants, the adverse effects of delayed treatment for gestational diabetes, and risk factors for birth defects, to stimulate these pregnant women's internal motivation for self-management behaviors and subsequently promote healthy pregnancy self-management behaviors.

4.2.4 Type IV: Proactive Participants In this study, 26.60% of pregnant women belonged to the proactive participant type, with an average self-management score of (72.9$±$15.3). These pregnant women possessed higher levels of prenatal care knowledge, self-efficacy, and strong internal motivation for self-management behaviors. This group generally had higher education levels (college/associate degree or above, 74.4%), higher income levels (annual in-

come >100,000 yuan, 38.4%), and planned pregnancies (88.0%). For this type of rural pregnant women, healthcare professionals should fully play the role of collaborator, focusing on popularizing prenatal education and maintaining stable self-management levels. They should work closely with rural pregnant women, cooperate and coordinate with each other to jointly improve deficiencies in their self-management behaviors, with the goal of maintaining these pregnant women's good self-management behaviors at a stable level long-term.

This study analyzed the types and characteristics of rural women from the perspective of self-management based on cluster analysis. However, pregnancy self-management behaviors are long-term and dynamic, and pregnant women's self-management behaviors may develop and change across different pregnancy stages. Future research that combines different types of rural pregnant women's self-management behaviors with temporal dimensions and provides dynamic, adapted intervention plans for different groups would have practical significance.

Author Contributions: Chen Junyu was responsible for research conception and design, results analysis and interpretation, and manuscript writing. Han Guangli and Li Chunhong conducted data collection and organization, statistical processing, and figure/table preparation and presentation. Chen Yidi and Yang Nana participated in manuscript revision. Luo Xiaoxi was responsible for research implementation, quality control and review of the article, final version revision, overall responsibility for the research and article, and supervision and management.

Conflict of Interest: The authors declare no conflict of interest.

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Note: Figure translations are in progress. See original paper for figures.