

Impact of Internal Interaction Networks within Family Doctor Teams in Central China on Job Satisfaction (Postprint)

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Abstract

Background: Family doctor contract services represent an important pathway for transforming primary healthcare service delivery models and constitute a key breakthrough for implementing tiered diagnosis and treatment. Strengthening family doctor team construction and thereby enhancing job satisfaction has become an urgent issue requiring attention.

Objective: To investigate the relationship between internal interaction network structural characteristics and job satisfaction at the team level, thereby providing evidence for strengthening family doctor team construction.

Methods: From October 2021 to December 2023, field surveys were conducted on family doctor teams in Qianjiang City (Hubei Province), Changsha County (Hunan Province), and Nanyang City (Henan Province) using convenience sampling and cluster random sampling. Data were collected through the Family Doctor Team Member Basic Information Questionnaire, Family Doctor Team Internal Interaction Network Questionnaire, and Family Doctor Team Job Satisfaction Scale. Hierarchical linear regression analysis was employed to examine the effects of internal interaction network density and network centralization on job satisfaction.

Results: The transformation process of family doctor teams demonstrated distinct network structural characteristics of low density (0.29 ± 0.11) and high centralization (0.88 ± 0.19). The mean $t = 7.091, P < 0.001$; transformation process network density positively affected job satisfaction ($t = 0.228, t = 2.478, P < 0.05$); implementation process network density positively affected job satisfaction ($t = 0.324, t = 2.624, P < 0.01$); and interpersonal process network density positively affected job satisfaction ($t = 3.549, P < 0.001$).

Conclusion: Internal interactions within family doctor teams in Central China present opportunities for optimization. Both internal interaction network density and network centralization exert positive influences on job satisfaction.

Recommendations include improving internal collaboration mechanisms and optimizing centralized network structures within family doctor teams.

Full Text

The Impact of Interaction Network within Family Physician Team on Job Satisfaction in Central China

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Abstract

Background

Family physician-contracted service is an important approach to transforming primary healthcare delivery models and represents a key breakthrough for implementing tiered diagnosis and treatment. Strengthening family physician team construction to improve job satisfaction has become an urgent priority.

Objective

To explore the relationship between network structural characteristics of internal interactions within family physician teams and job satisfaction at the team level, providing evidence for team development.

Methods

From October 2021 to December 2023, we conducted field research on family physician teams in Qianjiang (Hubei), Changsha County (Hunan), and Nanyang (Henan) using convenience sampling and cluster random sampling. Data were collected using the Family Physician Team Members' Basic Information Questionnaire, Family Physician Team Internal Interaction Network Questionnaire, and Family Physician Team Job Satisfaction Scale. Hierarchical linear regression analysis was employed to examine the effects of network density and centralization within family physician teams on job satisfaction.

Results

Family physician teams exhibited distinct network characteristics of low density (0.29 ± 0.11) and high centralization (0.88 ± 0.19) in their transition processes. The average job satisfaction score was 0.576, $t = 7.091$, $P < 0.001$; density of transition processes positively affected job satisfaction ($\beta = 0.228$, $t = 2.478$, $P < 0.05$); density of action processes positively affected job satisfaction ($\beta =$

0.324, $t = 2.624$, $P < 0.01$); and density of interpersonal processes positively affected job satisfaction ($\beta = 0.368$, $t = 3.549$, $P < 0.001$).

Conclusion

Interaction networks within family physician teams in Central China have room for optimization. Both network density and centralization demonstrate positive effects on job satisfaction. Recommendations include improving internal collaboration mechanisms and optimizing centralized network structures.

Keywords

Family practice; Family physician; Team processes; Social network; Job satisfaction

Introduction

As family physician systems advance, high-quality development of contracted services is crucial for promoting tiered diagnosis and treatment, transforming primary healthcare delivery models, improving chronic disease management, and enhancing residents' health literacy. Family physician teams are multidisciplinary collaborative groups providing basic and personalized contracted services to residents. Basic services include essential medical care and public health services, while personalized services address specific health needs such as chronic disease management. Teams primarily comprise family physicians, community nurses, and public health physicians, with family physicians serving as core members. Policy supports the inclusion of specialists, pharmacists, psychotherapists, health managers, and volunteers based on residents' health needs. As the main providers of contracted services, these teams are vital for integrating medical and preventive care for chronic diseases. However, Chinese family physician teams face challenges including insufficient numbers of general practitioners, weak incentives for collaboration, high levels of presenteeism, and prominent burnout, which hinder high-quality development of contracted services. Previous research has focused on staffing and performance management (input and output elements), paying limited attention to team processes. This study applies team process structural theory to analyze internal interaction networks within family physician teams and propose optimization strategies, providing references for team construction and service quality improvement.

Team processes refer to the set of interactive behaviors through which team members convert inputs into outputs via cognition, language, and activities aimed at achieving common goals, representing the core of team operational mechanisms. Marks et al. proposed a temporally based framework comprising transition processes, action processes, and interpersonal processes. Lepine et al. demonstrated through meta-analysis that these three dimensions significantly and positively correlate with team performance, member satisfaction, cohesion, and efficacy. Crawford et al. introduced team process structural theory, which incorporates social network theory and analytical methods to examine network structures of

team processes, providing a more comprehensive explanation of how team processes affect effectiveness. Family physician teams contain multiple interaction relationships, exhibiting multiplex social networks. This study classifies these networks according to the three-dimensional framework of transition, action, and interpersonal processes. Transition processes involve goal assessment and planning for contracted services; action processes involve task execution; and interpersonal processes involve informal interactions centered on emotional exchange. Social network structural variables can reveal team interaction patterns and are considered team process variables. Research on internal team networks predominantly examines network density or centralization to explore relationships with team-level outputs, with controlling network size being an established principle in social network research. This study employs network density and centralization to analyze the relationship between network structural characteristics and job satisfaction in family physician teams. Given current human resource shortages, optimizing internal interaction networks can enhance team construction, improve job satisfaction, and ultimately promote contracted service delivery and chronic disease management systems.

Methods

1.1 Data Sources

From October 2021 to December 2023, we conducted field research on family physician teams in Qianjiang (Hubei), Changsha County (Hunan), and Nanyang (Henan) using convenience sampling and cluster random sampling. These regions in Central China represent moderate economic development levels. Inclusion criteria required participants to be active team members engaged in contracted services. With informed consent and following voluntary and confidential principles, trained professionals provided on-site guidance. We invited all members from 172 family physician teams to participate, distributing 786 questionnaires. After initial screening, 13 invalid questionnaires were excluded. Since social network analysis of centralization requires a minimum of 4 team members, an additional 107 questionnaires from teams not meeting this requirement were removed. The final sample included 666 valid questionnaires from 131 teams, yielding an 84.73% valid response rate. This study was approved by the Medical Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (approval number: IORG0003571).

1.2 Survey Methods

We used three instruments: (1) **Family Physician Team Members' Basic Information Questionnaire**: A self-designed form collecting sociodemographic characteristics including gender, age, education, work experience, region, and team size. (2) **Family Physician Team Internal Interaction Network Questionnaire**: Based on Crawford et al.'s team cooperation net-

work questionnaire, we adapted items to the family physician team context and limited scenarios to team work. After expert review, the final instrument contained 6 items (2 per team process dimension). All items used a fill-in-the-blank format where respondents could list unlimited team member names. (3) **Family Physician Team Job Satisfaction Scale**: Developed by Tsui et al., this scale measures satisfaction with job nature, leadership, colleague relationships, compensation, and promotion opportunities. It has been widely applied among family physicians and caregivers. In this study, the scale demonstrated good reliability (Cronbach's $\alpha=0.86$).

1.3 Social Network Analysis Methods

Social network analysis is a method based on sociology and graph theory that investigates social structures by converting attribute data into matrix structures to calculate relational data. This study collected network structural data across three dimensions—transition, action, and interpersonal processes—calculating network density and centralization for each to analyze structural characteristics and their relationship with job satisfaction.

Network density measures the closeness between nodes in a network. For a fixed network size, more connections yield greater density. It is calculated as the ratio of actual connections to maximum possible connections:

$$D = m/[n(n - 1)] \quad \text{式 (1)}$$

where m and n represent the number of actual connections and network nodes, respectively. Density values range from 0 to 1, with values closer to 0 indicating looser connections and values closer to 1 indicating tighter connections.

Network centralization measures the degree of concentration among network nodes. Calculation involves first identifying the maximum centrality value (C_{max}), then computing the sum of differences between C_{max} and each node's centrality (C_i). The centralization index is the ratio of this sum to its theoretical maximum:

$$C = [\sum_{i=1}^n (C_{max} - C_i)] / \max[\sum_{i=1}^n (C_{max} - C_i)] \quad \text{式 (2)}$$

Centralization values also range from 0 to 1, with values closer to 0 indicating lower concentration and values closer to 1 indicating higher concentration.

This study employed binary relationship measurement, coding relationships as present (1) or absent (0). If a respondent listed a team member's name, their relationship was coded as 1; unlisted members were coded as 0. After data collection and cleaning, we constructed separate social network matrices for transition, action, and interpersonal processes to calculate density and centralization.

1.4 Statistical Methods

We used SPSS 26.0 for descriptive analysis of survey data. Normally distributed continuous variables were expressed as $(\bar{x}\pm s)$, and categorical variables as relative frequencies. As this was a team-level study, we used the within-group agreement index (*Rwg*) and intraclass correlation coefficient (*ICC*) to validate aggregation of individual job satisfaction scores to the team level. Hierarchical linear regression analysis was then employed to explore factors influencing job satisfaction, with network density and centralization of transition, action, and interpersonal processes as independent variables, job satisfaction as the dependent variable, and team size as a control variable. Statistical significance was set at $P<0.05$.

Results

2.1 Basic Information

The 131 family physician teams comprised 666 members, including 405 females (60.81%) and 261 males (39.19%). Mean age was 39.5 ± 9.4 years, with average work experience of 17.6 ± 10.0 years. Junior high school or below (9 members, 1.35 ± 0.11) and high centralization (0.88 ± 0.19), indicating loose connection. *Rwg* * mean for job satisfaction was 0.93 (exceeding the 0.70 threshold), within-group * *ICC* * was 0.42 (above the 0.12 cutoff), and between-group * *ICC* * was 0.79 (above the 0.50 cutoff), supporting aggregation to the team level. Mean job satisfaction score was (20.30 ± 2.5) , indicating moderately high satisfaction with room for improvement.

2.2 Analysis of Influencing Factors

To examine how network density and centralization across the three process dimensions affected job satisfaction, we first constructed Model 1 with team size as the independent variable and job satisfaction as the dependent variable (scored 1=strongly disagree to 5=strongly agree). Results showed team size significantly affected job satisfaction ($\beta=-0.267$, $t=-3.142$, $P<0.001$). Model 2 added network structure variables as independent variables while controlling for team size. The Durbin-Watson value was 1.906 (near 2), indicating independent residuals. All variance inflation factors (VIFs) were below 10, confirming no multicollinearity. Model 2 substantially improved explanation of job satisfaction ($\Delta R^2=0.509$, $P<0.001$). Specifically, centralization of transition processes positively affected job satisfaction ($\beta=0.576$, $t=7.091$, $P<0.001$); density of transition processes positively affected job satisfaction ($\beta=0.228$, $t=2.478$, $P<0.05$); density of action processes positively affected job satisfaction ($\beta=0.324$, $t=2.624$, $P<0.01$); and density of interpersonal processes positively affected job satisfaction ($\beta=0.368$, $t=3.549$, $P<0.001$).

Discussion

3.1 Optimization Space in Interaction Networks Within Central China Family Physician Teams

Interaction networks within Central China family physician teams show room for improvement in both closeness and concentration. Teams exhibited different network characteristics across the three processes. Only transition process centralization was relatively high; transition process density, action process density, and both density and centralization of interpersonal processes could be enhanced. Overall network density was lower than that of rural primary public health staff, possibly because some team members work part-time with diverse professional backgrounds. Most members are employed by primary healthcare institutions, while specialists and assistants work part-time in teams, resulting in weaker relationships. Teams independently expand based on residents' diverse health needs, with roles and tasks defined by professional identity. While this diversity advantages complex service delivery, differing knowledge backgrounds may hinder effective communication. Although network centralization was higher than in primary care teams, it remained below theoretical maximums, suggesting team leaders did not fully leverage their roles. Unequal resource distribution, with family physicians as core members possessing more valued expertise and resources, necessitates stronger leadership. Therefore, optimizing internal interaction networks offers an effective pathway to improve team construction and service delivery.

3.2 Positive Effects of Network Structure Features on Job Satisfaction

Network density within family physician teams positively affects job satisfaction. According to Barnard's systems organization theory, teams can be viewed as collaborative systems where internal relationships are crucial. Strong task interdependence helps members build social capital through emotional support and information diffusion, creating mutual dependence for resource utilization and benefiting members through collaboration. These benefits motivate increased interaction, enhancing familiarity and cooperation while improving knowledge transfer and cross-network effects, ultimately influencing job satisfaction. Transition process centralization also positively affected job satisfaction, contrasting with many studies reporting negative effects. The impact of centralization depends heavily on network context and type. The positive effect may relate to the informal structure of Chinese family physician teams, where members belong to different departments within primary healthcare institutions. High centralization during service execution creates concentrated power structures that strengthen information communication among weakly connected members, facilitate key information flow, reduce redundant work, and improve decision accuracy and team efficiency. In this relatively stable environment, members can focus on tasks while avoiding negative impacts from multiple leadership lines and complex interpersonal relationships, thereby enhancing job satisfaction.

Conclusion

4.1 Improving Internal Collaboration Mechanisms

Given the positive impact of network density on job satisfaction, teams should enhance internal collaboration mechanisms to increase task interdependence and team cohesion. Current performance evaluation systems should incorporate indicators measuring satisfaction with teammates' collaborative abilities to encourage stronger cooperation. Team leaders should recognize and reward collaborative achievements, create positive interaction climates, and foster shared team visions.

4.2 Optimizing Centralized Network Structures

Given the positive effect of action process centralization on job satisfaction, health administrative departments should strengthen top-level design of internal team relationships. Strategic human resource management should optimize asymmetric, power-concentrated structures by formally appointing leaders and implementing supporting policies to solidify their core position. Additionally, organizational frameworks should be refined with clear career development pathways to increase acceptance of asymmetric power structures.

Limitations

This cross-sectional study relied on subjective evaluations from team members, potentially introducing reporting bias. Future longitudinal studies examining internal interaction networks could provide more robust evidence for health human resource management.

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