การวิเคราะห์เครือข่ายคุณภาพชีวิตของผู้สูงอายุ ในชุมชนเกษตรกรรมชนบท: ข้อเสนอเชิงสุขภาพชุมชน

A Network Analysis of Quality of Life Among Older Adults Living in Rural Agricultural Communities: Implications for Community Health

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บทคัดย่อ

ประเทศไทยกำลังเข้าสู่สังคมผู้สูงอายุอย่างรวดเร็ว โดยเฉพาะในพื้นที่ชุมชนเกษตรกรรมชนบทที่ได้รับผลกระทบจากการย้ายถิ่นของแรงงานรุ่นใหม่และการเข้าถึงบริการสุขภาพที่จำกัด การทำความเข้าใจคุณภาพชีวิตของผู้สูงอายุในบริบทดังกล่าวจึงเป็นสิ่งจำเป็นต่อการวางแผนมาตรการสุขภาพชุมชนที่มีประสิทธิภาพ งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์เชิงโครงสร้างของคุณภาพชีวิตผู้สูงอายุ โดยใช้แบบประเมินคุณภาพชีวิตผู้สูงอายุขององค์การอนามัยโลก (WHOQOL-OLD) ฉบับภาษาไทย ซึ่งผ่านการตรวจสอบความตรงเชิงเนื้อหาและมีค่าความเชื่อมั่นเท่ากับ 0.87 กลุ่มตัวอย่างจำนวน 381 คน เป็นผู้สูงอายุที่ยังคงประกอบอาชีพเกษตรกรรมในอำเภอลานสกา จังหวัดนครศรีธรรมราช วิเคราะห์ข้อมูลด้วย Network Analysis วิธี EBICglasso

ผลการวิจัยพบว่าความสัมพันธ์เชิงโครงสร้างที่เด่นชัดที่สุด ได้แก่ ด้านความเป็นอิสระในการตัดสินใจและด้านความสำเร็จและความคาดหวังในชีวิต (partial r = 0.34) ด้านกิจกรรมในอดีต ปัจจุบัน และอนาคต มีค่าความสามารถในการอธิบายความแปรปรวนสูงที่สุด (R^2 = 0.71) ค่าความเป็นศูนย์กลางพบว่า การมีส่วนร่วมทางสังคม (strength = 1.12) และกิจกรรมในอดีต ปัจจุบัน และอนาคต (strength = 1.11) มีอิทธิพลสูงสุดในเครือข่ายคุณภาพชีวิต

ผลการวิจัยแสดงให้เห็นว่า “การมีส่วนร่วมทางสังคม” และ “กิจกรรมในอดีต ปัจจุบัน และอนาคต” ซึ่งสะท้อนความรู้สึกถึงคุณค่าและความพึงพอใจในความสำเร็จที่ผ่านมาและความคาดหวังในอนาคต ควรได้รับการให้ความสำคัญเป็นแนวทางหลักในการพัฒนางานด้านสุขภาพชุมชนเชิงพื้นที่ สำหรับผู้สูงอายุในพื้นที่เกษตรกรรมชนบท

คำสำคัญ: คุณภาพชีวิต, ผู้สูงอายุ, การวิเคราะห์เครือข่าย

Abstract

Thailand is rapidly transitioning into an aging society, with rural agricultural communities experiencing the greatest demographic impact due to youth outmigration and limited access to healthcare services. Understanding the quality of life (QoL) of older adults in these settings is essential for guiding effective community health strategies. This descriptive cross-sectional study examined the structural relationships among QoL domains using the World Health Organization Quality of Life–Older Adults Module (WHOQOL-OLD, Thai

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version, which demonstrated content validity and a reliability coefficient of 0.87). A total of 381 older adults who continued to engage in agricultural work in Lan Saka District, Nakhon Si Thammarat Province, were recruited, and the data were analyzed using network analysis with the EBICglasso method.

Results revealed that the strongest partial correlation occurred between autonomy and past–present–future activities (partial r = 0.34). Past–present–future activities demonstrated the highest predictability (R^2 = 0.71). Centrality analysis showed that social participation (strength = 1.12) and past–present–future activities (strength = 1.11) were the most influential domains within the QoL network.

These findings suggest that "social participation" and "past–present–future activities," which reflect a sense of value and life roles, should be prioritized as key directions in area-based community health initiatives aimed at improving the quality of life of older adults in agricultural communities.

Keywords: Quality of Life, Older Adults, Network Analysis

Introduction

Population aging is accelerating worldwide and is increasingly placing pressure on health and social systems. Thailand officially entered a complete aged society in 2022, with more than 20% of the population aged 60 years and older, and is projected to transition toward a super-aged society, defined as having over 30% of the population aged 60 years and above, between 2033 and 2035.[1], although the impact of this shift is not felt evenly across the country. In practice, rural and agricultural provinces experience the change more intensely. Many younger adults move out for work, leaving behind communities where older adults form a noticeably large share of the population. These older adults often live with socioeconomic constraints, limited access to services, and a high burden of chronic diseases[2]. Understanding their quality of life (QoL) is therefore not only an academic interest but also a practical concern for public health planning.

Lansaka District in Nakhon Si Thammarat is a clear example of this dynamic. It is a rural agricultural area where the effects of demographic aging show up in everyday routines. Because younger workers are scarce, older adults continue to take on agricultural tasks that demand physical effort, while access to health and social services remains relatively limited[3]. In many ways, these circumstances shape how older people work, interact with their families, and participate in the community. This makes Lansaka a particularly relevant setting for examining the different aspects of QoL.

The WHOQOL-OLD framework offers six domains for understanding QoL among older adults: sensory abilities (SAB), autonomy (AUT), past–present–future activities (PPF), social participation (SOP), death and dying (DAD), and intimacy (INT)[4]. Much of the previous research relies on regression-based approaches that treat each domain as an independent predictor. However, emerging evidence suggests that QoL functions more like a network or system in which a change in one area may influence several others[5]. For instance, declining sensory ability may reduce autonomy or limit participation in community activities, which could ultimately affect overall well-being.

Network analysis provides a way to explore these relationships more explicitly. Techniques such as EBICglasso estimate partial correlation networks that reveal how QoL domains are conditionally connected[6]. Identifying which domains are most central can help highlight areas where

community or nursing interventions might have the greatest impact, especially in rural settings.

Despite its potential, existing QoL research on older adults in Thailand has largely relied on regression-based approaches, which provide limited insight into how different QoL domains are structurally interconnected, particularly in rural agricultural contexts. Empirical evidence applying network analysis to examine the structural relationships among WHOQOL-OLD domains in Thai agricultural communities remains limited.[7] Accordingly, this study applies network analysis to examine the structural relationships among WHOQOL-OLD domains in older adults living in rural agricultural areas, with the aim of informing community health and primary care strategies that better support their well-being.

Objectives

1. Examine the network structure of the WHOQOL-OLD domains among older adults living in rural agricultural communities using EBICglasso network analysis.

2. Identify the central and influential QoL domains through centrality and predictability indices to inform community- and primary-care health strategies for older adults in rural agricultural settings.

Framework

This study applied EBICglasso network analysis[8] to the six WHOQOL-OLD domains to examine how QoL components interconnect among older adults. Domains were treated as nodes linked by partial correlations, with centrality and predictability (R^2) used to identify the most influential domains. The findings offer a system-level view of QoL and highlight key targets for improving well-being in rural agricultural communities.

Methodology

A cross-sectional study was conducted, and data were collected between June and July 2025 through face-to-face interviews.

Populations and Sample Size

The sample size was determined using the Taro Yamane formula at a 95% confidence level. Based on an elderly population of 7,611 in Lansaka District[9], a total of 381 older adults were recruited. A multistage sampling method was used. Lansaka District was purposively selected for its high proportion of older adults in agricultural work9. Subdistricts and villages were sampled using stratified random sampling, followed by simple random sampling of households. One eligible older adult from each selected household was invited to participate.

Participants were included if they were aged 60 years or older, and were continuously engaged in agricultural work. Individuals with severe cognitive impairment, terminal illness, or inability to complete the interview were excluded.

Data Analysis

All analyses were performed using R version 4.3.0. Descriptive statistics were used to summarize participant characteristics and WHOQOL-OLD scores.

A Gaussian Graphical Model (GGM) was estimated using the Extended Bayesian Information Criterion graphical LASSO (EBICglasso), which applies L1 regularization to shrink small partial correlations toward zero, producing a sparse and interpretable network10. The tuning parameter (λ) was automatically selected based on the EBIC with a γ value of 0.50, a commonly recommended setting for balancing sensitivity and specificity in psychological and health-related network models[11]. The EBIC penalty term is expressed as:

$$EBIC = -2\log(L) + k\log(n) + 4\gamma k\log(p)$$

where L is the likelihood, k is the number of non-zero parameters, n is the sample size, and p is the number of nodes.

Domains were modeled as nodes, with edges representing partial correlations. The network was visualized using the Fruchterman–Reingold algorithm. Strength centrality (sum of absolute edge weights) identified influential domains. Expected Influence was calculated but mirrored strength as all edges were positive. Predictability (R^2) was estimated via the mgm package to determine the variance explained by neighboring nodes.

Protection of Research Participants' Rights

The study was approved by the Human Research Ethics Committee of Nakhon Si Thammarat Rajabhat University (COA 042/2568; approved 22 May 2025). Participation was voluntary, with written informed consent obtained, and participants could withdraw at any time. All data were treated confidentially and reported only in aggregate form.

Research Tools and Instrument Quality

Research Instruments

A structured questionnaire was used to collect data on sociodemographic characteristics (sex, age, marital status, agricultural occupation, education, income, living arrangement, family size, and family relationship quality) and health-related factors including chronic illness, sleep duration, smoking, alcohol use, and physical activity.

QoL was assessed using the 24-item WHOQOL-OLD, which covers six domains (SAB, AUT, PPF, SOP, DAD, and INT). Items were rated on a 5-point Likert scale, with negatively worded items reverse-coded. Each domain contains four items, yielding scores from 4 to 20, classified as poor (4–9), moderate (10–15), or good (16–20) following the standardized framework for interpreting WHOQOL-OLD results[5].

Instrument Quality

The Thai WHOQOL-OLD demonstrated strong content validity, with IOC values exceeding 0.67. A pilot test with 30 older adults from a non-sampled agricultural village further supported its reliability, yielding an overall Cronbach's alpha of 0.87.

Results

This section details participant characteristics, descriptive statistics, and EBICglasso network analysis to identify influential WHOQOL-OLD domains for community health strategies.

Participant Characteristics

The study included 381 older adults from agricultural households in Lansaka District. Participants were primarily aged 60–69 (57.70%), female (51.40%), married (68.20%), and fruit farmers (57.70%). Socioeconomic status was generally low: 52.50% had primary education or less, and 34.10% earned <3,000 THB/month. Most lived with family (70.90%), 79.00% reported chronic conditions, and 63.51% had low physical activity (<3 days/week).

Descriptive Statistics

Table 1 summarizes WHOQOL-OLD domain scores. PPF (14.60 ± 3.10) and INT (14.00 ± 2.40) showed the highest mean scores, followed by AUT (13.70 ± 3.00), SAB (13.10 ± 2.70), SOP (12.80 ± 3.20), and DAD (12.20 ± 3.90).

Table 1. Descriptive Statistics of WHOQOL-OLD Domains (n = 381)

Domain	Mean	SD	Min	Max	Median	IQR
SAB	13.10	2.70	6.00	19.00	13.20	2.80
AUT	13.70	3.00	7.00	19.60	13.70	2.70
PPF	14.60	3.10	8.00	20.00	14.50	3.00
SOP	12.80	3.20	5.60	18.80	12.80	3.20
DAD	12.20	3.90	4.00	19.20	12.20	4.00
INT	14.00	2.40	6.80	18.60	14.00	2.40

Note. SAB = Sensory Abilities; AUT = Autonomy; PPF = Past–Present–Future Activities; SOP = Social Participation; DAD = Death and Dying; INT = Intimacy; SD = Standard Deviation; IQR = Interquartile Range.

Network Structure of WHOQOL-OLD Domains

EBICglasso analysis revealed a well-connected network (Figure 1) with all positive partial correlations (0.03–0.34). The strongest ties occurred between AUT–PPF (0.34), PPF–SOP (0.31), and SOP–INT (0.31), linking autonomy, activity, social participation, and intimacy. Moderate associations included SOP–DAD (0.28) and SAB–AUT (0.20). Conversely, DAD was less integrated, showing weaker peripheral links (e.g., INT–DAD = 0.07). Overall, activity and social domains formed the network core.

Central and Influential QoL Domains: Predictability and Centrality

To address the second objective, predictability and centrality indices were examined to identify the most influential QoL domains within the network.

Predictability (R^2)

Predictability varied across the six domains (Figure 2). The highest values were observed for PPF (R^2 = 0.71) and SOP (R^2 = 0.70), showing that these domains were strongly influenced by neighboring nodes. AUT (R^2 = 0.60), INT (R^2 = 0.58), and SAB (R^2 = 0.56) demonstrated moderate predictability. DAD had the lowest predictability (R^2 = 0.52), indicating that it was less shaped by other domains and functioned as a more distinct QoL component.

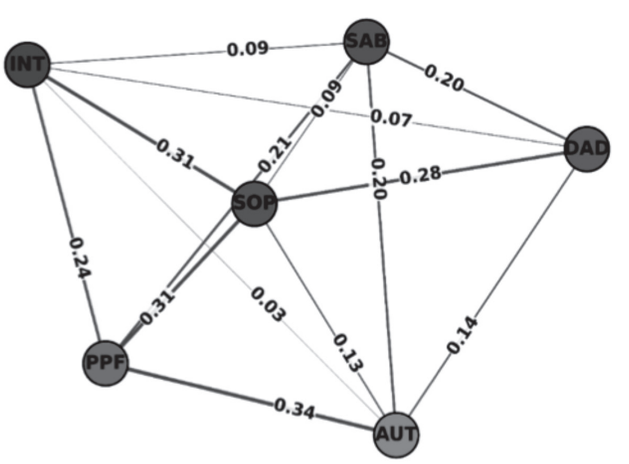

Figure 1. EBICglasso Network Structure

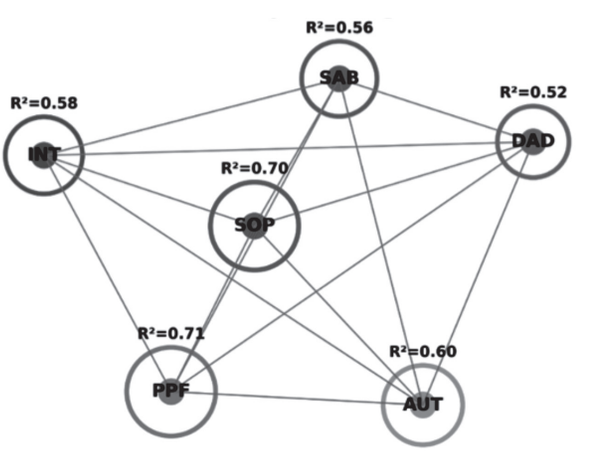

Figure 2. Predictability (R^2) Ring Plot

Centrality Indices

Centrality analysis showed that SOP (1.12) and PPF (1.11) had the highest strength centrality, indicating their strong influence within the QoL network (Figure 3). AUT (0.84) and SAB (0.80) displayed moderate centrality, while INT (0.75) exerted less influence. DAD (0.71) showed the lowest centrality, consistent with its weaker integration in the network. Because all partial correlations were positive, the EI values were identical to strength and were therefore not interpreted separately. For this reason, strength centrality was used as the primary indicator of node importance.

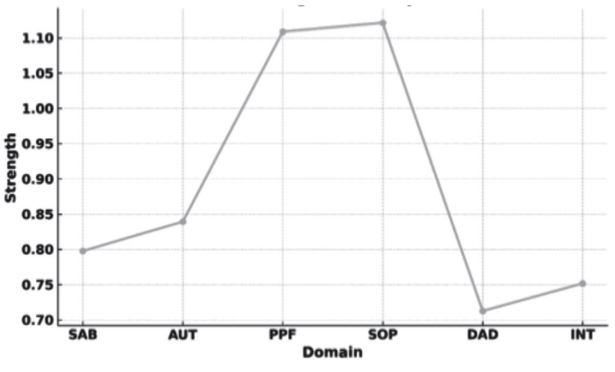

Figure 3. Strength Centrality of the QoL Domains Estimated Using EBICglasso.

Summary and Explanation

Objective 1: Network Structure of WHOQOL-OLD Domains

Using EBICglasso analysis, the study found a positively interconnected QoL network among rural older adults. SOP and PPF emerged as the most influential domains, with the strongest partial correlations, predictability, and strength centrality. Conversely, DAD showed low predictability and centrality, suggesting it operates independently from the overall QoL structure in this population.

Objective 2: Central and Influential QoL Domains

The prominence of SOP and PPF aligns with global findings that social participation and daily activities are primary QoL determinants[12]. Evidence from East Asia (Japan, China, Korea) similarly emphasizes social connectedness and continued role engagement as central to psychological well-being[13,14,15]. Western studies also support the contribution of activity-based engagement, with PPF-related activities mediating both physical and mental health outcomes[16]. Thai studies show comparable patterns, reporting that participation in community groups, religious activities, and agricultural cooperatives enhances QoL and social integration among older adults[17,18]. These contextual and cultural features likely contribute to the strong centrality of SOP found in this study.

The moderate centrality of AUT and SAB corresponds with previous research showing that autonomy and sensory abilities provide foundational functional support that enables participation in daily and community activities[19]. Thai studies likewise describe autonomy as an indirect facilitator of QoL rather than a direct predictor[20]. The peripheral position of DAD contrasts with findings from Western contexts, where attitudes toward mortality exert stronger psychological effects, especially among older adults with chronic illness or limited social support[21]. In rural Thai communities, Buddhist cultural norms, multigenerational family structures, and cohesive social networks may normalize views on aging and end-of-life, contributing to the relative independence of DAD[22,23].

The strong link between SOP and INT highlights the role of interpersonal closeness within broader social participation, particularly in collectivist agricultural communities. Similar patterns have been reported in rural Asian contexts[24]. However, the lower centrality of INT compared with SOP differs from findings in urban or high-income settings, where intimate relationships are stronger predictors of emotional well-being[23]. This distinction may reflect

the extensive social support structures in Thai agricultural communities, where connectedness is maintained through extended families and community relationships rather than relying solely on intimate dyads.

Agricultural Context and Interpretation of Findings

In rural settings, the centrality of SOP and PPF is deeply rooted in agricultural livelihoods. Sustained farming engagement, marked by seasonal routines and occupational identities, fosters purpose and future orientation, thereby strengthening PPF[6,10]. SOP extends beyond leisure, being integrated into daily cooperation through farmer groups, cooperatives, and religious networks[11,14,16,24]. These structures provide both emotional support and practical mutual assistance.AUT and SAB function as moderate enablers, providing the functional basis for independence in farming and community life[4,19]. Conversely, DAD remains peripheral, likely due to the normalization of mortality within communities shaped by natural life cycles, Buddhist values, and robust family support[21,22].

Methodological Considerations

A key strength of this study is the application of EBICglasso network analysis, which reveals conditional relationships not detectable through traditional regression methods. However, the cross-sectional design limits causal interpretation, and the focus on rural agricultural communities may reduce generalizability. Because all network edges were positive, Expected Influence added no value beyond strength centrality. Overall, the findings indicate that social participation and engagement in meaningful daily activities are the primary drivers of QoL among older adults in agricultural communities, while attitudes toward death and dying function more independently. These insights provide useful targets for community health strategies and based network studies to clarify dynamic QoL pathways.

Implications for Community Health

The study findings suggest several strategic directions for rural community health

1. Strengthen Core Domains (SOP & PPF): Interventions should prioritize social connectedness and meaningful engagement through community groups, agricultural cooperatives, religious activities, and intergenerational programs.

2. Support Functional Foundations (AUT & SAB): Promoting independence via mobility aids, home modifications, sensory screening, and self-care training can indirectly boost social and activity participation.

3. Address Psychosocial Needs (DAD): While peripheral, attitudes toward mortality should be supported through culturally sensitive palliative care, family counseling, and programs grounded in Buddhist perspectives to meet spiritual needs.

Overall, these results underscore the need for holistic strategies that integrate social participation, autonomy, and functional capacity with culturally grounded support to enhance the QoL of rural older adults.

Suggestions

Recommendations for Application

1. Local Governments & Administrators: Integrate social participation and meaningful activity programs into existing community platforms for rural older adults.

2. Primary-Care Providers: Prioritize functional support, sensory screening, and family-based care to enable sustained daily and community engagement.

3. Community Organizations: Align implementation with local cultures through collaboration with community leaders, farmer groups, and religious institutions.

Recommendations for Future Research

1. Methodology: Use longitudinal and

mixed-method designs to clarify causal relationships and explore underlying mechanisms qualitatively.

2. Scope: Expand comparative studies across regions and incorporate environmental, social, and health-service variables to broaden contextual understanding.

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