Research Square

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The Impact of Intergenerational Support on Quality of Life in Elderly Patients with Advanced Lung Cancer in China: A Chain Mediation Model of Meaning in Life and Psychological Distress

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Abstract

Background

This study explores the relationship between intergenerational support and quality of life (QoL) among elderly patients with advanced lung cancer, examining the dual perspectives of receiving and providing support. It further investigates the chained mediating effects of meaning in life and psychological distress.

Methods

A cross-sectional study was conducted from June to September 2025. A total of 300 elderly inpatients with advanced lung cancer were recruited from the oncology department of a tertiary hospital in Shanghai. Data were collected through paper-based questionnaires, including general demographic information, Parent-Child Social Support Questionnaire, Functional Assessment of Cancer Therapy–Lung (FACT-L), Meaning in Life Scale for Advanced Cancer Patients (MiLS), and the Distress Thermometer (DT). Descriptive statistics and Pearson correlations were performed using SPSS 27.0, and chained mediation analysis was conducted using Model 6 of PROCESS v5.0.

Results

Significant correlations were identified among received intergenerational support, provided intergenerational support, meaning in life, psychological distress, and QoL (all $P < 0.01$). Both received and provided intergenerational support had significant total effects on QoL ($B = 0.232$, $SE = 0.075$, 95% CI [0.084, 0.380]; $B = 0.430$, $SE = 0.077$, 95% CI [0.279, 0.581], respectively). Meaning in life and psychological distress significantly mediated this pathway.

Conclusions

Intergenerational support influences QoL through a chained mediation pathway involving meaning in life and psychological distress. Specifically, improving intergenerational interactions, fostering meaning in life, and reducing psychological distress collectively enhance QoL among elderly patients with advanced lung cancer.

Introduction

Global population ageing is accelerating [1], leading to a sustained increase in cancer incidence among older adults. Patients aged ≥ 65 years now account for approximately 70% of all cancer cases [2]. This trend is particularly evident in China, where lung cancer ranks first in both incidence and mortality among elderly populations [3, 4]. Most lung cancer diagnoses occur at an advanced stage. Consequently, elderly patients experience not only the heavy burden of disseminated disease but also age-related frailty and multiple comorbidities. This dual burden of illness and ageing greatly increases treatment complexity, caregiving demands, and socioeconomic costs. It also significantly reduces emotional well-being, social functioning, and quality of life (QoL) [5–7]. Given this context, traditional biological endpoints such as survival alone cannot adequately reflect overall patient benefit. Therefore, QoL has emerged as a crucial outcome in oncological care.

Social support is an important protective factor influencing patients' QoL [8]. In the traditional Chinese family-centred culture, intergenerational support from adult children serves as the core pillar of elderly social support [9]. Intergenerational support refers to the mutual exchange of resources between parents and their adult children within the family [10, 9]. This study specifically investigates how receiving and providing intergenerational support affect the QoL among elderly patients. Previous research indicates that high-quality intergenerational interactions not only enhance familial bonds but also significantly improve elderly individuals' psychological well-being and social functioning [11]. When families encounter major life events such as cancer, they become the primary source of support for elderly patients coping with stress. The voluntary and sustained nature of family-based intergenerational support holds important functional significance [12, 13]. Therefore, we propose Hypothesis 1: both receiving and providing intergenerational support have significant positive effects on the QoL among elderly patients with advanced lung cancer.

A sense of meaning in life refers to an individual's subjective perception of and belief in the purpose and value of their own existence. According to Frankl's logotherapy, the search for meaning is a fundamental human motivation [14]. Validated instruments such as the Life Regard Index (LRI) are widely used to assess this construct in cancer patients [15]. A substantial body of research indicates that social support is closely associated with cancer patients' sense of meaning in life [16, 17]. Higher levels of social support facilitate meaning reconstruction [17], while patients with a stronger sense of meaning show greater tolerance to illness [18], reduced anxiety and psychological distress, and improved mental health and QoL [19, 20]. Conversely, a diminished sense of meaning is linked to feelings of worthlessness and uncertainty about the future, thereby impairing overall QoL [21]. Thus, we propose Hypothesis 2: meaning in life mediates the relationship between intergenerational support and QoL.

Psychological distress is an umbrella term covering negative cognitive, behavioral, emotional, social, and/or spiritual experiences, and is common among oncology patients [22]. The Distress Thermometer (DT) is a widely validated rapid-screening tool implemented across various cancer populations [23, 24]. Empirical studies show that intergenerational support is negatively associated with distress in older adults [25]. Higher levels of such support provide coping resources and emotional buffering, enabling patients to manage challenges with a more positive mindset, thus reducing distress [26]. Reduced distress subsequently improves treatment adherence, emotional stability, and psychological resilience, and reduces the incidence of depression and adverse health outcomes [27, 28]. Conversely, severe distress compromises treatment efficacy, intensifies depressive symptoms, and reduces QoL. Therefore, we propose

Hypothesis 3: psychological distress mediates the relationship between intergenerational support and QoL. Additionally, we propose Hypothesis 4: meaning in life and psychological distress jointly mediate the relationship between intergenerational support and QoL through a chained mediation mechanism.

Theoretical Framework and Research Hypotheses

Theoretical Framework

This study integrates intergenerational solidarity theory, self-determination theory, and meaning-in-life theory to build a comprehensive framework. This framework explains how intergenerational support affects QoL in older adults with advanced lung cancer.

Intergenerational solidarity theory outlines the multidimensional nature of parent-child relationships across social, emotional, functional, and attitudinal domains [29]. It asserts that the quality of intergenerational interactions directly influences the physical and psychological well-being of family members. For older adults with advanced lung cancer, the bidirectional exchange of emotional comfort and instrumental assistance between patients and their children constitutes a critical social resource, enhancing their QoL.

Self-determination theory emphasizes the regulatory role of autonomy in motivating behavior [30]. When the fundamental psychological needs for autonomy, competence, and relatedness are met, individuals experience intrinsic motivation and enhanced well-being. This theory primarily explains how social resources translate into internal psychological energy. In this study, receiving emotional or financial assistance and providing emotional or instrumental support to offspring may fulfill patients' basic psychological needs, thereby fostering psychological empowerment.

Frankl's theory of meaning in life posits that the pursuit of meaning is a core human motivation [31]. When patients' psychological needs are empowered through intergenerational support during adversity, they are more likely to regain their sense of meaning in life. This reconstructed meaning may help patients buffer stress and alleviate psychological distress more effectively. Consequently, patients achieve more positive psychosomatic adaptation, ultimately improving their QoL.

Based on this theoretical framework, we propose a chained mediation model (Fig. 1). Intergenerational support (both received and provided) fulfills patients' basic psychological needs, enhancing their sense of meaning in life and reducing psychological distress. This process ultimately improves QoL among older adults with advanced lung cancer. This theoretical sequence represents an incremental psychological process described as "empowerment – reconstruction – adaptation."

Given the cross-sectional design, the proposed chained mediation model is a theory-driven exploratory test. The depicted pathways aim to clarify theoretical associations among variables rather than establish strict causal relationships. Although the model suggests plausible directions of influence, future longitudinal or experimental research is required to verify these causal mechanisms.

Research Hypotheses

To address existing gaps, this study examines the effect of intergenerational support on QoL among older adults with advanced lung cancer, as well as the chained mediating roles of meaning in life and psychological distress. We propose the following hypotheses (Fig. 1).

Hypothesis 1

Both received and provided intergenerational support significantly and positively influence QoL.

Hypothesis 2

Meaning in life mediates the relationship between received/provided intergenerational support and QoL.

Hypothesis 3

Psychological distress mediates the relationship between received/provided intergenerational support and QoL.

Hypothesis 4

Meaning in life and psychological distress jointly mediate the relationship between intergenerational support and QoL through a chained mediation pathway.

Research Methods

Participants

Using convenience sampling, we recruited 300 inpatients from the oncology department of a tertiary-level, grade-A hospital in Shanghai. Inclusion criteria: (1) pathologically confirmed stage III–IV lung cancer; (2) aged ≥ 60 years, with at least one living child; (3) aware of their diagnosis; (4) capable of understanding and completing the questionnaire independently or with assistance; and (5) provided written informed consent. Exclusion criteria: (1) severe cognitive impairment or documented psychiatric disorders; (2) concurrent malignancies or severe comorbidities; and (3) family refusal to participate. The study was conducted in the oncology ward of a tertiary-level, grade-A pulmonary hospital. Researchers screened medical records, approached eligible patients, explained the study's purpose and procedures, and obtained written informed consent. The study protocol was approved by the hospital's Institutional Review

Board (K25-661), and all participants volunteered with full knowledge of the study. Following Kendall's guideline that the sample size should be 5–10 times the number of variables, a range of 180 to 360 participants was needed for the 36 variables in this study. Anticipating a 20% attrition rate, we aimed to recruit 216–432 participants. Systematic data collection yielded 322 complete cases. After rigorous quality control (excluding 22 cases with > 20% missing data or failure to meet inclusion criteria), the final analytic sample comprised 300 patients.

Research Instruments

After providing written informed consent, participants anonymously completed uniformly distributed paper questionnaires. These included a self-designed general information questionnaire covering age, gender, marital status, fertility status, educational level, main income source, medical insurance, and pain score. Additional instruments were the Parent-Child Social Support Questionnaire (PCSSQ), Functional Assessment of Cancer Therapy–Lung (FACT-L, version 4.0, Chinese), Meaning in Life Scale for Advanced Cancer Patients (MiLS), and DT. All interviewers received standardized training and used identical scripts. On-site, they explained the purpose of each questionnaire, informed participants about the estimated completion time, obtained written consent, and distributed the forms. Patients completed the questionnaires independently. When necessary, interviewers read items aloud and recorded responses for participants with reading or writing difficulties. Questionnaires were collected immediately upon completion. From 322 distributed questionnaires, 22 were excluded due to missing or invalid responses, resulting in 300 valid questionnaires and an effective response rate of 93.17%.

PCSSQ

We assessed intergenerational supports using the Parent-Child Social Support Questionnaire for Older Adults developed by Wang et al. [10] in elderly patients with advanced lung cancer. This instrument includes two subscales: (a) Social Support Received from Children (26 items) and (b) Social Support Provided to Children (28 items). Each subscale comprises three dimensions: service, financial, and emotional support. Items are scored on a 4-point scale (1 = never, 4 = always), with higher scores indicating greater received or provided support. These scales have been extensively validated among Chinese older adults, including parents of only children and empty-nest elders, demonstrating satisfactory reliability and validity [33, 34]. In the present sample, Cronbach's α was 0.87 for the received-support subscale and 0.92 for the provided-support subscale, indicating strong reliability for evaluating intergenerational support among older adults with advanced lung cancer and their adult children.

Chinese Version of the FACT-L 4.0

The FACT-L 4.0 is a lung-cancer-specific module derived from the Functional Assessment of Cancer Therapy–General (FACT-G) developed by Bonomi et al. [35]. It evaluates five domains: physical well-being, social/family well-being, emotional well-being, functional well-being, and lung-cancer-specific symptoms, comprising 36 items. Each item is rated on a 5-point Likert scale (0 = not at all, 4 = very much), with 18 items reverse-scored. Total scores range from 0 to 168, with higher scores indicating better QoL. The scale was translated and culturally adapted by Wan et al. [36], and has shown satisfactory reliability and validity among Chinese lung-cancer patients [37, 38]. In the present study, Cronbach's α was 0.93, confirming its suitability for assessing QoL among older Chinese adults with advanced lung cancer.

MiLS

We employed the scale developed by Wu et al. [39] at the Palliative Care Unit of Guangxi Medical University. This instrument was specifically designed to reflect China's sociocultural context and traditional views regarding life and death. It consists of six dimensions: will to meaning, existential frustration, life meaning and satisfaction, life control, bearing hardship, and acceptance of death, comprising 28 items. Items are rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). All items are positively scored, with higher scores indicating a stronger sense of meaning in life. The MiLS is currently the only scale designed specifically for advanced cancer patients in China, demonstrating good reliability and validity [40, 39]. In this study, Cronbach's α was 0.86, and test-retest reliability was satisfactory, indicating appropriateness for measuring meaning in life among older adults with advanced lung cancer.

DT

The DT, developed by Dr. Roth and endorsed by the National Comprehensive Cancer Network (NCCN), was used to measure psychological distress [41]. The DT is a single-item visual-analogue scale asking patients to circle the number (0 = no distress, 10 = extreme distress) that best represents the highest level of distress experienced during the preceding week. The instrument has been validated in diverse oncology populations [42–44]. Although the NCCN recommends administering the DT along with a 39-item Problem List (PL) to identify sources of distress, we elected to use the DT alone. Our participants were elderly patients with advanced lung cancer, already experiencing significant somatic and psychological burdens. The study protocol included multiple questionnaires, and several PL items overlapped with other scales. Therefore, after careful deliberation, we omitted the PL to prevent respondent fatigue, preserve data quality, and minimize participant burden.

Statistical Analysis and Results

Data Analytic Strategy

All analyses were conducted using SPSS Statistics 27.0 and PROCESS macro (version 5.0) developed by Hayes (2022). Descriptive statistics were calculated for each variable. Continuous variables are reported as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Pearson correlations were computed to explore bivariate relationships among key variables. To test the integrated theoretical model, specifically the chained mediation involving meaning in life and psychological distress, Model 6 of the PROCESS macro was directly employed. All path coefficients are presented as unstandardized coefficients (B) to enhance clarity and rigor of interpretation [45]. Significance was estimated using non-parametric bootstrapping (5,000

resamples); effects were significant if the 95% confidence interval (CI) did not include zero. All statistical tests were two-tailed, with significance set at $p < 0.05$.

Analytic Results

Common Method Bias Test

As all data were collected through patient self-reports, procedural controls were implemented to minimize potential common method bias. Participants completed questionnaires anonymously and were informed that responses were solely for research purposes. They were encouraged to answer honestly. To prevent mechanical responding, item order was randomized, and reverse-scored items were included in multiple scales. Additionally, Harman's single-factor test was conducted. Without rotation, several factors yielded eigenvalues greater than 1.0, and the first factor accounted for 15.82% of total variance, significantly below the 40% threshold [46]. Thus, findings suggest that substantial common method bias was not present.

Descriptive Statistics

Table 1 summarizes the characteristics of the 300 participants. The sample comprised 218 men (72.7%) and 82 women (27.3%), with a mean age of 69.4 ± 6.4 years. Most participants were married (n = 275, 91.7%); 25 (8.3%) were unmarried, widowed, or divorced. Participants were predominantly from rural areas (n = 169, 56.3%), while 131 (43.7%) resided in urban regions. Regarding living arrangements, 90 (30.0%) lived with their children, 174 (58.0%) lived separately but in the same city, and 36 (12.0%) lived in different cities. Education was generally low, with 141 (47.0%) having completed primary education or less. Only 21 (7.0%) reported a religious affiliation. Basic medical insurance coverage was high (n = 290, 96.7%); commercial insurance and self-payment were uncommon. Participants interacted frequently with their children: 193 (64.3%) daily, 89 (29.7%) weekly, and 18 (6.0%) several times per month. Mean body mass index (BMI) was 23.24 ± 3.48, Karnofsky Performance Status (KPS) was 78.07 ± 11.19, and pain scores were generally low (1.06 ± 1.80). In summary, participants were predominantly older married men from rural areas with frequent intergenerational contact, basic medical insurance coverage, predominantly in stage IIIA or IV cancer, and maintained relatively good functional status.

Table 2 presents the Pearson correlation matrix for the primary variables: received intergenerational support, provided intergenerational support, meaning in life, psychological distress, and QoL. Results indicated a significant positive correlation between received and provided intergenerational support ($r = 0.527$, $p < 0.01$). Received intergenerational support was significantly positively correlated with meaning in life ($r = 0.343$, $p < 0.01$) and QoL ($r = 0.161$, $p < 0.01$), and significantly negatively correlated with psychological distress ($r = -0.158$, $p < 0.01$). Provided intergenerational support was significantly positively correlated with meaning in life ($r = 0.515$, $p < 0.01$) and QoL ($r = 0.373$, $p < 0.01$), and significantly negatively correlated with psychological distress ($r = -0.295$, $p < 0.01$). Meaning in life showed a significant negative correlation with psychological distress ($r = -0.355$, $p < 0.01$) and a significant positive correlation with QoL ($r = 0.403$, $p < 0.01$). Psychological distress was significantly negatively correlated with QoL ($r = -0.524$, $p < 0.01$). Gender positively correlated with both received and provided intergenerational support ($p < 0.05$), whereas age negatively correlated with QoL. Education level was positively correlated with meaning in life and QoL ($p < 0.01$). Pain score and clinical stage were negatively correlated with QoL ($p < 0.01$), while KPS was positively correlated with QoL ($p < 0.01$). Although these were not the primary predictors, they were controlled as covariates in subsequent mediation analyses.

Table 1
Demographic and Clinical Characteristics of Participants (n = 300)

Item	Frequency (%)	Mean ± SD	Range
Gender	218(72.67)	69.43 ± 6.35	60–89
Male	82(27.33)		
Female			
Age			
Marital status			
Married	275(91.67)		
Other (single, widowed, divorced)	25(8.33)		
Number of children			
1 child	138(46.00)		
2 children	90(30.00)		
3 or more children	72(24.00)		
Residence	131(43.67)		
Urban	169(56.33)		
Rural			
Distance from children	90(30.00)	23.24 ± 3.48	12.90–33.20
Live together	174(58.00)	78.07 ± 11.19	40–100
Same city	36(12.00)	1.06 ± 1.80	0–10
Different city	40(13.33)		
Education level	101(33.67)		
Illiterate	83(27.67)		
Elementary school	76(25.33)		
Middle school	21(7.00)		
High school or above	279(93.00)		
Religious belief	290(96.67)		
Yes	2(0.67)		
No	8(2.66)		
Medical insurance status	193(64.33)		
Basic medical insurance (urban/rural)	89(29.67)		
Commercial insurance	18(6.00)		
Self-payment	116(38.67)		
Interaction frequency with children	56(18.67)		
Daily	15(5.00)		
Several times a week (2–6 times)	113(37.66)		
Several times a month (2–6 times)			
Clinical stage			
A			
B			
C			
BMI			
KPS score			
Pain score			

Table 2
Pearson Correlation Analysis Results.

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1.Gender	1.273	0.446	1									
2.Age	69.427	6.353	-0.02	1								
3.Education level	2.707	1.101	-0.170**	-0.104	1							
4.Pain score	1.063	1.803	0.049	-0.053	-0.112	1						
5.Clinical stage	2.417	1.333	0.061	-0.017	-0.046	0.075	1					
6.KPS Score	78.067	11.196	-0.095	-0.107	0.130*	-0.377**	-0.239**	1				
7.Received Intergenerational Support	83.527	10.267	0.124*	0.033	0.035	0.043	-0.051	0.034	1			
8.Provided Intergenerational Support	67.367	10.259	0.117*	-0.039	0.246**	0.000	0.002	0.190**	0.527**	1		
9.Life Meaning	95.517	11.61	-0.06	-0.034	0.286**	0.017	-0.119*	0.221**	0.343**	0.515**	1	
10.Psychological Distress	1.343	1.909	-0.107	0.027	-0.259**	0.478**	-0.01	-0.349**	-0.158**	-0.295**	-0.355**	1
11.QoL	107.983	16.307	0.043	-0.058	0.252**	-0.409**	-0.027	0.479**	0.161**	0.373**	0.403**	-0.524**

Chained Mediating Effects of Meaning in Life and Psychological Distress

Given the significant correlations among the main variables, chained mediation analyses were conducted separately for received and provided intergenerational support. After controlling for gender, age, education, and other covariates, Model 6 of the PROCESS macro was applied. Received and provided support served as independent variables, meaning in life and psychological distress were first and second mediators, respectively, and QoL was the dependent variable. Indirect effects were assessed using 5,000 bootstrap resamples. Results partially supported both chained mediation pathways.

In the model with received intergenerational support (Fig. 2), the direct effect on QoL was not significant (B = 0.06, t = 0.76, p = 0.447). Received support significantly positively predicted meaning in life (B = 0.37, t = 6.26, p < 0.001), but its direct effect on psychological distress was not significant (B = − 0.009, t = − 1.04, p = 0.299). Meaning in life significantly negatively predicted psychological distress (B = − 0.05, t = − 5.83, p < 0.001) and positively predicted QoL (B = 0.35, t = 4.81, p < 0.001). Psychological distress significantly negatively predicted QoL (B = − 1.66, t = − 3.40, p = 0.001).

In the model with provided intergenerational support (Fig. 3), provided support significantly positively predicted QoL (B = 0.22, t = 2.67, p = 0.008) and meaning in life (B = 0.53, t = 9.01, p < 0.001), but its direct effect on psychological distress was not significant. Meaning in life significantly negatively predicted psychological distress (B = − 0.05, t = − 5.19, p < 0.001) and positively predicted QoL (B = 0.29, t = 3.74, p < 0.001). Psychological distress significantly negatively predicted QoL (B = − 1.58, t = − 3.27, p = 0.001).

Table 3
Chained Mediation Analysis for Received Intergenerational Support

Path	Effect	SE	95% CI Lower	95% CI Upper	% of Total Effect
RIS→MIL→QoL	0.130	0.035	0.069	0.204	56.03
RIS→PD→QoL	0.015	0.016	-0.010	0.053	6.47
RIS→MIL→PD→QoL	0.030	0.010	0.012	0.051	12.93
Direct effect	0.057	0.074	-0.090	0.203	24.57
Total indirect effect	0.175	0.038	0.106	0.255	75.43
Total effect	0.232	0.075	0.084	0.380	100

Note: RIS = Received Intergenerational Support, MIL = Meaning in Life, PD = Psychological Distress, QoL = Quality of Life. Percentages are calculated by dividing effect values by the total effect value. Due to rounding, percentages may not total exactly 100%.

Table 3 illustrates the mediating effects of meaning in life and psychological distress between received intergenerational support and QoL. The total indirect effect (effect = 0.175) was significant, accounting for 75.43% of the total effect (0.232). This indirect effect included three pathways: (a) meaning in life alone accounted for 56.03% of the total effect (effect = 0.130, Bootstrap 95% CI [0.069, 0.204]); (b) psychological distress alone accounted for 6.47% of the total effect (effect = 0.015, Bootstrap 95% CI [-0.010, 0.053]), which was not significant; and (c) the chained pathway through meaning in life and psychological distress sequentially accounted for 12.93% of the total effect (effect = 0.030, Bootstrap 95% CI [0.012, 0.051]).

Table 4
Chained Mediation Analysis for Provided Intergenerational Support

Path	Effect	SE	95% CI Lower	95% CI Upper	% of Total Effect
PIS→MIL→QoL	0.150	0.043	0.075	0.242	34.88
PIS→PD→QoL	0.022	0.016	-0.006	0.057	5.12
PIS→MIL→PD→QoL	0.038	0.013	0.014	0.067	8.84
Direct effect	0.220	0.082	0.058	0.382	51.16
Total indirect effect	0.210	0.042	0.136	0.297	48.84
Total effect	0.430	0.077	0.279	0.581	100

Note: PIS = Provided Intergenerational Support, MIL = Meaning in Life, PD = Psychological Distress, QoL = Quality of Life. Percentages are calculated by dividing effect values by the total effect value. Due to rounding, percentages may not total exactly 100%.

Table 4 presents the mediating effects of meaning in life and psychological distress between provided intergenerational support and QoL. The total indirect effect (effect = 0.210) was significant, accounting for 48.84% of the total effect (0.430). This indirect effect comprised three pathways: (a) meaning in life alone accounted for 34.88% of the total effect (effect = 0.150, Bootstrap 95% CI [0.075, 0.242]); (b) psychological distress alone accounted for 5.12% of the total effect (effect = 0.022, Bootstrap 95% CI [-0.006, 0.057]), which was not significant; and (c) the chained pathway through meaning in life and psychological distress sequentially accounted for 8.84% of the total effect (effect = 0.038, Bootstrap 95% CI [0.014, 0.067]). These results indicate that meaning in life and psychological distress jointly mediate the effects of both received and provided intergenerational support on QoL.

Discussion

Grounded in the Chinese cultural context, this study integrates intergenerational solidarity theory, self-determination theory, and meaning-in-life theory to develop a comprehensive conceptual model. This model examines how bidirectional intergenerational support influences the QoL of older adults with advanced lung cancer and clarifies the chained mediating roles of meaning in life and psychological distress. The findings indicate that providing intergenerational support has a direct positive effect on QoL, whereas receiving support influences QoL indirectly through psychological processes. These results suggest that intergenerational support, meaning in life, and psychological distress form a multilevel psychosocial pathway that shapes patients' QoL. Accordingly, in both clinical practice and family care, promoting intergenerational interactions, supporting meaning construction, and reducing psychological distress have important theoretical and practical value for improving QoL in older adults with advanced lung cancer. The discussion is organized as follows.

Relationship between Intergenerational Support and QoL in Older Adults with Advanced Lung Cancer

The results partially support Hypothesis 1. Providing intergenerational support significantly improves QoL, whereas receiving support affects QoL only through indirect pathways. This pattern is consistent with prior studies showing that intergenerational support, including instrumental, emotional, and financial support, serves as a critical social resource that protects physical and psychological health and enhances QoL [47, 9, 11]. Within the Chinese family-oriented culture, which emphasizes collective values, older adults who provide care, financial assistance, or emotional support to their children or grandchildren strengthen emotional bonds and maintain intergenerational solidarity [48, 47]. More importantly, these support-giving behaviors foster feelings of being needed and continued contribution, thereby satisfying core psychological needs and enhancing QoL [49]. Therefore, intergenerational support represents a key determinant of QoL among older adults with advanced lung cancer. Its effects reflect both cultural characteristics and the importance of psychological meaning construction. By contrast, receiving support is largely passive and externally derived. Its benefits must be realized through internal psychological mechanisms, whereas providing support more directly activates intrinsic motivation and personal value.

Chained Mediating Roles of Meaning in Life and Psychological Distress

The findings provide clear support for Hypotheses 2 and 4. First, meaning in life significantly mediated the association between intergenerational support and QoL, with the indirect effect of provided support being especially pronounced. This aligns closely with Frankl's meaning-in-life theory [31], which suggests that older patients facing advanced cancer can strengthen their sense of purpose and self-worth through altruistic acts, thereby enhancing their QoL. Providing intergenerational support positively influenced meaning in life among older adults with advanced lung cancer. This result is consistent with prior research indicating that supporting adult children benefits older adults' mental health [47]. According to self-determination theory, providing support fulfills the psychological needs for autonomy and competence, activates intrinsic motivation and psychological resources, reconstructs meaning in life, and ultimately reduces psychological distress. This finding clarifies how intergenerational support, by satisfying basic psychological needs, promotes psychological well-being and improves QoL.

Hypothesis

, however, was not supported. Psychological distress did not independently mediate the relationship. One plausible explanation is the multifaceted nature of psychological distress in older adults with advanced lung cancer [50]. Previous studies indicate that lung cancer patients experience greater illness stigma compared to patients with other malignancies because the disease is often attributed to personal responsibility [51]. Consequently, psychological distress in this group may arise from multiple sources: illness-related suffering, intense stigma, or shame related to caregiving burdens placed on family members. When patients receive external support, this can paradoxically intensify their feelings of self-perceived burden, shame, and guilt [52]. Thus, simply receiving intergenerational support does not directly alleviate psychological distress. Instead, support must be internalized as a positive cognitive experience,

enhancing the sense of meaning in life. Only when patients derive personal value from intergenerational interactions does this strengthened meaning serve as psychological capital, facilitating effective coping with illness and subsequently reducing distress. Therefore, psychological distress is more accurately viewed as an emotional consequence of enhanced meaning in life, rather than as an independent mediating pathway.

Although psychological distress did not function as an independent mediator, it significantly contributed to the overall chained pathway. The findings thus support Hypothesis 4, demonstrating that intergenerational support influences QoL sequentially through meaning in life and psychological distress. For received support, this chained mediation almost entirely explains its effect. Specifically, adult children's provision of services, emotional care, and financial assistance primarily helps patients feel loved and valued, affirming their self-worth and reconstructing a secure psychological environment, results consistent with prior research [53]. In contrast, provided support influenced QoL via a dual pathway, operating indirectly through the chained mediation sequence and exerting a direct positive effect. This finding confirms that altruistic acts are inherently meaningful, indicating that empowering support is deeper and more impactful than protective support. Thus, older patients directly enhance their mental health and QoL through their active contributions to family members.

In summary, the psychological mechanisms linking intergenerational support to QoL do not operate as simple parallel pathways. Instead, meaning in life and psychological distress form a chained mediation that moves sequentially from cognitive restructuring to emotional regulation. This sequential process clarifies the causal ordering and enriches understanding of psychosocial adaptation among older adults with advanced lung cancer. Moreover, empowering support provided by patients exerts stronger effects than protective support received, more effectively improving their psychological well-being and QoL.

Implications and Limitations of the Present Study

By integrating intergenerational solidarity theory, self-determination theory, and meaning-in-life theory, this study is the first to systematically examine the chained mediation mechanism linking bidirectional intergenerational support to QoL via meaning in life and psychological distress among older Chinese adults with advanced lung cancer. The findings provide empirical evidence for developing family-based psychosocial interventions. Nevertheless, several limitations should be noted. Data were collected from the oncology department of a single tertiary-level pulmonary hospital in Shanghai. Although the sample size was sufficient, participants were relatively homogeneous regarding geographic location, medical resources, and hospital specialization. Thus, generalizability to other medical contexts and regions may be limited. Additionally, the cross-sectional design precludes causal inferences. Although the theoretical model proposes a unidirectional pathway from intergenerational support through psychological mechanisms to QoL, reverse or bidirectional effects remain plausible. Future studies should adopt multicenter longitudinal designs to examine the dynamic interplay between intergenerational support and psychosocial adaptation among older cancer patients from diverse geographic and cultural contexts, thereby establishing causal relationships.

Conclusion

This study clarifies the internal mechanisms through which intergenerational support influences QoL among older adults with advanced lung cancer. Providing intergenerational support directly enhances QoL, while both receiving and providing support indirectly improve QoL through the sequential mediation of meaning in life and psychological distress. Collectively, these findings highlight that intergenerational support, meaning in life, and psychological distress constitute a multilevel psychosocial pathway shaping QoL in older cancer patients. Psychosocial interventions should thus not focus solely on alleviating distress but also proactively cultivate meaning by encouraging older patients to provide support rather than simply receive it, reinforcing their sense of personal value and motivation to cope with illness. Clinical programs should integrate intergenerational supportive interactions with meaning-centered interventions within family-focused, continuous nursing and psychosocial care. Such comprehensive interventions can significantly enhance the overall QoL in older patients with advanced lung cancer.

Declarations

Ethical approval and consent to participate

This manuscript is not under review elsewhere, and the results have not been published previously or accepted for publication. The ethical validity of this trial was reviewed and approved by the Ethics Review Committee of Shanghai Pulmonary Hospital (K25-661). All methods were performed in accordance with relevant guidelines and regulations (including the Declaration of Helsinki). Written informed consent forms were obtained from all subjects prior to their participation in the questionnaire survey.

Consent for publication

Not applicable

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Author Contribution

QYJ: data collection, data analysis, and drafting of the manuscript. JRY: data analysis, supervision. CS: conceptualization, data collection. LLP: conceptualization, data collection. YML: funding acquisition, supervision, and support of this study. All authors read and approved the final manuscript.

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Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures

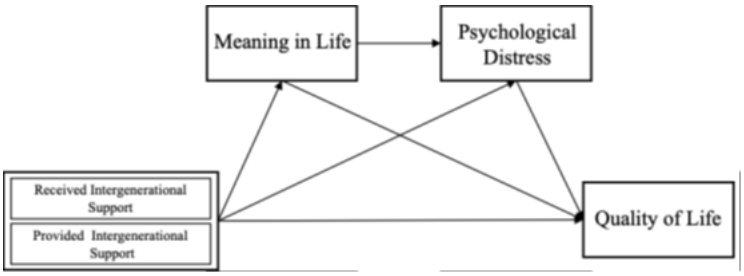


Figure 1

Hypothesized Model of Variable Relationships.

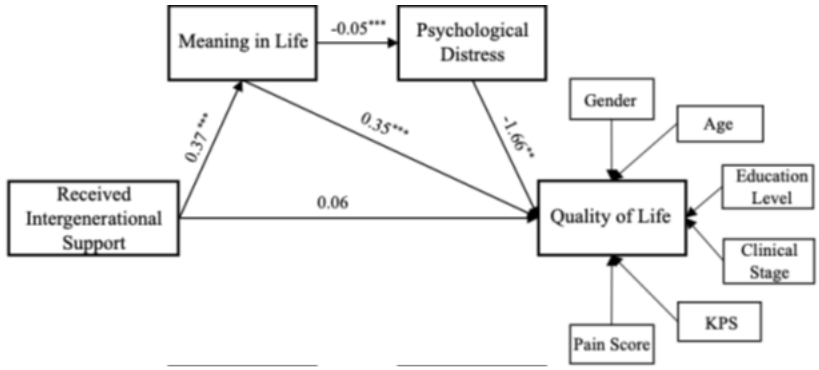


Figure 2

Mediation Model of Received Intergenerational Support, Meaning in Life, Psychological Distress, and QoL. Covariates: Gender, age, education level, clinical stage, KPS, and pain score.

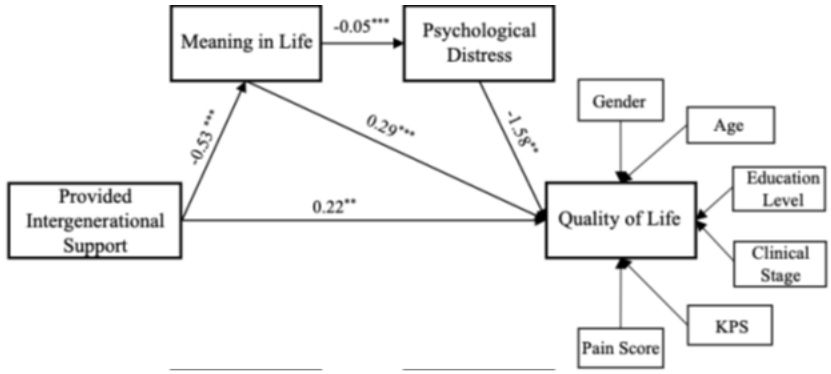


Figure 3

Mediation Model of Provided Intergenerational Support, Meaning in Life, Psychological Distress, and QoL. Covariates: Gender, age, education level, clinical stage, KPS, and pain score.