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Research Article

The Interactive Relationship between the Positive Coping Style and Life Quality of Survivors of Pancreatic Cancer and Their Main Family Caregivers Based on the Dyadic Perspective: An Actor-Partner Interdependence Model

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Objective. To analyze the interaction of positive coping style and quality of life (QoL) between survivors of pancreatic cancer and their family caregivers based on the Conceptual Framework of Caring Experience of Cancer Family and Actor-Partner Interdependence Model (APIM). *Methods*. This study adopted a cross-sectional design that selected 200 pairs of survivors of pancreatic cancer and their family caregivers hospitalized in the First and Second Affiliated Hospitals of Nanjing Medical University from August 2020 to February 2021. Survivors of pancreatic cancer and their family caregivers completed Simple Coping Style Questionnaire and 12-item Short-Form Health Survey, whose results successfully built an APIM model. *Results*. The spousal relationship was the most common type of dyadic relationship. Family caregivers had higher levels of positive coping and QoL than cancer survivors. In terms of actor effects, the positive coping style of both survivors and caregivers significantly affected individual total scores of QoL and personal physical and psychological dimensions of QoL. As for the partner effects, the positive coping style of both survivors and caregivers significantly impacted their partners' total QoL scores and the positive coping style of survivors significantly impacted their caregivers' psychological level of QoL. *Conclusions*. The positive coping style of survivors of pancreatic cancer affects both their own QoL and their partner's QoL. Examining mutual effects between coping styles and QoL among survivors and their informal caregivers is an essential first step in providing comprehensive and cooperative care. The study has been reviewed by the Chinese Clinical Trial Registry, and registration information has been sent to the central database of the World Health Organization International Clinical Trial Registration Platform for global retrieval. This trial is registered with ChiCTR2300074087.

1. Introduction

According to the latest data on cancer incidence, there were 495,773 new cases of pancreatic cancer worldwide in 2020. The number of new cases of pancreatic cancer in Asian populations (233,701) was much higher compared to that in other continents, of which there were 124,994 new cases of pancreatic cancer in China in 2020 [1, 2]. It was estimated that nearly half of overall incidence rates and more than half of cancer deaths worldwide occur in Asia (47.1%), compared to Europe where it accounted for 28.3 percent of total new cancer cases [3]. In 2022, China and the United States will have approximately 4,820,000 and 2,370,000 new cancer cases, respectively, and 3,210,000 and 640,000 cancer deaths [4]. Among these new cases, cancer-free survival hinges on receiving surgical treatment, resulting in complex

postoperative complications [5]. If some patients with pancreatic cancer receive early treatments including radical resection, radiotherapy, and chemotherapy of postoperation or cryotherapy, then they will have a higher chance of surviving for five years than without adopting these treatments (increasing from 14% to 40% in most Asia regions) [6]. Cancer survivors have been noticed by researchers and defined in various ways, but today, the term is often referred to as people who have no signs of cancer after having treatment, people receiving extended treatment over a longer period of time to control cancer or reduce the risk of its coming back, and people living with advanced cancer [7]. The above definition is accepted by the American Society of Clinical Oncology (ASCO). Many of these survivors of pancreatic cancer received critical support from main informal caregivers who are most often consanguineous or married and aim to cope with the disease or corresponding complications of their relatives with cancer without obtaining remuneration [8]. These family caregivers are usually the primary caregivers of cancer survivors, and it is shown that they undertake 70%–80% of cancer rehabilitation-related care work [9]. Cancer, as a stressor, has a serious impact on survivors and on their family caregivers. According to WHO, the 2002 report named National Cancer Control Programs, cancer survivors and caregivers comprise the unit of care, and both need to be protected and focused on ("Policies and managerial guidelines for national cancer control programs," 2002). Therefore, more and more scholars have begun to look at survivors with cancer and their primary family caregivers as a whole unit, and the concept of dyadic relationship arises [10, 11].

To achieve positive health outcomes, survivors and their family caregivers begin to demonstrate positive adjustment behaviors after surgical treatment to cope with cancer, such as working together to find caregiving knowledge to facilitate recovery, developing good self-care or professional caregiving skills, using resources or supports around them to cope positively with cancer, and ultimately achieving significant improvements in health outcomes, especially in quality of life (QoL) which has been viewed as the significant prognostic indicator [12, 13]. Researchers have noted that the relationship between individual's positive coping styles and health outcomes during cancer recovery is particularly strong [14–16]. Coping refers to the coping style (positive or negative coping) or coping mechanism adopted when a corresponding stressor is present in the vicinity of the subject, and this coping behavior influences the nature and intensity of the stress response while also mediating the relationship between the stress response and the stress outcome [17]. Positive psychology was proposed by American psychologist Seligman and Csikszentmihalyi [18], who aims to explore the psychological changes, the process of achieving growth and benefit, and the maintenance and reconstruction of QoL of individuals who experience adverse life events [18]. This scholar also advocated that people should face stressful events with a positive attitude and use this to stimulate some actual or potential positive qualities and strengths inherent in each person [18]. Positive psychology is widely used in the field of oncology nursing [19].

A viewpoint accepted by many scholars comes from the positive psychology of oncology: one can conquer cancer by thinking and behaving positively, which means that people have the ability to alleviate or even eliminate the negative outcomes of adverse and stressful events through positive coping styles [20]. In addition, this point was recognized by Lazarus's Stress and Coping Theory as early as 1984 that a stressful stimulus does not necessarily result in negative outcomes. Positive appraisals and effective coping behaviors may lead to positive outcomes [21]. Thus, medical staff should concentrate on the psychological energy that drives cancer survivors and their families to cope constructively rather than fully eliminating negative coping or emotions. This research explored the relationship between positive coping and health outcomes (QoL) from a positive perspective.

Building on the widespread use of Lazarus's Stress and Coping Theory, Fletcher et al. [22] developed a conceptual framework for the cancer family care experience, incorporating the findings of existing models of the dementia family care experience and other high-quality independent research on topics related to cancer family care [22]. The framework recognized the ability of people with cancer and their family caregivers to identify stressors and then cognitively evaluate and respond to them, subjectively determining the nature of their impact (positive or negative). If stressors such as cancer treatment or caregiving are assessed as beneficial events by individuals, effective positive coping behaviors will result, and both parties may experience positive feelings such as growth, a sense of achievement, and increased closeness to loved ones, which ultimately contribute to an improved QoL. This study relied on this conceptual framework to build hypotheses for testing the relationship between positive coping styles and QoL among pancreatic cancer dyads. However, as the conceptual framework mentioned above is relatively new, the target population underlying the widely used previous frameworks referenced is families of people with dementia, and the relationships between variables and pathways were constructed from the subjective synthesis of evidence from several single studies, the applicability to oncology families and the relationship between the pathways and interactive effects of the framework are still not proven, and further validation is necessary [23].

At present, research on the relationship between positive coping styles and QoL has focused on survivors of breast and prostate cancer. The positive coping styles of survivors or family caregivers in the univariate dimension are positively correlated with their own QoL, and it reveals that the more significant the positive coping, the higher the level of their QoL [24–26]. Guan et al. [27] used the Brief COPE, and the Medical Outcomes Study 12-item short-form (SF-12) to conduct a pathway analysis of coping styles and QoL in survivors of prostate cancer using a structural equation and showed that positive coping styles were positively associated with levels of psychological well-being ($\beta = 0.225$, $P < 0.001$) [27]. The prevalence of positive coping among cancer survivors is further reflected in the results of a qualitative study of QoL-related components in older Norwegian women with

breast cancer, in which women reported that they prefer to use several positive coping techniques, including social comparison, positive reappraisal, problem-focused coping, and reappraisal of daily events, to achieve an ultimately positive health outcome [28]. Notably, the study concluded a mutually positive relationship between positive coping styles and QoL improvement. The results of a study to examine the impact of coping styles on the QoL of husbands of survivors of breast cancer show a significant positive correlation between the total scores of QoL and the level of positive coping styles ($r = -0.017$ and $P = 0.830$) [29]. Therefore, the positive coping styles of cancer survivors or their family caregivers significantly influenced their individual QoL levels.

As for the interactive impact of cancer survivors' coping styles or QoL on their family caregivers, only a few studies have demonstrated interrelated levels of QoL for both parties at the monadic level [30, 31]. The first author has previously conducted a systematic review and meta-synthesis of the caregiving experience of family caregivers who are related to pancreatic cancer survivors by blood or marriage to understand the complexity of this phenomenon from a naturalistic and holistic perspective. The integrated findings of this study suggested that family caregivers of survivors with pancreatic cancer had abilities to autonomously seek positive ways of coping once their relatives have received clinical treatment for the disease, including browsing medical databases to accumulate rehabilitation knowledge, actively establishing viable communication channels with primary care physicians, nurses, or counsellors for professional advice, and developing interests related to psychological rehabilitation of the disease to alleviate negative emotions and that these positive ways of coping are beneficial to the QoL of both the family caregivers themselves and cancer survivors [32]. However, the abovementioned findings were only a consolidation of evidence from qualitative studies and focused on survivors of pancreatic cancer who experienced the advanced term. There was a lack of data collection and analysis of other critical stages of the whole cancer trajectory in the real world to demonstrate the reliability of the mutual relationships and impact pathways between positive coping styles and QoL in the cancer family.

Given the complex dyadic relationship between pancreatic cancer survivors and their family caregivers in coping with the disease, the unidimensional correlation is not a comprehensive basis for formulating measures and using a single dimension as the unit of analysis may overlook the nonindependence of paired data [33]. The actor-partner interdependence model (APIM) is an emerging approach to pairwise data analysis in cancer family care research and provides an effective means of interpreting pairwise relationships [34, 35]. Nesting individual measures within pairwise relationships effectively address the need for nonindependent data testing in the pairwise data analysis [36]. Applying this type of statistical approach to the path analysis of the novel model validation studies could provide a significant degree of theoretical justification for the development of future interventions in family care for the survivorship term of pancreatic cancer.

1.1. Purpose and Hypotheses.

This study aimed at examining the relationship between positive coping styles and QoL in survivors of pancreatic cancer and their family caregivers based on the conceptual framework of the cancer family caregiving experience. Figures 1–3 depict the hypotheses based on the model. The specific hypotheses are stated as follows:

The survivors' level of total QoL (psychological and physical dimension of QoL) is affected by their own level of positive coping style (actor effect) and by his/her family caregiver's perceived positive coping style (partner effect). Similarly, the family caregivers' level of total QoL (psychological and physical dimension of QoL) is influenced by their own perceived positive coping style (actor effect) and his/her partner's perceived positive coping style (partner effect).

H1: The positive coping style of survivors of pancreatic cancer is positively associated with the total level of their own QoL (Actor effect). The positive coping style of survivors of pancreatic cancer is positively associated with the total level of QoL of their dyadic partners (Partner effect).

H2: The positive coping style of family caregivers of survivors of pancreatic cancer is positively associated with the total level of their QoL (Actor effect). The positive coping style of family caregivers of survivors of pancreatic cancer is positively associated with the total level of QoL of their dyadic partners (Partner effect).

H3: The positive coping style of survivors of pancreatic cancer is positively associated with the psychological dimension of their QoL (Actor effect). The positive coping style of survivors of pancreatic cancer is positively associated with the psychological dimension of QoL of their dyadic partners (Partner effect).

H4: The positive coping style of family caregivers of survivors of pancreatic cancer is positively associated with the psychological dimension of their QoL (Actor effect). The positive coping style of family caregivers of survivors of pancreatic cancer is positively associated with the psychological dimension of QoL of their dyadic partners (Partner effect).

H5: The positive coping style of survivors of pancreatic cancer is positively associated with the physical dimension of their QoL (Actor effect). The positive coping style of survivors of pancreatic cancer is positively associated with the physical dimension of QoL of their dyadic partners (Partner effect).

H6: The positive coping style of family caregivers of survivors of pancreatic cancer is positively associated with the physical dimension of their QoL (Actor effect). The positive coping style of family caregivers of survivors of pancreatic cancer is positively associated with
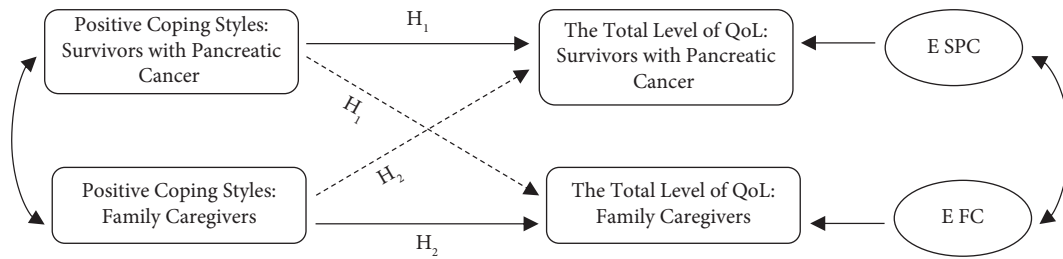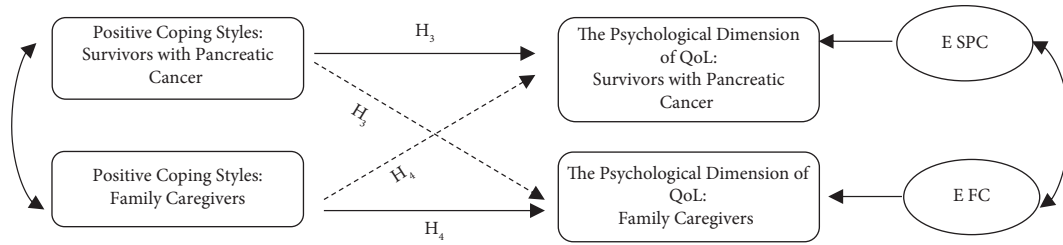
FIGURE 1: Hypothesized APIM model 1.

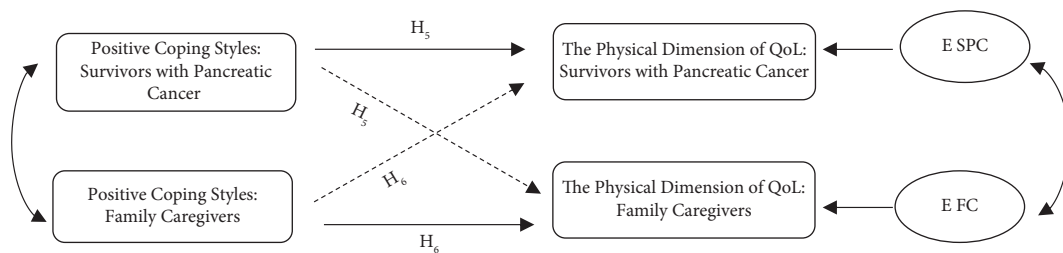FIGURE 2: Hypothesized APIM model 2.

FIGURE 3: Hypothesized APIM model 3.

the physical dimension of QoL of their dyadic partners (Partner effect).

Figures 1–3 Hypothesized APIM Model 1–3: survivor of pancreatic cancer and family caregiver positive coping styles and QoL. Note: the hypotheses relevant to each path in the model have been noted (i.e., H1 refers to Hypothesis 1 and 2). Independent effects (i.e., actor effects) are represented by solid lines. Interdependent effects (i.e., partner effects) are represented by dashed lines. Error covariances are represented by curved double-headed arrows.

ESPC: error covariances of survivors of pancreatic cancer; EFC: error covariances of family caregivers.

2. Methods

2.1. Study Design. A cross-sectional research design approach guided the practice of this study. All participants (survivors of pancreatic cancer and their family caregivers) in this study have read and signed the informed consent form, indicating that they fully understand the study's purpose and implementation methods and agree to provide their own questionnaire results for the analysis and dissemination of data from this study. The Ethics Review Division of Nanjing Medical University's Science and Technology Department approved this study (NUMSA Ethics Audit (2020) No. 568).

2.2. Data Collection. Surgeons and nurses from the Pancreatic Center in the First and Second Affiliated Hospitals of Nanjing Medical University totally identified 210 suitable survivors in the clinic and briefed them on the purpose of the study. Voluntary participation and data confidentiality were emphasized. At the same time, they were assured that they would not receive any unfair treatment if they did not agree to join the study. After obtaining their verbal consent, researchers Linglong (LL) and Changying (CY) confirmed the eligibility of potential participants by referring to their hospital medical records. After being fully informed about the study, 200 pairs signed an informed consent form and 10 declined to participate in the study. LL and CY completed all questionnaires involved in this study with the 200 participants via face-to-face meetings. LL and CY assisted participants in completing the questionnaires using a uniform guideline. Verbal responses were accepted from those who were unable to complete the questionnaires. All completed questionnaires were returned and examined by the principal researcher (LL). When questionnaires were returned, two research group members Jiarong (JR) and Wangsu (WS)

checked these to identify any obvious problems with responses (e.g., missing, or unusual data) and make timely contact with relevant participants for clarification. Two members of the research group (LL and CY) double-entered the data. After the completion of the data entry, two other members (JR and WS) of the research group performed the double-check. The researcher (CY) used data-cleaning procedures to find outliers, extreme values, and missing values. To fix the errors found and the mismatched data, the original data were consulted.

2.3. Participants. A convenience sampling method was used to select 200 pairs of survivors of pancreatic cancer and their family caregivers who were admitted to the Pancreatic Center of the First and Second Affiliated Hospitals of Nanjing Medical University and underwent the surgical treatment from August 2020 to February 2021. According to the rules of thumb, the minimum sample size for structural equations should not be less than 200 cases [37].

2.4. Inclusion Criteria. Inclusion criteria were defined as follows: for survivors: (1) diagnosed with early to midstage pancreatic cancer following the National Comprehensive Cancer Network (NCCN) guidelines (Version 1, 2022) and clinic pathological examination and has undergone radical resection for pancreatic cancer for the first time, (2) over the age of 18, and (3) have adequate reading and communication skills to complete the survey and for primary family caregivers: (1) a long-term family caregiver appointed by the survivor with pancreatic cancer who is related by blood or marriage, (2) over the age of 18, and (3) with adequate reading ability and communication skills to complete the survey.

2.5. Exclusion Criteria. Exclusion criteria were defined as follows: for survivors: (1) distant metastases at the time of recruitment and (2) serious complications during postoperative hospitalization, such as severe pancreatic fistula or anastomotic fistula and for family caregivers: (1) family caregivers whose primary goal is to be compensated for their care, (2) people with cognitive and mental impairment, and (3) people with serious physical illnesses such as cancer or major organ failure.

The survivor and the family caregiver were excluded if they either refused or withdrew from the study.

2.6. Measures

2.6.1. Self-Designed General Information Questionnaire, Including Socio-Demographic, Socio-Economic, and Clinical Information. Survivors of pancreatic cancer: age, sex, clinical diagnosis, surgical type, chronic illness and other complications, education level, marital status, place of residence, religious belief, and health insurance status.

Family caregivers: age, sex, chronic illness, and other complications, education level, marital status, place of residence, major occupation, payment of medical expenses,

religious belief, relationship with survivors of pancreatic cancer, and hours of daily care provided to the survivor.

2.6.2. Simplified Coping Style Questionnaire (SCSQ) in the Chinese Version. The scale has 20 items, 12 in the positive coping dimension and 8 in the negative. The scale scores "not taken" as 0, "occasionally taken" as 1, "sometimes taken" as 2, and "often taken" as 3 [38]. After the scale was validated in the family caregivers of patients with cancer, Cronbach's alpha coefficients of the positive and negative coping styles were 0.73 and 0.65, respectively [39]. Items mainly include attitudes or methods that can be adopted when encountering setbacks and blows: relieving through work-study or some other activities, talking to people and releasing your inner troubles, trying to see the bright side of things, etc. First, separate rough scores for the positive and negative dimensions were calculated to describe general levels of positive and negative coping styles. The scale can also determine if the group's coping tendency is positive or negative. Steps for assessing coping tendency: (1) perform continuous z-scores transformation on the rough values of positive and negative coping styles for each sample. The process of z-scores transformation is to convert each sample into the standard value with a mean of 0 and a standard deviation of 1 to ensure the balance and comparability of each value; (2) to judge the individual's coping tendency: the standard score (z-score) of the positive coping style of each sample minus the standard score (z-scores) of individual's negative coping style, if the value is greater than 0, it means that the group tends to adopt the positive coping style when facing cancer. On the contrary, if it is less than 0, it is judged as a negative coping style; and (3) the descriptive statistics method (percentage) describes the judgment result of the coping style tendency of the sample group. In the present study, the total Cronbach's alpha for this scale was 0.89. The tendencies of coping styles of the participants in this study, whether they are survivors or family caregivers, were positive (among a sample of two hundred pairs of survivors and caregivers, 59.5% of survivors preferred the positive coping style; 57.5% of caregivers preferred the positive coping style). This tool was free for use without permission required.

2.6.3. The 12-Item Short-Form Health Survey (SF-12) in the Chinese Version. This scale is a simplified version of the Universal Brief QoL Scale SF-36 developed by the Institute of Health Education in Boston, USA, and consists of two main components, the physical component summary and the psychological component summary [40]. The higher the score is, the better is the QoL. This scale measures the overall self-perceived health status, whether physical activities such as work, daily activities, and family tasks are affected by cancer and its severe clinical symptoms. It also measures psychological conditions, anxiety, and depression. Items mainly include the following: In general, would say your health is? Does your health now limit you in these activities? If so, how much? During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health/emotional

problems, how much did pain interfere with your normal work, etc. The scale is widely used in studies of family caregivers of patients with chronic diseases such as cancer and has Cronbach's alpha coefficient of 0.76 to 0.89 for the total scale and 0.70 to 0.78 for each dimension [40]. In the present study, the total Cronbach's alpha for this scale was 0.87. This tool was free for use without permission required.

2.6.4. Karnofsky Performance Status Scale (KPSS) in the Chinese Version.

The Karnofsky Performance Status Scale (KPSS) was originally developed in 1948 to provide an objective assessment of the functioning and likely survival ability of hospitalized patients receiving related therapy for cancer [41]. The KPSS scale ranges from 100, which indicates the full functional capacity to perform normal daily activities without clinical disease, to zero, which implies death. It is generally considered that a Karnofsky score above 80 is independent, that is the self-care level. From 50 to 70, people are classified as semiindependent. A score below 50 is dependent or in need of help in life. This tool is well validated in cancer populations and can even serve as a need and prognostic marker for some cancer populations [42]. This tool was free for use to test the self-care ability of survivors of pancreatic cancer, and the research team obtained permission from the research team that translated the original English version into a Chinese version before using the tool.

2.6.5. Covariates.

Age, gender, and the relationship between survivors and family caregivers were associated with their QoL [32, 43, 44]. Therefore, the age and gender of survivors and their family caregivers, as well as the relationship between survivors and family caregivers, were included as covariates in the model of this study. These concepts were captured using standard measures. The relationship type between the survivor and the caregiver was a nominal variable. The data transformation of the relationship was conducted in this section, using 1 for the spouse, 2 for the offspring, 3 for the parent, and 4 for others.

2.7. Data Analysis Strategy.

The hypotheses were tested using the APIM. The APIM consists of pairs of key study variables corresponding to each paired member: predictor variables (survivor/family caregiver positive coping styles, tested in the same model) and outcome variables (survivor/caregiver QoL total level, psychological and physical dimensions; see Figures 1–3). Path analysis was used to estimate the model parameters using Amos version 24.0. To generate bias-corrected confidence intervals, APIM analyses were performed using a structural equation modelling approach with full information standardized maximum likelihood estimation and 5000 bootstrap resampling procedures. Correlations between predictor variables and covariances of error terms of outcome variables were included in all models [45]. The root mean square error of approximation (RMSEA ≤ 0.08), comparative fit index (CFI > 0.95), standardized root means square residual (SRMR ≤ 0.08), and chi-square to degrees of freedom ratio (χ^2/df ratio < 5) were used to determine the adequacy of model fit.

3. Results

3.1. Characteristics of the Sample.

Table 1 displays demographic information obtained from survivors of pancreatic cancer and their family caregivers. Survivors had an average age of 59.74 years (SD: 12.73 years; range: 24–83 years), and family caregivers had an average age of 50.48 years (SD: 13.51 years; range: 24–78 years). Most survivors (61.50%) and family caregivers (67.50%) were male and female, respectively. Around 80% of the survivors and family caregivers were below the undergraduate level. Most survivors and family caregivers (99%) were married, and 54% were in a spousal relationship.

Table 2 provides medical information collected from survivors and caregivers. The inclusive survivors were receiving surgery resection treatment, with pancreaticoduodenectomy being the most common (46%). Most survivors reported without previous history of other surgeries or comorbidities. The self-care was generally higher in survivors who had undergone postpancreatic resection (Mean = 80.99 scores and SD = 28.37 scores), with a weak positive correlation between self-care and QoL ($r = 0.31$ and $P < 0.001$).

3.2. The Comparison of Mean Scores for Positive Coping Style and QoL in Survivor-Caregiver Dyads.

As shown from Table 3, the total average QoL score was 71.31 ± 16.85 scores in survivors: physical level (70.71 ± 20.10 scores), psychological level (72.16 ± 14.65 scores), and 81.81 ± 13.22 scores in caregivers: physical level (83.00 ± 14.02 scores) and psychological level (80.16 ± 14.08 scores). The positive coping scores were higher for caregivers (Mean = 27.48 scores and SD = 3.70 scores) than for survivors (Mean = 24.67 scores and SD = 3.61 scores). The scores of positive coping, total QoL, physical dimension, and psychological dimension of QoL were significantly different in survivors and caregivers (difference −2.82 scores, (95% CI −3.49, −2.14); difference −10.50 scores, (95% CI −12.87, −8.13); difference −12.11 scores, (95% CI −14.91, −9.31); difference −8.40, (95% CI −10.70, −6.10), respectively).

3.3. The Correlation Relationship for Positive Coping Style and QoL in Survivor-Caregiver Dyads.

According to Pearson's correlation analysis results in Table 4 (all $r > 0.13$; all $P < 0.05$), the positive coping style was significantly and positively correlated with individual's QoL (including total, physical, and psychological level) among family caregivers or survivors, which means that the higher scores of the positive coping style of survivors or family caregivers, the lower total level of QoL of survivors or family caregivers. The positive coping style was significantly and positively correlated with their partners' QoL (including total, physical, and psychological level) among family caregivers and

TABLE 1: Survivors and family caregivers' demographic information.

	Survivors ($N = 200$)	Family caregivers ($N = 200$)
Age in years		
Mean (SD)	59.74 ± 12.73	50.48 ± 13.51
Range	24–83	24–78
Gender (%)		
Female	77 (38.50%)	135 (67.50%)
Male	123 (61.50%)	65 (32.50%)
The level of education		
Primary school	47 (23.50%)	39 (19.50%)
Secondary school	62 (31%)	47 (23.50)
High school	61 (30.50%)	73 (36.50%)
University and above	30 (15%)	41 (20.50%)
Marital status (%)		
Married/living as married	199 (99.50%)	197 (98.50%)
Divorced/separated	1 (0.50%)	3 (1.50%)
Relationship to patient (% caregiver only)		
Spouse	—	108 (54%)
Offspring	—	70 (35%)
Parent	—	9 (4.50%)
Others	—	13 (6.50%)

[*]SD, standard deviation.

TABLE 2: Survivors' medical information at the baseline ($N = 200$).

	% or M (SD)	Difference tests in the QoL[a] (P value)
Type of surgery		0.94
Pancreaticoduodenectomy	92 (46%)	—
Middle segment pancreatectomy	10 (5%)	—
Distal pancreatectomy	64 (32%)	—
Total pancreaticoduodenectomy	4 (2%)	—
Cold and hot combination ablation	27 (13.50%)	—
Local resection of the head of pancreas	3 (1.50%)	—
Other surgical history		0.48
Yes	55 (27.50%)	
No	145 (72.50%)	
Co-morbidities		0.16
Yes	92 (46%)	
No	108 (54%)	
Self-care ability	80.99 ± 28.37	<0.001[**]

[a]Independent t-tests, Mann–Whitney U test, one way ANOVA, and Kruskal–Wallis test or Pearson's correlation. [**]P value <0.01.

TABLE 3: The comparison of the scores of positive coping style and QoL between survivors with pancreatic cancer and their family caregivers ($N = 200$).

Groups	Positive coping	Total QoL	Physical dimension of QoL	Psychological dimension of QoL
Survivors	24.67 ± 3.61	71.31 ± 16.85	70.71 ± 20.10	72.16 ± 14.65
Caregivers	27.48 ± 3.70	81.81 ± 13.22	83.00 ± 14.02	80.16 ± 14.08
Difference (95% CI)	-2.82 (-3.49, -2.14)	-10.50 (-12.87, -8.13)	-12.11 (-14.91, -9.31)	-8.40 (-10.70, -6.10)
t-value	-8.21	-8.74	-8.53	-7.20
P value	0.001[**]	0.001[**]	0.001[**]	0.001[**]

[**]P value <0.01.

survivors, which means that the higher scores of the positive coping style of survivors and family caregivers, the lower physical and psychological dimensions of their partners' QoL (all $r > 0.13$; all $P < 0.05$), except for the negative correlation between the positive coping style of family caregivers and the physiological dimension of QoL of survivors,

the lower level of the physiological dimension of QoL of survivors, the more positive coping style of family caregivers ($r = -0.18$, $P < 0.05$).

3.4. The Degree of Fit, Actor, and Partner Effect of Models. The results of three APIM models are reported in Table 5. Model fit was adequate (RMSEA range: 0.02–0.03; CFI: 1; SRMR: 0.05; $\chi 2/df$ ratio range: 0.89–0.99; TLI: 1).

3.5. APIM: Actor and Partner Effects

3.5.1. The Relationship between the Positive Coping Style and Total Level of QoL. The results are summarized in Figure 4 and Table 6. Controlling for the effect of covariates (i.e., age, gender, and relationship), survivors' ($\beta = 0.36$, $P < 0.001$) and caregivers' ($\beta = 0.17$, $P < 0.05$) perceived positive coping style was positively associated with their own total level of QoL. The actor effect of survivors was significantly stronger than the actor effect of caregivers. Survivors' perceived positive coping style was positively associated with their caregivers' total level of QoL ($\beta = 0.13$, $P < 0.05$). Caregivers' perceived positive coping style was negatively associated with their partners' total level of QoL ($\beta = -0.12$, $P < 0.05$).

3.5.2. The Relationship between the Positive Coping Style and Psychological Level of QoL. The results are summarized in Figure 5 and Table 6. Controlling for the effect of covariates (i.e., age, gender, and relationship), survivors' ($\beta = 0.34$ and $P < 0.001$) and caregivers' ($\beta = 0.15$ and $P < 0.05$) perceived positive coping style was positively associated with their own psychological level of QoL. The actor effect of survivors was significantly stronger than the actor effect of caregivers. In terms of partner effects, survivors' perceived positive coping style was positively associated with their caregivers' psychological level of QoL ($\beta = 0.14$ and $P < 0.05$). However, the positive coping style of caregivers had no significant impact on their partners' psychological level of QoL ($\beta = 0.01$ and $P = 0.86$).

3.5.3. The Relationship between the Positive Coping Style and Physical Level of QoL. The results are summarized in Figure 6 and Table 6. Controlling for the effect of covariates (i.e., age, gender, and relationship), survivors' ($\beta = 0.32$, $P < 0.001$) and caregivers' ($\beta = 0.16$, $P < 0.05$) perceived positive coping style was positively associated with their own physical level of QoL. The actor effect of survivors was significantly stronger than the actor effect of caregivers. However, the partner effects of positive coping style on the physical level of QoL were not statistically significant among survivors and their family caregivers.

4. Discussion

This study explored the mutual interaction between positive coping styles of survivors who followed pancreatic cancer resection and their primary family caregivers personally and each other's QoL. To begin with, this study found that the most common dyadic relationship was the spousal model, followed by a survivor-offspring model consistent with other evidence [10]. Family System Theory summarizes the family as a small unit in society that contains three main subsystems (marriage, parenthood, and sibling relationships) that work together and influence each other [46]. Gynecological cancer is one of the types of cancer currently receiving the most attention in the field of dyadic care because of their long survival and inextricable link to sexual function; researchers often look at survivors of gynecological cancer and their spousal caregivers as the whole unit [47, 48]. To date, there has been less research on the dyadic relationship between a survivor with pancreatic cancer and their spousal caregiver. The first author of this article previously conducted a meta-synthesis that condensed previous research on related topics. She found that spousal caregivers are the most preferred companions and the most trusted people for survivors of pancreatic cancer at the start of and during the subsequent period of treatment. Since the spousal relationship is perceived as the strongest emotional link in the face of death, or because the spouse is the person, they have spent the longest time with, dependency and familiarity both increase over time, and the spouse knows more about their daily habits, needs, etc. Secondly, offspring are also the most frequent family caregivers among older survivors of cancer, as their children's younger age means they are more able to accompany and carry out care-related tasks, such as accompanying rehabilitation exercises or follow-up examinations [32]. The above is consistent with the findings of this article. The same results were also found in prostate cancer and its spousal caregivers [27]. This study was unable to group the different binary relationships to explore the interactions separately due to sample size limitations. Therefore, future work is to explore both partners' needs, patterns, or difficulties in different dyadic relationships so that clinical practitioners can better guide their care and promote healthy outcomes for families with cancer.

In addition, both the positive coping styles and the level of QoL (encompassing both physical and psychological dimensions) were higher for family caregivers than survivors. Although in lung cancer and other types of gastrointestinal cancer, the positive coping style is the approach most often adopted by this group of people with cancer and their family caregivers, which means that positive coping scores are high generally [49, 50]. A noteworthy point is that this article was the first study to explore dyadic coping patterns and levels in pancreatic cancer, complementing the previously integrated evidence speculating that positive coping is universal. Common positive coping models include developing interest time to distract, choosing a trusting person to express, and shaping good psychological wishes to motivate health-seeking behaviors [8, 51]. These positive coping styles are often strongly associated with a range of health outcomes, particularly in the QoL [27, 52]. Regarding the dyadic pair of family caregiver-survivor, family caregivers generally have higher scores of positive copings and QoL than survivors, mainly related to pathological factors (type of cancer, type of treatment, self-care, literacy, and age) [53, 54]. Qualitative studies have also shown that caregivers are more likely to experience growth

TABLE 4: Correlation between positive coping style and QoL among survivors and family caregivers ($N = 200$).

Variation	1	2	3	4	5	6	7	8
(1) Positive coping of survivors	1							
(2) Positive coping of caregivers	0.14*	1						
(3) Total QoL of survivors	0.32**	0.18*	1					
(4) Total QoL of caregivers	0.16*	0.16*	0.38**	1				
(5) Psychological dimension of QoL of survivors	0.32**	0.14*	0.87**	0.33**	1			
(6) Psychological dimension of QoL of caregivers	0.15*	0.14*	0.16*	0.92**	0.28**	1		
(7) Physical dimension of QoL of survivors	0.28**	−0.18*	0.97**	0.38**	0.61**	0.30**	1	
(8) Physical dimension of QoL of caregivers	0.18*	0.15*	0.36**	0.95**	0.20**	0.64**	0.40**	1

*P value <0.05; **P value <0.01.

TABLE 5: Structural equation, degree of fit ($N = 200$).

	Chi-square	df	χ^2/df	RMSEA	CFI	TLI	SRMR
Model 1	12.46	14	0.89	0.02	1	1	0.05
Model 2	13.81	14	0.99	0.03	1	1	0.05
Model 3	13.40	14	0.96	0.03	1	1	0.05

*RMSEA: root mean square error of approximation), CFI: comparative fit index; TLI (Tucker–Lewis index); SRMR (standardized root mean square residual).
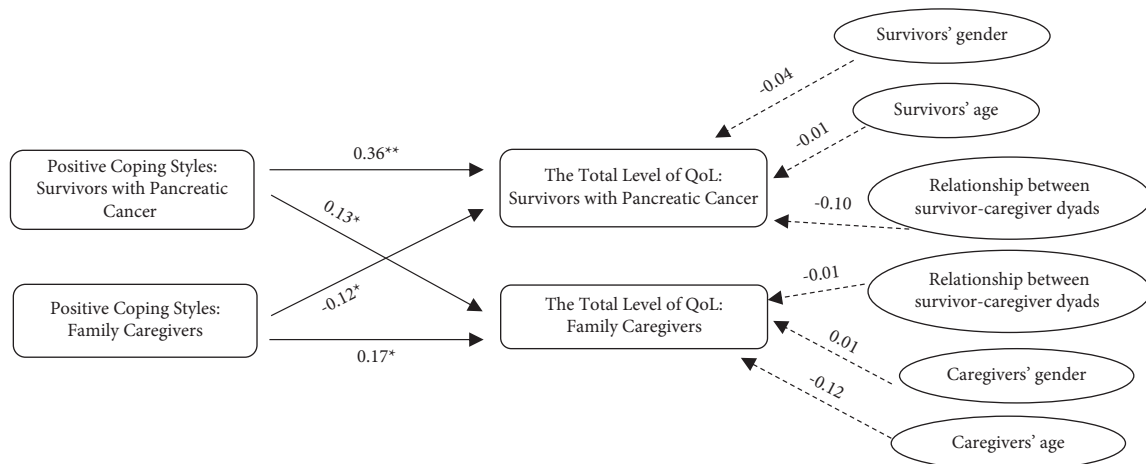

FIGURE 4: Final model 1. Note: Solid line indicates significant values. Dashed lines indicate statistically insignificant data. *P value < 0.05, **P value < 0.01.

and positive health-related outcomes like QoL or family cohesion because of the need to take on anchor responsibilities or due to their affective links and strength [48, 55], while existing binary response interventions have improved some dimensions of QoL for cancer families [56]. However, further research is needed on the frequency of intervention delivery and their use in combination with other enhancing approaches relevant to the QoL, particularly the differences in intervention approaches across different dyadic groups of different cancer types.

Finally, and most importantly, in the dyadic relationship of partners who experienced pancreatic cancer, the actor-partner effects were present and significant for both the survivor and their family caregiver in terms of the positive coping and total level of QoL (as well as the psychological dimension), except for the physical dimension where the partner effect was not significant, but the actor effect was also significant. Previous studies have been limited to separating this group and verifying that their association between

positive coping patterns and QoL [57]. Simple one-dimensional correlations are difficult to use as evidence for the need to formulate binary interventions for families with cancer, so it is particularly crucial to construct relevant multivariate statistical models based on existing theories and hypotheses. Most scholars have demonstrated both actor and partner effects between positive coping and QoL in the gynecological cancer group, but the evidence is still lacking in the gastrointestinal cancer group [47, 58]. Although this study did not confirm a partner effect between positive coping and the physical dimension of QoL, the available qualitative studies suggest that the more severe the patient's somatic symptoms, the more negative the coping style and QoL of their family caregivers, as most family caregivers do not have experienced caregiving expertise and time and therefore show an inability to cope, with subsequent worsening of their own somatic symptoms, insomnia, headaches, or aggravation of preexisting chronic diseases or comorbidities [59]. As a result, the QoL in the physical

TABLE 6: Effect coefficients for hypothetical models ($N = 200$).

Model	Effect	Independent variable	Dependent variable	Est.	S.E.	P value	95% CI
Model 1	Actor	Positive coping style: survivors	Overall QoL: survivors	0.36	0.06	0.001**	(0.16, 0.51)
	Partner	Positive coping style: caregivers		−0.12	0.07	0.04*	(−0.14, 0.12)
		Survivors' gender		−0.04	0.06	0.52	(−0.18, 0.08)
		Survivors' age		−0.01	0.06	0.90	(−0.12, 0.10)
	Error covariance	Relationship		−0.10	0.07	0.16	(−0.25, 0.03)
	Actor	Positive coping style: caregivers	Overall QoL: caregivers	0.17	0.07	0.02*	(0.03, 0.31)
	Partner	Positive coping style: survivors		0.13	0.07	0.03*	(−0.10, 0.17)
		Relationship		−0.01	0.07	0.95	(−0.16, 0.15)
		Caregivers' gender		0.01	0.07	0.86	(−0.12, 0.14)
	Error covariance	Caregivers' age		−0.12	0.07	0.07	(−0.21, 0.05)
Model 2	Actor	Positive coping style: survivors	The psychological dimension of QoL: survivors	0.34	0.06	0.001**	(0.16, 0.49)
	Partner	Positive coping style: caregivers		0.01	0.07	0.86	(−0.15, 0.17)
		Survivors' gender		−0.02	0.07	0.75	(−0.16, 0.12)
		Survivors' age		0.05	0.07	0.49	(−0.08, 0.17)
	Error covariance	Relationship		−0.04	0.07	0.53	(−0.17, 0.08)
	Actor	Positive coping style: caregivers	The psychological dimension of QoL: caregivers	0.15	0.07	0.03*	(−0.02, 0.29)
	Partner	Positive coping style: survivors		0.14	0.07	0.03*	(−0.09, 0.19)
		Relationship		−0.07	0.07	0.36	(−0.25, 0.11)
		Caregivers' gender		−0.04	0.07	0.57	(−0.17, 0.10)
	Error covariance	Caregivers' age		−0.09	0.07	0.17	(−0.19, 0.09)
Model 3	Actor	Positive coping style: survivors	The physical dimension of QoL: survivors	0.32	0.06	0.001**	(0.12, 0.48)
	Partner	Positive coping style: caregivers		−0.04	0.07	0.60	(−0.20, 0.15)
		Survivors' gender		−0.04	0.06	0.56	(−0.18, 0.09)
		Survivors' age		−0.03	0.06	0.61	(−0.14, 0.08)
	Error covariance	Relationship		−0.11	0.07	0.12	(−0.26, 0.03)
	Actor	Positive coping style: caregivers	The physical dimension of QoL: caregivers	0.16	0.07	0.02*	(0.03, 0.30)
	Partner	Positive coping style: survivors		0.02	0.07	0.82	(−0.11, 0.14)
		Relationship		0.03	0.07	0.69	(−0.11, 0.17)
		Caregivers' gender		0.03	0.07	0.60	(−0.10, 0.17)
	Error covariance	Caregivers' age		−0.12	0.06	0.07	(−0.20, 0.04)

**P value <0.01; *P value <0.05; relationship: the relationship between survivors and family caregivers; assignment of relationship: 1: spouse, 2: offspring, 3: parent, and 4: others; all models included correlations between each covariance and outcome variable; Est.: standardized maximum likelihood coefficients of variables; S.E.: standard error.
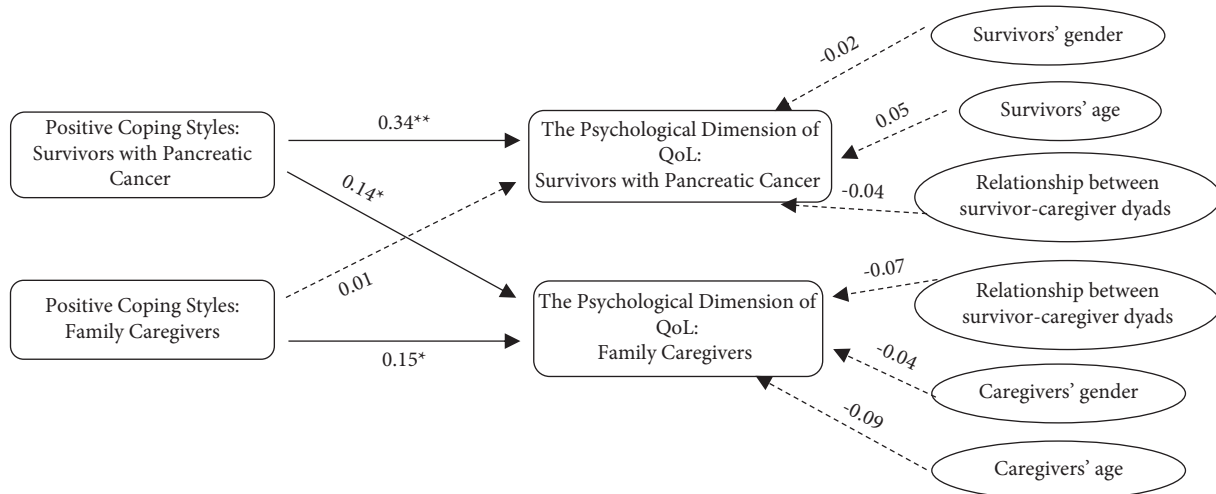
FIGURE 5: Final model 2. Note: Solid line indicates significant values. Dashed lines indicate statistically insignificant data. $^*P$ value < 0.05, $^*P$ value < 0.01.
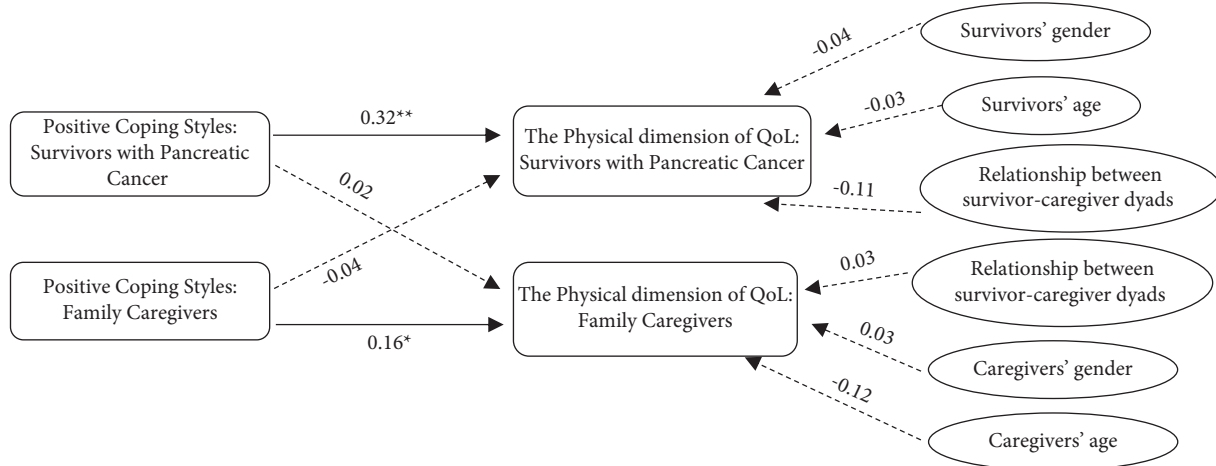

FIGURE 6: Final model 3. Note: solid line indicates significant values. Dashed lines indicate statistically insignificant data. $^*P$ value <0.05, $^{**}P$ value <0.01.

dimension eventually decreases [60]. Therefore, the implication of this finding for pancreatic cancer family nursing scholars is that when designing family coping plans in the future, attention should be paid to how effectively both partners manage symptoms clusters of symptoms, which may affect the physical health of both partners. Also noteworthy was the significant correlation between family caregivers' positive coping styles and the overall QoL of survivors. Although in the verification of the APIM model, the overall QoL of survivors was negatively affected by their partners' positive coping styles, it was inconsistent with the finding that the two variables in Pearson's correlation test were positively correlated. In view of the above findings, the essential result proves that the positive coping style was closely related to the overall QoL between the survivor-caregiver dyad, and because of the different models used in the validation of the relationship of two variables, different results were produced. Pearson's correlation coefficient is used to measure the relationship between two continuous

variables, and the relationship between variables is assumed to be linear, so it is often used to describe the direct relationship between two variables. The APIM model used in this study considered the complex relationship among multiple variables, especially the interaction in paired data, and controlled certain individual characteristic variables to provide a more accurate explanation of the relationship [61]. The finding gave us a new revelation, the positive coping styles adopted by family caregivers (such as seeking advice from relatives and friends, participating in other recreational and sports activities to divert negative emotions or not presupposing the problem in a bad way) may not necessarily associate with higher levels of QoL in cancer survivors. This may be because most of the positive coping behaviors they adopted focused only on themselves, with the purpose of eliminating their negative emotions and persevering in the care work more effectively. To a certain extent, they ignored the significance of both parties jointly coping with the difficulties in cancer survivorship. Thus, health practitioners

must examine the formulation and execution of coping styles from a dyadic perspective while developing family coping plans. [32]. Finally, the findings of this study partially confirmed the scientific validity of the conceptual framework and partially demonstrated the uniqueness of each cancer type; hence, some findings were different from the framework's pathways. The novelty of this study is to analyze the interaction between positive coping and QoL as paired data. The analytical approach provides a theoretical basis for the future development of dyadic coping measures in the cancer family. However, further evidence needs to be added with real-world data in the future. Examples include expanding sample sizes or stratified analyses to consider the impact of binary coping types on QoL.

5. Limitations

A few limitations must be identified. Initially, this study used a relatively small convenience sample of dyads ($N = 200$) of Chinese survivors with cancer and family caregivers. The sample characteristics may limit the findings' generalizability to other populations. Second, this was a cross-sectional study. Cancer, its treatment, and associated prognoses can change over time, as can the caregiver's role [62]. It is critical to consider the trajectories of their pairs over time to better measure changes in the impact of coping styles and QoL on patient-caregiver dyads. Finally, the primary family caregiver is not always the only one dealing with a family member with cancer [63]. Other caregivers in the family may be able to provide supplementary care when the person with cancer requires it, so categorizing the specific roles and relationships among caregivers in different types of cancer is an imperative endeavor in future research.

6. Conclusions

Our study showed that the most common dyadic caregiving relationship between pancreatic cancer survivors and their family caregivers was the spousal relationship. Family caregivers had higher scores of positive coping styles and QoL than pancreatic cancer survivors. The actor-partner effects were present and significant for both survivors and their family caregivers in the dyadic relationship of partners who had pancreatic cancer in terms of positive coping styles and the overall level of QoL (as well as the psychological dimension), apart from the physical dimension, where the partner effect was not significant, but the actor effect was also significant. All these data indicated the necessity of routine clinical assessment and management of pancreatic cancer families' coping mechanisms and QoL. In addition, the survivor-caregiver dyad should be viewed as a whole to develop partnership-based interventions that maintain equal attention to family caregivers to promote positive coping and QoL in order to maximize the role of family caregivers. Future research is needed to extend follow-up rather than cross-sectional measurements, expand sample sizes, and

provide theoretical support for family caregiving in the long period of cancer survivorship.

Data Availability

All data in this article are derived from individual collections from the two public tertiary hospitals in China. The data collection meets ethical criteria. The data used to support the findings of this study are available from the corresponding author (Xiaoping Fang) upon request.

Ethical Approval

Ethical approvals were obtained from the Research Ethics Committees of the Nanjing Medical University (NUMSA Ethics Audit (2020) No. 568).

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Linglong Liu, Mingxia Chen, Changying Liu, Jiarong Li, and Wang Su have made substantial contributions to conception and design, acquisition of data, and conflict discussion. Linglong Liu and Mingxia Chen have made substantial contributions to analysis and interpretation of data. Linglong Liu, Mingxia Chen, and Xiaoping Fang have been involved in drafting the manuscript or revising it critically for important intellectual content.

Acknowledgments

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