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# Exploring dyadic coping, self-efficacy, and quality of life in patients with cervical cancer and their spousal caregivers: an actor-partner interdependence mediated model analysis

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## Abstract

**Background** Cervical cancer and its treatment impose significant psychological and physical challenges for patients and their spousal caregivers. Understanding dyadic coping mechanisms and self-efficacy can significantly improve the quality of life (QoL) for both parties. However, research exploring these relationships from a dyadic perspective remains limited, particularly in the Chinese context.

**Methods** This cross-sectional study involved 288 dyads of patients with cervical cancer and their spousal caregivers from five hospitals in Jiangsu Province, China, between November 2022 and August 2023. Participants completed validated scales, including the Dyadic Coping Inventory, the General Self-Efficacy Scale and the 12-item Short-Form health survey. The mediating role of self-efficacy in the relationship between dyadic coping and QoL was assessed using Actor-Partner Interdependence Mediation Model (APIMeM).

**Results** Findings indicate significant actor and partner effects, suggesting that both patients' and caregivers' dyadic coping positively influences their own and each other's self-efficacy and QoL. Mediation analyses revealed that: (1) patients' and caregivers' self-efficacy fully mediated the relationship between dyadic coping and mental QoL (MCS); while (2) patients' self-efficacy partially mediated the relationship between dyadic coping and physical QoL (PCS). Spousal caregivers reported higher dyadic coping and self-efficacy scores, which were associated with better mental QoL (MCS) outcomes compared to patients.

**Conclusions** The study highlights the critical role of dyadic coping mechanisms and self-efficacy in enhancing the QoL of patients with cervical cancer and their spousal caregivers. These findings support the need for psychosocial interventions aimed at strengthening both dyadic coping and self-efficacy to improve the overall well-being in a

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cancer context. The insights offer a promising avenue for nursing practice in cervical cancer, suggesting that fostering these psychosocial resources can help manage the complex demands of cancer care.

**Keywords** Cervical cancer, Dyadic coping, Quality of life, Self-efficacy, Actor-partner interdependence model

## Introduction

Cervical cancer represents a critical dyadic health challenge that demands joint coping efforts from both patients and their spousal caregivers. While existing research has established individual impacts of the disease, the interdependent nature of patient-caregiver quality of life (QoL) remains underexplored, particularly through the mediating lens of self-efficacy within Chinese cultural contexts. This study addresses this gap by applying the Actor-Partner Interdependence Mediation Model (APIMeM) to elucidate how dyadic coping strategies influence QoL via self-efficacy pathways in Chinese patient-caregiver dyads. Our work makes three key contributions: (1) identifying culture-specific dyadic coping patterns in Chinese couples facing cervical cancer, (2) quantifying self-efficacy's mediating role in the dyadic coping-QoL relationship, and (3) providing empirical foundations for culturally tailored dyadic interventions.

## Background

Cervical cancer remains a critical global health challenge, ranking as the fourth most common malignancy among women worldwide, with an estimated 660,000 new cases and 350,000 deaths reported in 2022 [1]. In China, the burden is particularly pronounced, with approximately 110,000 new cases and over 60,000 deaths recorded in 2020, highlighting the significant public health impact of cervical cancer [2]. While high-income countries have seen declines in incidence rates due to widespread HPV vaccination and screening, low- and middle-income regions, including rural China, face persistent disparities. Delayed diagnosis - attributed to limited healthcare access, cultural stigma, and low health literacy - leads to advanced-stage presentations, thereby increasing the complexity of treatment regimens and exacerbating the burden on affected patients.

Debilitating physical sequelae and profound psychosocial distress characterize the clinical trajectory of cervical cancer. Standard treatments (e.g., radical hysterectomy, chemoradiation) often result in chronic complications, including sexual health impairments (e.g., dyspareunia, reduced libido), pelvic floor dysfunction, urinary incontinence, and menopausal symptoms [3]. Additionally, psychosocial challenges such as cancer-related anxiety, fatigue, and depression, driven by fear of recurrence, body image concerns, and societal stigma associated with gynecological malignancies [4–6]. In China, cultural taboos around reproductive health further suppress open

discussions, intensifying emotional isolation and hindering access to essential psychosocial support [7].

QoL is a pivotal indicator for assessing an individual's health status and treatment outcomes. It is a multidimensional construct that encompasses physical, psychological, and social dimensions of well-being and functioning [8]. In this study, QoL is operationalized into two core dimensions: physical QoL and mental QoL, measured through the Physical Component Summary (PCS) and Mental Component Summary (MCS) scales of the SF-12 questionnaire, which assess physical and mental functioning, respectively [9]. The PCS is often adversely affected by treatment-related functional limitations. Many survivors continue to suffer from chronic pelvic pain, while lymphedema remains a prevalent long-term complication that requires ongoing management [10]. Compared with other gynecologic cancers, cervical cancer survivors have reported higher rates of mood disorders, contributing to suboptimal MCS scores [11, 12]. Moreover, social withdrawal and perceived discrimination have been identified as key contributors to poor mental health outcomes, illustrating the compounded effects of clinical and sociocultural stressors [13].

Prior research indicates that spousal caregivers of cancer patients experience higher levels of stress compared to those caring for individuals with other chronic conditions, such as diabetes [14]. This heightened stress is largely attributed to the multifaceted demands of cancer care, which require both emotional and physical support, as well as adherence to complex treatment protocols [15, 16]. The caregiving burden and the accompanying psychological distress may be comparable, or even exceed, that experienced by spouses of patients with other chronic illnesses [17]. These caregivers often encounter additional responsibilities and must manage their own emotional strain while supporting their partners. Prolonged exposure to such stress can negatively affect the QoL of both the patient and the caregiver [18, 19]. Furthermore, the dynamics of marital interactions play a critical role in how couples adapt to these challenges. Collaborative coping strategies within the dyad can buffer the effects of cancer-related stress and help preserve relationship quality [20].

The interdependence between patient and caregiver well-being necessitates adopting a dyadic perspective. Kim et al. analyzed 361 cancer survivor-caregiver dyads and found that individual spiritual well-being correlated not only with their own mental health but also with their partner's physical health [21]. Studies have indicated that

both patients with cervical cancer and their spousal caregivers report lower QoL compared to survivors of other gynecological cancers and the age-matched individuals in the general population [22, 23]. Thus, dyad-centric approaches are not merely beneficial but essential for interrupting the reciprocal decline in QoL experienced by both members of the caregiving relationship.

Effectively addressing the challenges of cervical cancer demands collaborative engagement between patients and their caregivers. Dyadic coping is the interpersonal process by which intimate partners manage shared stressors together. Our previous study found that the overall dyadic coping capacity among spousal caregivers of cervical cancer patients ranged from moderate to low [23]. Positive dyadic coping encompasses strategies such as supportive behaviors, delegated coping (the caregiver temporarily takes over tasks or responsibilities to alleviate the patient's stress), and common coping (both partners jointly address stressors). These strategies benefit both individuals and their relationship. In contrast, negative dyadic coping is characterized by hostile, ambivalent, and superficial interactions, which may exacerbate stress and relationship strain [24]. Therefore, dyadic coping transcends individual efforts, incorporating elements of open communication, role flexibility, and shared problem-solving. Positive dyadic coping not only alleviates relational stress but also fosters emotional closeness, intimacy, and mutual trust, whereas negative dyadic coping can undermine relationship quality and well-being [25].

Numerous studies demonstrate that positive dyadic coping strategies are significantly associated with healthier behavioral patterns, greater relationship satisfaction, and improved QoL for both patients and caregivers [26–29]. Ștefănuț et al. [28] demonstrated a significant association between dyadic coping and overall QoL among oncology patients and their spousal caregivers, with caregiver-reported positive dyadic coping by patients positively influencing the caregivers' own QoL. Similarly, Ernst et al. [27] identified the direct impact of dyadic coping behaviors on the psychological and physical QoL of their partners in the case of hematologic neoplasms. In the realm of gynecological cancer, a study involving Chinese couples revealed that most couples had dyadic coping scores below normative averages, indicating a higher-than-average occurrence of negative dyadic coping among both patients and spouses [30]. For couples facing gynecological cancer, including cervical cancer, the use of positive dyadic coping strategies can effectively alleviate psychological distress and improve QoL for both partners. Conversely, negative dyadic coping is associated with increased physical and emotional burden, deterioration of marital relationship, and reduced QoL. These findings underscore the importance of understanding the mechanism by which dyadic coping influences QoL

in couples affected by cervical cancer, thereby providing a theoretical foundation for the development of targeted nursing interventions tailored to both patients and their spouse caregivers.

The theoretical framework of communal coping and adjustment posits that dyadic coping shapes individuals' adaptive capacities by enhancing intrinsic motivation to manage stress, particularly through the development of self-efficacy [31]. Self-efficacy refers to an individual's confidence in their capability to execute actions to manage situations and achieve desired outcomes [32]. Higher levels of self-efficacy are associated with improved health outcomes [33], including enhanced QoL among patients with cancer [34, 35]. In the context of cancer care, positive dyadic coping affected self-efficacy [34] and QoL [35] in patients and their spousal caregivers. Self-efficacy has also been found to mediate improvements in QoL for both patients and caregivers through its effects on benefit finding and alleviate anxiety and depression, highlighting its importance for psychological well-being [36]. Thus, patients' and caregivers' dyadic coping strategies may directly influence each other's QoL through their impact on self-efficacy beliefs. For example, patients with positive dyadic coping are more likely to develop higher self-efficacy, perceive greater sense of control over their illness, and actively engage in symptom self-management. This enhanced self-efficacy contributes to improved QoL by reducing symptom burden (e.g., fatigue, pain) and promoting emotional well-being. For caregivers, greater self-efficacy mitigates caregiving strain and supports their sustained ability to fulfill responsibilities effectively.

Exploring the interactions within cervical cancer patient-caregiver dyads offers novel insights and potential avenues for enhancing dyadic well-being. While self-efficacy is recognized as a key role that may mediate the relationship between dyadic coping and QoL, this mechanism remains unclear in existing research. The Theory of Dyadic Illness Management (TDIM) [37] and the Actor-Partner Interdependence Mediation Model (APIMeM) offer a valuable framework for understanding the complex interactions within relationships between dyadic coping and QoL within relational and cultural contexts. TDIM conceptualizes illness management as an inherently interdependent process, shaped by continuous mutual influences between partners. A patient's avoidance of prognosis-related discussions might alleviate her anxiety but simultaneously increase her spouse's sense of uncertainty, compromising both partners' mental QoL [38]. This interdependence highlights the limitations of traditional individual-centric models, which overlook relational spillover effects that characterize coping within couples. While dyadic coping is critical for QoL in cervical cancer couples, prior research often neglects how

partners' strategies and self-efficacy mutually shape outcomes [23, 39].

In Chinese context, TDIM's relevance is amplified by cultural norms emphasizing family collectivism and relational harmony. Within this cultural framework, spouses frequently suppress personal distress to prioritize patients' well-being, reflecting socially sanctioned caregiving roles. While this behavior aligns with cultural expectations, it may inadvertently contribute to mutual declines in QoL. For example, caregivers may conceal their burden to maintain family stability, which can unintentionally intensify dyadic strain and compromise both partners' well-being. By conceptualizing cervical cancer as a shared stressor, TDIM underscores the importance of dyad-centered approaches that promote collaborative coping and holistic health among Chinese couples navigating the challenges of chronic illness.

The APIMeM provides a robust analytical framework for examining how individual-level predictors simultaneously influence both own outcomes (actor effects) and partner-related outcomes (partner effects) within dyadic relationships. This model also facilitates the exploration of mediating mechanisms that may explain interpersonal associations observed in paired data structures [40]. A growing body of research has demonstrated that the distress and well-being of patients and their partners are mutually influential [41, 42], reinforcing the view that cancer is a shared experience that affects couples as a relational unit.

### Purpose of the study

This study aimed to examine the dyadic relationships among dyadic coping, self-efficacy, and QoL in cervical cancer patient-caregiver dyads, focusing on the mediating role of self-efficacy in the association between dyadic coping and QoL. The understanding of the potential mechanism of dyadic coping and self-efficacy in shaping QoL among Chinese cervical cancer couples can provide valuable insights for developing targeted psychosocial interventions that enhance dyadic well-being.

## Method

### Participants

This cross-sectional study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines and employed convenience sampling. Patients with cervical cancer and their spousal caregivers were recruited from five tertiary hospitals (including participants from various demographic backgrounds) in Jiangsu Province, China, between November 2022 and August 2023. Participants were first screened for eligibility and then asked to voluntarily provide written informed consent before data collection began. Patients with cervical cancer were surveyed during their

treatment sessions, while interviews with spousal caregivers were conducted in the gynecologic oncology ward. Patient-caregiver dyads undergoing cervical cancer treatment filled out questionnaires separately. The eligibility criteria for patients with cervical cancer and their spousal caregivers included: (1) age > 18 years; (2) clear consciousness and cognition; and (3) voluntary consent to participate in the study. Additionally, eligible patients had to be undergoing cancer treatment or have been newly diagnosed with cervical cancer within 3 months. Spousal caregivers had to provide informal care for patients with cervical cancer without remuneration and live with the patients. Patients with cervical cancer and their spousal caregivers who had been recently exposed to other malignant tumors or were complicated with other severe diseases besides cervical cancer therapy were excluded from the study. Based on power calculations for a distinguishable-dyad APIMeM, detecting actor or partner effects of standardized  $\beta = 0.20$ , using a two-sided  $\alpha$  of 0.05 and 90% power, requires a minimum of approximately 264 dyads. To account for an anticipated 20% dropout rate [43], 360 dyads were initially invited. Of those 72 dyads declined due to either disinterest, non-responses, or health issues, resulting in 288 patient-spouse dyads who completed the survey.

### Procedures

Data collection occurred at the gynecologic oncology ward and was conducted by trained research assistants. The study staff provided an overview of the survey's objectives, inviting participants to join the study voluntarily, anonymously, and confidentially. Before data collection, each participant signed an informed consent form. The questionnaire package was digitized and converted into an online format. Participants could either scan a QR code to access and complete the questionnaire online or manually fill out a paper version with a pen. The questionnaire, encoded and distributed by researchers, included standardized instructions for completion. Researchers provided clarification on questionnaire items when necessary. Participants typically spent 10–15 min to complete the questionnaire. Each partner filled out the questionnaire independently. If patients or spousal caregivers failed to complete the questionnaire or selected identical options throughout, the questionnaire for that dyad was excluded. Ethical approval for this project was obtained from the Institutional Review Board (IRB) at Burapha University and Yancheng No. 1 People's Hospital in Jiangsu, China. This study was conducted in accordance with the Declaration of Helsinki.

## Measures

### **Demographics and disease-related information questionnaire**

Both partners in the couples completed a questionnaire on demographics, including age, marital status, education level, occupation, residence, monthly income, and health care payment method. Additionally, cervical cancer patients provided disease-related information, including the stage of cancer, pathological type, and treatment method.

**Dyadic Coping Inventory (DCI)** was used to measure how couples support each other in stressful situations. Xu et al. [44] developed the Chinese version of the DCI with 37 items measured on a 5-point Likert scale, including subscales for stress communication (e.g., openly expressing stress or emotional vulnerability to a partner), supportive dyadic coping (e.g., providing emotional or practical support to a partner in response to their expressed stress.), delegated dyadic coping (e.g., temporarily taking over tasks or responsibilities to alleviate a partner's burden), common dyadic coping (e.g., joint efforts by both partners to address shared stressors), and negative dyadic coping (e.g., hostile, dismissive, or superficial responses to a partner's stress), along with two single items regarding satisfaction with and efficiency of dyadic coping. Scores range from 35 to 175, with 111 as the critical value. Scores below 111 indicate below-average coping, scores between 111 and 145 indicate normal coping, and scores above 145 indicate above-average coping. In the current sample, the Cronbach's coefficients were 0.959 for patients and 0.969 for spousal caregivers.

**The General Self-efficacy Scale (GSES)** was used to measure general self-efficacy. It is a 10-item Chinese version of the General Self-efficacy Scale [45]. Each item is rated on a 4-point scale from 1 (strongly disagree) to 4 (strongly agree). Based on the total score, self-efficacy is categorized into three levels: 10–19 indicates low, 20–30 indicates medium, and 31–40 indicates high self-efficacy. The total score is the sum of all the items, with higher scores indicating higher self-efficacy. In the current sample, the Cronbach's coefficients were 0.959 for patients and 0.964 for spousal caregivers.

**The 12-item Short-Form health survey (SF-12)** was used to measure the QoL of cervical cancer patients and their spouses [46]. There are 12 items on the SF-12, with 8 subscales: physical functioning (PF), role limitations due to physical problems (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and perceived mental health (MH). Additionally, it includes two summary scales. The physical QoL (PCS), which stands for the summary score of physical function, is a composite score calculated from four aspects: PF, RP, BP, and GH. The mental QoL (MCS), representing the summary

score of mental function, is derived from four aspects: VT, SF, RE, and MH. Scores range from 0 to 100, with higher scores indicating better QoL. The Chinese SF-12 version has been validated and showed high reliability in this study, with Cronbach's alpha coefficients of 0.896 for patients and 0.837 for spousal caregivers.

### **Data analysis**

Data analysis was conducted using SPSS 25.0 and AMOS 20.0. Descriptive statistics, including means and standard deviations for continuous variables and proportions for categorical variables, were initially calculated to profile demographic and cancer-related characteristics, dyadic coping, self-efficacy, and QoL. Mean differences between patients' and spouses' reports were compared using one-way ANOVA or paired samples t-test. Pearson correlation analysis was used to assess relationships among dyadic coping, self-efficacy, and QoL in the patient-spouse dyads.

To examine dyadic interdependence and mediation mechanisms, the APIMeM with distinguishable dyads was employed. The APIMeM was utilized to investigate whether dyadic coping of patients and spouses, directly and indirectly, affected their own and their partner's mental QoL (MCS) and physical QoL (PCS) through the mediating role of their own and their partners' self-efficacy in this study. Two separate APIMeMs were constructed for mental QoL (MCS) and physical QoL (PCS), incorporating dyadic variables (dyadic coping and self-efficacy) as predictors and mediators. Path analysis with full information maximum likelihood estimation and bootstrapping was used to test the hypotheses, utilizing two APIMeMs [40], one for mental QoL (MCS) and another for physical QoL (PCS), incorporating dyadic variables such as dyadic coping and self-efficacy. Missing data were handled using FIML estimation, which ensures unbiased parameter estimates and maximizes the use of available data, reducing potential bias due to missing values. Prior to conducting path analysis, assumptions of normality and homogeneity of variance were tested. Model estimation was performed using maximum likelihood with bootstrapping (5,000 resamples). The models aimed to identify direct (actor and partner effects) and indirect effects (self-efficacy's mediation between dyadic coping and MCS/PCS). Insignificant paths were removed to achieve an unsaturated model. Model fit was evaluated using the Comparative Fit Index ( $CFI > 0.90$ ), Normed Fit Index ( $NFI > 0.90$ ), Root Mean Square Error of Approximation ( $RMSEA < 0.05$  for a good fit;  $< 0.08$  as acceptable), and the chi-square to degrees of freedom ratio ( $\chi^2/df$ ;  $< 2.0$  recommended) (43,44). Mediation effects were tested by examining bootstrapped 95% confidence intervals (CIs) of path parameters, which were considered significant if they did not include zero.

## Results

### Demographic and clinical characteristics of patients with cervical cancer and their spousal caregivers

Table 1 presents the demographic and medical information of all patients with cervical cancer and their spousal caregivers. Most participants were aged between 40 and

**Table 1** Sociodemographic characteristics and clinical data of patients with cervical cancer and their spousal caregivers

| Characteristics                            | Patients<br>(n = 288) | Spousal<br>caregivers<br>(n = 288) |
|--------------------------------------------|-----------------------|------------------------------------|
| <b>Age (years)</b>                         |                       |                                    |
| ≤40                                        | 38 (13.2)             | 33 (11.5)                          |
| 40–60                                      | 148 (51.4)            | 140 (48.6)                         |
| ≥60                                        | 102 (35.4)            | 115 (39.9)                         |
| <b>Marital status</b>                      |                       |                                    |
| Married within 20 years                    | 43 (14.9)             | -                                  |
| Married within 20 ~ 30 years               | 72 (25.0)             | -                                  |
| Married for over 30 years                  | 173 (60.1)            | -                                  |
| <b>Education level</b>                     |                       |                                    |
| Elementary school or less                  | 146 (50.7)            | 89 (30.9)                          |
| Junior high school                         | 89 (30.9)             | 122 (42.4)                         |
| High school or more                        | 53 (18.4)             | 77 (26.7)                          |
| <b>Occupation, n (%)</b>                   |                       |                                    |
| Unemployed                                 | 71 (24.7)             | 16 (5.6)                           |
| Employed                                   | 185 (64.2)            | 242 (84.0)                         |
| Retired                                    | 32 (11.1)             | 30 (10.4)                          |
| <b>Residence, n (%)</b>                    |                       |                                    |
| Rural                                      | 123 (42.7)            | -                                  |
| Town                                       | 64 (22.2)             | -                                  |
| County                                     | 63 (21.9)             | -                                  |
| City                                       | 38 (13.2)             | -                                  |
| <b>Monthly income (RMB [US \$]), n (%)</b> |                       |                                    |
| <3000 (444.18)                             | 110 (38.2)            | -                                  |
| 3000 ~ 5000 (444.18–740.30)                | 101 (35.1)            | -                                  |
| >5000 (740.30)                             | 77 (26.7)             | -                                  |
| <b>Health care payment method</b>          |                       |                                    |
| Self-supporting                            | 14 (4.9)              | -                                  |
| Medical insurance for urban residents      | 120 (41.7)            | -                                  |
| New rural cooperative medical care system  | 154 (53.5)            | -                                  |
| <b>Stage of tumor, n (%)</b>               |                       |                                    |
| Stage I                                    | 93 (32.3)             | -                                  |
| Stage II                                   | 126 (43.8)            | -                                  |
| Stage III                                  | 55 (19.1)             | -                                  |
| Stage IV                                   | 14 (4.9)              | -                                  |
| <b>Pathological type</b>                   |                       |                                    |
| Squamous cell carcinoma                    | 261 (90.6)            | -                                  |
| Adenocarcinoma                             | 24 (8.3)              | -                                  |
| Other                                      | 3 (1.1)               | -                                  |
| <b>Treatment method</b>                    |                       |                                    |
| Surgical Treatment                         | 94 (32.6)             | -                                  |
| Surgery + Radiotherapy + Chemotherapy      | 125 (43.4)            | -                                  |
| Radiotherapy + Chemotherapy                | 69 (24.0)             | -                                  |

Note: CC = cervical cancer

60 years, couples married for more than 30 years were the most represented group. Education levels were relatively low among patients with cervical cancer, with only 18.4% having a high school education or higher. Most patients with cervical cancer and their spousal caregivers were currently employed, accounting for 64.2% and 84.0%, respectively. Most participants resided in rural areas, and 73.3% reported low to moderate monthly incomes levels. The main healthcare payment method was the New Rural Cooperative Medical Care System (53.5%). Most patients were diagnosed with cancer below stage II (76.1%) and had squamous carcinoma (90.6%), and 76.0% were scheduled for treatment options involving surgery alone or surgery combined with chemotherapy and radiotherapy.

### Descriptive characteristics for dyadic coping, self-efficacy, and quality of life among patients with cervical cancer and their spousal caregivers

Table 2 presents the descriptive statistics of the model's constructs, including dyadic coping, self-efficacy, and QoL among patients with cervical cancer and their spousal caregivers. Harman's Single-Factor Test was used to mitigate potential common method biases inherent in the questionnaire-based methodology. Exploratory factor analysis revealed that the maximum unrotated factor variance accounted for was 31.42%, which is below the critical threshold of 40% (45). This indicates an absence of any single dominant factor explaining the majority of variance in the sample data, suggesting no substantial common method biases in this study. The variables exhibited skewness values from −0.720 to 0.824 and kurtosis values from −0.524 to 0.677, indicating a relatively normal distribution.

Paired sample t-tests were used to examine potential disparities in dyadic coping, self-efficacy, and QoL between patients with cervical cancer and their spousal caregivers. The results showed that except for Common dyadic coping and Evaluation of dyadic within dyadic coping, which had no significant differences between the two groups ( $p > .05$ ), all other scales and components exhibited significant differences ( $p < .05$ ). Dyadic coping mean scores for cervical cancer patients and their spousal caregivers were  $125.55 \pm 22.78$  and  $130.46 \pm 21.42$  respectively, suggesting a standard level of dyadic coping. Self-efficacy mean scores for cervical cancer patients and their spousal caregivers were  $23.12 \pm 6.34$  and  $25.63 \pm 6.94$  respectively, indicating a moderate level of self-efficacy. Physical QoL (PCS) T-scores for patients with cervical cancer were  $38.95 \pm 9.55$ , and mental QoL (MCS) scores were  $41.62 \pm 10.18$ , indicating low levels of physical and mental health in QoL. Notably, spousal caregivers had a normal level of physiological status with physical QoL(PCS) T-score of  $58.90 \pm 10.11$ . However,

**Table 2** Descriptive characteristics for dyadic coping, self-efficacy, and quality of life among patients with cervical cancer and their spousal caregivers ( $n = 288$ )

| Variable                           | Patients<br>( $n = 288$ ) | Spousal<br>caregivers<br>( $n = 288$ ) | t       | p-value |
|------------------------------------|---------------------------|----------------------------------------|---------|---------|
|                                    | M(SD)                     | M(SD)                                  |         |         |
| <b>Dyadic coping</b>               |                           |                                        |         |         |
| Total                              | 125.55 ± 22.78            | 130.46 ± 21.42                         | -5.106  | < 0.001 |
| Stress communicated                | 27.38 ± 7.27              | 29 ± 5.93                              | -4.419  | < 0.001 |
| Supportive dyadic coping           | 34.67 ± 8.55              | 37.35 ± 7.10                           | -6.579  | < 0.001 |
| Delegated dyadic coping            | 14.63 ± 3.06              | 14.96 ± 2.70                           | -2.167  | 0.031   |
| Common dyadic coping               | 17.79 ± 4.06              | 17.84 ± 4.02                           | -0.326  | 0.745   |
| Negative dyadic coping             | 31.09 ± 6.28              | 31.32 ± 6.41                           | -0.723  | 0.47    |
| Evaluation of dyadic coping        | 7.58 ± 1.55               | 7.59 ± 1.62                            | -0.264  | 0.792   |
| <b>Self-efficacy</b>               | 23.12 ± 6.34              | 25.63 ± 6.94                           | -6.584  | < 0.001 |
| <b>Quality of life<sup>a</sup></b> |                           |                                        |         |         |
| <b>Physical component summary</b>  | 38.95 ± 9.55              | 58.90 ± 10.11                          | -25.342 | < 0.001 |
| Physical functioning               | 39.82 ± 11.57             | 66.90 ± 11.23                          | -30.533 | < 0.001 |
| Role-physical                      | 39.44 ± 10.58             | 51.56 ± 7.68                           | -16.24  | < 0.001 |
| Bodily pain                        | 39.57 ± 11.47             | 51.46 ± 9.55                           | -15.122 | < 0.001 |
| General health                     | 34.35 ± 12.37             | 48.92 ± 13.28                          | -15.744 | < 0.001 |
| <b>Mental component summary</b>    | 41.62 ± 10.18             | 43.85 ± 9.82                           | -3.417  | 0.001   |
| Vitality                           | 48.55 ± 10.20             | 56.00 ± 11.83                          | -8.67   | < 0.001 |
| Social functioning                 | 36.23 ± 12.21             | 43.98 ± 12.09                          | -8.617  | < 0.001 |
| Role-emotional                     | 37.30 ± 8.72              | 46.12 ± 10.33                          | -13.751 | < 0.001 |
| Mental health                      | 42.32 ± 11.81             | 49.89 ± 9.46                           | -10.048 | < 0.001 |

<sup>a</sup> Transformed into T-scores based on the normative data from the 1998 general U.S. population

Note: \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

their mental QoL (MCS) T-score of  $43.85 \pm 9.82$  indicated a lower level of mental health.

### Correlations between dyadic coping, self-efficacy, and QoL in Patient-Spousal caregiver dyads

The partial correlations are presented in Table 3. Correlations between dyad members are presented in Table 3. The scores of overall dyadic coping, stress communicated, supportive dyadic coping, delegated dyadic coping, common dyadic coping, negative dyadic coping and

self-efficacy of patients with cervical cancer and of their spousal caregivers were significantly positively correlated with their own physical (PCS), mental (MCS) and overall QoL as well as the spousal caregivers' mental (MCS) and overall QoL but not physical QoL (PCS). Additionally, the negative dyadic coping of patients with cervical cancer exhibited no significant correlation with their own self-efficacy, physical (PCS) and mental (MCS) QoL, nor with that of their spousal caregivers.

### Self-efficacy mediated the association between dyadic coping and mental QoL (MCS) in cervical cancer couples

Standardized estimates for the APIMeM of hypotheses 1 and 2 are presented in Table 4; Fig. 1, showing four significant actor effects and three partner effects. The direct effects observed for both patients and their spouses were not statistically significant. In terms of indirect effects, the analysis indicated that self-efficacy fully mediated the relationship between dyadic coping and mental QoL (MCS) for both patients ( $\beta = 0.068$ ,  $p = .014$ ) and their spouses ( $\beta = 0.062$ ,  $p = .039$ ). Additionally, the partner indirect effect revealed that patients' self-efficacy completely mediated the relationship between their spouses' dyadic coping and the patients' mental QoL (MCS;  $\beta = 0.077$ ,  $p = .005$ ). Specific parameters are listed in Table 3. The original model was a saturation model, which couldn't explore the model fitness and sample data. To test the hypothesis model's fit to the sample data, we deleted insignificant paths: dyadic coping (patient)→mental QoL (patient), dyadic coping (patient)→mental QoL (spouse), dyadic coping (spouse)→mental QoL (spouse), and dyadic coping (spouse)→mental QoL (patient). This resulted in an unsaturated model 1 with good fit indices (RMSEA = 0.067; CFI = 0.989; NFI = 0.981;  $\chi^2 = 11.439$ ;  $df = 5$ ;  $\chi^2 / df = 2.288$ ).

### Self-efficacy mediated the association between dyadic coping and physical QoL (PCS) in cervical cancer couples

Standardized estimates for the APIMeM of hypotheses 3 and 4 are presented in Table 4; Fig. 2. In terms of direct effects, patients' dyadic coping exhibited significant actor effects on their own physical QoL (PCS;  $\beta = 0.375$ ,  $p = .001$ ). Conversely, spouses' dyadic coping demonstrated significant partner effects on patients' physical QoL (PCS;  $\beta = -0.311$ ,  $p = .004$ ). Regarding indirect effects, the actor indirect effects indicated that patients' self-efficacy partially mediated the relationship between dyadic coping and physical QoL (PCS) in patients ( $\beta = 0.074$ ,  $p = .014$ ). Similarly, the partner indirect effects revealed that patients' self-efficacy partially mediated the relationship between spouses' dyadic coping and patients' physical QoL (PCS;  $\beta = 0.084$ ,  $p = .006$ ). After eliminating non-significant pathways, the following relationships were excluded: dyadic coping (spouse)→physical QoL

**Table 3** Partial correlation analysis and correlation matrix among dyadic coping, self-efficacy, and quality of life

| Variables                         | CCP      |          |          |          |          | SCG      |          |          |          |          |          |          |          |          |          |          |          |     |
|-----------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----|
|                                   | 1.       | 2.       | 3.       | 4.       | 5.       | 6.       | 7.       | 8.       | 9.       | 10.      | 11.      | 12.      | 13.      | 14.      | 15.      | 16.      | 17.      | 18. |
| 1.CCP Dyadic coping Total         | 1        |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |     |
| 2.CCP Stress communicated         | 0.873*** | 1        |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |     |
| 3.CCP Supportive dyadic coping    | 0.917*** | 0.841*** | 1        |          |          |          |          |          |          |          |          |          |          |          |          |          |          |     |
| 4.CCP Delegated dyadic coping     | 0.818*** | 0.654*** | 0.782*** | 1        |          |          |          |          |          |          |          |          |          |          |          |          |          |     |
| 5.CCP Common dyadic coping        | 0.751*** | 0.588*** | 0.624*** | 0.637*** | 1        |          |          |          |          |          |          |          |          |          |          |          |          |     |
| 6.CCP Negative dyadic coping      | 0.480*** | 0.162**  | 0.203**  | 0.245*** | 0.234*** | 1        |          |          |          |          |          |          |          |          |          |          |          |     |
| 7.SCG Dyadic coping Total         | 0.728*** | 0.566*** | 0.588*** | 0.636*** | 0.736*** | 0.397*** | 1        |          |          |          |          |          |          |          |          |          |          |     |
| 8.SCG Stress communicated         | 0.653*** | 0.567*** | 0.592*** | 0.587*** | 0.687*** | 0.189**  | 0.902*** | 1        |          |          |          |          |          |          |          |          |          |     |
| 9.SCG Supportive dyadic coping    | 0.704*** | 0.574*** | 0.626*** | 0.640*** | 0.754*** | 0.234*** | 0.941*** | 0.898*** | 1        |          |          |          |          |          |          |          |          |     |
| 10.SCG Delegated dyadic coping    | 0.668*** | 0.540*** | 0.555*** | 0.603*** | 0.669*** | 0.314*** | 0.878*** | 0.806*** | 0.875*** | 1        |          |          |          |          |          |          |          |     |
| 11.SCG Common dyadic coping       | 0.645**  | 0.533*** | 0.552*** | 0.557*** | 0.804*** | 0.177**  | 0.866*** | 0.798*** | 0.867*** | 0.770*** | 1        |          |          |          |          |          |          |     |
| 12.SCG Negative dyadic coping     | 0.363*** | 0.169**  | 0.151*   | 0.270*** | 0.201**  | 0.650*** | 0.551*** | 0.253*** | 0.292*** | 0.314*** | 0.243*** | 1        |          |          |          |          |          |     |
| 13.CCP Self-efficacy              | 0.343*** | 0.342*** | 0.322*** | 0.286*** | 0.354*** | 0.043    | 0.355*** | 0.388*** | 0.357*** | 0.320*** | 0.366*** | 0.066    | 1        |          |          |          |          |     |
| 14.SCG Self-efficacy              | 0.472*** | 0.444*** | 0.456*** | 0.413*** | 0.447*** | 0.086    | 0.549*** | 0.528*** | 0.532*** | 0.487*** | 0.504*** | 0.234*** | 0.527*** | 1        |          |          |          |     |
| 15.CCP Physical component summary | 0.337*** | 0.396*** | 0.409*** | 0.162**  | 0.194**  | 0.002    | 0.175**  | 0.211**  | 0.180**  | 0.165**  | 0.163**  | 0.019    | 0.445*** | 0.330*** | 1        |          |          |     |
| 16.CCP Mental component summary   | 0.313*** | 0.291*** | 0.283*** | 0.166**  | 0.224*** | 0.185**  | 0.275*** | 0.254*** | 0.228*** | 0.213*** | 0.201**  | 0.216*** | 0.504*** | 0.386*** | 0.702*** | 1        |          |     |
| 17.SCG Physical component summary | 0.009    | -0.007   | -0.005   | 0.016    | 0.034    | 0.015    | 0.106    | 0.083    | 0.076    | 0.059    | 0.084    | 0.116    | 0.059    | 0.138*   | 0.071    | 0.107    | 1        |     |
| 18.SCG Mental component summary   | 0.220*** | 0.196**  | 0.168**  | 0.133*   | 0.150*   | 0.180**  | 0.27***  | 0.245*** | 0.207*** | 0.154**  | 0.198**  | 0.258*** | 0.236*** | 0.310*** | 0.293*** | 0.410*** | 0.475*** | 1   |

Adjusted: the age of patients with cervical cancer and spousal caregivers

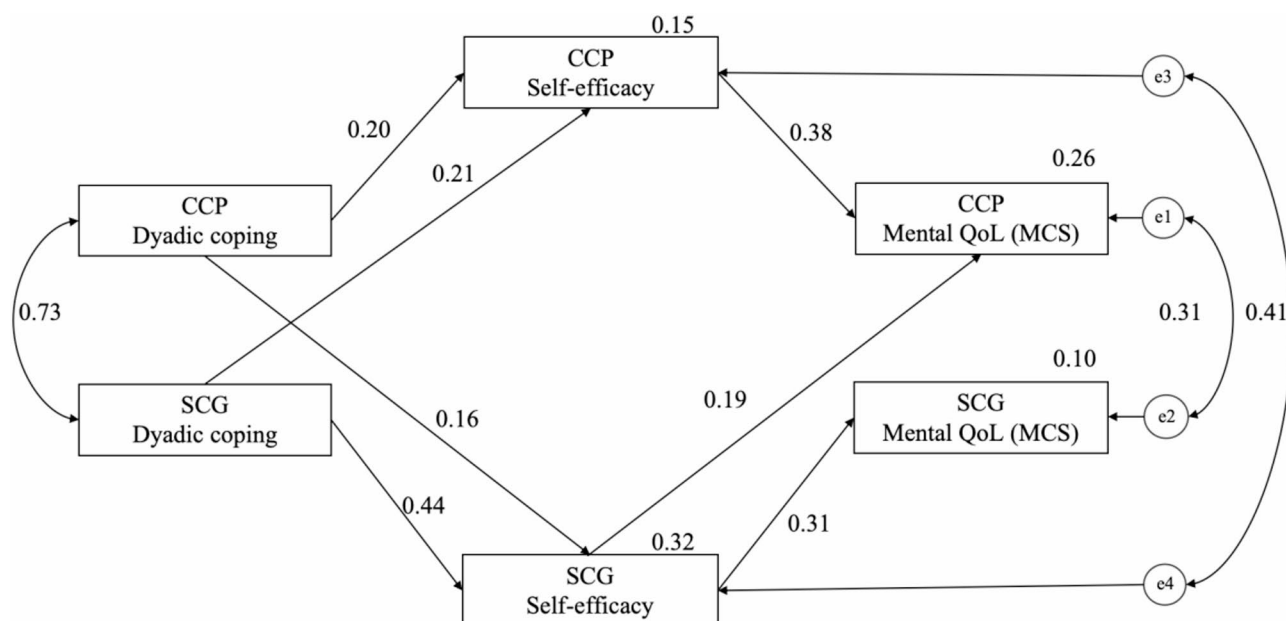
Note: \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$  CCP = patients with cervical cancer; SCG = spousal caregivers

**Table 4** Effect estimates for patients with cervical cancer and their spousal caregivers

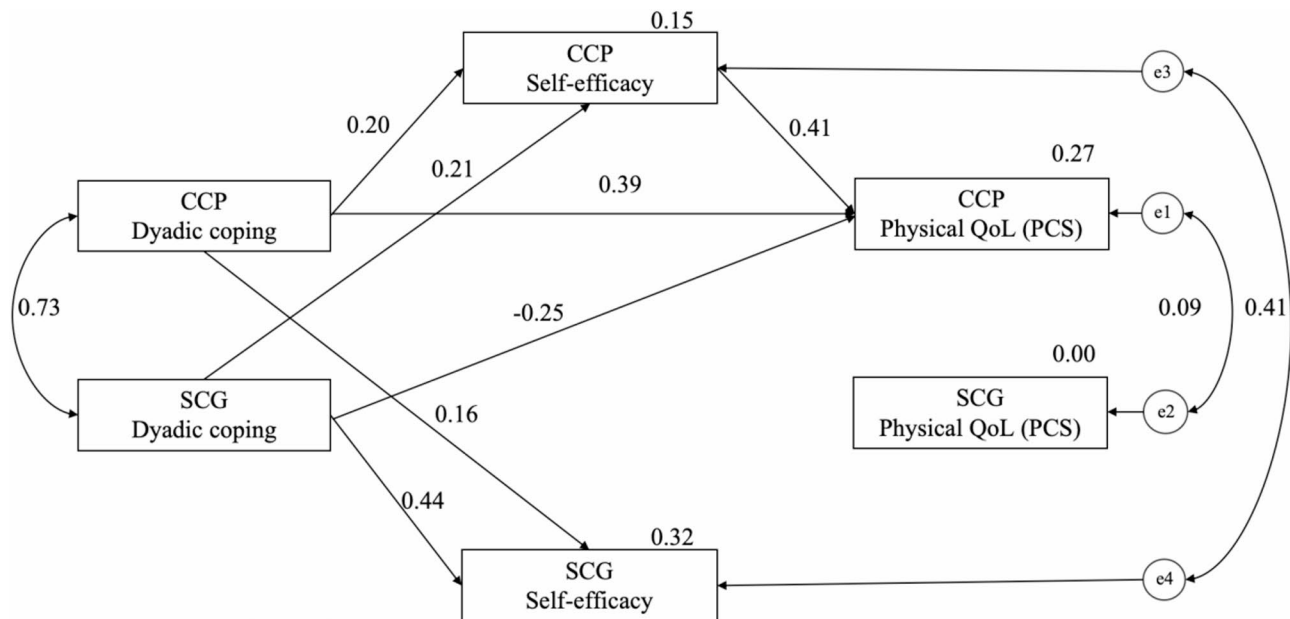
| Effect                        | Submodel mental QoL (MCS) |       |            |             | Submodel physical QoL (PCS) |       |            |             |
|-------------------------------|---------------------------|-------|------------|-------------|-----------------------------|-------|------------|-------------|
|                               | Estimate                  | SE    | 95% CI low | 95% CI high | Estimate                    | SE    | 95% CI low | 95% CI high |
| <b>Patient actor effect</b>   |                           |       |            |             |                             |       |            |             |
| Total effect                  | 0.203**                   | 0.078 | 0.054      | 0.362       | 0.454***                    | 0.101 | 0.254      | 0.651       |
| Total IE                      | 0.086**                   | 0.035 | 0.022      | 0.158       | 0.094**                     | 0.039 | 0.023      | 0.177       |
| Actor-actor simple IE         | 0.068*                    | 0.028 | 0.014      | 0.127       | 0.074*                      | 0.032 | 0.015      | 0.140       |
| Partner-partner simple IE     | 0.018                     | 0.016 | -0.002     | 0.057       | 0.020                       | 0.018 | -0.003     | 0.064       |
| Direct effect c'              | 0.121                     | 0.070 | -0.019     | 0.261       | 0.375***                    | 0.097 | 0.185      | 0.559       |
| <b>Spouse actor effect</b>    |                           |       |            |             |                             |       |            |             |
| Total effect                  | 0.180*                    | 0.070 | 0.042      | 0.313       | 0.168*                      | 0.082 | 0.008      | 0.326       |
| Total IE                      | 0.081**                   | 0.033 | 0.02       | 0.152       | 0.049                       | 0.031 | -0.006     | 0.116       |
| Actor-actor simple IE         | 0.062*                    | 0.032 | 0.003      | 0.130       | 0.044                       | 0.033 | -0.014     | 0.115       |
| Partner-partner simple IE     | 0.019                     | 0.013 | -0.004     | 0.049       | 0.006                       | 0.011 | -0.016     | 0.031       |
| Direct effect c'              | 0.099                     | 0.073 | -0.049     | 0.235       | 0.119                       | 0.086 | -0.054     | 0.282       |
| <b>Patient partner effect</b> |                           |       |            |             |                             |       |            |             |
| Total effect                  | 0.093                     | 0.084 | -0.078     | 0.255       | -0.166                      | 0.108 | -0.377     | 0.049       |
| Total IE                      | 0.131***                  | 0.037 | 0.057      | 0.206       | 0.144***                    | 0.042 | 0.064      | 0.229       |
| Actor-partner actor simple IE | 0.054                     | 0.029 | -0.005     | 0.112       | 0.060                       | 0.033 | -0.007     | 0.123       |
| Partner-actor simple IE       | 0.077**                   | 0.032 | 0.021      | 0.145       | 0.084**                     | 0.036 | 0.022      | 0.162       |
| Direct effect c'              | -0.038                    | 0.085 | -0.208     | 0.124       | -0.311**                    | 0.106 | -0.513     | -0.096      |
| <b>Spouse partner effect</b>  |                           |       |            |             |                             |       |            |             |
| Total effect                  | 0.054                     | 0.063 | -0.068     | 0.179       | -0.088                      | 0.074 | -0.230     | 0.061       |
| Total IE                      | 0.037*                    | 0.020 | 0.005      | 0.082       | 0.020                       | 0.015 | -0.005     | 0.055       |
| Actor-partner actor simple IE | 0.017                     | 0.012 | -0.004     | 0.044       | 0.005                       | 0.010 | -0.014     | 0.028       |
| Partner-actor simple IE       | 0.021                     | 0.015 | -0.002     | 0.057       | 0.015                       | 0.013 | -0.006     | 0.046       |
| Direct effect c'              | 0.017                     | 0.064 | -0.104     | 0.144       | -0.108                      | 0.076 | -0.254     | 0.043       |

Note: QoL=quality of life; MCS=mental component summary; PCS=physical component summary; SE=standard error; CI=confidence interval; IE=indirect effect.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$



**Fig. 1** Standardized estimates of Model 1, including the path analysis results for Hypotheses 1 and 2. CCP=patients with cervical cancer; SCG=spousal caregivers; QoL=quality of life; MCS=mental component summary



**Fig. 2** Standardized estimates of Model 2, including the path analysis results for Hypotheses 3 and 4. CCP = patients with cervical cancer; SCG = spousal caregivers; QoL = quality of life; PCS = physical component summary

(spouse), self-efficacy (spouse)→physical QoL(spouse), self-efficacy (spouse)→physical QoL(patient), self-efficacy (patient)→physical QoL(spouse), and dyadic coping (patient)→physical QoL (spouse). The fit indices for model 2 indicated a good fit (RMSEA = 0.067; CFI = 0.987; NFI = 0.978;  $\chi^2 = 11.531$ ;  $df = 5$ ;  $\chi^2 / df = 2.306$ ).

## Discussions

This study aims to uncover the interconnectedness between dyadic coping, self-efficacy, and QoL among patients with cervical cancer and their spousal caregivers, providing insights for targeted support and interventions to enhance their overall well-being. This study employed the APIMeM to investigate self-efficacy as a mediator in the relationship between dyadic coping and QoL among patients with cervical cancer and their spousal caregivers. The APIMeM allowed us to explore self-efficacy as the mechanism through which dyadic coping predicts QoL for both cervical cancer patients and their spousal caregivers, independently and dyadically, considering the interdependence of the couples' relationship. This is the first study to investigate the dyadic associations among dyadic coping, self-efficacy, and QoL in patients with cervical cancer and their spousal caregivers. Overall, the findings suggest that self-efficacy mediates the relationship between dyadic coping and QoL in cervical cancer patients and their spousal caregivers. Additionally, significant partner effects were observed, indicating that the experiences of dyadic coping by family members affect QoL, especially for spousal caregivers.

### Spousal caregivers demonstrated higher dyadic coping than cervical cancer patients

This study investigated the performance of newly diagnosed cervical cancer patients and their spousal caregivers in dyadic coping, self-efficacy, and QoL, as well as the differences between them. Results showed that spousal caregivers had higher dyadic coping scores than patients. There was no significant difference in common dyadic coping between patients and their spousal caregivers, suggesting they can form a united front in facing cancer, sharing emotions, and collaborating in dealing with the disease's challenges. However, this may also indicate a lack of independent coping strategies, necessitating nurse-led interventions that balance joint and individual coping [37]. For example, integrating structured exercises (e.g., role-specific problem-solving tasks) into psychoeducation programs could empower both partners to develop autonomy while maintaining collaboration. Significant differences were observed in all other aspects of dyadic coping, except common dyadic coping. This phenomenon may relate to caregivers adopting more active and diverse strategies in coping with stress and adapting to changes in the medical condition. They might take a more proactive approach to maintain family harmony and manage personal stress better [47].

### Spousal caregivers exhibited higher self-efficacy than cervical cancer patients

Spousal caregivers also scored significantly higher in self-efficacy than patients. This may be attributed to the sense of control and problem-solving capabilities that spouses

gradually develop in the caregiving process. According to self-efficacy theory [32], an individual's self-efficacy is enhanced through successful experiences and observational learning. Thus, spousal caregivers may experience an increase in self-efficacy as they continuously face and overcome challenges associated with caregiving [48].

### **Spousal caregivers had higher QoL than cervical cancer patients**

Regarding QoL, although both groups scored lower than the average for the normal population in psychological aspects of QoL, spousal caregivers scored significantly higher than patients. This may reflect the greater direct psychological stress caused by the cancer diagnosis and treatment for patients. In contrast, while spouses also experience stress, they may better utilize resources such as social support to alleviate it [49]. Physiologically, the QoL scores for spousal caregivers were higher than the average for the US normal population [9], which may be related to our sample characteristics, namely newly diagnosed cervical cancer patients and their spouses. Healthier individuals may self-select into caregiving roles, potentially skewing the sample towards those with better physical health. Over time, however, these scores may decline as the stress and responsibilities of caregiving increase [50].

Overall, these findings are consistent with existing literature on coping strategies, self-efficacy, and QoL for chronic disease patients and their caregivers [51–53]. For instance, the literature indicates that chronic diseases can have a broad impact on patients and their family members, and spouses as informal caregivers may experience significant psychological and physiological stress [51]. However, in some cases, spouses gain positive experiences and personal growth through their involvement in caregiving [53].

### **Actor-partner effects in dyadic coping and self-efficacy among cervical cancer couples**

This study found significant actor and partner effects in the relationship between dyadic coping and self-efficacy among cervical cancer patients and their spousal caregivers and emphasized the importance of interaction between patients and spouses in managing chronic diseases. These findings echo Banford Witting et al. [54], who observed similar bidirectional effects in couples under stress. The influence of Chinese culture, which strongly emphasizes collectivism and group harmony, plays a significant role in shaping how couples experience and manage illness. Cultural expectations encourage couples to share weal and woe, treating illness as a shared challenge that both partners confront together. In addition, rooted in the tradition of filial piety, adult children often provide intergenerational support, including

caregiving duties and financial support. This broader familial involvement may foster more collaborative dyadic coping strategies and enhance self-efficacy within the patient-caregiver dyad. Similar cultural dynamics are observed in other collectivistic societies, such as South Korea and Japan [55].

In contrast, individualistic cultures (e.g., Western countries) often prioritize personal autonomy, which shapes illness management differently. In this culture, illness is typically viewed as a patient's challenge, and the partner often assumes the role of a supporter rather than a co-decision maker. This dynamic may reduce shared coping capacity and limit the development of mutual self-efficacy. These cultural distinctions underscore the importance of designing culturally tailored interventions. In collectivist contexts, promoting joint coping efforts between patients and caregivers—as well as engaging other family members in decision-making and emotional support—can help enhance patients' confidence in treatment and boost self-efficacy. Conversely, in the individualistic culture, interventions may benefit from encouraging mutual empowerment while also respecting personal boundaries and autonomy, and from developing family support plans that strengthen caregiver involvement and decision-making, ultimately improving family cohesion and self-efficacy.

Additionally, China's increasing trend toward gender egalitarianism may promote the development of shared coping responsibilities, potentially enhancing both dyadic coping and self-efficacy. According to Bandura's [32] theory of self-efficacy, an individual's belief in their capacity to manage challenges is crucial to adaptive functioning. When patients adopt positive coping strategies, their self-efficacy increase, and through behavioral modeling or emotional support, their partners' self-efficacy may also increase. This process aligns with Revenson and DeLongis's [56] dyadic coping model, which suggests that partners' coping behaviors influence one another and jointly affect the adaptation process. Recent studies support these findings. For instance, Acquati et al. [57] found that joint coping strategies in breast cancer patients and their partners were significantly associated with better psychological outcomes for both. Similarly, Lyons et al. [58] revealed that partner support positively influenced patients' self-management behaviors and self-efficacy in patients with chronic illness.

### **Self-efficacy differentially impacts mental and physical quality of life in cervical cancer dyads**

Analyzing the association between self-efficacy and QoL among cervical cancer patients and their caregiving spouses, we first focused on mental QoL (MCS) impact. This study found a positive actor effect between the self-efficacy of cervical cancer patients and their spouses and

their respective mental QoL(MCS) levels, consistent with Bandura's self-efficacy theory [32]. This theory posits that self-efficacy is a key factor affecting an individual's psychological state. The results are supported by recent research indicating that self-efficacy plays a significant role in managing chronic diseases [59]. For spouses, the positive effect their self-efficacy has on the psychological health of patients further emphasizes the role of the spouse in the caregiving process, aligning with the previous finding [60] who found that active participation and supportive behaviors of spouses can significantly enhance patients' psychological well-being. However, our study suggests that this positive impact is not just due to emotional support but also stems from the spouses' own self-efficacy, offering a new perspective on partner interactions. Discussing the impact of self-efficacy on physical QoL (PCS), the significant positive main effect between patients' self-efficacy and physical QoL (PCS) suggests that self-efficacy enhances patients' confidence in managing their illness. During early cervical cancer treatment, patients may face uncertainty and stress, where increased self-efficacy helps them adhere to treatment plans and engage in health management behaviors [61]. Moreover, actor and partner effects are not significant in the relationship between self-efficacy and physical QoL (PCS) among spousal caregivers, nor are there partner effects between patients' self-efficacy and spousal caregivers' physical QoL (PCS), contradicting Cao et al. [36] who reported a positive impact of patient self-efficacy on couples. This discrepancy might be due to cultural differences, sample characteristics, or research design differences. Another reason might be that caregivers focus more on providing emotional support rather than directly managing the patient's physical health.

#### **The mediating role of self-efficacy in dyadic coping and mental QoL**

Additionally, our results demonstrated that spousal caregivers' self-efficacy mediated the relationship between dyadic coping and mental QoL (MCS) for both patients with cervical cancer and their spousal caregivers. Similarly, cervical cancer patient's self-efficacy mediated the relationship between their own dyadic coping, spousal caregivers' dyadic coping, and their own mental QoL (MCS). This finding aligns with the TDIM [58], which posits that partner interaction is crucial for illness management and can promote psychological health by enhancing self-efficacy in both parties. Previous studies [62–64] have confirmed that cervical cancer is a dyadic stressor affecting both patients and spousal caregivers. Our findings align with a previous study [62], which also found that dyadic coping strategies improve mental health by enhancing self-efficacy. However, no significant actor direct effect was observed between dyadic coping

and mental QoL (MCS) in both cervical cancer patients and their spousal caregivers, contrary to Mitra et al. [65], who reported that effective dyadic coping strategies could directly improve partners' mental health. This discrepancy may be due to sample specificity, disease stage, or cultural background. Future research should explore how these factors influence the relationship between dyadic coping and mental health in different contexts.

#### **The mediating role of self-efficacy in dyadic coping and physical QoL**

This study employed the APIMeM to elucidate the dyadic relationships among dyadic coping, self-efficacy, and QoL in cervical cancer patient-caregiver dyads, revealing that self-efficacy fully mediated the dyadic coping-mental QoL (MCS) relationship while partially mediating the dyadic coping-physical QoL (PCS) association. However, there was no mediating effect of self-efficacy between dyadic coping and physical QoL (PCS) among spousal caregivers, and no actor effect was found between caregivers' dyadic coping and their own physical QoL (PCS) in Model 2. Interestingly, a significant negative partner effect was observed—higher caregiver dyadic coping was associated with lower physical QoL in patients ( $\beta = -0.311, p < .01$ ). In Chinese collectivist contexts, caregivers' intensive engagement may manifest as over-protective behaviors (e.g., restricting patients' physical activities), inadvertently hindering functional recovery. Simultaneously, patients may perceive such devotion as implicit demands for dependency, generating guilt that exacerbates physical symptoms [66]. This aligns with the “sacrifice paradox” observed in Confucian dyads, where disproportionate caregiving investment correlates with poorer recipient outcomes. Future interventions should calibrate caregiver involvement to avoid compromising patient autonomy. This dynamic could obscure the potential benefits of dyadic coping on caregivers' physical QoL (PCS). To address this, nurses might design interventions that explicitly address caregivers' physical health, such as integrating brief physical activity routines (e.g., partnered stretching exercises) into caregiving tasks [67]. Our findings partially agree with previous literature documenting the positive impact of dyadic coping on patient outcomes [59, 68]. However, the lack of a mediating effect on caregivers' physical QoL (PCS) highlights the complexity of dyadic processes and suggests that different mechanisms may operate for patients and their spouses [61].

#### **Clinical implications and limitations**

Understanding the mediating role of self-efficacy in the relationship between dyadic coping and QoL allows healthcare professionals to tailor support programs that build confidence in managing illness-related challenges. The interventions aimed at enhancing self-efficacy could

significantly improve the QoL for both cervical cancer patients and their spousal caregivers. Such interventions should facilitate emotional expression and mutual spousal support, provide structured positive feedback, and organize group sessions for shared experiential learning. Involving extended family in decision-making and encouraging their practical/emotional assistance could further strengthen the caregiving environment. The characteristics of the interventions should be (1) Integrating dyadic communication and self-efficacy strategies into clinical care routines, (2) Conducting longitudinal or intervention studies to verify causal mechanisms of culturally adapted programs; (3) Enhancing nursing education to develop skills in recognizing dyadic dynamic and delivering self-efficacy support; (4) Embedding psychosocial support within oncology services while promoting interdisciplinary collaboration.

However, limitations require acknowledgment: First, the cross-sectional design restricts us from establishing causal directionality among dyadic coping, self-efficacy, and QoL; therefore, longitudinal cohort studies or randomized controlled trials are needed to confirm self-efficacy's mediating role. Second, the exclusive reliance on self-reported measures may introduce response bias, as participants' answers could be influenced by social desirability or inaccurate self-perception. Although the study included participants with varied demographic and clinical backgrounds, the use of convenience sampling limits the representativeness and generalizability of findings. To address this, future studies should consider incorporating observational methods, physiological markers, or third-party evaluations to enhance validity. Third, convenience sampling restricts external validity; future work should adopt stratified random or multicenter sampling that spans different disease stages, treatment modalities, and socioeconomic factors to enhance generalizability. Fourth, unmeasured confounders—such as cancer stage, treatment timeline, and financial burden—may have influenced our findings; thus, researchers should systematically collect clinical and socioeconomic data to include as covariates or moderators. From a methodological perspective, future research should adopt more rigorous designs, such as stratified random sampling or multicenter studies, and control for key covariates. Theoretically, the study was based on the dyadic coping model, but did not explore how cultural or contextual factors might interact with dyadic processes, which warrants further investigation. Addressing these limitations will strengthen the robustness of future studies and contribute to more comprehensive intervention development.

## Conclusion

In conclusion, this research emphasizes the importance of considering both partners in the dyadic illness management process, particularly during the initial stages of adapting to a cervical cancer diagnosis. For future research, conducting longitudinal studies to track coping strategies, self-efficacy, and QoL of patients and spouses over time is recommended to validate these findings and gain deeper insights. Additionally, considering the impact of cultural background, socioeconomic status, and individual differences on these variables is crucial. Furthermore, future researchers should incorporate qualitative methods to explore the complex factors affecting these variables in depth and to develop targeted interventions in practice to enhance the QoL for cervical cancer patients and their spouses.

## Acknowledgements

The authors acknowledge the cervical cancer couples who participated in the study, as well as the hospital staff members who assisted in data collection.

## Author contributions

Material preparation and data collection were performed by Chuntao Wang. Conceptualization, funding acquisition, project administration, software, supervision and visualization were performed by Chuntao Wang, Longyan Bian, Pornpat Hengudomsub, and Chintana Wacharasin. Data analysis were performed by Chuntao Wang, Fan Wu, and Yaling Wang. The first draft of the manuscript was written by Chuntao Wang, Pornpat Hengudomsub, all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

## Funding

This work was supported by The Project of Foreign Experts' Workshops in Jiangsu Province, Jiangsu Higher Education Institution Innovative Research Team for Science and Technology (2023), the Science and Technology Program of Yancheng City (YCBE202316), and the Jiangsu Provincial Education Science Planning Project (Key Project; B-b/2024/02/82), Leading Talents Cultivation Support Program of Jiangsu Medicine College. The funders had no role in considering the study design or in the collection, analysis, interpretation of data, writing of the report, or decision to submit the article for publication.

## Data availability

The data supporting the findings of this study are available from the corresponding author, Chintana Wacharasin, upon reasonable request.

## Declarations

### Ethics approval and consent to participate

This study was approved by the Institutional Review Board (IRB) of Yancheng No. 1 Peoples' Hospital in Jiangsu, China (IRB No. 2021K131) and the Ethics Committee for Human Research at the Burapha University (IRB No. IRB3-067/2565). This study was also conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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Received: 28 June 2024 / Accepted: 8 July 2025

Published online: 08 August 2025

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