A Qualitative Study on Influencing Factors of Preoperative Frailty in Elderly Gastric Cancer Patients from a Health Ecology Perspective: Postprint

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Date: 2022-10-28T00:00:00+00:00

Abstract

Background Preoperative frailty is a serious negative state reflecting reduced overall physiological reserve, which is highly prevalent among elderly gastric cancer patients. Describing patient-perceived influencing factors of frailty can provide an important basis for developing targeted intervention programs.

Objective To specifically describe the influencing factors of preoperative frailty perceived by elderly gastric cancer patients.

Methods Based on the health ecology theory, a descriptive qualitative study was conducted using purposeful sampling to select 29 frail patients scheduled for gastric cancer surgery at a tertiary Grade A hospital in Jiangsu Province from February to June 2021 for semi-structured interviews. Directed content analysis was employed for data analysis.

Results A total of 5 themes and 13 sub-themes were extracted: physiological characteristics, including age-related cumulative deficits, prominent gastrointestinal symptoms, and persistent disease impact; behavioral characteristics, including lack of exercise behavior and significant physical activity expenditure; interpersonal networks, including insufficient peer socialization, lack of parent-child interaction, and lack of spousal communication and self-disclosure; living and working conditions, including heavy personal economic burden, unplanned family caregiving tasks, and insufficient health and disease management information resources; macro-level factors, including limited medical service levels and restricted health insurance support.

Conclusion This study specifically described the impact of factors from different dimensions on preoperative frailty from a health ecology perspective as per-

ceived by elderly gastric cancer patients. Healthcare professionals can develop and implement systematic prehabilitation programs based on these multidimensional factors to effectively improve patients' preoperative stress resistance and postoperative outcomes.

Full Text

Preamble

Perceived Influencing Factors of Preoperative Frailty among Elderly Patients with Gastric Cancer from the Perspective of Health Ecology: A Qualitative Study

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Funding: National Natural Science Foundation of China General Program "Exploration of Frailty Trajectories and Intervention Design for Gastric Cancer Survivors from the Perspective of Health Ecology" (Project No.: 82073407)

Abstract

Background: Preoperative frailty is a severe negative state reflecting reduced overall physiological reserve that is highly prevalent among elderly gastric cancer patients. Describing patients' perceived influencing factors of frailty can provide an important basis for developing targeted intervention plans. **Objective:** To describe the perceived influencing factors of preoperative frailty among elderly gastric cancer patients. **Methods:** Based on health ecology theory, a descriptive qualitative study was conducted using purposive sampling to select 29 frail patients scheduled for gastric cancer surgery at a tertiary hospital in Jiangsu Province between February and June 2021 for semi-structured interviews. Directed content analysis was used for data analysis. **Results:** Five themes and thirteen sub-themes were extracted: physiological traits (including accumulated aging-related losses, obvious gastrointestinal symptoms, and successive disease attacks); behavioral characteristics (including lack of exercise behavior and significant physical activity consumption); interpersonal networks (including insufficient peer social interaction, lack of parent-child interaction, and lack of

communication and self-disclosure between spouses); living and working conditions (including heavy individual financial burden, heavy unplanned family care tasks, and insufficient health and disease management information resources); and macro factors (including limited medical service levels and limited medical insurance support). **Conclusion:** This study specifically described the perceived effects of multi-dimensional factors on preoperative frailty among elderly gastric cancer patients from a health ecology perspective. Healthcare professionals should formulate and implement systematic prehabilitation programs based on these factors to effectively improve patients' preoperative anti-stress capacity and postoperative outcomes.

Keywords: Gastric cancer; Frailty; Health ecology; Qualitative study

Introduction

The incidence and mortality rates of gastric cancer rank second and third respectively among all cancers in China, posing a major public health threat to residents' lives and health. Surgery remains the primary treatment modality. With the intensifying aging trend, patients aged 60 and above account for 70.8% of all gastric cancer cases, making elderly gastric cancer patients a substantial population. Due to factors such as tumor consumption, aging, and malnutrition, frailty is highly prevalent among elderly gastric cancer patients, with an incidence rate of 36.13%. Frailty refers to a non-specific state of multi-system dysfunction and reduced physiological reserve that increases susceptibility to stressors, characterized by decreased grip strength, fatigue, slowed gait, reduced physical activity, and weight loss. Research has shown that preoperative frailty significantly increases the risk of multiple adverse postoperative outcomes in elderly gastric cancer patients, including increased complications and mortality. Therefore, it is urgent to identify key influencing factors of preoperative frailty in this population and implement preoperative prehabilitation to improve their preoperative health status and postoperative outcomes.

Multiple quantitative studies have identified numerous frailty influencing factors, including malnutrition, depression, and insufficient social support. However, these studies typically employ predetermined universal scales for objective measurement of each factor, which cannot capture patients' specific experiences and perceptions, and lack detailed descriptions of these perceived influencing factors. Moreover, existing frailty influencing factor studies often lack theoretical frameworks, resulting in fragmented analysis findings. Health ecology theory posits that health problems result from interactions among five levels: physiological traits, behavioral characteristics, interpersonal networks, living and working conditions, and macro factors (including local, national, and global policies, economics, and culture). This framework aligns well with the multi-dimensional nature of frailty influences and has been widely applied in studies examining influencing factors of mental disorders and chronic diseases. This study em-

ploys qualitative research to describe elderly gastric cancer patients' perceived preoperative frailty influencing factors from a health ecology perspective, aiming to supplement and enrich previous quantitative findings and provide a basis for developing more systematic and targeted preoperative frailty prehabilitation programs.

Methods

1.1 Study Participants

Using purposive sampling, elderly patients scheduled for gastric cancer surgery at a tertiary hospital in Jiangsu Province between February and June 2021 were selected as study participants. Inclusion criteria: aged $ $60 years; diagnosed with gastric cancer through gastroscopy and pathology; identified as frail through the Frailty Phenotype (FP) assessment (score $ $3 points) and able to perceive their own frailty status; scheduled for initial time-limited gastric cancer surgery; clear consciousness with ability to express views fluently; aware of their disease diagnosis. Exclusion criteria: severe cardiac, hepatic, or renal insufficiency; physical disability; concurrent tumors at other sites. This study was approved by the hospital ethics committee (Approval No.: 2020-SR-516), and all participants voluntarily agreed to participate and signed informed consent forms. Following the principle of information saturation, 29 patients were ultimately included for interviews. General information about the participants is shown in Table 1 .

1.2.1 Development of Interview Outline

Based on health ecology theory and through discussion among research team members, a preliminary interview outline was developed. Two patients were selected for pilot interviews, and based on the results, the outline was revised to form the final version. Specific content included: Do you consider yourself to be in a frail state? That is, compared to before, have you recently experienced obvious physical decline, such as weight loss, fatigue, lack of energy, reduced activity, and slow walking? Which aspects of your individual health condition do you think affect this state? Which behavioral characteristics or habits do you think affect this state? Which aspects of interpersonal relationships or interactions do you think affect this state? Which aspects of living or working conditions do you think affect this state? Which aspects of macro-level factors (such as economy, policy, and culture) do you think affect this state?

1.2.2 Data Collection Methods

Data were collected through one-on-one semi-structured interviews. Interview times were scheduled in advance with participants, with interviews conducted in quiet meeting rooms ensuring no outsiders entered during the process. All par-

ticipants received one interview session lasting 30-60 minutes. Before interviews, the research purpose, significance, and content were explained, and participants were assured of complete confidentiality. Interviews were recorded with participants' consent. During interviews, researchers listened carefully, maintained a neutral attitude, encouraged participants to fully express their views and experiences, and employed appropriate probing, paraphrasing, and summarizing techniques while observing and recording non-verbal behaviors such as facial expressions and body language.

1.2.3 Data Processing and Analysis Methods

Within 24 hours after each interview, recordings were transcribed into text documents annotated with participants' basic information, recording duration, and interview time. To protect privacy, participants' names were replaced with codes. Transcripts were imported into NVivo 12.0 software in numerical order, and two researchers independently conducted repeated reading, organization, and coding of the data. Guided by health ecology theory, this study employed directed content analysis. Specific steps included: identifying analysis units, treating sentences related to elderly gastric cancer patients' perceived preoperative frailty influencing factors as the smallest analysis units; reading original materials multiple times to immerse in the text content; developing a classification framework based on health ecology theory, using physiological traits, behavioral characteristics, interpersonal networks, living and working conditions, and macro factors as thematic coding categories; conducting content coding and categorization by marking significant meanings and concepts in the text, classifying relevant content under corresponding thematic categories, and further analyzing to form sub-themes; interpreting and explaining results by establishing connections between text content and extracted themes/sub-themes, identifying corresponding original examples from the data.

Results

2.1.1 Accumulated Aging-Related Losses

With advancing age, the body gradually ages, and patients experience inevitable declines and disorders in organ and system functions, leading to frailty. Moreover, after reaching a certain degree of aging, the progression of frailty may accelerate. P13: "After getting old, the body gradually becomes frail and unable to do what one wishes. It' s like melons in a melon field—when they grow to a certain point, they naturally fall." P11: "It' s natural frailty. As age gradually increases, one becomes less willing to move and loses strength, just like a machine aging." P7: "After turning 70, I felt my body becoming increasingly frail, starting to degenerate rapidly. I get tired from doing just a little bit of work."

2.1.2 Obvious Gastrointestinal Symptoms

Gastric cancer-related gastrointestinal symptoms, including swallowing difficulties, abdominal pain, and decreased appetite, all lead to reduced food intake and increased negative emotions, making patients prone to weight loss, physical and mental fatigue, and accelerating frailty development. P5: "I can' t swallow hard food, can only eat soft food. The psychological pressure is also high, and I lost more than ten pounds. My overall condition is not as good as before, and frailty is quite obvious." P12: "When I eat, my stomach hurts, so I don' t dare to eat much. I' ve always eaten little, and that' s how I became frail." P4: "Mainly it' s the lack of appetite. I don' t want to eat any meat at all, and I' m in a bad mood. Gradually I felt I was losing weight, becoming weak, and having no strength."

2.1.3 Successive Disease Attacks

Multiple diseases occurring consecutively over a period of time and related treatments, including surgery and medications, continuously consume patients' physiological reserves, ultimately leading to frailty. P17: "Last year I first had a cold, then high blood sugar, and later skin disease. I was constantly dealing with these issues during that period, lost quite a lot of weight, and my body gradually became frail." P7: "I previously had surgery for gallstones, then kidney surgery, and now I' m about to have stomach surgery. My walking speed and strength have both declined–I' m definitely more frail than average people." P16: "I took medication for cerebral infarction for three months before, and my stomach probably became uncomfortable from the medication. Then I took anticoagulants for one month after heart surgery. I lost my appetite, my body became frail, and I had no energy."

2.2.1 Lack of Exercise Behavior

Due to disease and advanced age, patients' subjective willingness to exercise decreases. Additionally, patients face specific objective barriers to exercise behavior, such as limited exercise venues and conflicts between spousal companionship needs and exercise schedules. All these factors lead to lack of exercise behavior, increased physical fatigue, and ultimately frailty. P14: "I used to love exercising, but now that I' m old and my stomach is always uncomfortable, I don' t feel like moving much. The less I move, the less energetic I feel, and the faster frailty sets in." P10: "I used to dance in the square, but as I got older, I didn' t want to dance anymore. Later I moved to my son' s place, and I' m not familiar with the environment there, so I haven' t danced at all. My body is frailer than before." P15: "I used to have a habit of walking, but later my spouse' s health wasn' t very good and they could only stay at home, so I stayed with them and stopped walking much. It seems my body has become increasingly frail."

2.2.2 Significant Physical Activity Consumption

Due to personal hobbies, personality traits, and work requirements, patients often engage in a series of physically demanding activities, including excessively long duration, high frequency, and high intensity, which may cause excessive physical depletion and promote frailty development. P13: "I used to love outdoor activities, climbing mountains three times a week. I always believed life lies in movement. Now looking back, I was over-exercising, which reduced my resistance. Now my body has suddenly become extremely frail." P9: "I have an impatient personality. Whether working for others or doing housework at home, I must finish tasks before resting. Doing this continuously, the body will easily become frail." P20: "I work in auto repair and often need to work overtime to complete repair jobs. Such high-intensity physical activity consumes me quite a lot, making me frailer faster than others."

2.3.1 Insufficient Peer Social Interaction

Insufficient peer social interaction refers to patients having minimal contact with neighbors and friends, causing them to lose important external channels for relieving negative emotions and obtaining emotional support, resulting in reduced emotional regulation capacity. Moreover, as patients'abundant free time is concentrated in monotonous home environments, their mental vitality and willingness to go out decrease, ultimately accelerating frailty development. P10: "After moving from my hometown to Nanjing, I became completely disconnected from society. I have no friends to talk to about unhappy matters, and I keep everything bottled up inside. This might be related to frailty." P3: "At my age, my vision and hearing are both poor, so I don' t want to go out often. There' s nothing to do outside anyway, but staying at home is even more boring. I just cook meals, gradually becoming 迟钝 (slow/dull), and probably frail." P8: "When working, everyone shared common interests. After retirement, everyone has their own arrangements, and contact with others has decreased. Staying at home all the time, after a long period, I don' t want to go out anymore, and my body is less energetic than before."

2.3.2 Lack of Parent-Child Interaction

Lack of parent-child interaction refers to minimal contact between patients and their children and grandchildren, which prevents children from accurately understanding patients' disease conditions and medical needs to provide timely health guidance and assistance, indirectly accelerating patients' physical deterioration. Additionally, the absence of children or grandchildren increases patients' feelings of dullness, emptiness, and loneliness, ultimately leading to frailty. P19: "We don' t want to bother our children with minor ailments. I don' t understand much and always think that although my body is somewhat frail, it' s not that serious." P15: "Usually the children are busy with work, and we don' t tell them much about our discomfort. Only after losing a lot of weight did we tell them this time. We should have spoken up earlier and sought treatment earlier

—our bodies might not be this frail now." P10: "My granddaughter used to live with us, but later they moved out and don' t have time to visit us often. Life has become lonely, and later stomach problems emerged. My whole body feels weak and frail."

2.3.3 Lack of Communication and Self-Disclosure Between Spouses

Some patients often worry that their spouses lack good problem-handling and psychological coping abilities, and habitually take on more family responsibilities while being unwilling to disclose negative events they have experienced to their partners. This indicates insufficient communication and self-disclosure with spouses, creating additional physical and mental burdens that accelerate frailty development. P2: "My spouse is an honest person who can' t be relied on for family matters. I bear most responsibilities, big and small. Plus, I' ve had stomach problems for years, and my body has obviously become weaker." P16: "I thought physical discomfort would pass if I endured it. Telling my spouse would be useless anyway. But enduring it continuously is indeed not good for the body. Now I' m frailer than before." P12: "My stomach has been uncomfortable for a while. I had some suspicions and worries but didn' t tell my spouse, fearing she would make a fuss. Now my body has suddenly become noticeably frail."

2.4.1 Heavy Individual Financial Burden

Heavy financial burden often prevents patients' key needs from being met, causing negative physical impacts including compromised disease treatment quality, unbalanced dietary nutrition, and high work pressure, accelerating frailty progression. P9: "I' m a farmer with no pension. I' m always reluctant to spend money on medical care, including this hospitalization. This also affects my physical frailty." P16: "I don' t earn much money and eat very simply every day. Over time, my body becomes frail faster." P6: "Our family is not well-off. Even with some physical discomfort, I still need to continue working. This is definitely a burden on the body. Now that I' m sick, the pressure is even greater, and frailty progresses faster."

2.4.2 Heavy Unplanned Family Care Tasks

The heavy unplanned family care tasks patients recently undertake disrupt their established life patterns, creating additional physical and mental stress. As patients are already in a serious disease state, what seems like a manageable care task becomes a trigger for rapid frailty development. P10: "My son has been busy this year and needs me to help care for the children. I go to his house every morning to cook and return in the evening. With my own health issues plus the daily back-and-forth, my body has gradually become frailer than before." P14: "Last year my spouse suddenly became ill, and I had to care for her. The mental pressure was quite high, and my body probably couldn' t handle it. My weight gradually dropped by about 10 pounds." P1: "At the

beginning of the year, my spouse was hospitalized, and I cared for him for three months, staying by his side all day. If I hadn' t been so exhausted, I definitely wouldn' t be as frail as I am now."

2.4.3 Insufficient Health and Disease Management Information Resources

Patients lack professional information resources related to disease diagnosis, treatment, and healthy living, resulting in insufficient health and disease management knowledge. This leads to gradual accumulation of health deficits and accelerated frailty development. P15: "Usually I don' t know how to properly care for my body. I didn' t go to the hospital promptly when feeling uncomfortable, resulting in my current poor physical condition and lack of energy." P10: "I' ve always had gastric ulcers and should have received scientific treatment, but I never paid attention. Now my body is relatively frail." P12: "Nutrition is theoretically important for the body, but we rural people have no concept of nutrition in daily life, so our bodies become frail faster."

2.5.1 Limited Medical Service Levels

Due to local economic and policy factors, medical institutions in different regions vary in equipment, staff educational background, and patient volume. Consequently, medical service levels in some regions may be limited, negatively impacting patients' physical and mental health and accelerating frailty development. P27: "Stomach pain has been an old problem. The town hospital just prescribed some medication. Later I felt frail and weak, so I came to the provincial capital for examination. After many tests, this disease was diagnosed. I should have come to a big hospital earlier." P24, P25: "The education level and professional knowledge of doctors in our area are far inferior to those in developed city hospitals. Some diseases heal slower when treated in our area. Over time, this definitely affects physical frailty." P22: "Small local hospitals see fewer patients, while big city hospitals see more. It' s like a book—one has read a few pages, the other half the book. Their diagnostic levels differ, which definitely affects frailty." P29: "My hometown hospital said my situation was quite complicated. I had high psychological pressure and weak body. I felt relieved coming to the city hospital. The director said I could have surgery, and my psychological burden immediately decreased, and I regained strength. Hospital diagnostic level greatly influences frailty."

2.5.2 Limited Medical Insurance Support

Limited medical insurance support at the macro level increases individual financial pressure, changes patients' healthcare utilization behavior, reduces medical care quality, increases mental burden, and promotes frailty progression. P21: "Medical insurance policies are much better now, but reimbursement is still limited. Seeing the daily cost list makes me want to be discharged early—each extra day costs more money. Having financial pressure and inner stress, plus

this disease, makes me feel frail faster." P23, P26: "For common people, the most relevant factor to physical frailty is financial assistance, because medical care costs money in many places, and common people' s earnings are limited. Stronger medical insurance policies make medical care smoother." P28: "Relying solely on farming income to treat this disease is definitely difficult. Medical insurance policy support makes it slightly better; otherwise, frailty would progress faster because without money, one cannot access good hospitals."

Discussion

3.1 Physiological Trait Level: Emphasizing Elderly Patients and Actively Managing Gastrointestinal Symptoms and Comorbidities

Regarding physiological traits, aging, symptom burden, and continuous disease attacks were perceived by patients as frailty influencing factors. First, patients believed that accumulated aging-related losses could accelerate frailty progression. Aging can directly reduce organ and system functions, promoting frailty. Moreover, patients generally considered aging inevitable, and their continuously reinforced awareness of aging might increase the rate of physiological depletion and frailty risk. This suggests that clinically, besides focusing on frailty management in elderly gastric cancer patients, healthcare providers should also guide patients toward a positive mindset about healthy aging to enhance internal motivation for resisting aging-related frailty.

Additionally, patients believed their gastrointestinal symptoms were closely related to frailty. Persistent and significant gastrointestinal symptoms can cause patients' oral intake to remain below target requirements long-term, impairing nutritional reserves and manifesting as weight loss, significant fatigue, and other frailty characteristics. Previous quantitative studies mainly revealed the negative impact of objectively assessed nutritional risk on frailty, complementing our findings. Although interview results preliminarily described the potential role of gastrointestinal symptoms in promoting frailty, this conclusion has not been directly confirmed in quantitative data. Future research could use machine learning methods to further verify the association between related symptoms and frailty, identifying symptom indicators that could serve as specific predictors for gastric cancer-related frailty. In clinical practice, for elderly gastric cancer patients with significant gastrointestinal symptoms, close attention should be paid to their nutritional assessment results, with supplementation of key nutrients that delay frailty such as leucine and omega-3 fatty acids when necessary.

Furthermore, patients perceived that continuous attacks from comorbidities could also accelerate frailty development. The reason may be that multiple diseases and related treatments can stimulate a series of frailty-related pathophysiological changes, including neuroendocrine alterations and excessive release of inflammatory mediators. Multimorbidity leads to gradual accumulation of these pathophysiological changes, causing multi-system dysfunction and frailty.

Additionally, interview results revealed that the short interval between different disease occurrences (“occurring consecutively within a period”) might also be an important frailty-inducing factor, though the specific quantitative relationship remains unclear and requires further exploration. In practice, elderly gastric cancer patients with multiple disease histories, medication histories, and surgical histories should be prioritized for targeted management after active multidisciplinary team assessment.

3.2 Behavioral Characteristics Level: Promoting Exercise Behavior Development and Balancing Total Physical Activity Level

Interview results indicated that lack of exercise behavior related to multiple subjective and objective factors was perceived as a frailty influencing factor. Rogers et al. found through a 5-year follow-up study that the frailty incidence rate among patients regularly performing low-intensity exercise was higher than those performing moderate or high-intensity exercise. Pan et al. used total metabolic equivalents to reflect patients’ exercise volume and identified lower exercise volume as a frailty risk factor. Thus, previous studies objectively revealed associations between exercise intensity, dosage, and frailty, supporting and validating our findings. Simultaneously, by exploring patient experiences, this study supplemented descriptions of possible internal reasons for lack of exercise behavior, including decreased subjective exercise willingness due to disease and aging, as well as specific objective barriers such as limited exercise venues and conflicts between spousal companionship needs and exercise schedules. This not only provides detailed supplements to existing quantitative conclusions but also offers strategic references for improving patients’ exercise compliance and intervention feasibility.

Meanwhile, patients perceived that significant physical activity consumption could also affect frailty development. The reason may be that elderly gastric cancer patients already have compromised physiological reserves, and on this basis, the negative impact of physical activity consumption behaviors related to personal hobbies, personality traits, and work requirements on physical status is further intensified, increasing frailty risk. However, Sagong et al. demonstrated through quantitative surveys and analysis that high physical activity levels (assessed through the International Physical Activity Questionnaire) have a protective effect against frailty. The inconsistent results may be because the quantitative study subjects were community-dwelling elderly with higher physiological reserves and tolerance than the elderly gastric cancer patients in this study, making them more likely to benefit from high-level physical activity. Second, the “significant physical activity consumption” in this study was summarized based on patients’ intolerance experiences, likely representing a higher degree than the high physical activity level categorized based on tools in the aforementioned quantitative study. Future research should further clarify the association between frailty and physical activity levels in elderly gastric cancer patients to help guide precise clinical intervention implementation.

In clinical practice, to ensure safety, healthcare providers should guide elderly gastric cancer patients to engage in low-intensity comprehensive exercise training, including resistance, aerobic, and balance training, and instruct family members to pay attention to factors causing exercise behavior barriers and significant physical activity consumption, such as venue limitations and work requirements, providing timely assistance to promote exercise behavior development, balance total physical activity intensity, and delay frailty progression.

3.3.1 External Interpersonal Network Support

Peer social interaction is an important component of individuals' external interpersonal networks. Interview results indicated that insufficient peer social interaction was perceived as a frailty influencing factor. Lack of peer social interaction can accelerate frailty development by reducing patients' emotional regulation capacity and decreasing mental vitality and willingness to go out. Maltby et al. showed that contacting friends less than once per month or not participating in any social activities could limit patients' access to various forms of material resources and increase frailty risk. A 4-year longitudinal study indicated that social frailty (reduced social networks and activities) often precedes physical frailty and can increase the risk of physical frailty by 3.93 times. Previous quantitative studies directly revealed quantitative relationships between social deficiency and frailty, while this study, through condensing patient experiences, specifically described the possible key roles of emotional support, mental vitality, and activity willingness in the process of how insufficient peer social interaction affects frailty, supplementing previous research and guiding specific intervention development. Additionally, Yin et al. specifically examined the association between participation in different types of group activities and frailty. Results showed that physically participatory activities (dancing, qigong, etc.) had the best effect on improving frailty, followed by interactive activities (mahjong, chess, etc.). The reason may be that the former increases patients' physical activity volume and function, while the latter provides brain stimulation, improves cognitive function, and offers emotional support, all beneficial for frailty alleviation. Thus, group activity participation, as a form of peer social interaction, provides important external interpersonal network support with positive effects on physical training, emotional support, and cognitive improvement, potentially serving as a key intervention target for slowing frailty progression.

3.3.2 Internal Interpersonal Network Support

Children, grandchildren, and spouses are key members of elderly gastric cancer patients' family internal interpersonal networks. In this study, lack of parent-child interaction was perceived as a frailty influencing factor. Previous studies have also briefly mentioned correlations between indirect indicators reflecting internal interpersonal networks such as number of children, marital status, and living alone, providing some support for our findings. Simultaneously, based on

interview content, this study more clearly described the impact of insufficient internal interpersonal network support on frailty, providing theoretical references for subsequent precise frailty intervention development and internal mechanism exploration. First, due to children' s busy work schedules and minimal participation in patients' lives, the disease information support they provide is limited, indirectly accelerating patients' frailty development. Additionally, under the influence of Chinese traditional culture, children' s companionship and care are parents' core spiritual support. Lack of parent-child interaction can significantly increase patients' loneliness, which is a fundamental element of negative emotions in elderly patients with diseases and can reduce their dietary quality and activity participation willingness, promoting frailty. In clinical practice, healthcare providers should guide patients' children to use modern communication methods such as telephone and social media to interact with patients, actively integrate into their daily lives, understand their physical and mental conditions, and provide comprehensive emotional and instrumental support.

Furthermore, patients perceived that lack of communication and self-disclosure between spouses was also an important frailty influencing factor. The reason may be that long-term lack of communication and self-expression suppresses patients' disease experiences, negative emotions, and thoughts, and accumulated stress directly impacts individuals, increasing their physical and mental vulnerability and ultimately causing frailty. Therefore, healthcare providers need to encourage patients to actively communicate with their spouses, engage in appropriate self-disclosure, seek spousal support early and proactively, discover positive meanings in disease, and truly improve their ability to cope with difficulties, thereby delaying frailty progression.

3.4 Living and Working Conditions Level: Focusing on Economic Burden and Care Tasks, Providing Disease Management Information Support

At the conditions level, heavy individual financial burden was perceived as a frailty influencing factor. Heavy financial burden prevents patients' key needs from being met, causing multiple negative physical impacts including compromised disease treatment quality, unbalanced dietary nutrition, and high work pressure, accelerating frailty development. Quantitative research has indicated that when patients' monthly income is below 1000 yuan, their frailty risk increases significantly. This study not only echoes previous quantitative results but also provides preliminary explanation of possible reasons for how economic burden affects frailty, offering more detailed guidance for clinical practice. When facing patients with lower income levels, healthcare providers need to further pay attention to their dietary habits and work types to comprehensively understand potential factors promoting frailty development and provide corresponding health guidance or psychological counseling to mitigate negative impacts of heavy economic burden.

In this study, patients believed that heavy unplanned family care tasks were

closely related to frailty development. Sudden family task arrangements disrupt patients' established life patterns and physical-mental reserve balance, and are perceived as triggering events for rapid physical frailty. Therefore, healthcare providers should guide patients' family members to master simple frailty screening methods for regular frailty screening of elderly gastric cancer patients in home environments, avoiding assigning additional family tasks to patients in pre-frail or frail states.

Additionally, our results indicated that insufficient health and disease management information resources were perceived as frailty influencing factors. The reason may be that barriers to information transmission and acquisition can directly hinder the development of reasonable health and disease management behaviors, leading to accumulated health deficits and accelerated frailty development. Wray et al. conducted qualitative interviews with elderly hospitalized patients and found that clear and personalized information support could effectively alleviate frailty development by improving patients' health management awareness and cognition and strengthening their confidence in facing disease. Patients indicated that information guidance provided by more familiar healthcare professionals could significantly increase communication effectiveness and help maximize positive effects of information support. Therefore, to gradually delay frailty progression, bedside healthcare providers who have close contact with patients should proactively provide elderly gastric cancer patients with knowledge about gastric disease and other comorbidities diagnosis and treatment, as well as basic health 常识 (common sense). Given elderly gastric cancer patients' limited learning capacity, scientific education strategies should be employed during information delivery, such as adding video demonstrations and case guidance.

3.5 Macro Factor Level: Enhancing Overall Medical Service System Efficiency and Medical Insurance Support

At the macro factor level, limited medical service levels were perceived as frailty influencing factors. Due to shortages in material and human resources and lack of breakthrough progress in resource integration, medical service levels still vary across regions. Limited medical service levels can reduce elderly gastric cancer patients' disease diagnosis and treatment quality and their subjective trust in medical institutions, thereby affecting frailty progression. No studies directly examining the relationship between macro medical service levels and frailty occurrence have been retrieved; future research could use quantitative data to detail associations between medical service level indicators and frailty to verify interview results. Additionally, our findings suggest that achieving medical resource integration and sharing may be key to better meeting patients' medical needs and delaying frailty progression. In recent years, Chinese authorities have continuously promoted medical alliance construction at policy and practice levels to expand and connect high-quality resources and enhance overall medical service system efficiency. Thus, medical alliances represent a major livelihood

reform initiative and may also be an important macro target for frailty prevention and treatment. Future attention should be paid to the specific development and application of frailty intervention models based on medical alliances.

Patients perceived that limited macro-level medical insurance support could also promote frailty progression. For elderly gastric cancer patients, economic support is an important condition for ensuring access to high-quality medical resources and avoiding frailty progression. Limited medical insurance support can directly reduce individual economic support levels, decrease healthcare utilization behaviors, hinder health capital replenishment and physiological reserve recovery, and accelerate frailty progression. In recent years, with vigorous promotion of medical reform policies, China' s medical security system and practice have greatly improved. However, given that patients' medical insurance support needs remain unmet, scholars in related fields need to further address hot issues in medical insurance. Meanwhile, elderly gastric cancer patients and healthcare providers also need to deepen their understanding of the latest medical insurance policies to jointly promote standardized use of medical insurance funds and improve patients' healthcare utilization, ultimately alleviating frailty.

Conclusion

In summary, this study used semi-structured interviews to specifically describe elderly gastric cancer patients' perceived effects of multi-dimensional factors on preoperative frailty from a health ecology perspective, including aging, gastrointestinal symptoms, disease attacks, physical activity, peer social interaction, parent-child interaction, spousal communication and disclosure, economic burden, care tasks, health and disease management information resources, medical service levels, and medical insurance support. This study also suggests that when implementing frailty interventions for elderly gastric cancer patients, a health ecology perspective should be adopted to simultaneously address symptom and comorbidity management, physical activity arrangement, establishment of supportive interpersonal networks, improvement of disease management information support, and enhancement of overall medical service system efficiency and medical insurance support. This provides important references for subsequently constructing systematic preoperative frailty prehabilitation programs for elderly gastric cancer patients.

Limitations

This study has several limitations. First, only elderly gastric cancer patients were selected as participants. Considering the complexity of frailty prevention and treatment, future research needs to further understand perspectives of healthcare providers, policymakers, and others on frailty influencing factors. Additionally, based on qualitative research, this study provided specific descriptions of patients' perceived frailty influencing factors to supplement and enrich

existing research findings. However, it should be noted that perceived influencing factors may not necessarily be actual influencing factors and require further verification in future studies. Finally, although this study followed the principle of information saturation for data collection and analysis, due to researchers' limited time and energy, some themes may not have been fully represented and require further improvement in the future.

Author Contributions

DING Lingyu was responsible for research conception and article writing; DING Lingyu, JIANG Xiaoman, and MIAO Xueyi were responsible for interview implementation and data organization; CHEN Li, ZHU Hanfei, LU Jinling, HU Jieman, and XU Xinyi were responsible for article revision; XU Qin was responsible for quality control and final review, and is accountable for the entire article.

Conflict of Interest

The authors declare no conflict of interest.

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