Research Article

Changes in Patient-Reported Health Status in Advanced Cancer Patients from a Symptom Management Clinic: A Longitudinal Study Conducted in China

Yening Zhang, Zimeng Li, Ying Pang, Yi He, Shuangzhi He, Zhongge Su, Yuhe Zhou, Yan Wang, Bingmei Wang, Lili Song, Jinjiang Li, Xinkun Han, Chengcheng Zhou, Xiumin Li, and Lili Tang

Department of Psycho-Oncology, Key Laboratory of Carcinogenesis and Translational Research (Ministry of Education/Beijing), Peking University Cancer Hospital & Institute, Beijing, China

Correspondence should be addressed to Lili Tang; tanglili_cpos@126.com

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Objectives. The integration of patient-reported health status has been increasingly emphasised for delivering high-quality care to advanced cancer patients. This research is designed to track health status changes over time in Chinese advanced cancer patients to explore the risk factors affecting their health status. Methods. Advanced cancer patients were recruited from Peking University Cancer Hospital. An electronic patient-reported outcome (ePRO) system with validated measurements was used to collect the data. ANOVA, the chi-square test, the nonparametric Kruskal–Wallis H test, and generalized estimating equation (GEE) analysis were used for the data analysis. Results. One hundred and three patients completed a baseline survey (T = 0) and two follow-up surveys (T1 = 14 days, T2 = 28 days). Chi-square test results indicate a significant decrease in the percentage of patients reporting moderate or severe difficulty experienced by patients in terms of mobility, pain/discomfort, and anxiety/depression. However, there is a significant increase in the percentage of patients reporting moderate or severe difficulty in self-care and usual activities. Scores on the visual analogue scale in the EQ-5D-5L instrument (EQ-VAS) are associated with patients’ income, and the degree of moderate or severe anxiety/depression is found to be associated with employment status. The GEE results show that pain, loss of appetite, poor walking status, and distress related to symptoms, depression, and anxiety have worsened the health status. Conclusions. The health status of Chinese advanced cancer patients under ePRO follow-up in China significantly improves in the physical and psychological dimensions, accompanied by a decrease in usual activities and self-care. Routine screening and rational supportive care are recommended in oncology for cancer care. Based on the rational application of ePRO, longitudinal studies exploring the potential mechanisms of health status changing would provide more beneficial guidance for improving the quality of life in patients with advanced cancer.

1. Background

Cancer patients experience subjective distress induced by various symptoms related to both the disease itself and treatment-related adverse events [1, 2]. Though the five-year survival rate for cancer in China has increased from 30.9% recorded in 2003 to 40.5% in 2015 [3], it is still lower than the rates in developed countries [4]. Available data indicate that approximately 60% of cancer will progress to the advanced stages; symptom burden would be complicated and difficult to manage in this population [5, 6]. Quality of life (QoL) or health status improvement is the primary objective of high-quality care for advanced cancer patients. Studies on cancer-related mechanisms, patient-reported outcome (PRO) monitoring, and multidisciplinary interventions for improving QoL in this population have been reported in various research publications. Recurrent or persistent inflammation is a common factor in the pathogenesis of neoplasia [7], and QoL is associated with systemic inflammation in patients with advanced cancer (based on PRO...
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with anticancer treatments. Second, the extant research does not include longitudinal studies and none of the studies monitor changes in the health status of advanced cancer patients. Therefore, the objectives of this study are as follows: (1) to track changes in health status over time in Chinese advanced cancer patients registered on multiple ePRO QoL assessment platforms, (2) to examine discrepancies in the EQ-5D-5L results in patients with different demographic and medical condition, and (3) to explore risk factors that influence the changing of health status in advanced cancer patients.

2. Materials and Methods

This longitudinal study was conducted at Peking University Cancer Hospital. Patients who visited the symptom management clinic at Peking University Cancer Hospital between June 1st to December 31st, 2019 were recruited as participants in the study on their initial visit. The inclusion criteria were as follows: (1) aged ≥ 18 years old; (2) diagnosis of an advanced cancer (UICC TNM classification stage III without curative treatment chance and stage IV), including lung cancer, gastric cancer, oesophageal cancer, liver cancer, colorectal cancer, and breast cancer; (3) able to sign informed consent; and (4) could understand the items. Participants were excluded if they had a history of severe mental disorders or major communication difficulties. The study was approved by the Institutional Research Board (IRB) of Peking University Cancer Hospital (approval number 2019YJZ07).

2.1. Measures. EQ-5D-5L. The EQ-5D-5L instrument comprises a short descriptive system questionnaire and a visual analogue scale (EQ-VAS) [24]. Each respondent is asked to choose a digital number that best describes their health status for the day on each of the five dimensions, and the response for each health status dimension is assigned a five-digit code. The EQ-5D-5L health status results are then converted into a single index value for China [25]. The EQ VAS records the self-rated overall health status of the respondent. The EQ-5D-5L instrument is used to assess the participants’ health status on the day of evaluation. The EQ-5D is a preference-based measure of health status and QoL used worldwide in clinical trials, population studies and real-world clinical settings. It was developed from the EQ-5D-3L [24], the EQ-5D-3L was introduced in the 1990s [26], comprises five dimensions: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD) and has three levels in each dimension: no problems, some problems, and extreme problems. Although widely used in the clinical trials, the EQ-5D-3L instrument also has several limitations; for example, it is not sensitive to mild health changes and it suffers from ceiling effects [27]. To solve the issues, a new five-level EQ-5D (EQ-5D-5L) instrument was developed by the EuroQol Group. It remains the original dimension and expands the number of levels of severity in each dimension from three to five: no problems, slight problems, moderate problems, severe problems, and unable to/extreme problems; thus defining 3,125 (55) distinct
health statuses. The EQ VAS records the self-rated health status valuation of the respondent on a vertical visual analogue scale, with the end points labelled ‘The best health you can imagine’ (100 score) and ‘The worst health you can imagine’ (0 score). The measurement results of the EQ-5D-5L instrument can be used to generate health utility values using value sets. It is generally suggested that different value sets reflect the health preferences of people in different countries. Currently, many countries, including China, have developed EQ-5D-5L value sets based on the health preferences of their respective populations [25, 28, 29]. We used the EQ-5D-5L tariff suggested by Liu in this study [30].

The Chinese version of the MD Anderson Symptom Inventory (MDASI-C). It is a widely used multisymptom inventory with 19 items (13 items for symptom severity and six items for life interference) rated on a 0–10 scale on which 0 = nothing and 10 = most severe. MDASI-C is used to assess the symptom severity and the degree of life interference over the past 24 hours. As proposed by Cleenland et al., moderate-to-severe symptoms were defined as scores ≥5 on the MDASI [6]. The MDASI-C has passed reliability and validity tests and can be used to measure the severity of multiple symptoms and their impact on function [31].

The Hospital Anxiety and Depression Scale (HADS). It has 14 items, with a 0–3 score range for each item. It is used to measure the anxiety and depression symptoms of patients over the past two weeks and is a relatively complete assessment with good reliability and validity [32].

The case report form (CRF). It captures the following: (1) demographic and social economic information, such as age, sex, occupation, education, marital status, and medical payments; (2) disease data, such as information on disease diagnosis, staging, treatment, and medication; (3) The Charlson Comorbidity Index (CCI) [33] is used to evaluate complications that have a significant impact on the survival and prognosis of cancer patients.

The Eastern Cooperative Oncology Group Performance Status (ECOG-PS) scale. It is a widely used tool for measuring the current functional status of cancer patients on five levels [34]: 0 = normal with no limitations; 1 = not my normal self, but able to be up and about with fairly normal activities; 2 = not feeling up to most things, but in bed or chair less than half the day; 3 = able to do little activity and spend most of the day in bed or chair; and 4 = pretty much bedridden, rarely out of bed.

2.3. Statistical Analysis. The EQ-5D-5L results were calculated following the user guide by the EuroQol Research Foundation [35]. The frequencies and proportions of the EQ-5D-5L dimensions and levels are presented using descriptive analysis. Moderate-to-severe difficulty was defined as a dimension-level score of ≥3. The overall health status was measured using the EQ VAS, employing mean and standard deviation. The EQ-5D-5L index was calculated using the Chinese value set and presented as the mean and standard deviation values. To explore discrepancies in the EQ-5D-5L results recorded over time against demography and medical data, chi-square tests were used, along with one-way ANOVA (if the homogeneity of variance assumption was satisfied) and the nonparametric Kruskal–Wallis H test (if homogeneity of variance assumption was not satisfied). Generalized estimated equation (GEE) analysis was applied to repeated measures of EQ-5D-5L and to explore the risk factors for changes in health status. All demographic information, medical data, and MDASI-C and HADS data were included in the GEE model. The statistical analyses were all conducted using SPSS 25.0 (IBM Corporation).

3. Results

3.1. Demography, Medical Data, and Other Descriptive Results at Baseline. One hundred-and-sixty-one advanced cancer patients were recruited as participants and completed informed consent, with 156 participants completing the survey at baseline, 126 participants completing the first two surveys and 103 participants completing all three surveys (flowchart shown in Figure 1). The mean age of our sample was 56.22 ± 10.898, with most of these individuals being middle-aged and elderly (age ≥45) (n = 125, 55.7%), living with a spouse (n = 147, 94.2%), and having their medical costs covered by a government-pay scheme or a medical insurance policy (n = 129, 82.7%). Half the patients with cancer have a progress duration of less than half a year. The results of the one-way ANOVA and nonparametric Kruskal–Wallis H test indicate that discrepancies in the EQ-5D-5L dimension responses correspond to specific demographic characteristics. There was a significant discrepancy in the EQ-5D-5L VAS mean scores of patients with different incomes: patients with an income of 15,000 Yuan per month and higher reported poorer health status (measured via VAS scores) than those with lower incomes. Furthermore, there was a significant discrepancy in the Dimension 5 (anxiety/depression) responses of patients with different employment statuses:
unemployed patients reported higher levels of anxiety/depression than those employed (Table 1).

The top five symptoms reported as moderate-to-severe by advanced cancer patients are as follows: fatigue (61.5%), insomnia (60.9%), pain (58.3%), distress (53.2%), and loss of appetite (46.8%). 57.1% of the participants reported experiencing significant mood distress via the HADS (score of ≥ 15).

3.2. Health Status Measured via EQ-5D-5L at Baseline and Trends at Three Time Points. Significant discrepancy was found via the chi-square test between the three time points, T0 vs. T2 and T1 vs. T2. Responses with moderate and severe difficulty changed significantly in the following dimensions: decreased in mobility (three time points, $\chi^2 = 84.541$; T1 vs. T2, $\chi^2 = 60.438$; T0 vs. T2, $\chi^2 = 55.060$; $p < 0.001$), pain/discomfort (three time points, $\chi^2 = 136.303$; T1 vs. T2, $\chi^2 = 88.542$; T0 vs. T2, $\chi^2 = 99.651$; $p < 0.001$); and anxiety/depression (three time points, $\chi^2 = 91.625$; T1 vs. T2, $\chi^2 = 60.027$; T0 vs. T2, $\chi^2 = 64.254$; $p < 0.001$) dimensions; but increased in self-care (three time points, $\chi^2 = 50.202$; T1 vs. T2, $\chi^2 = 33.052$; T0 vs. T2, $\chi^2 = 29.277$; $p < 0.001$), and usual activities (three time points, $\chi^2 = 78.562$; T1 vs. T2, $\chi^2 = 53.007$; T0 vs. T2, $\chi^2 = 48.228$; $p < 0.001$) dimensions (Table 2). The mean scores of the EQ-5D-5L index and the VAS values at the three time points improved slightly but not significantly (Table 2).

3.3. Risk Factors for Health Status from the Longitudinal Study. The results from the GEE model show that ECOG-PS scores (OR = 0.910, $p < 0.001$), pain (OR = 0.984, $p = 0.005$), poor walking status affected by symptoms (OR = 0.972, $p < 0.001$), and anxiety/depression (OR = 0.991, $p < 0.001$) were risk factors, which were strongly associated with changes in the health status of patients with advanced cancer (Table 3).

4. Discussion

4.1. Main Findings. The EQ-5D-5L has been used extensively to explore health status among different populations. We found that health status scores among advanced cancer patients (VAS score: 58.35, index value: 0.614) were significantly lower than the norm scores of the Chinese population (VAS score: 85.4, index value: 0.932) [36] and those of cancer survivors in general (VAS score: 70.35, index value: 0.841) [35]. Su et al. report that lung cancer patients have the lowest health-related QoL compared to other cancer patients [37]. However, in our study sample, we found no discrepancies among advanced cancer patients with different diagnoses. Several recent studies have shown that the health status is increasingly viewed as a predictor of survival [38]. This was confirmed by Kyproitakis et al. with respect to advanced cancer patients; they concluded that longitudinal experience of health status is a significant prognostic factor for survival and holds important implications for medical decision-making concerning advanced cancer patients [14]. If health status monitoring is indeed beneficial for survival, it would be more adoptable—from the perspective of health economics—than expensive anticancer treatments. Discrepancies in health status were found among patients with different demographics and medical data. Patients with monthly incomes of 15,000 Yuan per month and higher reported poorer health statuses, as reflected by their EQ-5D-5L VAS scores, than those with lower incomes. This finding is similar to one of the findings in the research by Tribius, who reports that locally advanced HNC patients with a high socioeconomic status reported worse QoL than similar patients with a low economic status [39]. Furthermore, a larger proportion of unemployed patients reported moderate problems on the anxiety/depression dimension than patients who were employed. By contrast, Morrison reports that lung cancer patients are more likely to report emotional problems upon diagnosis if they are employed [40]. Discrepancies may also occur because the compared samples are different, which indicates that the nature of the emotional challenges experienced by advanced cancer patients is different from those experienced by other populations.

Symptoms, function and mood can significantly influence the health status among advanced cancer patients. In our study, pain, poor walking status affected by symptoms, and anxiety/depression are risk factors that significantly influence the health status of advanced cancer patients. Pain is a factor influencing poor health status, which calls for more attention to pain management for advanced cancer patients, as indicated by the high prevalence of pain in our sample (58.3%). Walking status affected by symptoms has also been confirmed as another factor for low health status by Laird et al., who reported that, among advanced cancer patients, performance status is strongly associated with deteriorating QoL parameters [8]. Dunn et al. indicated that advanced melanoma patients have more significantly decreased emotional function than patients with a localised form of the disease. A high proportion of patients in our sample reported significant psychological distress, which is
Table 1: Demographic information, medical data, and distribution of EQ-5D-5L dimension responses (% of responses with moderate problems—i.e., Level 3—and above) as a function of various demographic characteristics.

| Demographic characteristics | N (%)/M ± SD | Mobility N (%) | Self-care N (%) | Usual activities N (%) | Pain/discomfort N (%) | Anxiety/Depression N (%) | EQ-5D-5L index M (SD) | VAS M (SD) |
|-----------------------------|-------------|----------------|----------------|------------------------|------------------------|-------------------------|-----------------------|----------|
| Age (years)                 |             |                |                |                        |                        |                         |                       |          |
| ≤44                         | 23 (14.7)   | 6 (26.1)       | 3 (13.0)       | 6 (26.1)               | 9 (39.1)               | 10 (43.5)               | 0.67 (0.33)           | 61.78 (24.34) |
| 45–59                       | 64 (41.0)   | 20 (31.3)      | 6 (9.4)        | 17 (26.6)              | 43 (67.2)              | 26 (40.6)               | 0.59 (0.31)           | 56.58 (23.36) |
| ≥60                         | 61 (39.1)   | 20 (32.8)      | 9 (14.8)       | 20 (32.8)              | 35 (57.4)              | 17 (27.9)               | 0.63 (0.31)           | 59.10 (21.00) |
| Missing                     | 8 (5.1)     |                |                |                        |                        |                         |                       |          |
| Sex                         |             |                |                |                        |                        |                         |                       |          |
| Male                        | 86 (55.1)   | 23 (26.7)      | 8 (9.3)        | 21 (24.4)              | 51 (59.3)              | 28 (32.6)               | 0.65 (0.29)           | 60.26 (20.45) |
| Female                      | 69 (44.2)   | 26 (36.2)      | 12 (17.4)      | 24 (34.8)              | 41 (59.4)              | 29 (42.0)               | 0.58 (0.35)           | 55.48 (23.91) |
| Missing                     | 1 (0.6)     |                |                |                        |                        |                         |                       |          |
| Marital status              |             |                |                |                        |                        |                         |                       |          |
| Without partner (single, separated, divorced, or widowed) | 8 (5.1) | 44 (29.9) | 19 (12.9) | 42 (28.6) | 88 (59.9) | 55 (37.4) | 0.61 (0.32) | 57.98 (22.41) |
| With spouse                 | 147 (94.2)  | 4 (50.0)       | 1 (12.5)       | 3 (37.5)               | 4 (50.0)               | 2 (25.0)                | 0.61 (0.37)           | 60.88 (16.39) |
| Missing                     | 1 (0.6)     |                |                |                        |                        |                         |                       |          |
| Education level             |             |                |                |                        |                        |                         |                       |          |
| Junior, middle school, and lower | 49 (31.4) | 12 (24.5) | 6 (12.2) | 11 (22.4) | 31 (63.3) | 17 (34.7) | 0.63 (0.30) | 57.57 (23.08) |
| High middle school and special secondary school | 45 (28.8) | 15 (33.3) | 7 (15.6) | 17 (37.8) | 26 (57.8) | 18 (40.0) | 0.59 (0.35) | 56.16 (23.91) |
| Junior college and above    | 61 (39.1)   | 21 (34.4)      | 7 (11.5)       | 17 (27.9)              | 35 (57.4)              | 22 (36.1)               | 0.63 (0.31)           | 60.03 (20.01) |
| Missing                     | 1 (0.6)     |                |                |                        |                        |                         |                       |          |
| Average family income       |             |                |                |                        |                        |                         |                       |          |
| <5,000 Yuan/month           | 42 (26.9)   | 13 (31.0)      | 5 (11.9)       | 14 (33.3)              | 26 (61.9)              | 19 (45.2)               | 0.60 (0.30)           | 58.67 (20.31) |
| 5,000–10,000 Yuan/month     | 50 (32.1)   | 13 (26.0)      | 7 (14.0)       | 12 (24.0)              | 29 (58.0)              | 15 (30.0)               | 0.65 (0.33)           | 60.36 (22.10) |
| 10,000–15,000 Yuan/month    | 40 (25.6)   | 14 (35.0)      | 4 (10.0)       | 11 (27.5)              | 22 (55.0)              | 11 (27.5)               | 0.63 (0.30)           | 61.55 (21.66) |
| 15000 Yuan/month and above  | 23 (14.7)   | 8 (34.8)       | 4 (17.4)       | 8 (34.8)               | 15 (65.2)              | 12 (52.2)               | 0.53 (0.37)           | 46.35 (23.56) |
| Missing                     | 1 (0.6)     |                |                |                        |                        |                         |                       |          |
| Medical cost coverage       |             |                |                |                        |                        |                         |                       |          |
| Government-pay/Medical insurance | 129 (82.7) | 40 (31.0) | 15 (11.6) | 38 (29.5) | 74 (57.4) | 45 (34.9) | 0.63 (0.31) | 59.17 (22.74) |
| Self-pay                    | 26 (16.7)   | 8 (30.8)       | 5 (19.2)       | 7 (26.9)               | 18 (69.2)              | 12 (46.2)               | 0.55 (0.34)           | 52.96 (18.17) |
| Missing                     | 1 (0.6)     |                |                |                        |                        |                         |                       |          |
| Employment status           |             |                |                |                        |                        |                         |                       |          |
| Retired                     | 54 (34.6)   | 17 (34.5)      | 9 (16.7)       | 19 (35.2)              | 33 (61.1)              | 19 (35.2)               | 0.60 (0.34)           | 59.46 (22.39) |
| Employed                    | 71 (45.5)   | 22 (31.0)      | 5 (7.0)        | 16 (22.5)              | 38 (53.5)              | 20 (28.2)               | 0.66 (0.28)           | 60.20 (22.49) |
| Without work                | 28 (17.9)   | 9 (32.1)       | 5 (17.9)       | 8 (28.6)               | 20 (71.4)              | 17 (60.7)               | 0.52 (0.36)           | 50.11 (20.03) |
| Missing                     | 3 (91.9)    |                |                |                        |                        |                         |                       |          |
| Cancer site                 |             |                |                |                        |                        |                         |                       |          |

*p < 0.05*
| Demographic characteristics | N (%)/M ± SD (N= 156) | Mobility N (%) | Self-care N (%) | Usual activities N (%) | Pain/discomfort N (%) | Anxiety/Depression N (%) | EQ-5D-5L index M (SD) | VAS M (SD) |
|-----------------------------|------------------------|----------------|----------------|------------------------|------------------------|--------------------------|----------------------|-----------|
| Breast                      | 18 (11.5)              | 7 (38.9)       | 5 (27.8)       | 8 (44.4)               | 9 (50.0)               | 9 (50.0)                 | 0.51 (0.44)          | 55.28 (28.44) |
| Gastric                     | 21 (13.5)              | 2 (10.0)       | 1 (5.0)        | 7 (35.0)               | 5 (25.0)               | 0.78 (0.19)              | 59.05 (19.15)        |
| Oesophageal                 | 10 (6.4)               | 4 (36.4)       | 1 (9.1)        | 9 (72.7)               | 5 (45.5)               | 0.58 (0.31)              | 62.45 (19.86)        |
| Liver                       | 12 (7.7)               | 4 (33.3)       | 0 (0)          | 9 (75.0)               | 3 (33.3)               | 0.67 (0.23)              | 64.75 (19.86)        |
| Lung                        | 49 (31.4)              | 17 (34.7)      | 8 (16.3)       | 34 (69.4)              | 18 (36.7)              | 0.58 (0.30)              | 56.37 (23.14)        |
| Colorectal                  | 47 (30.1)              | 15 (32.6)      | 5 (10.9)       | 26 (56.5)              | 16 (34.8)              | 0.62 (0.33)              | 58.70 (20.55)        |
| P value                     | 0.114                  | 0.214          | 0.305          | 0.491                  | 0.155                  | 0.127                    | 0.834                |
| Duration of cancer progression (days) |                    |                |                |                        |                        |                         |                      |
| <Half years                 | 66 (42.3)              | 20 (30.3)      | 11 (16.7)      | 20 (30.3)              | 39 (59.1)              | 27 (40.9)                | 0.59 (0.35)          | 56.23 (21.86) |
| Half to less than one year  | 35 (22.4)              | 14 (40.0)      | 3 (8.6)        | 11 (31.4)              | 23 (65.7)              | 14 (40.0)                | 0.59 (0.31)          | 60.97 (18.80) |
| Longer than one year        | 40 (25.6)              | 12 (30.0)      | 6 (15.0)       | 12 (30.0)              | 24 (60.0)              | 12 (30.0)                | 0.62 (0.29)          | 55.15 (25.27) |
| Missing                     | 15 (9.6)               |                |                |                        |                        |                         |                      |
| P value                     | 0.384                  | 0.335          | 0.781          | 0.807                  | 0.353                  | 0.840                    | 0.404                |
| Oncology therapies          |                       |                |                |                        |                        |                         |                      |
| No                          | 63 (40.4)              | 21 (33.3)      | 9 (14.3)       | 17 (27.0)              | 44 (69.8)              | 22 (34.9)                | 0.60 (0.32)          | 58.83 (20.86) |
| Yes                         | 91 (58.3)              | 27 (29.7)      | 11 (12.1)      | 28 (30.8)              | 48 (52.7)              | 34 (37.4)                | 0.62 (0.32)          | 57.74 (23.14) |
| Missing                     | 2 (1.3)                |                |                |                        |                        |                         |                      |
| P value                     | 0.394                  | 0.303          | 0.893          | 0.106                  | 0.839                  | 0.566                    | 0.981                |

NS: Not significant. *p < 0.05 duration of cancer progression (days): it is the duration between the time when filling out the questionnaires and the time of diagnosis of cancer progression. One-way ANOVA was applied if the homogeneity of variance assumption was satisfied, and the non-parametric Kruskal–Wallis H test was utilised if the homogeneity of variance assumption was not satisfied.
Table 2: Distribution of EQ-5D-5L dimension responses at three time points (T0, T1, and T2) and chi-square test results reporting the percentage of patients with moderate and severe problems across three time points.

| Dimensions          | T0 N (%)/M (SD) | T1 N (%)/M (SD) | T2 N (%)/M (SD) | Chi-square (T0, T1, T2) ($\chi^2$, P)/ One-way ANOVA | Chi-square (T1, T2) ($\chi^2$, P)/ One-way ANOVA | Chi-square (T0, T2) ($\chi^2$, P)/ One-way ANOVA |
|---------------------|-----------------|-----------------|-----------------|--------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| **Mobility**        |                 |                 |                 |                                                        |                                                  |                                                  |
| No problems and slight problems (level ≤2) | 74 (71.8)       | 69 (67.0)       | 77 (74.8)       | $\chi^2 = 84.541, p < 0.001^{**}$                     | $\chi^2 = 60.438, p < 0.001^{**}$                 | $\chi^2 = 55.060, p < 0.001^{**}$                 |
| Moderate, severe problems, and unable to do (level ≥3) | 29 (28.2)       | 34 (33.0)       | 26 (25.2)       |                                                        |                                                  |                                                  |
| **Self-care**       |                 |                 |                 |                                                        |                                                  |                                                  |
| No problems and slight problems (level ≤2) | 92 (89.3)       | 88 (85.4)       | 85 (82.5)       | $\chi^2 = 50.202, p < 0.001^{**}$                     | $\chi^2 = 33.052, p < 0.001^{**}$                 | $\chi^2 = 29.277, p < 0.001^{**}$                 |
| Moderate, severe problems, and unable to do (level ≥3) | 11 (10.7)       | 15 (14.6)       | 18 (17.5)       |                                                        |                                                  |                                                  |
| **Usual activities**|                 |                 |                 |                                                        |                                                  |                                                  |
| No problems and slight problems (level ≤2) | 82 (79.6)       | 77 (74.8)       | 76 (73.8)       | $\chi^2 = 78.562, p < 0.001^{**}$                     | $\chi^2 = 53.007, p < 0.001^{**}$                 | $\chi^2 = 48.228, p < 0.001^{**}$                 |
| Moderate, severe problems, and unable to do (level ≥3) | 21 (20.4)       | 26 (25.2)       | 27 (26.2)       |                                                        |                                                  |                                                  |
| **Pain/Discomfort** |                 |                 |                 |                                                        |                                                  |                                                  |
| No problems and slight problems (level ≤2) | 46 (44.7)       | 55 (53.4)       | 63 (61.2)       | $\chi^2 = 136.303, p < 0.001^{**}$                     | $\chi^2 = 88.542, p < 0.001^{**}$                 | $\chi^2 = 99.651, p < 0.001^{**}$                 |
| Moderate, severe problems, and unable to do (level ≥3) | 57 (55.3)       | 48 (46.6)       | 40 (38.8)       |                                                        |                                                  |                                                  |
| **Anxiety/Depression**|                |                 |                 |                                                        |                                                  |                                                  |
| No problems and slight problems (level ≤2) | 68 (66.0)       | 72 (69.9)       | 74 (71.8)       | $\chi^2 = 91.625, p < 0.001^{**}$                     | $\chi^2 = 60.027, p < 0.001^{**}$                 | $\chi^2 = 64.254, p < 0.001^{**}$                 |
| Moderate, severe problems, and unable to do (level ≥3) | 35 (34.0)       | 31 (30.1)       | 29 (28.2)       |                                                        |                                                  |                                                  |
| EQ-5D-5L index value | 0.614 (0.318)   | 0.623 (0.330)   | 0.660 (0.323)   | $F = 0.093, p = 0.911$                                 | $F = 0.155, p = 0.694$                             | $F = 0.114, p = 0.736$                             |
| VAS | 58.35 (22.205)  | 61.79 (21.207)  | 62.28 (22.832)  | $F = 1.145, p = 0.320$                                 | $F = 0.027, p = 0.870$                             | $F = 1.813, p = 0.180$                             |

** $p < 0.01$. Chi-square tests were used for categorical variables, while ANOVA tests were used for continuous variables.
Inflammation is one of the key factors that modulate cancer pain, as proinflammatory cytokines and chemokines modulate neuronal activity. Corticosteroids can relieve pain when administered as anti-inflammatory drugs [43]. Both physical and psychological symptoms associated with inflammation are independent risk factors for fluctuating health status. Furthermore, inflammation negatively impacts cancer prognosis, which is associated with diminished QoL [44]. The results of this research have also inspired us to further investigate the fluctuation of inflammatory mediators in relation to changing in health status among patients with advanced cancer.

4.2. Limitations. The limitations of this study are as follows: the sample size is small and the study was conducted at a single centre. A multicenter study with a more representative sample is recommended for future research. This longitudinal study was designed primarily to investigate changes in health status among advanced cancer patients; hence, a comparison group was not concluded. However, we compared our results against those of the normal Chinese population and cancer survivors. The findings of this study indicate that advanced cancer patients could benefit from routine health status monitoring. Therefore, we recommend that a random clinical trial designed specifically to investigate the benefits of the ePRO system to the health status of advanced cancer patients be conducted.

4.3. Clinical Implications. For advanced cancer patients, curative care is not the dominant medical strategy. However, this population would benefit more from supportive care that focuses on how to improve the patient's health status. It is necessary to monitor the health status of advanced cancer patients using a validated ePRO platform and to develop individualised supportive care protocols. Pain management, improving mobility, and psychosocial care for anxiety and depression should be incorporated into supportive care protocols.
5. Conclusion

Monitoring the health status of advanced cancer patients and developing individualised supportive care protocols are imperative for positive outcomes. The EQ-5D-5L is a useful tool for recording patients’ health status via dimension responses, index scores and the VAS, as well as for capturing changes in the health status over time under reasonable symptom management or supportive care. The risk factors for deteriorating health status can serve as useful references for health status management in advanced cancer patients, especially for symptom management.

Data Availability

All data supporting the findings of this study and all supplementary materials are available from the corresponding author upon reasonable request.

Consent

Written informed consent was obtained from all participants.

Conflicts of Interest

The authors of this study declare that they have no conflicts of interest.

Authors’ Contributions

Yening Zhang and Zimeng Li contributed equally to this article. All authors provided consent to publish this paper.

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