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RESEARCH

Assessing the performance of QLQ-C30 in predicting all-cause mortality in community cancer patients

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Abstract

Background To evaluate the ability of QLQ-C30 in predicting mortality in community-based cancer patients in China.

Methods A whole-cluster sampling method was adopted to enroll cancer patients in four communities in Shanghai from 2018 to 2019. The patients were surveyed using a questionnaire enquiring demographic information, cancer types, and QLQ-C30 scale. Death information of participants was collected and updated from community health care centers. Cox regression models were used to assess the relationship between various QLQ-C30 scores (i.e., total score, five dimension scores, and utility score) and all-cause mortality.

Results A total of 3,304 participants were enrolled with a mean age of 63.9 years. Among them, 2,710 patients survived while 594 died by 2023. The mean total QLQ-C30 score in living patients was statistically significantly higher than that in deceased patients (92.96 vs. 85.21, $p < 0.001$); and the mean values of the five dimension scores and utility score were also significantly higher for the living patients. Cox regression models with the adjustment of covariates also confirmed that higher QLQ-C30 scores were associated with lower risk of death, with the hazard ratio value being 0.81 for the total score, 0.83–0.89 for the dimension scores, and 0.83 for the utility score, respectively ($p < 0.001$ for all).

Conclusions QLQ-C30 could accurately predict all-cause mortality in Chinese community cancer patients.

Keywords QLQ-C30, Health-related quality of life, Community cancer patients, Prediction, Mortality

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Introduction

Cancer is the leading disease of death globally [1]; China even has the highest number of cancer deaths worldwide (2,574,200 total deaths in 2022), which necessitates a feasible and valid method to predict its mortality so as to identify the high-risk patients.

Conventional methods such as sequencing of mutant genes [2] and optical diagnostics [3] employ costly biochemical detection [4], leading to limited accessibility, especially in impoverished areas. In recent years, health-related quality of life (HRQoL), a major patient-reported outcome measure, has been shown as a promising tool in predicting mortality. Various studies using different HRQoL instruments including the generic measure the SF-36 [5]; and cancer-specific measures such as the QLQ-C30 [6] have consistently suggested that HRQoL information could accurately predict mortality in different cancer patients (e.g., breast cancer [7], pancreatic cancer [8], colorectal cancer [9], and prostate cancer [10, 11]). For example, an analysis of 6,895 hospitalized cancer patients with 12 types of cancer in the Netherlands found that the QLQ-C30 total score was significantly associated with all-cause mortality.[6] Another study of 165 non-small cell lung cancer (NSCLC) patients in Korea also suggested that the FACT-G total score could be used as a predictor of survival in the patients [12].

Nevertheless, most of the studies enrolled hospitalized patients only. With the advancements in medical technology, more and more cancer patients have received their medicine and health care in the community [13]. Those patients could have a more stable status than their counterparts in hospitals. It remains unclear whether HRQoL information is still a valid measure for estimating mortality in these patients.

In China, although studies have also assessed the relationship between HRQoL and mortality in Hong Kong and Taiwan [14–16], no similar studies have yet been conducted in mainland China. Hence, the study aimed to assess whether the QLQ-C30, could predict mortality in cancer patients with various types living in a community in Shanghai, China.

Methods

Study design and participants

The study was conducted from October 2018 to January 2019. Four of 14 communities in Jing'an District, Shanghai, were randomly selected as the study sites. A whole-cluster sampling was then used to enroll all eligible tumor cases through the Shanghai Tumor Registry Reporting System. The inclusion criteria were: (1) household registration belonged to the above 4 communities; (2) the first diagnosis of a malignant tumor was from January 1, 2013 to December 31, 2017; (3) 18 years old or above; (4) alive before the survey and under community management. Exclusion criteria were: (1) poor compliance (i.e., unwillingness to cooperate in filling out questionnaire); (2) unable to complete the survey due to severe health conditions such as extreme physical weakness or mental disorders. A questionnaire [17] survey was conducted on the eligible cancer patients who had already been diagnosed by 36 trained investigators, through door-to-door or centralized at community health centres way. The questionnaire included socio-demographic questions, the QLQ-C30, levels of physical activity and nutritional risk, etc. All the study participants were informed of the survey content before the survey.

QLQ-C30

QLQ-C30, developed by the European Organization for Research and Treatment of Cancer (EORTC), was adopted in the study. It consists of 30 items distributed into five dimensions [18] (i.e., physical functioning, role functioning, emotional functioning, cognitive functioning, and social functioning), three types of symptoms (i.e., fatigue, pain, and nausea and vomiting), overall health/overall quality of life, and six separate questions (i.e., sleep quality, appetite, diarrhea, constipation, dyspnea, and economic status). The items for the five dimensions all had four levels of responses: "none", "a little", "some", and "lots of"; and the responses can be used to generate corresponding dimension scores, ranging from 0 to 100. The five dimension scores, three symptom scores, and five separate questions (except for economic status) can also be adapted to yield a QLQ-C30 total score ranging from 0 to 100, with higher values indicating better health.

Moreover, by using the 10 items of QLQ-C30, a utility-based QLU-C10D index score can also be derived based on a value set. In the study, the Chinese QLU-C10D utility value set derived from a nationally representative Chinese sample was used, and the resultant QLU-C10D utility scores varied between 0.083 and 1.000 [19].

Cancer types

The cancer types of the patients were obtained from the Shanghai Tumor Registry Reporting System as well. A total of ten categories were defined according to the human system, including the respiratory system, urinary system, endocrine system, nervous system, reproductive system, digestive system, motor system, hematological system, immune system, and epidermal system [20].

Assessment of covariates

Three types of covariates including socio-demographic variables, nutritional status, and physical activity were used in the analysis. Socio-demographic information included age, gender, BMI, marriage (married and other), occupation (employed, retired, and others), education level (junior school and or below, senior school, undergraduate and/or above), and monthly household income (< 6000, 6000–9999 and > = 10000 Chinese Yuan).

Nutritional status was categorized according to the Malnutrition Universal Screening Tool (MUST) assessment scale, which is a nutritional screening tool developed by the Multidisciplinary Malnutrition Advisory Group of the British Society for Parenteral and Enteral Nutrition (BSPEN). It assesses the presence of nutritional risk by calculating three scores: BMI, recent weight loss, and fasting or insufficient intake due to the effects of acute illness for more than 5 days. Its score ranges from 0 to 5; scores of 0 and ≥ 1 are considered low nutritional risk and high nutritional risk respectively.

Physical activity level categorized the patients into 3 scores (i.e. 1, 2, and 3) according to the survey questions including vigorous exercise, moderate-intensity exercise, walking lasting more than 10 min during the week, and time spent sitting and lying down. A higher score indicates a higher level of physical activity. Specifically, the patients who had performed strenuous or moderate-intensity exercise in the past week; who had not performed strenuous or moderate-intensity exercise in the past week and had walked for more than 10 min on 7 days; and who had not performed strenuous or moderate-intensity exercise in the past week and had walked for more than 10 min on less than 7 days were scored as 3, 2, 1, respectively.

Determination of death

The death information of participants up to July 31, 2023 was collected and updated from the community health care center in accordance with the requirements of the "Shanghai Cancer Registration and Management Measures". That is, the investigators of the center checked the death cases of residents in the death information registration and management system of Jing'an District annually.

Quality control

On-site data quality control was conducted by multiple rounds of centralized verification. Data quality control and centralized multi-round checking the filled questionnaires were confirmed to be complete by the quality controller and then entered into the database with quality control procedures to avoid omissions and logical errors.

Statistical analysis

The patients' data were analyzed descriptively including number and percentage for qualitative variables; mean (standard deviation [SD]), median (interquartile range [Q1, Q3]), and range for quantitative variables. Socio-demographic characteristics, cancer types, nutritional status, physical activity level, and QLQ-C30 scores including dimension scores, total score, QLU-C10D utility score; as well as the proportion of responses on each QLQ-C30 item were compared between the living and dead respondents, in which we dichotomized the responses into with problems (i.e., "a little", "some" and "lots of") and without problems (i.e., none). T-tests, rank sum tests, chi-square tests, or Fisher's exact test were adopted when the appropriate conditions were met.

The relationships between the QLQ-C30 scores and mortality were assessed by using a series of Cox regression models corresponding to different QLQ-C30 scores. In the models, a binary outcomes (i.e. death or survival) was used as the dependent variables, and survival time was defined as the time from the start of the survey to the time of death or the end of the survey. Two models (i.e., Model I and Model II) with progressively increasing numbers of covariates were developed for each QLQ-C30 score. Model I included cancer types and socio-demographic characteristics such as age, sex, BMI, marriage, occupation, educational background, and monthly household income. We used a stepwise regression method to screen the independent variables and select the best-fitting model based on the minimum Akaike information criterion (AIC). Nutritional status and physical activity level were further included as covariates in Model II based on Model I.

In Cox regression, the hazard ratio (HR) is used to assess the impact of variables on the risk of death. HR in our model represents the relative change in the risk of death in the reference group for every unit change (e.g., 10 points) in a variable (e.g., total QLQ-C30 score), other things being equal.

In terms of multicollinearity, the coefficients of each covariate included in Model I were checked for consistency with the corresponding coefficients in the corresponding Model II. The variance inflation factor (VIF) was calculated for each of the newly adopted variables (i.e., nutritional status and physical activity level) in the last model (Model II). If the VIF was below 10, multicollinearity was considered negligible. All hypothesis tests were two-sided and the significance level was defined as 5%. All statistical analyses were performed using R 4.3.2.

Results

A total of 4,396 questionnaires were distributed, and 3,319 questionnaires were collected. After the quality check, 3,304 valid questionnaires were used for the final analysis.

Characteristics of study participants

The mean age of all the patients was 63.9 years old, with females being 55.3%. Among them, 2,710 were living and 594 were dead according to the death information (Table 1). The mean age of the deceased was significantly older than the living (71.8 years vs. 62.1 years, $P < 0.001$). The participants who died were also more likely to be

Table 1 Comparison of demographic characteristics between the living and the dead respondents

Characteristics	All respondents ($N=3,304$)	Living ($N=2,710$)	Dead ($N=594$)	*p*-value
Age(years), N(%)				
<60	958(29.0)	884(32.6)	74(12.5)	< 0.001
60–75	1702(51.5)	1428(52.7)	274(46.1)	
>75	644(19.5)	398(14.7)	246(41.4)	
Gender, N(%)				
Male	1477(44.7)	1128(41.6)	349(58.8)	< 0.001
Female	1827(55.3)	1582(58.4)	245(41.2)	
BMI, N(%)				
<18.5	172(5.2)	112(4.1)	60(10.1)	< 0.001
18.5–23.9	1849(56.0)	1503(55.5)	346(58.2)	
>=24.0	1283(38.8)	1095(40.4)	188(31.6)	
Marital status, N(%)				
Married	2870(86.9)	2395(88.4)	475(80.0)	< 0.001
Others[a]	434(13.1)	315(11.6)	119(20.0)	
Occupational status, N(%)				
Employed	464(14.0)	449(16.6)	15(2.5)	< 0.001
Retirement	2700(81.7)	2148(79.3)	552(92.9)	
Others[b]	140(4.2)	113(4.2)	27(4.5)	
Educational level, N(%)				
Junior school and/or below	1494(45.2)	1153(42.5)	341(57.4)	< 0.001
Senior school	1077(32.6)	909(33.5)	168(28.3)	
Undergraduate and/or above	733(22.2)	648(23.9)	85(14.3)	
Monthly household income(Chinese Yuan), N(%)				
< 6000	990(30.0)	779(28.7)	211(35.5)	< 0.001
6000–9999	1475(44.6)	1214(44.8)	261(43.9)	
>= 10,000	839(25.4)	717(26.5)	122(20.5)	

[a]: single, divorced and widowed

[b]: sick leave, unemployed, peasant and student

male, with a BMI < 18.5, single or divorced or widowed, retired, with a lower education level and with monthly family income < 6000 CNY.

Table 2 shows the distributions of cancer types, nutritional status, and physical activity levels of the patients. Among all the patients, reproductive system cancer showed the highest prevalence (26.7%), followed by digestive system cancer (25.7%), endocrine system cancer (16.7%) and respiratory system cancer (14.6%), and the order was the same for the living. On the other hand, digestive system cancer (35.4%) was the most common type in the deceased, followed by reproductive system cancer (24.1%) and respiratory system cancer (20.4%). In terms of nutritional risk score, most patients were with a score of 0 no matter whether they were living or not. Nevertheless, the deceased patients still had worse nutritional status. Similarly, they also had worse physical activity levels.

Table 2 Comparison of Tumor Type, Nutritional Risk score, and physical activity levels between the living and the dead respondents

	All respondents ($N=3,304$)	Living ($N=2,710$)	Dead ($N=594$)	*p*-value
Tumor type by system, N(%)				
Reproductive system[a]	882(26.7)	739(27.3)	143(24.1)	0.12
Digestive system[b]	850(25.7)	640(23.6)	210(35.4)	< 0.001
Endocrine system[c]	551(16.7)	534(19.7)	17(2.9)	< 0.001
Respiratory system[d]	481(14.6)	360(13.3)	121(20.4)	< 0.001
Urinary system[e]	256(7.7)	208(7.7)	48(8.1)	0.80
Immune system[f]	84(2.5)	67(2.5)	17(2.9)	0.69
Nervous system[g]	75(2.3)	67(2.5)	8(1.3)	0.13
Hematological system[h]	54(1.6)	39(1.4)	15(2.5)	0.09
Integumentary system[i]	51(1.5)	40(1.5)	11(1.9)	0.62
Motor system[j]	20(0.6)	16(0.6)	4(0.7)	> 0.999
Nutritional risk score, N(%)				
0	2892(87.5)	2414(89.1)	478(80.5)	< 0.001
1	229(6.9)	179(6.6)	50(8.4)	
2	169(5.1)	114(4.2)	55(9.3)	
3	10(0.3)	2(0.1)	8(1.3)	
4	2(0.1)	1(0.0)	1(0.2)	
5	2(0.1)	0(0.0)	2(0.3)	
Physical activity levels, N(%)				
1	1397(42.3)	1073(39.6)	324(54.5)	< 0.001
2	1503(45.5)	1267(46.8)	236(39.7)	
3	404(12.2)	370(13.7)	34(5.7)	

[a] Breast cancer, prostate cancer, cervical cancer, ovarian cancer, etc

[b] Liver cancer, stomach cancer, esophageal cancer, pancreatic cancer, rectal cancer, etc

[c] Thyroid, adrenal and pituitary tumors, etc

[d] Laryngeal, lung, and nasopharyngeal cancers, etc

[e] Kidney cancer, renal pelvis cancer, bladder cancer, ureteral cancer, etc

[f] Lymphoma, tonsil cancer, thymic cancer, etc

[g] Melanoma, meningeal carcinoma, nerve sheath tumor, etc

[h] Leukemia, myeloma, etc

[i] Skin cancer, etc

[j] Bone cancer, etc

Health-related quality of life of the patients

Table 3 shows the distributions of QLQ-C30 dimension scores, total score and QLU-C10D utility score of the patients. The mean QLQ-C30 total and QLU-C10D utility scores of all the patients were 91.57 and 0.87, respectively. In terms of the five dimension scores, emotional functioning scored highest (93.71), followed by cognitive functioning (92.42), role functioning (88.77) and social functioning (87.39); while physical functioning had the lowest mean score (85.40). The average QLQ-C30 total and QLU-C10 utility scores for the living and dead were

Table 3 Comparison of QLQ-C30 scores between the living and the dead respondents

	All respondents (*N* = 3,304)	Living (*N* = 2,710)	Dead (*N* = 594)	*p*-value
Physical functioning				
Mean ± SD[a]	85.40 ± 18.05	87.91 ± 15.14	73.94 ± 24.66	< 0.001
Median(Q1[b],Q3[c])	86.67(80.00,100.00)	93.33(80.00,100.00)	80.00(66.67,93.33)	
Role functioning				
Mean ± SD	88.77 ± 21.00	91.13 ± 17.92	77.97 ± 29.08	< 0.001
Median(Q1,Q3)	100.00(83.33,100.00)	100.00(100.00,100.00)	100.00(66.67,100.00)	
Cognitive functioning				
Mean ± SD	92.42 ± 15.39	93.79 ± 13.70	86.17 ± 20.35	< 0.001
Median(Q1,Q3)	100.00(83.33,100.00)	100.00(100.00,100.00)	100.00(66.67,100.00)	
Emotional functioning				
Mean ± SD	93.71 ± 13.99	94.58 ± 12.74	89.74 ± 18.14	< 0.001
Median(Q1,Q3)	100.00(100.00,100.00)	100.00(100.00,100.00)	100.00(83.33,100.00)	
Social functioning				
Mean ± SD	87.39 ± 21.41	89.18 ± 19.36	79.21 ± 27.55	< 0.001
Median(Q1,Q3)	100.00(66.67,100.00)	100.00(83.33,100.00)	100.00(66.67,100.00)	
Total score				
Mean ± SD	91.57 ± 12.30	92.96 ± 10.73	85.21 ± 16.33	< 0.001
Median(Q1,Q3)	96.58(88.75,99.49)	97.44(91.11,100.00)	91.28(77.77,97.07)	
QLU-C10D Utility Score				
Mean ± SD	0.87 ± 0.15	0.89 ± 0.14	0.78 ± 0.19	< 0.001
Median(Q1,Q3)	0.89(0.82,1.00)	0.89(0.84,1.00)	0.84(0.70,0.89)	

[a] *SD* Standard Deviation

[b] *Q1* 25% percentile

[c] *Q3* 75% percentile

Table 4 The performance of QLQ-C30 five dimension scores, total score and utility scores in predicting all-cause mortality according to two Cox regression models

ModelI[a]				ModelII[a]			
Score	HR[b]	95%CI[c]	*p-value*	Score	HR	95%CI	*p-value*
Physical functioning	0.81	(0.78–0.83)	< 0.001	Physical functioning	0.83	(0.80–0.86)	< 0.001
Role functioning	0.85	(0.83–0.88)	< 0.001	Role functioning	0.87	(0.85–0.90)	< 0.001
Cognitive functioning	0.87	(0.83–0.91)	< 0.001	Cognitive functioning	0.88	(0.84–0.92)	< 0.001
Emotional functioning	0.87	(0.83–0.91)	< 0.001	Emotional functioning	0.88	(0.84–0.93)	< 0.001
Social functioning	0.87	(0.84–0.90)	< 0.001	Social functioning	0.89	(0.86–0.92)	< 0.001
Total	0.79	(0.75–0.83)	< 0.001	Total score	0.81	(0.77–0.86)	< 0.001
Utility	0.80	(0.77–0.83)	< 0.001	Utility	0.83	(0.79–0.86)	< 0.001

[a] Model I: adjusted for tumor type by system, age, sex, education level, occupation, marital status, and monthly income; Model II: covariates in the model I plus nutrition status and activity level

[b] *HR*: hazard ratio

[c] *CI*: confidence interval

92.96 and 0.89, as well as 85.21 and 0.78, respectively ($p < 0.001$ for both). The order of the five dimensions of the living was consistent with that of the population, and the role functioning score of the dead was lower than the social functioning score. In terms of the comparison of QLQ-C30 dimension scores, the living had significantly higher values in all five scores ($p < 0.001$ for all), with the largest difference identified in the physical functioning score (87.91 vs. 73.94).

Table S1 also displays the distributions of the responses to each of the QLQ-C30 items between the living and the dead. It can be found that the proportion of reported problems of the dead was significantly higher than that of the living for all the items. Among them, three dimensions physical functioning, shortness of breath and tiredness had the largest difference in the proportion of living and dead.

Cox regression models

For all the patients surveyed, the mean survival time was 1,670 days (range: 4 days to 2,136 days). According to the two kinds of Cox regression models (Table 4), a higher QLQ-C30 score was associated with a lower risk of death. The patients with higher scores on each of the five

QLQ-C30 dimensions had a reduced risk of death, with HRs ranging from 0.81 to 0.87 (Model I, $p<0.001$) and 0.83–0.89 (Model II, $p<0.001$). The patients with higher QLQ-C30 total score and QLU-C10D utility score also had reduced risk of death, with HRs of 0.79 and 0.80 for Model I and HRs of 0.81 and 0.83 for Model II ($p<0.001$), respectively. From a clinical perspective, for each 10 point increase in the total QLQ-C30 score, the risk of mortality risk decreases by 21% and 19% in the two models, respectively.

Compared with reproductive system cancer (the reference type), respiratory or blood system cancers were significantly associated with an increased risk of death. With regard to other covariates, older age, male, less educated, single or divorced or widowed, and unemployed or retired were significantly associated with an increased risk of death (Table S2, S3). Higher nutritional risk scores and lower physical activity levels were related to the risk as well (Table S4, S5).

For all the models, there is no multicollinearity between variables, and all VIFs were < 10.

Discussion

To our knowledge, it was the first study to explore the relationship between HRQoL and mortality in community cancer patients. Our results showed that the patients with better HRQoL assessed by the QLQ-C30 would have a lower risk of death over time, thus indicating it could be a valid tool to predict death in the patients. The finding is also consistent with the evidence based on QLQ-C30 in hospitalized cancer patients [6, 21]. Moreover, we systematically assessed the performance of seven QLQ-C30 scores in various kinds of cancer patients in comparison with those who only adopted its total or dimension scores [18] or focused on a specific type of cancer. Hence, our findings not only expand the use of QLQ-C30 in death prediction in different settings, but also deepen the understanding of the performance of QLQ-C30 in the estimation.

We found that the proportion of the deceased with QLQ-C30 problems was greater than that of the living. Among the 30 items of QLQ-C30, three items physical functioning, shortness of breath and fatigue showed a greater difference in proportion between the living and the dead. Physical functioning has been proved by most studies to be able to predict the death outcome of patients, and the strong predictive ability of shortness of breath and fatigue may be because they could be the indicators of later-stage cancer [22].

Consistent with prior evidence [23], the Cox regression models showed that all the five QLQ-C30 dimension scores could predict the death outcome; and their predictive ability were robust to the adjustment of covariates. Among them, the physical function dimension score had a better predictive power according to HR value. Studies have consistently confirmed that it is one of the most common predictors of mortality in cancer patients. For example, a Turkish study of advanced lung cancer patients confirmed that it is more predictive than the other dimension scores [24]. This may be because the score could be a more sensitive indicator of cancer severity than the other dimension scores [25]. In other words, the lower the physical function score, the more severe the cancer status is. Shortness of breath and fatigue are the two obvious indicators of poor physical function, which can cause a dual burden on patients' physiology and psychology [26].

Meanwhile, empirical evidence regarding the predictive performance of the QLQ-C30 total score was not inclusive. Several studies have reported that it is an important predictor of patients' survival [27–29]; while a few studies have given the opposite results. The mixed findings were possibly because of different study designs and different populations or cancer types which could influence the results. In a study of patients with throat squamous cell carcinoma with a limited sample size ($n=208$), only the cognitive functioning predicted death among the five dimension scores of QLQ-C30, while the total score did not show the predictive power [30]. In terms of the QLU-C10D utility value, the good performance in mortality estimation supported its predictive validity.

In this study, the top four prevalent cancer types were the reproductive system, digestive system, endocrine system and respiratory system, which were roughly similar to the cancer prevalence rate in Chinese residents (i.e., digestive system, respiratory system, reproductive system and endocrine system [31]). The similarity may suggest the representativeness of the sample. Our results also showed that in comparison with the patients with reproductive cancer, the patients with endocrine system cancer had a lower risk of death; while the patients with respiratory and hematologic cancers had a higher risk. Respiratory cancer such as lung cancer has high incidence in Chinese people. For example, the number of new cases of lung cancer accounts for 22% of the total number of new cases of all types of cancer, far exceeding the number of colorectal cancer (10.7%) [32]. However, it is difficult to be detected at the initial stage and has a poor prognosis, which may be the main reason for its high mortality. Since no study in China has explored the mechanisms of the difference in mortality among different types of cancer, future in-depth studies may be warranted.

As expected, the death risk increased with age in the analysis. We also found that the risk was greater for men, while previous studies found that women could have higher risk [33–35]. This may be due to the fact that previous studies mainly focused on cancer populations in western countries. Meanwhile, men more likely lived in underdeveloped areas compared to women in China, resulting in their limited accessibility to cancer-related treatment in a timely manner [36]. The risk of death gradually decreases with higher education level and being employed, possibly because they indicate better socioeconomic status of the patients, thus reducing their death risk [37, 38]. Belonging to married status was a protective factor compared to other statuses. A study on breast cancer in the US, also showed that unmarried patients had a significantly higher risk of death. The study identified better economic resources and greater social support as two major factors for marriage to increase the life expectancy of cancer patients [39]. We also found that nutritional risk score was a risk factor in all models, which is consistent with the results of most studies [40–43]. Finally, for better physical activity level, which can be seen as a protective factor.

Conclusions

In conclusion, the QLQ-C30 can accurately predict all-cause mortality outcomes in Chinese community cancer patients, which could thus be adopted to identify and monitor those with high mortality risk in the population.

Strengths and limitations

The study adopted a large sample of community cancer patients with various cancer types, indicating good representativeness. Meanwhile, it yet suffered from two limitations. First, the sample was from 4 communities in Shanghai, which may not be fully representative of the entire community of cancer patients in China. Second, this study cannot explore the effects of other potentially important variables including cancer duration, cancer complications, cancer staging, and psychological factors. This was due to the fact that the survey was conducted in communities, and thus we were unable to obtain those important clinical data.

Abbreviations

HRQoL	health-related quality of life
NSCLC	non-small cell lung cancer
EORTC	European Organization for Research and Treatment of Cancer
MUST	Malnutrition Universal Screening Tool
BSPEN	British Society for Parenteral and Enteral Nutrition
SD	standard deviation
AIC	Akaike information criterion
VIF	variance inflation factor
Q1	25% percentile
Q3	75% percentile
HR	hazard ratio
CI	confidence interval

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions

Jin Zhao and Pei Wang wrote the main manuscript text Concept and design: Pei Wang and Xiaoming YangAcquisition of data: Yanmin WangAnalysis and interpretation of data: Jin ZhaoCritical revision of the paper for important intellectual content: Weidong Huang and Richard H Xu.

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Data availability

The data used and analyzed for this are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study followed the principles of the Helsinki declaration and was approved by the Institutional Review Board of Fudan University.All participants gave informed written consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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