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**Cancer-related financial hardship among head and neck cancer survivors: risk factors  
and associations with health-related quality-of-life**

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## **Abstract**

### ***Objective***

Cancer survivors are susceptible to financial hardship. In head and neck (HNC) survivors, we investigated (i) predictors for cancer-related financial hardship and (ii) associations between financial hardship and health-related quality-of-life (HRQoL).

### ***Methods***

We conducted a cross-sectional study in HNC survivors identified from the National Cancer Registry Ireland. HRQoL was based on the Functional Assessment for Cancer Therapy General (FACT-G) plus Head and Neck module (FACT-HN). Objective cancer-related financial hardship (financial stress) was assessed as household ability to make ends meet due to cancer and subjective financial hardship (financial strain) as feelings about household financial situation due to cancer. Modified Poisson regression was used to identify predictors for financial hardship. Bootstrap linear regression was used to estimate associations between hardship and FACT domain scores.

### ***Results***

Pre-diagnosis retirement (relative risk [RR]=0.50, 95% confidence interval [CI] 0.37-0.67), pre-diagnosis financial stress (RR=1.85, 95% CI 1.58-2.15), and treatment were significantly associated with objective financial hardship. Predictors of subjective financial hardship were similar: aged  $\geq 65$  years, pre-diagnosis financial stress and treatment. Participants with objective financial hardship reported significantly lower physical (coefficient -3.45, 95% CI -4.39- -2.44), emotional (-2.01, 95% CI -2.83- -1.24), functional (-2.56, 95% CI -3.77- -1.33) and HN-specific HRQoL (-3.55 95% CI -5.04- -2.23). Physical, emotional, functional HN-specific HRQoL were also significantly lower in participants with subjective financial hardship.

## ***Conclusion***

Cancer-related financial hardship is common and associated with worse HRQoL among HNC survivors. This supports the need for services and supports to address financial concerns among HNC survivors.

## **Keywords**

Head and neck cancer, Survivorship, Financial hardship, Cancer-related financial stress, Cancer-related financial strain, Quality-of-life, Ireland

Accepted Article

## Introduction

Head and neck cancer (HNC) accounts for over 550,000 cases and 380,000 deaths annually worldwide<sup>1</sup> and poses a substantial economic burden for healthcare payers, employers, society, and importantly, patients and their families/carers. In US in 2010, the estimated direct medical costs paid by healthcare payers for HNC were \$3.64 billion<sup>2</sup> and cancer-related productivity losses were \$3.63 billion<sup>3</sup>. The full costs encompass direct treatment-associated medical costs, direct non-medical costs (e.g. transportation), indirect costs (e.g. reduced workforce participation), and intangible costs (e.g. pain)<sup>4</sup>.

Out-of-pocket costs (OOPCs) from cancer diagnosis, treatment, and follow-up care are expected to rise due to increasing medical care costs even for survivors with health insurance<sup>5</sup>. Absence from work and/or reduced work ability after HNC may result in lost income. Together these can result in cancer-related financial hardship<sup>6</sup>. Since HNC incidence and mortality is higher in socioeconomically-deprived populations, survivors may be more vulnerable to financial hardship than survivors with other cancers<sup>7</sup>.

Following recommendations<sup>8</sup>, some recent studies<sup>9,10</sup> discriminate cancer-related financial hardship into material/objective hardship (financial stress, which incorporates both medical and non-medical financial stressors for the household due to cancer)<sup>8,11</sup> and psychological/subjective hardship (financial strain, which is individual-perceived financial difficulties experienced due to cancer including worries about expenses for cancer care/daily living)<sup>8,11</sup>. Most previous studies included patients with either all cancers combined or the most common cancers<sup>12</sup>; little is known about cancer-related financial stress and strain among HNC survivors.

Associations between financial hardship and various health outcomes, including health-related quality-of-life (HRQoL)<sup>9,13</sup>, psychological wellbeing<sup>10</sup> and mortality<sup>14</sup>, have been reported. A possible circular relation between poorer health, financial strain and poorer HRQoL has been hypothesized<sup>11</sup>. Survivors with financial hardship may more often delay, discontinue or forgo medical care<sup>15</sup>, and consequently have reduced HRQoL<sup>9,16</sup>. Meanwhile poor HRQoL may increase healthcare need, resulting in increased costs, and hence greater financial hardship<sup>11</sup>. A single previous HNC study tentatively suggested a positive association between patient-perceived financial burden and poor QoL<sup>17</sup>.

The current study investigated: (i) predictors for cancer-related financial hardship and (ii) associations between financial hardship and HRQoL among adult survivors with a primary HNC in the Republic of Ireland (RoI). Two different aspects of cancer-related financial hardship were considered – objective stress and subjective strain.

## **Methods**

### *Setting*

The RoI has a mixed public–private healthcare system<sup>18</sup>. All residents are entitled to use the public system. Individuals without a medical card (eligibility based on financial means and age) make co-payments for GP appointments or hospital in-patient stays (approximately €60 per visit/stay) and pay full costs of prescription medications. Private health insurance usually covers in-patient stays either in a private hospital or as a private patient within a public hospital. Individuals may join the Drug Payment Scheme (with a monthly co-payment ceiling of €120), but many medical items (e.g. dressings) and oral health products and devices are not covered by this scheme.

### ***Data collection***

This study used data from the National Cancer Registry Ireland (NCRI) supplemented by a postal survey<sup>19</sup>. Since 1994, the NCRI has recorded incident cancers diagnosed in the RoI following internationally-accepted registration and coding conventions<sup>20</sup>. Completeness of registration is estimated to be  $\geq 97\%$ <sup>21</sup>. In 2012, potentially eligible survivors were identified from the NCRI; they were  $\geq 18$  years at diagnosis,  $\geq$ eight-months post-diagnosis, and treated in  $\geq 1$  of the major HNC treating centres. The treating consultant confirmed whether each survivor: was alive and aware they had cancer; had completed treatment; was not terminally-ill; and that there was no medical or other reason why it would be inappropriate to contact them. Following this, a postal survey was sent to 991 eligible survivors. A pen was enclosed with the survey and survivors were informed that respondents would be entered into a prize draw. Up to two reminders were sent, at fortnightly intervals.

The study conformed to the ethical standards of the 1964 Declaration of Helsinki and later amendments. Ethical approval was granted by the ethical committee for each participating hospital<sup>19</sup>. Participants provided signed informed consent.

### ***Measures***

Data on age at diagnosis, sex, stage, site, and initial treatment were obtained from the NCRI. The survey collected information on marital status, nationality, whether had children, whether lived alone, highest level of education, employment status, insurance, financial situation, cancer recurrence, and social support. Following previous work<sup>13,16</sup>, cancer-related financial stress was assessed as household ability to make ends meet as a result of cancer. Cancer-related financial strain was measured as feelings about household financial situation as a

result of cancer. Since we aimed to identify predictors for presence/absence of cancer-related hardship, these two financial hardship variables (7-level Likert scale) were transformed into dichotomous variables for analysis. Participants were considered to have “cancer-related financial stress” if they responded “Much more difficult/More difficult/A little more difficult”. Participants were considered to have “cancer-related financial strain” if they responded “Very concerned/Much more concerned/A little more concerned”. HRQoL was measured using the Functional Assessment for Cancer Therapy-General (FACT-G) questionnaire plus the Head and Neck Module (FACT-HN), psychometrically-validated tools<sup>22</sup> comprising 39 items in five domains: physical, social/family, emotional, and functional wellbeing, and HNC-specific<sup>23</sup>. For each item, participants rated the extent to which they applied in the week pre-survey (5-level Likert scale: “Not at all/A little bit/Somewhat/Quite a bit/Very much”). A higher total score indicated higher HRQoL.

Age at diagnosis was categorised: <50, 50-64, ≥65 years. Employment status was classified: employed, self-employed, unemployed, retired and other. Initial treatment (within eight months post-diagnosis) was categorised: surgery; surgery+radiotherapy; radiotherapy; chemotherapy±radiotherapy; chemotherapy+surgery±radiotherapy. Cancer site was categorised: oropharynx, oral cavity, larynx and other. Time since diagnosis was grouped: <5 and ≥ 5 years. Social support, derived from the Oslo Social Support Scale<sup>24</sup> was split into: strong (total score ≥12), moderate (9-11) and poor (≤8). Pre-diagnosis financial situation may be an important determinant of post-diagnosis financial hardship<sup>8,16</sup>; participants were considered to have “pre-diagnosis financial stress” if they responded “Very difficult/Difficult/Somewhat difficult” to a question on ability to make ends meet pre-diagnosis.



## *Statistical analyses*

The analyses included respondents who answered the cancer-related financial hardship questions (n=531). Using  $\chi^2$  tests, response bias was tested by comparing characteristics of respondents who answered the cancer-related financial hardship questions and (i) those who returned the survey but did not answer these questions (n=52) and (ii) those who did not respond to the survey (n=408). Because cancer-related financial hardship was common, we used modified Poisson regression models<sup>25</sup> to calculate relative risks (RR) for predictors of hardship. Models were developed separately for financial stress and strain. Model fitting involved: (i) variables that were statistically significant in univariable analyses were fitted together initially; (ii) variables which remained statistically significant when fitted together were retained (likelihood ratio test:  $p < 0.05$ ); (iii) variables which were not statistically significant in univariable analyses were then assessed for possible inclusion. Care was taken to avoid multicollinearity; variables in the final models had variance inflation factor  $< 10$  and tolerance  $> 0.1$ .

For each FACT item, responses indicating the lowest and second lowest scores were categorised as “low score”<sup>19</sup>. For each FACT domain score, responses for those who had answered at least half, but not all, questions in a domain were imputed using the individual’s mean score from completed questions<sup>23</sup>. Because domain scores were skewed, Wilcoxon-Mann-Whitney tests were used to compare scores between participants with and without hardship. Separate bootstrap multivariable linear regression models (with bias-corrected and accelerated confidence intervals [CIs])<sup>26</sup> were used to estimate associations between cancer-related financial hardship and each domain score. The model fitting process was as above. Since cancer-related financial stress and strain are inter-related, they were fitted separately.

## Results

### *Study sample*

Completed surveys were returned by 583 survivors (response rate=59%). Of these, 531 (91%) responded to the cancer-related financial hardship questions and constituted the study population. Comparing the study population with the 52 participants excluded due to incomplete data on financial hardship, there were no statistically significant differences in sex, marital status, pre-diagnosis financial stress, stage at diagnosis, cancer site, and time since diagnosis. The study population was younger ( $\chi^2$  test for trend:  $p=0.003$ ), more often had higher education ( $\chi^2$  test for trend:  $p=0.043$ ) and less often had a medical card ( $\chi^2$  test:  $p=0.001$ ). When the study population was compared with survey non-respondents, participants were younger ( $\chi^2$  test for trend:  $p=0.003$ ) and somewhat different in terms of site ( $\chi^2$  test:  $p<0.001$ ), with non-respondents more often categorised as “other site”. The study population did not differ from non-respondents in sex, stage, and time since diagnosis.

Among eligible participants, about three-quarters were <65 years (75%), married/cohabiting (72%), and reported primary/secondary only education (76%). Immediately pre-diagnosis, 23% of participants were unemployed, 22% retired and 32% reported financial stress (Table 1).

### *Cancer-related financial hardship*

Of the 531, 272 (51%) reported cancer-related financial stress, 282 (53%) reported strain, and 240 (45%) reported both stress and strain. Supplementary Tables 1 and 2 summarise the results of  $\chi^2$  tests and univariable Poisson regression analyses.

In the multivariable Poisson regression analyses, participants with cancer-related financial stress were significantly less likely to have retired pre-diagnosis (RR=0.50, 95% CI 0.37-0.67), more likely to have pre-diagnosis financial stress (RR=1.85, 95% CI 1.58-2.15), and have received the following initial treatment: radiotherapy (RR=1.77, 95% CI 1.41-2.23), chemotherapy±radiotherapy (RR=1.49, 95% CI 1.15-1.92), chemotherapy+surgery±radiotherapy (RR=1.67, 95% CI 1.30-2.14). Significant predictors for financial strain were similar: aged ≥65 years (RR=0.67, 95% CI 0.47-0.95), pre-diagnosis financial stress (RR=1.89, 95% CI 1.48-2.40), and initial treatment of chemotherapy+surgery±radiotherapy (RR=1.45, 95% CI 1.00-2.11) (Table 2).

#### *Cancer-related financial hardship and HRQoL*

Participants with cancer-related financial hardship more often had a “low score” in most FACT items (Supplementary Tables 3&4). Participants with cancer-related financial stress or strain reported worse overall physical, emotional, functional domain, and HN-specific scores than those without (Wilcoxon rank-sum test: all  $p < 0.001$ ) (Table 3A, 3B). There was a borderline statistical difference in social domain scores between participants with financial strain and those without (Table 3B).

In regression analyses, after controlling for demographics and clinical confounders, physical, emotional, functional and HN-specific HRQoL were statistically significantly lower among participants with cancer-related financial stress or strain than those without (Table 4).

## Discussion

### *Main findings*

Cancer-related financial hardship was common among HNC survivors. Pre-diagnosis financial stress may be a stronger predictor for cancer-related financial hardship than age, pre-diagnosis employment status and initial treatment. Physical, emotional, functional and HN-specific HRQoL were significantly lower among survivors with cancer-related financial hardship than those without.

### *Cancer-related financial hardship*

Measures of cancer-related financial hardship are heterogeneous so comparisons of prevalence of hardship between studies are difficult<sup>27</sup>. Most studies have focused on material aspects including OOPC<sup>28,29</sup>, debt<sup>30,31</sup> and bankruptcy<sup>32</sup>. Some recent studies derived a financial stress variable from variables on financial stressors including debt, bankruptcy, inability to cover medical care costs<sup>12,33</sup>, and making financial sacrifices due to cancer and treatment<sup>12</sup>. A strength of our study is the consideration of both material/objective and psychological/subjective hardship; the latter has been infrequently studied.

In two previous Irish studies which used the same questions to assess cancer-related financial hardship question, of breast and prostate cancer survivors, 48% reported stress and 32% reported strain<sup>16</sup>, while of colorectal cancer survivors, 41% reported stress and 39% reported strain<sup>13</sup>. In this study, >50% of HNC survivors reported cancer-related stress and strain. This is consistent with earlier suggestions that HNC patients may be more susceptible to post-diagnosis financial hardship, given their lower socioeconomic status<sup>7</sup>, high rates of non-

resumption of work post-cancer<sup>34</sup> and OOPCs of supportive products and therapies (e.g. speech therapy, oral care products)<sup>35</sup>. Most HNC survivors who reported cancer-related financial stress experienced financial strain. This may be because, in Ireland, citizens have to make modest co-payments for publically-funded healthcare. Due to having insufficient resources to cope with cancer-related financial stress, survivors may experience financial strain.

The current study, like a previous Irish study, demonstrated the association between pre-diagnosis financial stress and cancer-related financial stress and strain<sup>16</sup>. Similarly, a longitudinal Asian study of 9,513 patients found that pre-diagnosis financial stress was a significant predictor for post-treatment cancer-related catastrophe (OOPC in the previous year of  $\geq 30\%$  of annual household income)<sup>29</sup>. In struggling to meet OOPC, HNC patients who experienced pre-diagnosis financial hardship might have to use savings, sell possessions, borrow money, or obtain loans, particularly, if their reduced work participation restricted their options for employment-based insurance or other cost-coping strategies; we did not collect information on financial adjustments so could not examine this. However, we might speculate that HNC survivors who had pre-diagnosis financial stress may be more susceptible to cancer-related financial strain even for the same level of cancer-related financial stress.

Roger et al. examined 447 patients with primary HNC from a University Hospital HNC database in Merseyside, UK. Patients under 65 had more financial problems than older patients<sup>17</sup>. Consistent with this, our results showed a lower risk of cancer-related financial stress among survivors who had retired pre-diagnosis and a lower risk of financial strain among elderly survivors. Without a pension as a source of stable income, younger patients

may have more difficulty coping with OOPCs, on top of household expenses (e.g. mortgage payments/dependent-rearing) and reduced work participation post-cancer.

Our results also suggest that initial treatments other than surgery only were independently associated with cancer-related financial stress and strain. This may reflect the stage distribution of participants. Single modality treatment (surgery/radiotherapy) is often an adequate treatment for early-stage HNC<sup>36,37</sup>. Advanced-stage patients often require more complex multimodal treatment. Consequently, they may incur additional OOPCs and require more support from benefits<sup>36,37</sup>, and be more likely to experience cancer-related financial hardship.

### ***Cancer-related financial hardship and HRQoL***

There is growing evidence that cancer-related financial hardship is associated with poor HRQoL in a range of countries and healthcare settings<sup>17,38</sup>. A recently published Chinese study of 227 lung cancer patients aged  $\geq 18$  years evaluated the association between both objective (healthcare-cost-to-income ratio of  $> 40\%$ ) and subjective financial burden (perceived financial difficulty) and HRQoL. This found a significant lower level of emotional wellbeing and overall HRQoL among patients with a high level of objective/subjective financial burden<sup>9</sup>. In a US study of 2108 patients aged  $\geq 18$  years with all cancer types selected from the National Health Interview Survey, patients with “a lot” of perceived financial problems carried a four-fold decrease in the likelihood of reporting a QoL of “good” or better (odds ratio=0.24, 95% CI 0.14-0.40)<sup>38</sup>. Other studies in Ireland and the US, among breast, prostate, and lung cancer patients also related financial stress and strain to increased risks of depression and anxiety<sup>10,39</sup>.

However, few studies have explored the association between cancer-related financial hardship and HRQoL among HNC patients. Roger et al. demonstrated in univariate analyses that worse physical and social-emotional functioning, measured using the University of Washington Quality-of-life Questionnaire, were associated with financial burden<sup>17</sup>. We extend these findings by reporting independent associations between both cancer-related financial stress and strain and poorer physical, functional, emotional and HN-specific HRQoL after adjustment for confounders.

### ***Limitations***

As with previous studies, our study is cross-sectional, therefore the directions of the associations between financial hardship and HRQoL are uncertain. The study population were younger and less likely to have a medical card, compared with survey respondents who did not complete the cancer-related financial hardship questions. We were unable to compare socio-economic status between survey respondents and non-respondents, but these groups differed in age and cancer site. Since age is associated with financial strain, it is possible we have underestimated the true prevalence of this. Medical card status may be associated with financial stress<sup>29</sup> and poor HRQoL<sup>40</sup>. However, in the model fitting process, medical card status was neither a strong predictor for cancer-related financial hardship nor for HRQoL. Cancer site was a potential predictor for physical wellbeing but not a strong risk factor for cancer-related financial hardship. We adjusted for cancer site in the multivariable regression models. Another concern is that the follow-up survey time since diagnosis varied from less than a year to up to 18 years. Both HRQoL and cancer-related financial hardship may vary over time since diagnosis. A short time since diagnosis may not be long enough to capture financial consequences of cancer, which may take some time to emerge fully, whereas those

who have survived a long time post-cancer may have experienced hardship in the past, but that could have resolved by the time of questionnaire completion. We did not pre-test the questionnaire, but used previously validated instruments to assess HRQoL. Since the study was conducted a validated questionnaire to assess financial hardship has been developed (Comprehensive Score for Financial Toxicity-Functional Assessment of Chronic Illness Therapy (COST-FACIT)). Our financial hardship questions were used in a previous study in which convergent validity was assessed; responses correlated with objective measures of financial burden<sup>10,16</sup>. Recall bias in pre-diagnosis financial stress is possible. We re-ran the Poisson regression models excluding pre-diagnosis financial stress; the association between unemployment status and cancer-related financial stress was more pronounced (RR=1.25, 95% CI 1.04-1.50, p=0.018). However, unemployment is correlated with pre-diagnosis financial stress, so this strengthened association perhaps reflects uncontrolled confounding. Given that the distributions of potential moderators of cancer-related financial hardship (e.g. health insurance coverage, social welfare benefits) may be different from population to population, the results may not be necessarily generalised to other populations. Studies in different healthcare settings with well-defined populations of HNC survivors, using longitudinal designs and employing validated measures of financial hardship and HRQoL, are needed.

### ***Clinical implications & conclusion***

Our study adds to the limited published evidence on the association between potential predictors, cancer-related financial hardship and HRQoL among HNC survivors. Our findings highlight the impact of cancer-related financial hardship upon post-diagnosis HRQoL and vice versa and indicate financial hardship can be common even within settings



with a public healthcare system. The development of screening tools for use in treatment or follow-up clinics to identify survivors at risk of, or experiencing, cancer-related hardship would be valuable; if such tools were available, it would facilitate the direction of relevant survivors towards benefits advice and other sources of financial support and advice. There is an urgent need to implement policies to address cancer-related financial hardship among HNC survivors, especially those with limited resources; this may, in turn, help improve HRQoL.

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### **Conflict of interest**

None.

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**Table 1. Participants' characteristics<sup>a</sup>**

	n (%)
<b>Age at diagnosis (years)</b>	
<50	142 (26.7)
50-64	254 (47.8)
≥65	133 (25.1)
Unknown	2
<b>Sex</b>	
Male	361 (68.0)
Female	170 (32.0)
Unknown	0
<b>Nationality</b>	
Irish	487 (91.7)
Other	26 (4.9)
Unknown	18
<b>Marital status</b>	
Married/cohabiting	380 (71.6)
Other	146 (27.5)
Unknown	5
<b>Children</b>	
No	119 (22.4)
Yes	397 (74.8)
Unknown	15
<b>Live alone</b>	
No	429 (80.8)
Yes	83 (15.6)
Unknown	19
<b>Education</b>	
Tertiary	115 (21.7)
Secondary school	235 (44.3)
Primary school	166 (31.3)
Unknown	15
<b>Pre-diagnosis employment</b>	
Employed	170 (32.0)
Self-employed	105 (19.8)
Unemployed	122 (23.0)
Retired	117 (22.0)
Other	13 (2.5)
Unknown	4
<b>Pre-diagnosis financial stress</b>	
Easy	358 (67.4)
Difficult	168 (31.6)
Unknown	5
<b>Medical card<sup>b</sup></b>	
Yes	230 (43.3)
No	275 (51.8)
Unknown	26
<b>Private health insurance</b>	
Yes	230 (43.3)
No	275 (51.8)
Unknown	26

<b>Stage</b>	
1-2	250 (47.1)
3-4	200 (37.7)
Unknown	81
<b>Cancer site</b>	
Oropharynx	22 (4.1)
Oral cavity	230 (43.3)
Larynx	158 (29.8)
Other	105 (19.8)
Unknown	16
<b>Cancer recurrence</b>	
No	468 (88.1)
Yes	32 (6.0)
Unknown	31
<b>Initial treatment</b>	
Surgery only	160 (30.1)
Surgery+radiotherapy	140 (26.4)
Radiotherapy only	86 (16.2)
Chemotherapy±radiotherapy	59 (11.1)
Chemotherapy+surgery±radiotherapy	66 (12.4)
Other	20
<b>Time since diagnosis (years)</b>	
<5	266 (50.1)
≥5	263(49.5)
Unknown	2
<b>Social support</b>	
Strong	148 (27.9)
Moderate	245 (46.1)
Poor	122 (23.0)
Unknown	16

<sup>a</sup> N=531

<sup>b</sup> Eligibility based on financial means and age

Accepted

**Table 2. Multivariable Poisson regression analyses -demographic and clinical variables significantly associated with cancer-related financial hardship: relative risks (RR) with 95% confidence intervals (CI) and p values**

	Cancer-related financial stress		Cancer-related financial strain	
	RR (95% CI)	P	RR (95% CI)	P
<b>Age at diagnosis (years)</b>				
<50	-	-	1.00	-
50-64	-	-	0.82 (0.63-1.07)	0.152
≥65	-	-	0.67 (0.47-0.95)	0.024
<b>Pre-diagnosis employment</b>				
Employed	1.00	-	-	-
Self-employed	1.04 (0.85-1.28)	0.700	-	-
Unemployed	1.06 (0.87-1.26)	0.533	-	-
Retired	0.50 (0.37-0.67)	<0.001	-	-
Other	0.92 (0.64-1.32)	0.662	-	-
<b>Pre-diagnosis financial stress</b>				
Easy	1.00	-	1.00	-
Difficult	1.85 (1.58-2.15)	<0.001	1.89 (1.48-2.40)	<0.001
<b>Initial treatment</b>				
Surgery only	1.00	-	1.00	-
Surgery+radiotherapy	1.16 (0.91-1.47)	0.230	1.00 (0.72-1.40)	0.994
Radiotherapy only	1.77 (1.41-2.23)	<0.001	1.25 (0.87-1.80)	0.221
Chemotherapy±radiotherapy	1.49 (1.15-1.92)	0.003	1.23 (0.82-1.84)	0.327
Chemotherapy+surgery±radiotherapy	1.67 (1.30-2.14)	<0.001	1.45 (1.00-2.11)	0.048
Other	1.12 (0.63-1.97)	0.704	0.82 (0.38-1.79)	0.624

**Table 3. FACT domain scores: medians and interquartile range (IQR)**

**A.**

FACT domain	All respondents	With cancer-related financial stress	Without cancer-related financial stress	z-score <sup>a</sup>	P <sup>a</sup>
	Median (IQR)	Median (IQR)	Median (IQR)		
Physical wellbeing	25.0 (20.0-28.0)	22.0 (17.0-26.0)	26.8 (24.0-28.0)	8.59	<0.0001
Social wellbeing	21.0 (16.3-25.7)	21.0 (16.2-25.0)	22.0 (17.0-26.0)	1.26	0.208
Emotional wellbeing	20.0 (17.0-23.0)	20.0 (15.0-22.0)	21.0 (19.0-24.0)	5.05	<0.0001
Functional wellbeing	21.0 (15.0-26.0)	19.0 (12.0-24.5)	23.0 (18.0-27.0)	5.54	<0.0001
Head and neck specific	36.0 (28.4-41.0)	33.0 (27.0-38.0)	38.0 (33.0-43.0)	6.72	<0.0001

**B.**

FACT domain	All respondents	With cancer-related financial strain	Without cancer-related financial strain	z-score <sup>a</sup>	P <sup>a</sup>
	Median (IQR)	Median (IQR)	Median (IQR)		
Physical wellbeing	25.0 (20.0-28.0)	23.0 (17.0-26.0)	26.8 (24.0-28.0)	8.56	<0.0001
Social wellbeing	21.0 (16.3-25.7)	21.0 (15.2-25.0)	22.2 (17.5-26.0)	1.98	0.048
Emotional wellbeing	20.0 (17.0-23.0)	19.6 (15.0-22.0)	21.0 (19.0-24.0)	5.44	<0.0001
Functional wellbeing	21.0 (15.0-26.0)	19.0 (13.0-24.0)	24.0 (18.0-27.0)	6.26	<0.0001
Head and neck specific	36.0 (28.4-41.0)	33.0 (27.0-38.2)	38.0 (32.7-43.0)	6.12	<0.0001

a Wilcoxon rank-sum test

**Table 4. Multivariable linear regression analyses - associations between cancer-related financial hardship and HRQoL domain: bootstrap coefficients (Coef) with bias-corrected and accelerated confidence intervals (BCA 95%CI)**

	<b>Physical</b> Coef (BCA 95% CI)	<b>Social</b> Coef (BCA 95% CI)	<b>Emotional</b> Coef (BCA 95% CI)	<b>Functional</b> Coef (BCA 95% CI)	<b>Head and neck specific</b> Coef (BCA 95% CI)
<b>Cancer-related financial stress</b>					
No	Reference	Reference	Reference	Reference	Reference
Yes	-3.45 (-4.39- -2.44) <sup>a, b</sup>	0.35 (-0.72-1.31) <sup>c</sup>	-2.01 (-2.83- -1.24) <sup>a, d</sup>	-2.56 (-3.77- -1.33) <sup>a, e</sup>	-3.55 (-5.04- -2.23) <sup>a, f</sup>
<b>Cancer-related financial strain</b>					
No	Reference	Reference	Reference	Reference	Reference
Yes	-3.78 (-4.76- -2.79) <sup>a, b</sup>	0.10 (-0.97-1.08) <sup>c</sup>	-2.17 (-2.97- -1.47) <sup>a, d</sup>	-2.90 (-4.02- -1.65) <sup>a, e</sup>	-3.32 (-4.80- -2.06) <sup>a, f</sup>

a p<0.001

b Adjusted for education, site, recurrence, treatment and social support

c Adjusted for live alone and social support

d Adjusted for sex, employment, time since diagnosis and social support

e Adjusted for treatment and social support

f Adjusted for live alone, education, employment, stage, treatment, recurrence and social support