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# Comparison of the impact of cancer between British and US long-term non-Hodgkin lymphoma survivors

**Shah-Jalal Sarker**[1], **Sophia K. Smith**[2], **Kashfia Chowdhury**[1], **Patricia A. Ganz**[3], **Sheryl Zimmerman**[4], **John Gribben**[5], and **Ania Korszun**[6]

[1]Centre for Experimental Cancer Medicine, Barts Cancer Institute, Queen Mary University of London, London, UK

[2]Cancer Care Research Program, Duke Clinical Research Institute, Durham, USA

[3]UCLA Schools of Medicine and Public Health, Jonsson Comprehensive Cancer Center, Los Angeles, USA

[4]School of Social Work, University of Illinois , Chicago, USA

[5]Centre for Haemato-Oncology, Barts Cancer Institute , Queen Mary University of London, London, UK

[6]Centre for Psychiatry, Wolfson Institute of Preventive Medicine, Queen Mary University of London,, London, UK

## Abstract

**Purpose—**The aims of this study were to examine quality of life, using the Impact of Cancer version 2 (IOCv2), in British non-Hodgkin lymphoma (NHL) survivors and investigate differences between survivors in the UK and the USA.

**Methods—**NHL survivors (326 UK and 667 US) completed the 37-item IOCv2 and psychological distress, fatigue and social support questionnaires.

**Results—**The IOCv2 showed good reliability in the British sample with higher internal consistency (Cronbach alpha 0.7–0.9) and no floor and ceiling effects. UK survivors showed significantly higher negative ($p < 0.001$) and higher positive ($p = 0.003$) IOC compared to US survivors. Younger survivors ($p = 0.003$), those with shorter time since diagnosis ($p < 0.001$) and with lower levels of social support ($p = 0.001$), showed more negative IOC in both groups. Higher negative IOC was also significantly associated with fatigue ($p < 0.001$) and depressive symptoms ($p < 0.001$) in both countries. Higher positive IOC was associated with female gender ($p < 0.001$), longer time since diagnosis ($p = 0.02$), those diagnosed at later stage ($p < 0.05$) and with greater social support ($p = 0.004$). Whereas significantly lower positive IOC was associated with white ethnicity ($p < 0.001$), higher education levels ($p < 0.05$) and fatigue ($p = 0.001$).

Ania Korszun, a.korszun@qmul.ac.uk.

**Compliance with ethical standards** For the UK study, ethical approval was obtained from the National Research Ethics Service Ref: 11/NE/ 0095; for the US study, from the Institutional Review Boards of Duke University and the University of North Carolina at Chapel Hill (UNC). Written informed consent was obtained from each participant in both countries.

**Conflict of interest** The authors declare that they have no conflicts of interest.

**Conclusions—**The IOCv2 is reliable and applicable in UK and US populations. Both negative and positive IOC scores were higher in British compared to US survivors. However, in both countries, psychosocial factors consistently showed the greatest impact on QOL irrespective of clinical characteristics. Recognition and treatment of individuals with these risk factors is a high priority for improving QOL in long-term cancer survivors, as is the development of modular interventions aimed at increasing positive IOC as well as decreasing negative impact. The IOCv2 shows great potential both as a screening and assessment measure for examining cancer-related outcomes among survivors.

### Keywords

Impact of cancer scale; Cancer survivors; Depression; Social support; Quality of life; Non-Hodgkin lymphoma

## Introduction

For the ever-growing numbers of survivors, cancer is a chronic life-altering condition. As a case in point, non- Hodgkin lymphoma (NHL) survivors experience various adverse physical late effects of cancer therapy [1–3], as well as psychosocial problems, including depression and anxiety that affect their quality of life (QOL). Although these problems are clearly reported by long-term survivors [4], they have received comparatively less attention from researchers.

Defining and measuring QOL in cancer survivors is not straightforward. Many existing measures focus largely on physical symptoms related to the cancer and include generic symptoms such as shortness of breath or limited mobility, which could result from comorbid conditions. In a recent study, medical comorbidity explained more variance in health-related QOL than did cancer characteristics [5]. The Impact of Cancer (IOCv2) questionnaire was specifically designed to measure QOL in long-term cancer survivors and includes both positive and negative impacts of cancer. It has been used in breast and lymphoma cancer survivors [6]. In our recent study of British survivors of lymphoma and leukaemia (5–40-year post-diagnosis) [7], we found the levels of depression and psychological distress in the survivor group were three times higher than in the general population, and these symptoms were significantly associated with more negative IOC scores. On the other hand, the type and stage of the cancer or whether there had been a recurrence showed no relationship to QOL, on either positive or negative IOC. Positive IOC scores showed a different pattern of association that reflected factors such as ethnicity, level of education and social support. Consequently, we need a greater understanding of how these factors interact and may differ in different survivor groups so that we can identify individuals with greatest needs and who might benefit from early psychological interventions.

In order to develop and evaluate specific health interventions for cancer patients aimed not only at reducing negative impacts (e.g. by identifying and treating depression) but also at maximising the potential to achieve and maintain positive impact using a range of therapies [8] (e.g. cognitive behavioural therapy, acceptance and commitment therapy [9]), we need reliable screening and outcome measures that are widely generalisable. Although evidence

for the usefulness of IOC is favourable [10–14], a comparison between UK and US samples would provide evidence of reproducibility of the IOC in a British population, and further exploration of key psychosocial and clinical factors associated with IOC scores. The aims of this study were thus to examine QOL in a British sample using the IOC and also investigate differences in IOC between US and UK NHL survivor groups, taking into account clinical and psychosocial factors previously shown to be associated with IOC.

## Materials and methods

For the UK study, ethical approval was obtained from the National Research Ethics Service Ref: 11/NE/0095; for the US study, from the Institutional Review Boards of Duke University and the University of North Carolina at Chapel Hill (UNC). Written informed consent was obtained from each participant in both countries.

### UK patient population

Those eligible for the study were surviving patients who had been treated at St. Bartholomew's Hospital (Barts) between 1957 and 2006 with a confirmed diagnosis of haematological malignancy, aged ≥18 years at the time of entry into study (a proportion being children at the time of treatment) and ≥5 years since initial diagnosis (excluding those who had moved overseas, were untraceable or died prior to study commencement). Between September 2011 and May 2012, 1363 participants who met study eligibility criteria were sent a self-administered questionnaire package. Of these 1363, 718 completed the questionnaire (56 % responded). This study focuses on the responses from 326 NHL patients who participated and includes indolent NHL (29 % of all respondents) and aggressive NHL (17 %). The response rate for the NHL subgroup was also 56 % suggesting that they are representative of the entire sample.

NHL US survivors were identified through the Duke University Cancer Center and the UNC Lineberger Tumor Registries in November 2004 [15]. Patients were eligible if they were ≥18 years old at diagnosis and were ≥2 years post-diagnosis. Potential participants were mailed a self-administered survey. Of the 1195 eligible survivors who were assumed to have received an invitation, 886 (74 %) returned a completed questionnaire. After excluding survivors < 5 years post-diagnosis, 667 remained for analysis.

### Total sample

To create more similar samples for comparison, we excluded survivors diagnosed < 5 years post-diagnosis from the US sample. The IOC was originally developed for longer-term survivors and thus the UK sample included only those survivors. The total sample size thus consisted of 993 survivors, 326 in the UK sample and 667 in the US sample (see Fig. 1).

### UK questionnaire

The questionnaire included socio-demographic characteristics, in part based on the British Childhood Cancer Survival Study [16].

**Impact of Cancer—**The British and US studies used the IOCv2, a 37-item shortened version of the IOC, validated in NHL survivors [10]. The IOC measures the unique positive and negative impacts of cancer associated with long-term survivorship [6]. Item responses indicate level of agreement from 1 (strongly disagree) to 5 (strongly agree) and form two summary scales: positive and negative impact. Scale scores are calculated by averaging the item scores forming the scale (high scores representing greater impact). The scales are subdivided into eight subscales: positive—'Altruism/Empathy', 'Health Awareness', 'Meaning of Cancer' and 'Positive Self-Evaluation,' and negative—'Appearance Concerns', 'Body Change Concerns', 'Life Interferences' and 'Worry'. Subscale level scores are calculated by averaging scores of all items defining the subscale.

**The Hospital Anxiety and Depression Scale (HADS) [17—**Total scores on the HADS can range from 0 to 21 for each subscale (anxiety and depression), with lower scores (< 8) indicating normality and higher scores (11–21) indicating likelihood of clinical disorder [17].

**The Chalder Fatigue Questionnaire (CFQ) [18—**The CFQ measures fatigue over the past month and comprises 11 items with a total score range of 0–33. Higher scores represent more fatigue. In addition, the Social Support Inventory (SSI) [19], a 7-item validated instrument, was used to assess social support. The categories range from 1 (none of the time) to 5 (all of the time).

Socio-demographic and clinical characteristics included age, sex, educational attainment, ethnicity, relationship status and past history of depression and other medical conditions (including heart disease, high blood pressure, lung disease, non-haematological cancer or arthritis). Clinical details (date of diagnosis, stage of cancer and primary and follow-up treatments and recurrences) were obtained from the Barts Medical Oncology Unit database.

## US questionnaire

In addition to the IOCv2, other measures and demographic characteristics, the US questionnaire included the Medical Outcomes Study Short Form *SF-36*. The 36 items represent eight subscales (physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems and mental health) and two summary scores, the physical component (PCS) and the mental component (MCS) [19]. The scores were reversed for the convenience of matching with the other scales used in the UK study. Also, the *Medical Outcome Study* (*MOS*) *Social Support Scale* assessed perceived availability of social support [20]. In analyses, the MOS standardised index was used.

## Statistical analysis

In the UK data, when calculating scale scores, the mean of non-missing items for that individual was imputed to replace missing items if the percentage of missing items forming the scale was less than 25 %. The imputation rate did not exceed 3.9 %. The HADS, SSI, CFQ, positive IOC and negative IOC scales had 0.97, 2.23, 1.53, 1.25 and 8.50 % missing scores, respectively. No imputation was done to the outcome variables in the US data.

Probability values < 0.05 were considered statistically significant based on a two-tailed test. All calculations were performed using the statistical software package STATA version 12 (Stata Corp, College Station, TX).

Distribution of the IOCv2 scale scores were studied using descriptive statistics and notched box and whisker plots. Floor and ceiling effects were evaluated by calculating the percentage of participants scoring the highest and lowest scale scores. They were considered to be present if more than 15 % of respondents achieve the lowest or highest possible score [21]. Internal consistency was checked by calculating Cronbach's coefficient alpha (α) for each scale and subscale [22]. A criterion of 0.70 to 0.90 is a measure of good internal consistency [21]. To enhance the comparability of the UK sample to the US sample, 'education' was classified as low (no qualifications from school), medium (qualification from school or equivalent Higher National Certificate or vocational training) or high (high vocational training, university or professional qualification), and 'comorbidities' were grouped as none, 1, 2 and >2 using responses regarding other medical conditions, matching the responses to the categorisation used in the Self-administered Comorbidity Questionnaire [23] used in the US sample. The socio-demographic and clinical characteristics between UK and US study groups were compared using chi-squared tests or Fisher's exact test, where appropriate.

The mean IOCv2 summary scales and subscale scores of the UK and US patients were compared using independent sample *t* tests.

The respondent groups were further harmonised for psychosocial factors—depression, fatigue and social support—using linear transformation of all relevant scale scores into percentages. The HADS scores of UK respondents were matched to the Emotional well-being domain of SF-36; CFQ scores of UK group were matched to the Energy/Fatigue domain of SF-36; and the UK SSI scores were matched to US MOS Social Support Survey index.

Two hierarchical linear regression models were used on the combined dataset to examine the relationship of country to positive and negative IOC after adjusting for various factors. Each set of factors was added to the model sequentially—at step 1, the country variable was added; at step 2, socio-demographics; at step 3, clinical factors relating to the cancer; at step 4, psychosocial factors and finally at step 5, comorbidities were added. All continuous variables in the multivariable regression analyses were entered into the models as continuous unless presented otherwise.

## Results

### Patient characteristics

Socio-demographics and clinical characteristics of the 326 UK and 667 US participants are presented in Table 1. The two patient groups show significant differences in race, education, age at study, years since diagnosis, stage at diagnosis, type of treatment and self-reported comorbidity. Only 7 % of respondents in the UK sample were non-white compared to 14 % in the US sample ($p < 0.001$). The majority of the UK participants (56 %) had a medium level of education compared to 60 % of US participants having high level of education. UK

patients had a longer median time since diagnosis of 14.8 years compared to those in the US (10.0 years). However, UK patients were significantly younger ($p = 0.03$) at the time of study compared to US patients (62 vs. 64 years).

### Distribution and comparison of the IOCv2 scale scores

The IOCv2 scale has high internal consistency in both the UK and US NHL groups with Cronbach's alpha (α)—statistics ranging from 0.70 to 0.91 except for in the 'Life interferences' subscale in US data ($\alpha = 0.68$). The floor and ceiling effects in the UK summary scales are compared to those in the US in Fig. 2. A relatively large number (7.4 %) of UK patients had a maximum score on the IOC positive scale as compared with only 0.90 % in US group ($p < 0.001$). There was, however, no significant difference in minimum scores of negative IOC between the two groups. The UK data had slight negative skewness (−0.24) whereas US data were positively skewed (0.73). Table 2 shows that significant differences were observed in mean IOC scores between UK and US survivors in the positive IOC score and all positive subscale scores ($p \leq 0.02$), as well as in the negative summary scale and all negative subscales ($p < 0.001$) except for in 'Body change concerns' ($p = 0.60$). Looking at individual comparisons, the unadjusted mean scores suggested UK survivors were generally more positive but also more negative about the impact of cancer compared to US survivors. However, they were less positive with regard to 'Altruism and empathy' and 'Positive self-evaluation' and reported significantly less 'Worry' compared to US survivors.

Table 3 displays adjusted results for the positive IOC, showing that UK patients had significantly higher positive IOC compared to US patients after adjusting for sociodemographics and clinical and psychosocial factors. In addition, there was a higher positive IOC score among female patients, those diagnosed longer ago, and at a later stage, those who had chemotherapy and those with higher social support. However, there was no significant difference between indolent vs. aggressive NHL. Significantly lower positive impact was observed among patients of white race, with higher education and with higher levels of fatigue. As a set, the variables included in the final model explained 20 % (adjusted $R^2 = 0.18$) of the variance in positive IOC scores ($F = 8.63$, $p < 0.001$).

As shown in Table 4, UK survivors had significantly higher negative IOC ($p < 0.001$) than US survivors. There was a small but significantly higher negative IOC among patients with higher levels of fatigue and depressive symptoms. Patients with longer time since diagnosis and older showed less negative IOC. Those with higher levels of social support also had lower negative IOC. As a set, the variables included in the final model explained 51 % (adjusted $R^2 = 0.49$) of the variance in negative IOC scores ($F = 35.5$, $p < 0.001$).

## Discussion

In order to investigate the reproducibility of the IOCv2 as a QOL measure in a British population, we assessed the distribution of the scale in a British group of long-term NHL survivors compared to a US sample. The scale showed good reliability in the British sample with high internal consistency and no floor and ceiling effects.

We also investigated differences in IOCv2 in the two populations taking into account clinical factors, including histological type (indolent or aggressive), stage and treatments and psychosocial variables. In both countries, it was higher levels of fatigue and depressive symptoms that were associated with greater negative IOC rather than cancer characteristics. This is consistent with other reports from survivor groups [4]. Older patients, those with longer time since diagnosis and those with greater social support showed less negative IOC. Interestingly, both positive and negative IOC scores in British survivors were higher than among US survivors. Higher positive IOC was also reported by women, those with longer time since diagnosis, diagnosed at later stage and with greater social support. There was significantly lower positive IOC associated with white ethnicity, higher levels of education and those reporting higher fatigue levels.

Though these two population samples offered a unique opportunity for comparison, there were significant differences between them. The mean age of the British patients was lower and a greater proportion was under 50 years. Also, there was a greater proportion of white participants in the British sample. The low number of non-white participants in both studies makes it difficult to generalise the findings to black and minority ethnic (BME) groups and there were also marked cultural differences between the non-white participants from the two countries: the US non-white participants were predominantly African-American, whereas the British BME group comprised a mix of South Asian and British-African and British-Caribbean patients.

There was also a significant difference in levels of education across the two samples, with US patients having a higher level of education, which may reflect differences in the healthcare and education systems in the two countries. In the British NHS system, treatment is available for all patients in a catchment area regardless of income or education, whereas in the US, although all patients would also receive treatment, those treated in a private health care system (which reflects part of the sample) may be more likely to have a higher education. Thus, one would expect the UK sample to have proportionately lower education and SES levels.

NHL stage at diagnosis was also different; UK survivors had more advanced disease at diagnosis. Although the British group was significantly younger, they were diagnosed longer ago compared to the US group and there were also differences in the treatments received by the two groups. However, in this study, all differences in the population and clinical characteristics were wee included the multivariable analyses for adjusting their effect on outcome variables.

A limitation of this study was the use of different scales in the US and UK samples. For instance, the HADS and Chalder scales are designed specifically for measurement of psychological distress and fatigue, respectively, whereas in the US studies, this information was obtained from items within the SF-36 and are therefore less sensitive at identifying US patients with significant problems in these areas, leading to a possible underestimation of clinically significant psychological distress and fatigue. Nevertheless, both depression and fatigue were significantly correlated with summary negative IOC in both samples,

emphasising the importance of taking these factors into account when addressing the healthcare needs of long-term cancer survivors.

The UK NHL sample size was smaller than the US but was large enough for statistical inference, and the UK sample was from a single centre. Although findings cannot be generalised to the whole survivor population in either country, the cohorts enabled analysis without the variability of treatment approaches inherent in a multicentre study.

After taking into account the type of cancer and other clinical and psychosocial factors, we found a strong association of both depression and fatigue with negative IOC in both survivor populations, consistent with findings from large group of UK survivors with various types of haematological cancer [7]. Negative impact of cancer was also greater in younger patients, those with a more recent diagnosis and those with less social support. These findings indicate the importance of screening patients for depression and fatigue so that appropriate psychosocial interventions to improve quality of life can be provided to those at higher risk (e.g. those without a support network); of course, the cross-sectional nature of this analysis does not allow us to rule out that depression, fatigue and less social support might be a result of experiencing a more negative impact of cancer. Previous studies of NHL long-term survivors have shown that one third of survivors experience persisting posttraumatic stress disorder (PTSD), with greater negative IOC being an independent predictor of PTSD symptoms [15, 24].

The IOC also measures positive IOC, which is not merely the inverse of negative IOC but appears to be influenced by different factors and may reflect posttraumatic growth and the underlying personality traits of individuals, such as optimism. In a comparison between the present group of US cancer survivors with a Dutch survivor group [11], the Dutch patients showed lower positive IOC scores and the authors suggested that these differences may reflect the difference in healthcare systems; that is, the socialised system in the Netherlands may result in a lower sense of personal control than in the USA where health care relies more on individual responsibility with a consequent feeling of more personal control and thus positive cancer impact in US patients. That said, the UK also has socialised healthcare system but, in this study, British survivors showed higher positive IOC than US patients—a finding that could be equally interpreted as being the effect of the support that is provided by a universal health care system like the NHS [25]. However, it is more likely that more complex reasons prevail, such as cultural differences in how cancer and chronic illness are perceived. Although the literature on cultural differences in cancer survivors is limited, one Spanish study reported a similar association between psychological distress and worsened QOL in breast cancer patients, but a positive effect among patients who reported having a ‘fighting spirit’ or who used ‘denial’ as a defence mechanism [25]. Clearly, there is cause to more fully explore the reasons underlying differences in the impact of cancer across countries and culture; doing so may help identify new strategies to promote QOL among survivors.

Interestingly, we found that those with higher education reported lower positive IOC whereas there was no relationship between education and negative IOC. This finding may reflect that those who are more educated are also more aware of the full implications of a

cancer diagnosis. Relatedly, lower positive IOC was associated with white race. We need a greater understanding of how these factors interact in different countries and how they may differ in particular groups so that we can identify which individuals have greater needs and who would particularly benefit from early psychological interventions. Such interventions would be aimed not only at reducing negative IOC but also maximising the potential to achieve and maintain positive impact using a range of therapies [8] such as cognitive behavioural therapy, acceptance and commitment therapy [9]. Those reporting higher fatigue levels had lower positive IOC and there is increasing evidence of the beneficial effects of exercise therapies on cancer-related QOL [26].

## Conclusions

The IOCv2 is reliable and applicable in British, as well as other European [11] and US populations [10]. Both the positive and negative IOC in British survivors were higher than in US survivors; differences in IOC between UK and US probably reflect differences in both cultural and healthcare systems. However, in both countries, rather than clinical characteristics of the cancer, it was psychosocial factors that were consistently associated with the greatest impact on QOL.

Recognition and treatment of individuals with these risk factors is a high priority for improving QOL in long-term cancer survivors, as is the development of modular interventions to increase positive IOC as well as to decrease negative impact. The IOCv2 shows great potential as both a screening tool and outcome measure for evaluating complex interventions for cancer survivors.

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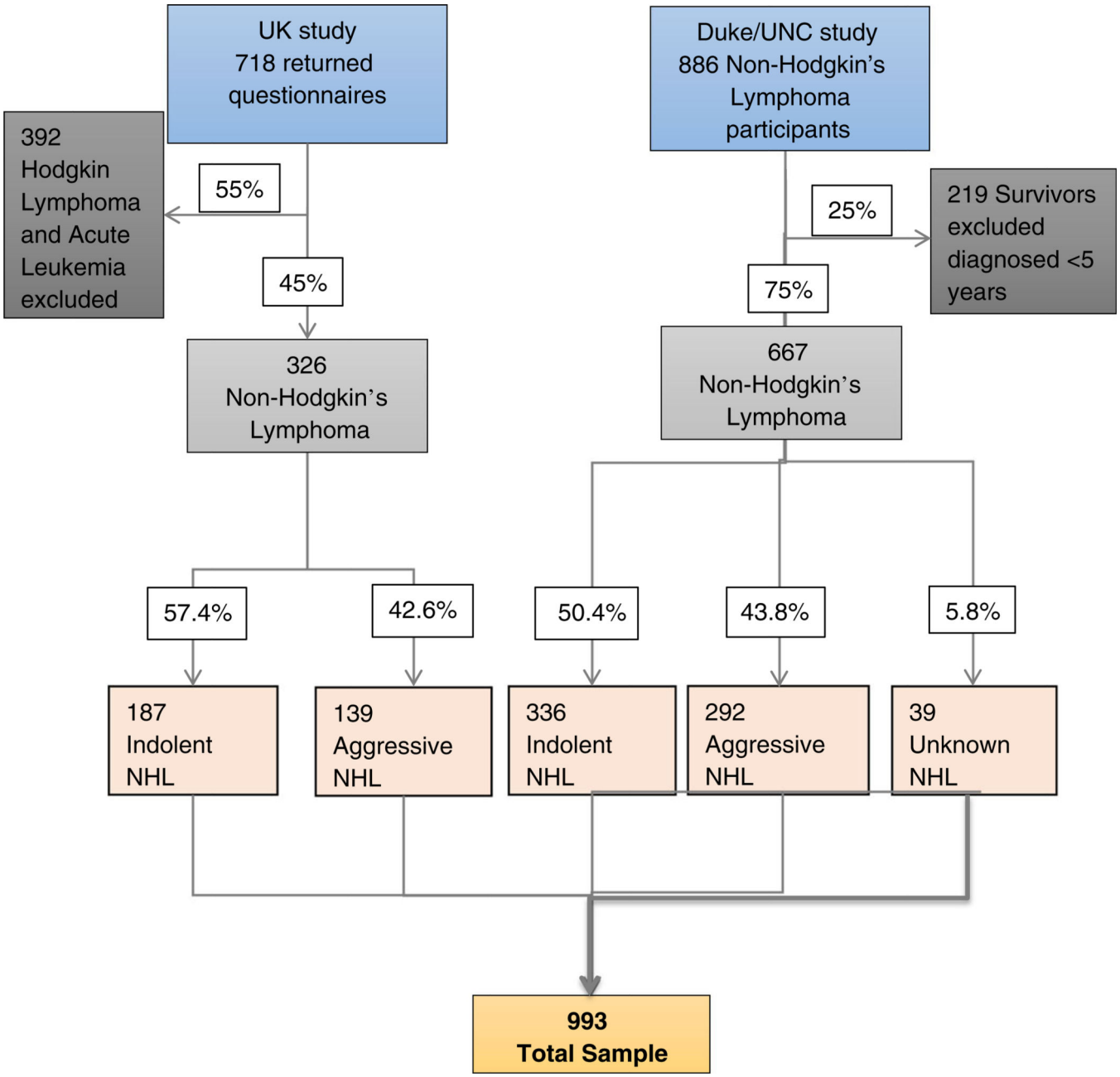


**Fig. 1.**
Flow diagram of the study data structure

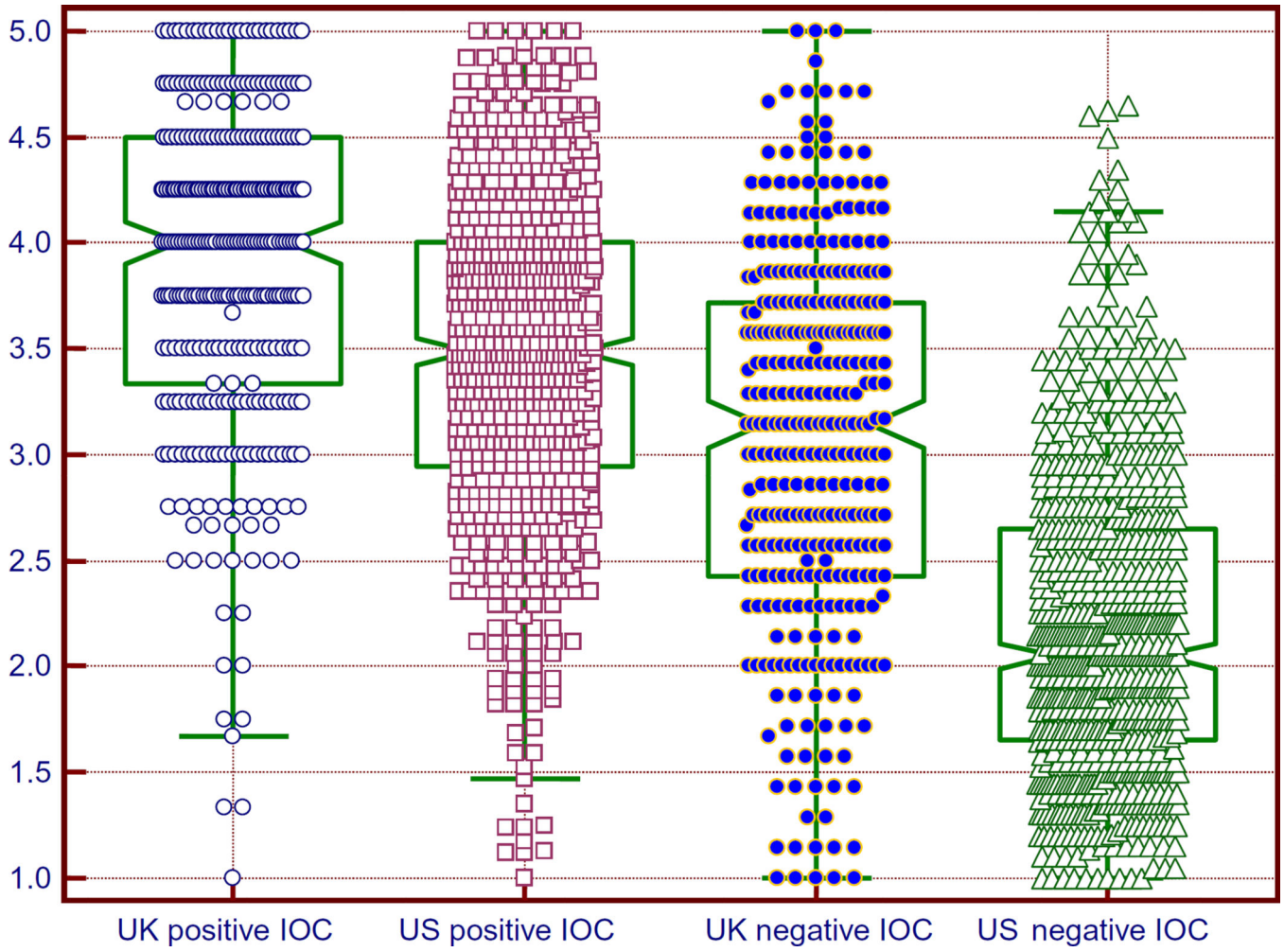


**Fig. 2.**

Floor and ceiling effects in the UK ($N = 323$) and US ($N = 666$) samples for the IOC positive and negative summary scales. *Notched box* and *whisker plot* showing median and interquartile range (IQR). The median (*quartiles*) positive IOC score in UK and US patients are 4.0 (3.3, 4.5) and 3.5 (2.9, 4.0), respectively, while the median (*quartiles*) negative IOC scores are 3.1 (2.4, 3.7) and 2.1 (1.6, 2.6), respectively

**Table 1**

Characteristics of NHL survivor samples in the UK and USA

| | UK study | | US study | | *p* |
|---|---|---|---|---|---|
| | ***N*** | **%** | ***N*** | **%** | |
| Total | 326 | | 667 | | |
| Sex | | | | | |
| Male | 176 | 54 | 331 | 50 | 0.20 |
| Female | 150 | 54 | 336 | 50 | |
| Race | | | | | |
| Non-white | 21 | 7 | 94 | 14 | |
| White | 301 | 93 | 573 | 86 | <0.001 |
| Marital status | | | | | |
| Widowed/divorced/separated/single | 77 | 24 | 157 | 24 | 0.96 |
| Married/living with partner | 244 | 76 | 502 | 76 | |
| Education | | | | | |
| Low | 105 | 36 | 75 | 12 | <0.001 |
| Medium | 162 | 56 | 186 | 29 | |
| High | 24 | 8 | 390 | 60 | |
| Employment | | | | | |
| Not employed or retired | 183 | 57 | 392 | 60 | 0.48 |
| Currently employed | 137 | 43 | 266 | 40 | |
| Age (years) | | | | | |
| <50 | 79 | 24 | 122 | 18 | 0.03 |
| 50–64 | 114 | 35 | 225 | 34 | |
| 65+ | 131 | 40 | 320 | 48 | |
| Mean (SD) | 61.7(11.8) | | 63.7(13.2) | | 0.03 |
| Time since diagnosis (years) | | | | | |
| 5–7 | 47 | 15 | 223 | 33 | <0.001 |
| 8–10 | 64 | 20 | 151 | 23 | |
| 10+ | 213 | 63 | 293 | 44 | |
| Median (IQR) | 14.8(5.5–22.2) | | 10.0(7.0–15.5) | | <0.001 |

*Support Care Cancer*. Author manuscript; available in PMC 2017 March 01.

| | UK study | | US study | | *p* |
|---|---|---|---|---|---|
| | *N* | % | *N* | % | |
| NHL stage at diagnosis | | | | | |
| I | 67 | 21 | 183 | 27 | <0.001 |
| II | 56 | 17 | 123 | 18 | |
| III | 34 | 10 | 113 | 17 | |
| IV | 120 | 37 | 157 | 24 | |
| Unknown | 49 | 15 | 91 | 14 | |
| NHL histology | | | | | |
| Indolent | 187 | 57 | 336 | 50 | 0.26 |
| Aggressive | 139 | 43 | 292 | 44 | |
| Unknown | – | – | 39 | 6 | |
| Treatment | | | | | |
| Radiotherapy | 79 | 24 | 334 | 50 | <0.001 |
| | | 89 | | 80 | |
| Chemotherapy | 289 | 532 | | 26 | |
| Biologic | 0 | – | 173 | | |
| Observation | 70 | 21 | 0 | – | |
| Transplant | 110 | 34 | 97 | 15 | |
| Surgery | 25 | 8 | 192 | 29 | |
| Self-reported comorbidity | | | | | |
| None | 108 | 33 | 67 | 10 | <0.001 |
| 1 | 73 | 22 | 118 | 18 | |
| 2 | 82 | 25 | 125 | 19 | |
| >2 | 63 | 19 | 357 | 54 | |

**Table 2**

Comparison of mean IOCv2 scores between UK and US NHL survivors

| | Unadjusted mean (SD) | | Difference | p* |
|---|---|---|---|---|
| | UK data (*N* = 296) | US data (*N* = 661) | | |
| Positive impact | 3.87 (0.76) | 3.47 (0.79) | 0.4 | <0.001 |
| Negative impact | 3.07 (0.89) | 2.19 (0.73) | 0.9 | <0.001 |
| Positive subscales | | | | |
| Altruism and empathy | 3.65 (0.55) | 3.84 (0.97) | −0.2 | 0.02 |
| Health awareness | 3.84 (0.70) | 3.66 (0.87) | 0.2 | 0.02 |
| Meaning of cancer | 3.82 (0.74) | 2.71 (1.08) | 1.1 | <0.001 |
| Positive self-evaluation | 3.17 (0.76) | 3.85 (0.98) | −0.7 | <0.001 |
| Negative subscales | | | | |
| Appearance concerns | 2.56 (0.70) | 1.71 (0.91) | 0.9 | <0.001 |
| Body change concerns | 2.21 (0.97) | 2.34 (1.16) | −0.1 | 0.60 |
| Life interferences | 2.84 (1.05) | 1.99 (0.70) | 0.9 | <0.001 |
| Worry | 2.15 (0.79) | 2.53 (0.99) | −0.4 | <0.001 |

* *p* values are corrected for multiple testing using Bonferroni method

**Table 3**

Hierarchical multiple regression models for positive IOCv2

| | | Positive subscales | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Step 1** | | **Step 2** | | **Step 3** | | **Step 4** | | **Step 5** | |
| | | **β** | ***p*** | **β** | ***p*** | **β** | ***p*** | **β** | ***p*** | **β** | ***p*** |
| Country | Country | | | | | | | | | | |
| | USA | 1 | | 1 | | 1 | | 1 | | 1 | |
| | UK | 0.41 | <0.001 | 0.27 | <0.001 | 0.16 | 0.02 | 0.20 | 0.01 | 0.24 | *0.003* |
| Socio-demographics | Sex | | | | | | | | | | |
| | Male | | | 1 | | 1 | | 1 | | 1 | |
| | Female | | | 0.21 | <0.001 | 0.24 | <0.001 | 0.23 | <0.001 | 0.23 | *<0.001* |
| | Race | | | | | | | | | | |
| | Non-white | | | 1 | | 1 | | 1 | | 1 | |
| | White | | | −0.35 | <0.001 | −0.46 | <0.001 | −0.44 | <0.001 | −0.44 | *<0.001* |
| | Marital status | | | | | | | | | | |
| | Widowed/divorced/separated/single | | | 1 | | 1 | | 1 | | 1 | |
| | Married/living with partner | | | 0.06 | 0.32 | 0.04 | 0.55 | −0.004 | 0.95 | 0.00 | 0.94 |
| | Education[a] | | | | | | | | | | |
| | Low | | | 1 | | 1 | | 1 | | 1 | |
| | Medium | | | −0.01 | 0.94 | 0.02 | 0.84 | 0.01 | 0.89 | 0.01 | 0.87 |
| | High | | | −0.27 | 0.001 | −0.24 | 0.003 | −0.25 | 0.002 | −0.25 | *0.002* |
| | Employment | | | | | | | | | | |
| | Not employed or retired | | | 1 | | 1 | | 1 | | 1 | |
| | Currently employed | | | −0.06 | 0.33 | −0.11 | 0.10 | −0.10 | 0.11 | −0.12 | 0.07 |
| | Age (years) | | | −0.01 | 0.01 | −0.003 | 0.22 | −0.003 | 0.30 | −0.004 | 0.14 |
| Clinical factors | Time since diagnosis (years) | | | | | 0.01 | 0.002 | 0.01 | 0.01 | 0.01 | *0.02* |
| | NHL stage at diagnosis[a] | | | | | | | | | | |
| | I | | | | | 1 | | 1 | | 1 | |
| | II | | | | | 0.29 | <0.001 | 0.28 | <0.001 | 0.27 | *<0.001* |
| | III | | | | | 0.28 | 0.001 | 0.26 | 0.002 | 0.26 | *0.002* |
| | IV | | | | | 0.18 | 0.01 | 0.18 | 0.01 | 0.18 | *0.01* |

| | | Positive subscales | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Step 1 | | Step 2 | | Step 3 | | Step 4 | | Step 5 | |
| | | β | *p* | β | *p* | β | *p* | β | *p* | β | *p* |
| | NHL histology | | | | | | | | | | |
| | Indolent | | | | | 1 | | 1 | | 1 | |
| | Aggressive | | | | | 0.01 | 0.90 | 0.002 | 0.97 | 0.005 | 0.93 |
| | Radiotherapy | | | | | | | | | | |
| | No | | | | | 1 | | 1 | | 1 | |
| | Yes | | | | | −0.06 | 0.26 | −0.07 | 0.24 | −0.07 | 0.25 |
| | Chemotherapy | | | | | | | | | | |
| | No | | | | | 1 | | 1 | | 1 | |
| | Yes | | | | | 0.18 | 0.03 | 0.18 | 0.03 | 0.19 | *0.02* |
| Psychosocial factors | Depression | | | | | | | 0.003 | 0.17 | 0.002 | 0.22 |
| | Fatigue | | | | | | | −0.01 | 0.002 | −0.01 | *0.001* |
| | Social support | | | | | | | 0.004 | 0.003 | 0.004 | *0.004* |
| Current health | Self-reported comorbidity | | | | | | | | | | |
| | None | | | | | | | | | 1 | |
| | 1 | | | | | | | | | 0.03 | 0.74 |
| | 2 | | | | | | | | | 0.11 | 0.20 |
| | >2 | | | | | | | | | 0.15 | 0.09 |
| *N* | | | | | | | | | | 753 | |
| *F* | | | | | | | | | | 8.63 | <0.001 |
| *R*-squared | | | | | | | | | | 0.20 | |
| Adjusted *R*-squared | | | | | | | | | | 0.18 | |

β regression coefficient (slope)

[a]Significant at the 5 % level based on likelihood ratio test (LRT) for variables with more than two categories at step 5

[b]Significant *P*-values in the final model are italicised

**Table 4**

Hierarchical multiple regression models for negative IOCv2

| | | Negative subscales | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Step 1 | | Step 2 | | Step 3 | | Step 4 | | Step 5 | |
| | | β | *p* | β | *p* | β | *p* | β | *p* | β | *p* |
| Country | Country | | | | | | | | | | |
| | USA | 1 | | 1 | | 1 | | 1 | | 1 | |
| | UK | 0.89 | <0.001 | 0.80 | <0.001 | 0.86 | <0.001 | 1.00 | <0.001 | 1.03 | *<0.001* |
| Socio-demographics | Sex | | | | | | | | | | |
| | Male | | | 1 | | 1 | | 1 | | 1 | |
| | Female | | | 0.05 | 0.39 | 0.03 | 0.58 | -0.01 | 0.88 | −0.01 | 0.86 |
| | Race | | | | | | | | | | |
| | Non-white | | | 1 | | 1 | | 1 | | 1 | |
| | White | | | −0.04 | 0.67 | −0.08 | 0.37 | −0.03 | 0.66 | −0.04 | 0.63 |
| | Marital status | | | | | | | | | | |
| | Widowed/divorced/separated/single | | | 1 | | 1 | | 1 | | 1 | |
| | Married/living with partner | | | −0.08 | 0.22 | −0.05 | 0.43 | 0.03 | 0.57 | 0.04 | 0.52 |
| | Education | | | | | | | | | | |
| | Low | | | 1 | | 1 | | 1 | | 1 | |
| | Medium | | | −0.01 | 0.84 | −0.02 | 0.77 | 0.02 | 0.82 | 0.02 | 0.78 |
| | High | | | −0.11 | 0.17 | −0.11 | 0.18 | −0.01 | 0.94 | −0.01 | 0.93 |
| | Employment | | | | | | | | | | |
| | Not employed or retired | | | 1 | | 1 | | 1 | | 1 | |
| | Currently employed | | | 0.06 | 0.32 | 0.09 | 0.17 | 0.04 | 0.45 | 0.02 | 0.69 |
| | Age (years) | | | −0.01 | <0.001 | −0.01 | <0.001 | −0.01 | 0.01 | −0.01 | *0.003* |
| Clinical factors | Time since diagnosis (years) | | | | | −0.02 | <0.001 | −0.02 | <0.001 | −0.02 | *<0.001* |
| | NHL stage at diagnosis[a] | | | | | | | | | | |
| | I | | | | | 1 | | 1 | | 1 | |
| | II | | | | | 0.14 | 0.09 | 0.13 | 0.06 | 0.13 | 0.06 |
| | III | | | | | 0.18 | 0.03 | 0.21 | 0.004 | 0.21 | *0.004* |
| | IV | | | | | 0.12 | 0.10 | 0.11 | 0.07 | 0.12 | 0.06 |

| | | Negative subscales | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Step 1 | | Step 2 | | Step 3 | | Step 4 | | Step 5 | |
| | | β | *p* | β | *p* | β | *p* | β | *p* | β | *p* |
| | NHL histology | | | | | | | | | | |
| | Indolent | | | | | 1 | | 1 | | 1 | |
| | Aggressive | | | | | −0.07 | 0.24 | −0.04 | 0.45 | −0.03 | 0.51 |
| | Radiotherapy | | | | | | | | | | |
| | No | | | | | 1 | | 1 | | 1 | |
| | Yes | | | | | −0.01 | 0.90 | 0.02 | 0.75 | 0.02 | 0.68 |
| | Chemotherapy | | | | | | | | | | |
| | No | | | | | 1 | | 1 | | 1 | |
| | Yes | | | | | 0.10 | 0.24 | 0.03 | 0.71 | 0.03 | 0.68 |
| Psychosocial factors | Depression | | | | | | | 0.01 | <0.001 | 0.01 | *<0.001* |
| | Fatigue | | | | | | | 0.01 | <0.001 | 0.01 | *<0.001* |
| | Social support | | | | | | | −0.004 | 0.001 | −0.004 | *0.001* |
| Current health | Self-reported comorbidity | | | | | | | | | | |
| | None | | | | | | | | | 1 | |
| | 1 | | | | | | | | | 0.15 | 0.05 |
| | 2 | | | | | | | | | 0.15 | 0.05 |
| | >2 | | | | | | | | | 0.14 | 0.07 |
| *N* | | | | | | | | | | 752 | |
| *F* | | | | | | | | | | 35.5 | *<0.001* |
| *R*-squared | | | | | | | | | | 0.51 | |
| Adjusted *R*-squared | | | | | | | | | | 0.49 | |

β regression coefficient (slope)

[a]Significant at the 5 % level based on likelihood ratio test (LRT) for variables with more than two categories at step 5

[b]Significant *P*-values in the final model are italicised