Title: **Long term workforce participation patterns following head and neck cancer**

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Abstract

Purpose: This analysis describes the long term workforce participation patterns of individuals diagnosed with head and neck cancer (HNC), about which little is known.

Methods: Survivors of HNC (ICD10 C00-C14, C32) diagnosed at least 8 months previously were identified from the National Cancer Registry Ireland and sent a survey including questions about working arrangements before and since diagnosis. Descriptive statistics and multivariate logistic regression were used to examine the factors that influence workforce participation at zero, 1 and 5 years after diagnosis.

Results: 264 individuals employed at the time of diagnosis responded to the survey, an average 6 years post-diagnosis. 77% took time off work after diagnosis, with a mean work absence of 9 months (range 0-65 months). 52% of participants reduced their working hours (mean reduction 15 hours/week). The odds of workforce participation following HNC were increased by ~~not having a medical card~~not being eligible for free medical care (OR 2.61, 95% CI 1.15 – 5.94), having lip, mouth or salivary gland cancer (compared to cancer of the pharynx or cancer of the larynx, OR 2.79, 1.20-6.46), being self-employed (OR 2.01, 1.07-3.80), having private health insurance (OR 2.06, 1.11-3.85) and not receiving chemotherapy (OR 2.82, 1.31 – 6.06). After five years only the effect of medical card remained (OR 4.03, 1.69 – 9.62).

Conclusions: Workforce participation patterns after HNC are complex, and are influenced by cancer, treatment and employment factors.

Implications for survivors: Patients should be informed of the potential impacts of HNC on workforce participation, and ~~there is a clear message that~~ clinicians, policy makers and employers should be aware of these potential ~~consider workforce participation and encourage workplace flexibility to accommodate~~ longer-term effects ~~following HNC~~.

Key words: Head and neck cancer, head and neck neoplasms [MESH], work [MESH], workforce participation, return to work [MESH]

Long term workforce participation patterns following head and neck cancer

Background

Head and neck cancer (HNC) includes cancers at a range of sites including the mouth, salivary glands, pharynx, nasal cavity, sinuses and larynx [1]. The overall incidence of HNC has changed little over the last 20 years, with an estimated age standardised rate of 11 per 100,000 in Europe in 2012 [2]. However, the emergence of human papilloma virus (HPV)-related HNC means that the traditional pattern of higher incidence in older people, often associated with tobacco and alcohol use, is changing [3, 4]. Since HPV-related HNC occurs primarily among younger individuals, and the incidence of these tumours is rising [4], an increasing number of HNC will be diagnosed in people of working age.

Treatment for HNC is primarily through surgery and radiotherapy, with increasing use of chemotherapy [1]. While trends towards less invasive treatments are emerging, HNC and its treatments often have significant and long term impact on an individual's functional abilities, including ability to work [5]. These may include fatigue [6], speech difficulties [6], oral dysfunction [5], loss of appetite [5] decreased social function [5], high levels of anxiety [5], physical discomfort [7], and changes in appearance [7].

Most people with cancer who are working at the time of diagnosis take a period of absence. In cancer generally, the overall rate of returning to work following diagnosis is approximately 62% [8]. In the few studies of HNC, rates of returning to work following diagnosis for those who were working at the time of diagnosis range from 40% [6] at 12 months to over 80% after at least two years [5]. However, some of those who return to work may reduce their hours [9], change jobs, or adapt their role [5, 10].

Demographic, clinical and social factors have all been found to influence an individual's likelihood of returning to work following cancer, in both the short and long term [6, 7, 11, 12, 5]. In a model of cancer and work based on the literature, Feuerstein and colleagues identify seven factors which influence an individual's return to work, work ability, work performance and workplace retention [13]. These include characteristics of the cancer survivor, factors of health and wellbeing, symptoms experienced, functional abilities, the demands and environment of the job, as well as policies and economic factors [13].

There is little research that examines the characteristics of the individuals who successfully participate in the workforce following HNC specifically, and there has been no research examining those who return to work more than 24 months after HNC diagnosis. The patterns of workforce participation following head and neck cancer have implications not only for individuals, but also for clinicians and for the policy and delivery of cancer rehabilitation services. Ability to identify those who are at risk of not returning to the workforce or taking longer to do so would allow greater financial, psycho-social and clinical support to be targeted at those who would most benefit from intervention.

The aim of this research was to describe the long-term workforce participation patterns of HNC survivors in Ireland, with a particular focus on identifying predictors of workforce participation. The research questions were (i) what is the workforce participation rate of HNC survivors in Ireland at 12 months and 5 years post-diagnosis? (ii) what factors influence HNC survivors' odds of returning to work at 12 months and at 5 years?

Participants and Methods:

Setting: In Ireland, which has a mixed public-private healthcare system, all citizens are entitled to treatment free of charge within the public system if they have a medical card. At the time of the survey, entitlement to a medical card was means tested for those aged up to 70 years. Those without a medical card must pay the full costs of prescription medications and a contribution for visiting primary care physicians and for public hospital inpatient stays (approximately €75 per visit or night, up to a maximum cost of €750 per year, at the time of the study). Around 40% of the population have a medical card [14], and nearly half have private health insurance [15]. Under employment law an employee has no automatic right to be paid whilst on sick leave and sick pay policies are at the discretion of employers [16]. Those whose employer does not provide sick pay may apply to receive an illness benefit. Where an employee has consistently been absent from work due to illness, employment can be terminated [16].

Participants: Individuals who were at least 8 months post-diagnosis of HNC were identified from the National Cancer Registry Ireland in April 2012, meaning they were diagnosed and treated between 1994 and 2011. The registry aims to record all cancers diagnosed in the population resident in Ireland, and completeness of registration is estimated to be approximately 97% [17]. Within the definition of HNC the following ICD codes were included: cancers of the lip (ICD 10 code COO), mouth (ICD 10 codes C01-C06), salivary glands (C07-C08), pharynx (C09-C14), and larynx (C32).

Eligible individuals (n=991) who had attended one of 14 hospitals across Ireland (which included all of the main treating centres for HNC) were invited to participate following the agreement of their main treating clinician. Exclusion criteria were as follows: the individual had died, ~~had advanced disease,~~ was ~~undergoing palliative~~

~~treatment~~terminally ill, was unaware they had cancer or the treating clinician indicated that it would be inappropriate to contact them (e.g. they had dementia~~, a recent recurrence~~). Ethical approval was provided by the research ethics committee for each of the participating hospitals.

Survey instrument: The postal survey was developed from a review of the literature and two sets of face-to-face, semi-structured interviews with a) health professionals involved in HNC care and b) HNC survivors at least one-year post-diagnosis. The survey instrument was pre-tested on a convenience sample of six HNC survivors for acceptability, ease of understanding and face validity. The survey contained questions regarding patient demographics, cancer diagnosis, support needs during and after treatment, quality of life, work and financial situation. The questions about work utilised for this analysis include a) employment status and occupation at the time of diagnosis, b) hours worked at time of diagnosis and at the time of the survey, c) whether time was taken off after diagnosis, and for how long, d) whether sick pay was received e) why work hours were reduced and f) whether work ability was reduced. Individual survey responses were linked to cancer registry data to identify additional clinical information including cancer stage and treatments received within the first year following diagnosis.

Analysis: The analysis was limited to survey respondents whose employment status was either working for an employer or self-employed at the time of cancer diagnosis. Occupation categories were coded to SOC2010 codes [18] using CASCOT software [19], and then grouped into occupation types. Descriptive analyses were undertaken of the variables relating to demographics and work, including time taken off work and weekly hours worked. Wilcoxon Signed Rank Test was used to assess differences between hours worked pre and post-diagnosis.

Logistic regression was used to assess the odds of an individual participating in the workforce at 12 months and five years after diagnosis. Logistic regression allows for those who never return to work to be included in the model, as well as those who do not take time off (who were considered 'returned to work' at month 0). Five years was selected because any longer time period may introduce other life events which influence working status, while shorter periods may not capture the full workforce participation patterns. Workforce participation at each time point was characterised as a dichotomous variable.

Independent demographic variables were identified for the model based on the cancer survivor characteristics from Feuerstein and colleagues' model of work in cancer survivors [13]. Ethnicity, race and socioeconomic status were not available, however age (<46, 46-55, 56-65, 66-75), gender and marital status (married/cohabiting vs not) were included. Additional demographic, occupational and clinical variables were included in the regression to capture many of the categories identified in the model by Feuerstein and colleagues [13], such as indicators of work demands, work environment and health and wellbeing. These included educational attainment (primary school, secondary school, third level or post-graduate), employment status (employed vs self-employed), occupation type (professional vs service vs manual), residential location (urban vs rural: with rural defined as two or more of self-reported living in a village or open country, residing >49.88 km from the treating hospital, and population density <1 person per hectare) [20], cancer site (pharynx vs larynx vs other – lip, mouth or salivary glands), cancer stage (stages I vs II vs III vs IV vs unknown), medical card status (medical card holder at time of diagnosis or not, with having a medical card a potential proxy for comorbidities at the time of diagnosis and/or lower socioeconomic status), receipt of chemotherapy in the first 8 months following diagnosis, receipt of radiotherapy in the first 8 months following diagnosis, and surgical intervention (no surgery vs less aggressive surgery vs more aggressive surgery). Due to the number of potential variables identified, backwards selection was used to generate the final model. To reduce the issue of censoring, only those individuals who responded to the survey at least 5 years since diagnosis were included in the 5 year model. All analyses were done using SAS 9.3.

Results

583 eligible, completed surveys were received (response rate 59%). Excluding the 21 participants who reported having a second cancer diagnosis following their HNC diagnosis, this analysis is limited to the 264 respondents who reported that they were employed (n=166) or self-employed (n=98) at the time of diagnosis. In comparison to those who were not working at the time of diagnosis, the analysis group was, as expected, more likely to be younger, male, have higher education, have private health insurance, not have a medical card, and be diagnosed over 6 years ago (data not shown). There were no differences between these groups in terms of cancer site, stage, chemotherapy, radiotherapy, surgery, or rurality of residence.

The mean age at diagnosis for the analysis group was 52 years (median 53 years, range 23 to 81 years), and the mean time since diagnosis was 6 years (median 5 years, range 8 months to 18 years). Of the individuals who had surgery, 59% had early stage (stage I/II) disease. Radiotherapy use was fairly evenly distributed across cancer stages (42% had stage I/II disease). Those who received chemotherapy generally had more advanced disease (18% were stage I/II) and, for the majority (84%), chemotherapy was delivered in addition to surgery and/or radiotherapy. Demographic and clinical characteristics of the analysis group are displayed in Table I.

203 individuals (77%) reported taking time off work following their HNC diagnosis, with 119 of these individuals (59%) reporting that they had since returned to work (45% of all respondents). The mean amount of time taken off work was 9 months (median 6 months, range 0 to 65 months). While 59% of individuals returned to work within 6 months of diagnosis, 26% took 6 to 12 months, and 15% of individuals who returned to work did so after more than 12 months. Data on multiple changes in workforce participation were not collected. However, 18 individuals reported returning to work after a period of time off following their HNC diagnosis, but were not currently working at the time of the survey. Figure I displays the proportion of people working at monthly time points since diagnosis to five years.

Of those who participated in the workforce following HNC diagnosis, 52% reported reduced working hours, 44% reported working the same hours, while 3% reported increased hours (7 individuals did not report working hours). Prior to diagnosis the mean hours worked was 43 hours per week; post- diagnosis the mean was 28 hours worked per week (Wilcoxon Signed Rank Test $p<0.0001$). Of the 58 individuals who gave a reason for their reduced working hours, 33% reported reducing their hours due to cancer, with a further 14% reporting reducing working hours because of treatment side effects. Individuals who reported reduced working hours generally had similar characteristics to the total sample, such as being predominantly male (72%), aged over 60 years (26%), married or cohabiting (73%), employed by an employer (66%) and employed in manual roles (47%).

In the people who reduced their hours (n = 76), 78% took time off before returning to work, with the remaining 22% not taking any time off after HNC diagnosis. Those who reduced their hours took a mean 7 months off work after diagnosis (median 6 months, range 0 – 36 months). In those who did not change the hours they worked (n = 64), 83% took time off before returning to work.

The results of the regression analyses are presented in Table II, with additional details of the univariate regression analyses in the online appendix Table III. The analysis of workforce participation at 12 months (n=264) demonstrated that the factors which significantly influenced the odds of returning to work were medical card status, cancer site, employment status, insurance status and receipt of chemotherapy. Individuals without a medical card had over two and a half times the odds of returning to work compared with those who had a medical card at the time of diagnosis (OR 2.61, 95% CI 1.15 – 5.94). The odds of returning to work were higher for individuals with lip, mouth and salivary gland cancer than those with cancer of the pharynx (OR 2.79, 95% CI 1.20 – 6.46). Compared to individuals who were employed by an employer at the time of diagnosis, those who were self-employed had double the odds of returning to work (OR 2.01, 95% CI 1.07 – 3.80). Having private health insurance doubled the odds of workforce participation (OR 2.06, 95% CI 1.11-3.85). Finally, those who did not receive chemotherapy had nearly three times the odds of returning to work compared to those who did receive chemotherapy (OR 2.81, 95% CI 1.31 – 6.06).

At five years (n=147), only the effect of medical card status remained. Individuals without a medical card continued to have over four times the odds of returning to work compared to those with a medical card (OR 4.03, 95% CI 1.69 – 9.62).

Given the higher than anticipated proportion of individuals who took no time off after diagnosis (n = 35), an additional regression analysis was conducted for the time point immediately after diagnosis (month 0, n=264)). The aim of this analysis was to identify which factors might influence the odds of an individual having to take any time off work following a diagnosis of HNC. The same regression model as for the 12 month and 5 year time points was used. The backwards selection process produced models which did not converge correctly during the early model selection stages; however, models with fewer variables converged correctly. The only variable which significantly influenced the odds of having to take time off was being self-employed, with being employed by an employer reducing the odds of remaining at work immediately after diagnosis by 75% (OR 0.26, 95% CI 0.12 – 0.56).

Discussion:

Workforce participation rates over time

Estimates in this study of workforce participation at 6 months (59%) and 12 months (85%) are consistent with estimates for cancer in general [8], and for HNC specifically [6, 5, 10]. However, the longer follow-up in this study allowed an examination of workforce participation rates in the longer term following HNC. 15% of those who eventually returned to work took more than 12 months off, with the longest temporary absence from work being over 5 years. This result contradicts the assumption in much of the literature that workforce participation status is defined at 12 months post-diagnosis [21], and indicates that in a small but important proportion of individuals following HNC, time to return to work may be extended.

This extended period during which individuals return to work has implications for patients, clinical practice, policy makers and employers. Given the evidence that working contributes to an individual's sense of self and quality of life [22, 23], as well as protects against financial distress, it is important that HNC survivors are aware that return to work is possible but may take an extended period of time. Clinicians should be aware that workforce participation should be considered from the time of diagnosis, and may continue to be an issue during and beyond the period of rehabilitation. For policy makers and employers there is a clear message that flexibility in the workplace to accommodate longer term effects following HNC is required, and that occupational rehabilitation may be required.

This is the first study in HNC that provides an estimate of the proportion of people who take at least some time off work following HNC diagnosis. The proportion of individuals who did not take any time off work following diagnosis was higher than anticipated, and indicates that the patterns of workforce participation are complex.

18 individuals who reported returning to work following their HNC diagnosis were no longer working at the time of the survey. Whilst the reasons for their departure are unknown, this could point to a pattern of return to work which is not a single, simple step from not working to working. This is consistent with the model of Feuerstein and colleagues, who recognise the potential long term implications of cancer for workforce participation by considering sustainability of workforce participation as one of the model outcomes [13]. Similarly qualitative research has found that workforce participation following cancer is not a linear concept [22, 23].

Factors influencing workforce participation

Self-employment was the only factor identified to impact on the odds of taking no time off following HNC diagnosis. It may be that those who are self-employed have a greater financial incentive to minimise time off work, as the responsibility for the business lies with them. In addition, those who are self-employed are likely to have additional flexibility in the workplace to allow graduated return to work, such as a slow increase in weekly hours or a rearrangement of duties.

The factors identified to impact on the odds of an individual returning to work after 12 months are supported by other studies of HNC. Cancer site and employment status have both been found to influence the likelihood of ceasing to work following HNC [11, 7]. While being older has been identified previously as having an impact on workforce participation [6], this was not seen in this study. This may be due to the relatively small proportion of older people in the sample (7% aged over 65 years), most likely due to the high proportion of people in Ireland who retire at age 65 years.

Chemotherapy is generally given to those with higher risk disease – aggressive disease with unfavourable prognostic features such as close resection margins, or presence of lymphovascular or perineural invasion. In this series those patients who received chemotherapy also tended to have higher stage of disease at presentation and multimodal care. The greater disease burden associated with higher stage disease and increased therapeutic morbidity associated with multimodal care may explain the reduced risk of return to work found in those receiving chemotherapy.

~~The role of chemotherapy in workforce participation at 12 months could be due to other patient factors which influence treatment selection, such as HPV status, that were not included in this analysis. It may also be that while chemotherapy treatment itself does not usually extend beyond a few months, the side effects individuals may experience can continue in the long-term. Chemotherapy for HNC is usually given in combination with radiotherapy, which considerably increases side effects experienced, however we were unable to identify the use of combination therapies in this analysis. The disappearance of chemotherapy status from the analysis at five years, and the non-significance of the radiotherapy and surgery variables, suggests long term workforce participation patterns are not influenced by treatment type itself at the broad level included in this analysis. These results suggest that, while occupational rehabilitation will be important for all individuals with HNC, it may be particularly valuable for those who receive chemotherapy.~~

The strength of the role of medical card status in influencing workforce participation is unexpected. The survey asked respondents to indicate whether or not they had a medical card 'at the time of diagnosis'. Although the intention of the question was to ascertain status prior to diagnosis, it is possible individuals misinterpreted the question and answered whether they received a medical card as a result of their cancer diagnosis. Despite this, there are a number of potential interpretations of these results. A number of socio-economic indicators such as having a blue-collar job [7] or low level of education [12] have previously been found to influence patterns of workforce participation but these were not significant in this study. This may indicate that the medical card variable is acting as a proxy for socioeconomic status within the model. It would then follow that those without a medical card are more likely to have professional roles which are less physically strenuous than those in the service industry or manual labour, making return to work easier, although the variable for occupation type was not significant in the models.

~~It would then follow that~~In addition, those without a medical card at the time of diagnosis may have an additional financial burden associated with their diagnosis and treatment and therefore have a greater economic incentive to return to work. Medical cards are a form of public insurance, and there is evidence that public policies which increase costs to individuals of taking time off work, such as employment-contingent health insurance in the US, result in decreased work absences [24-27]. This is supported by research into the patient experience, which identifies insurance status as one of the considerations in an individual’s decision to return to work [8, 28]. The results in this study suggest that the current medical card and financial support system in Ireland may be acting as a disincentive to return to work, which may be relevant for other countries with universal health care systems, such as the UK and Australia, as well as those public insurance such as Medicaid/Medicare in the US.

~~Alternatively, or in addition, it may be that those without a medical card are more likely to have professional roles which are less physically strenuous than those in the service industry or manual labour, making return to work easier, although the variable for occupation type was not significant in the models. The difficulty in getting and retaining a medical card may also mean that the current medical card and financial support system in Ireland is acting as a disincentive to work.~~

Another way of interpreting the medical card variable is as an indicator of having a comorbidity at diagnosis. A comorbidity could compound the effects of HNC and its treatments, making workforce participation more difficult. That this effect continues to five years following diagnosis indicates a lasting effect. This interpretation of the results is supported by research which finds that cancer survivors with another chronic disease experience higher levels of burden compared to those with a history of cancer only [29]. The role of medical cards in likelihood of returning to work is an important area for further research, particularly as this is the first study to examine the factors that influence return to work at 5 years following HNC.

The non-significance of many of the other variables is likely a factor of the relatively small sample size for the regression analyses, particularly at five years. However for variables such as occupation type it may also be that the measure used does not identify the specific aspects of employment which make workforce participation difficult following HNC. The division of roles into professional, service and manual may not adequately identify factors such as a clean environment for managing feeding tubes, the level of speech required or the amount of face-to-face contact with the public.

There is currently limited evidence for interventions to enhance workforce participation outcomes in cancer survivors [30], and by identifying risk factors for not returning to work such as financial situation or comorbidities, targeted interventions to improve work outcomes in those groups can be developed.

Reduced hours at work

52% of participants who participated in the workforce following their HNC diagnosis reported reducing their hours at work after their head and neck diagnosis. This is higher than previous estimates, with one study finding that 72% of individuals working full time at the time of diagnosis were still working full time five years after diagnosis and radiotherapy for tongue base cancer [9], and another finding 34% of individuals returning to work after HNC adapted or changed their job [5].

This higher rate of reduced work hours could be related to the profile of study participants, in particular the diversity of HNC patients in this study. In addition, in comparison to the US and the Netherlands, where the other studies [9, 5] were based, the limited provisions in Ireland for sick leave and protection from dismissal due to illness may mean individuals are more likely to attempt to return to work part-time rather than take extended periods of leave due to illness, than in countries where greater social provision or legal protections may be in place.

Strengths and limitations

This paper presents analysis based on data from a population-based cancer registry, which provides comprehensive coverage of cancer survivors in Ireland. The participation rate in the survey was acceptable, and the characteristics of the survey responders were similar to the characteristics of those who did not respond.

~~Other~~A number of factors previously suggested in the literature to influence return to work ~~which~~ were not ~~assessed~~considered in this ~~analysis~~study. ~~include alcohol and smoking status [12], having depression [12], pain [12], fatigue [6] and oral dysfunction [5], decreased social function [5], changes in appearance [7] and high levels of anxiety [5]~~. In particular, alcohol use and smoking are two of the strongest HNC risk factors [31]~~.~~, and many individuals continue their use during and after diagnosis and treatment [32-35]. Individuals who continue to smoke and use alcohol after diagnosis and treatment are more likely to experience tumour recurrence and second primary malignancies [35], as well having lower quality of life, poorer functional abilities and higher levels of pain [32-34]. All of these could also influence patterns of return to work, and thus the unavailability of information on tobacco and alcohol use is a limitation. Other factors not available for consideration included having depression or high levels of anxiety [12, 5], pain [12], fatigue [6], oral dysfunction [5], changes in appearance [7] and decreased social function [5].

Running the 12 month model allowed for the characteristics which influence returning to work in HNC patients to be compared to those for other cancers presented in the literature, which predominantly have 12 month follow up. However, the strength of this study is in the longer follow up of patients. Thus, workforce participation status at 5 years was also assessed. This allows comparison of the factors associated with workforce participation between those who return to work before 12 months, and those who take longer.

While the extended follow up is a unique aspect of this study, this extended time period may also be a limitation. The accuracy of recall of work absence due to illness in general decreases as recall time increases [36]. However, this recall bias may be minimised in this study by asking for total period off work, with a significant life mile stone (cancer diagnosis) as a marker for the time period. Despite this, potential issues in reliability should be considered in interpretation of the results.

While many individuals with HNC return to the workforce, it is possible that their performance in the workplace is reduced due to physical, cognitive or psychosocial factors following their diagnosis and treatment. Similarly, whether in paid employment or not, at the time of HNC diagnosis, individuals may have unpaid roles which are affected by their diagnosis and treatment. These may include household tasks such as childcare or meal preparation, as well as education and leisure. The return to these roles may be just as important to individuals as workforce participation, and may need to be considered in rehabilitation plans following treatment.

Conclusion

This study finds that many individuals in Ireland return to work after head and neck cancer, but it takes 9 months on average to do so, and 15% of those who eventually return do so after an absence of more than 12 months. Having pharyngeal cancer, being employed by an employer, receiving chemotherapy, not having private health insurance and having a medical card all reduce the odds of returning to work within 12 months of diagnosis. Five years from diagnosis only the effect of medical card remains. Patients, clinicians and policy-makers need to be aware of the extended period of return to work following head and neck cancer and the need for flexibility in the workplace to encourage workforce participation.

Table I: Demographics and clinical characteristics of individuals employed at the time of head and neck cancer diagnosis included in the analysis, presented by time taken off work following diagnosis

Variable	**No time off**	**Time off < 12 months**	**Time off > 12 months**	**Didn't return to work**	**Total**
	N (row %)	**N (row %)**	**N (row %)**	**N (row %)**	**N**
Gender					
Male	31 (16)	75 (40)	16 (9)	66 (35)	188
Female	4 (5)	33 (43)	7 (9)	32 (42)	76
Age					
<45	5 (8)	33 (53)	8 (13)	16 (26)	62
45-50	4 (8)	18 (36)	7 (14)	21 (42)	50
51-55	6 (12)	20 (38)	7 (13)	19 (37)	52
56-60	7 (15)	21 (45)	1 (2)	18 (38)	47
60+	13 (25)	16 (30)	0 (0)	24 (45)	53
Marital status					
Married/living with partner	24 (13)	80 (42)	15 (8)	71 (37)	190
Not married or living with a partner	11 (16)	28 (40)	8 (11)	23 (33)	70
Educational attainment					
Primary School	11 (17)	24 (37)	5 (8)	25 (38)	65
Secondary School	14 (12)	44 (39)	13 (11)	43 (38)	114
Third level	10 (19)	22 (42)	3 (6)	18 (34)	53
Post-graduate	0 (0)	17 (68)	2 (8)	6 (24)	25
Unknown	0 (0)	1 (14)	0 (0)	6 (86)	7
Residential location					
Unknown	0 (0)	0 (0)	0 (0)	1 (100)	1
Rural	17 (11)	63 (40)	17 (11)	59 (38)	156
Urban	18 (17)	45 (42)	6 (6)	38 (36)	107
Private health insurance at diagnosis?					
No	17 (15)	40 (34)	11 (9)	48 (41)	116
Yes	18 (13)	67 (48)	12 (9)	42 (30)	139
Unknown	0 (0)	1 (11)	0 (0)	8 (89)	9
Medical card at diagnosis?					
No	26 (12)	94 (44)	21 (10)	71 (33)	212
Yes	8 (17)	14 (30)	2 (4)	22 (48)	46
Unknown	1 (17)	0 (0)	0 (0)	5 (83)	6
Employment type					
Employed	15 (9)	68 (41)	17 (10)	66 (40)	166
Self-employed	20 (20)	40 (41)	6 (6)	32 (33)	98
Occupation					
Professional	10 (13)	42 (53)	8 (10)	20 (25)	80
Service	6 (15)	17 (41)	5 (12)	13 (32)	41

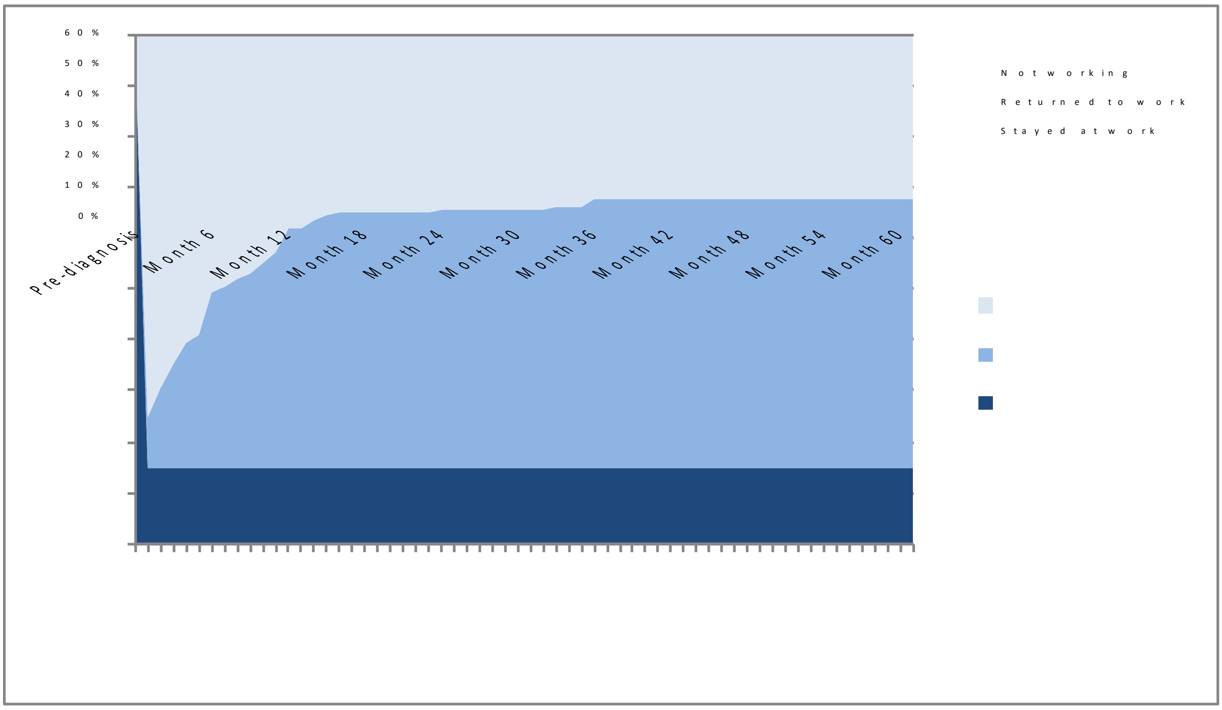
Manual	16 (15)	41 (39)	10 (10)	38 (36)	105
Unknown	3 (8)	8 (21)	0 (0)	27 (71)	38
Cancer site					
Other	19 (16)	60 (50)	7 (6)	34 (28)	120
Pharynx	4 (7)	18 (30)	10 (17)	28 (47)	60
Larynx	12 (14)	30 (36)	6 (7)	36 (43)	84
Cancer stage at diagnosis					
I	14 (18)	41 (53)	3 (4)	20 (26)	78
II	6 (13)	20 (43)	4 (9)	16 (35)	46
III	3 (8)	10 (27)	7 (19)	17 (46)	37
IV	6 (10)	17 (29)	3 (5)	32 (55)	58
Unknown	6 (13)	20 (44)	6 (13)	13 (29)	45
Chemotherapy					
No	30 (15)	92 (46)	9 (5)	67 (34)	198
Yes	5 (8)	16 (24)	14 (21)	31 (47)	66
Radiotherapy					
No	15 (16)	44 (48)	4 (4)	28 (31)	91
Yes	20 (12)	64 (37)	19 (11)	70 (40)	173
Cancer-directed surgery					
No	8 (10)	34 (41)	5 (6)	36 (43)	83
Yes	27 (15)	74 (41)	18 (10)	62 (34)	181

Table II: Logistic regression results – factors influencing workforce participation status at 0, 1 and 5 years[1] in those employed at the time of head and neck cancer diagnosis included in the analysis

Odds Ratio Estimates: Workforce participation									
Effect	**At 12 months (n=264)**			**At 5 years (n=147)**			**At Month 0 (no time off) (n=264)**		
	Point Estimate	**95% Wald Confidence Limits**		**Point Estimate**	**95% Wald Confidence Limits**		**Point Estimate**	**95% Wald Confidence Limits**	
No medical card at diagnosis Reference: Medical card at diagnosis	2.612	1.148	5.942	4.032	1.691	9.617	-	-	-
Cancer site - larynx Reference: pharynx	1.496	0.632	3.541	-	-	-	-	-	-
Cancer site - other Reference: pharynx	2.786	1.201	6.462	-	-	-	-	-	-
Employed Reference: self-employed	0.497	0.263	0.938	-	-	-	0.259	0.119	0.564
No private health insurance at diagnosis Reference: Had private health insurance	0.485	0.26	0.904						
No chemotherapy Reference: Received chemotherapy	2.815	1.309	6.055	-	-	-	-	-	-

[1] Backwards selection of variables was conducted – variables included in the original model for selection were: sex, age, marital status, medical card status, educational attainment, cancer site, cancer stage, residential rurality, employment status, occupation type, living alone, health insurance status, receipt of chemotherapy, receipt of radiotherapy, receipt of surgery

Figure I: Proportion of individuals employed at the time of head and neck cancer diagnosis and included in the analysis, working from time of diagnosis to 5 years following HNC diagnosis



Online supplementary material

Table III: Univariate logistic regression analysis odds ratio estimates for explanatory variables at 12 months, 5 years and 0 months

Odds Ratio Estimates – Univariate analyses									
	12 months (n=264)			5 years (n=147)			0 Months (no time off) (n=264)		
Effect	**Point Estimate**	**95% Wald Confidence Limits**		**Point Estimate**	**95% Wald Confidence Limits**		**Point Estimate**	**95% Wald Confidence Limits**	
Female vs Male	0.811	0.463	1.42	0.816	0.462	1.439	0.276	0.093	0.819
Age 46-55 vs <46 years	0.577	0.289	1.153	0.676	0.329	1.39	1.085	0.343	3.431
Age 56-65 vs <46 years	0.556	0.273	1.132	0.455	0.219	0.946	2.431	0.823	7.178
Age 66-75 vs <46 years	0.616	0.181	2.094	0.479	0.139	1.648	4.178	0.936	18.644
Unmarried vs married	1.273	0.718	2.255	1.143	0.639	2.045	0.739	0.335	1.631
No medical card vs card	0.423	0.21	0.851	0.362	0.18	0.727	1.346	0.538	3.368
Primary school vs secondary school	0.942	0.497	1.785	0.931	0.488	1.776	**		
Third level education vs secondary school	2.01	0.972	4.158	1.678	0.801	3.516	**		
Post-graduate education vs secondary school	1.767	0.688	4.535	1.627	0.615	4.302	**		
Other cancer vs larynx	2.445	1.326	4.508	2.18	1.17	4.063	1.152	0.517	2.567
Pharynx vs larynx	0.602	0.297	1.219	0.678	0.339	1.357	0.335	0.09	1.255
Cancer stage II vs I	0.587	0.266	1.293	0.677	0.304	1.508	0.864	0.299	2.495
Cancer stage III vs I	0.45	0.191	1.06	0.714	0.298	1.712	0.478	0.126	1.815
Cancer stage IV vs I	0.285	0.135	0.602	0.316	0.15	0.664	0.507	0.168	1.528
Cancer stage unknown vs I	0.72	0.324	1.6	1.052	0.456	2.429	0.864	0.299	2.495
Rural residence vs urban	1.442	0.851	2.44	1.233	0.722	2.104	1.694	0.807	3.558
Employed vs Self-Employed	0.472	0.269	0.83	0.468	0.261	0.838	0.261	0.121	0.561
Unknown occupation vs professional	0.5	0.177	1.41	0.393	0.138	1.12	1.744	0.415	7.322
Manual vs professional	0.435	0.236	0.803	0.451	0.241	0.847	1.55	0.643	3.732

Technical vs professional	0.647	0.294	1.424	0.629	0.279	1.416	1.145	0.355	3.686
Lived alone vs not lived alone	1.28	0.603	2.716	1.132	0.527	2.433	1.486	0.556	3.97
No private health insurance vs insurance	2.603	1.536	4.412	2.533	1.482	4.33	0.899	0.429	1.883
No chemotherapy vs chemotherapy	0.331	0.18	0.61	0.464	0.256	0.841	0.381	0.128	1.138
No radiotherapy vs radiotherapy	0.497	0.284	0.869	0.588	0.333	1.039	0.572	0.271	1.21
No surgery vs major surgery	0.872	0.392	1.938	0.695	0.31	1.556	1.069	0.298	3.832
Minor surgery vs major surgery	1.592	0.756	3.352	1.498	0.701	3.203	1.58	0.504	4.949

**Quasi-complete separation of data points, model fit questionable

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Conflict of interest

Alison Pearce, Aileen Timmons, Eleanor O'Sullivan, Pamela Gallagher, Rachael Gooberman-Hill, Audrey Alforque Thomas, Michal Molcho, Phyllis Butow and Linda Sharp declare that they have no conflict of interest.

Informed consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

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