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Associations of health behaviours with return to work outcomes after colorectal cancer

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Abstract

Purpose: Engaging in positive health behaviours can improve quality of life amongst cancer survivors; whether this facilitates return to work is unknown. We examined associations of health behaviours with return to work outcomes following a diagnosis of colorectal cancer in middle-aged men and women (45-64 years).

Methods: We recruited 239 participants through the Queensland Cancer Registry between January 2010 and September 2011. Data were collected through telephone-administered interviews and postal questionnaires at six and 12 months post-diagnosis. Logistic regression examined likelihood of ceasing or reducing work, and Cox regression examined factors associated with time to return to work.

Results: No significant associations were observed between health behaviours (fruit and vegetables consumption, alcohol consumption, smoking status, physical activity or sitting time) at six months and ceasing or reducing work at 12 months post-diagnosis. Participants who reported excessive sleep (≥ 9 hrs/day) were 2.69-times more likely to reduce work time or retire (relative to those sleeping the recommended 7 to < 9 hrs/day; 95% CI: 1.06, 6.87, adjusted for cancer treatment). In Cox regression analysis, excessive sleep was associated with a longer work re-entry time (relative to sleeping 7 to < 9 h/day; HR = 0.47; 95% CI: 0.22, 1.00, adjusted for education and cancer treatment).

Conclusions: Further research into how excessive sleep might be related to return to work amongst colorectal cancer survivors is warranted. Interventions focused on achieving optimal sleep patterns may assist colorectal cancer survivors to return to work, and should be tested in future studies.

Keywords: colorectal cancer, health behaviour, return to work, middle-aged.

Employment provides a number of important benefits to individuals, including economic stability, professional identity, supportive social relationships,[1] and maintaining a sense of normalcy and control.[2] A cancer diagnosis can cause a major disruption to an individual's employment, which can subsequently affect the abovementioned quality of life-related factors. Hence, return to work after cancer treatment often signifies an important step in a cancer survivor's recovery.[3]

Overall, cancer survivors are 1.4 times more likely to be unemployed than adults without cancer.[4] Both the likelihood of returning to work, and the length of leave from employment, may be related to the adverse side-effects from cancer treatment. We have previously identified that, for Australian colorectal cancer survivors who were in paid employment at the time of their diagnosis, not having returned to work by 12 months post-diagnosis was associated with being older, having a lower BMI and lower physical well-being. Factors associated with delayed work re-entry included not being university-educated, working for an employer with more than 20 employees in a non-professional or managerial role, longer hospital stay, financial stress and having had chemotherapy.[3]

Factors that may facilitate cancer survivors' return to work have not been well documented. Modifiable health behaviours, such as diet and physical activity, can affect survival and quality of life outcomes for colorectal cancer survivors.[5, 6] We hypothesise that engaging in positive health behaviours (physical activity; fruit and vegetable consumption; optimal sleep duration) and avoiding negative health behaviours (tobacco smoking; excessive alcohol intake; prolonged sitting time) following a diagnosis of colorectal cancer will facilitate a return to paid

employment. Therefore, the aims of our study are to determine the associations of health behaviours reported at six months post-diagnosis with: (i) likelihood of ceasing or reducing work (by more than 4 hours per week) at 12 months post-diagnosis; and (ii) time to work re-entry, in middle-aged men and women diagnosed with colorectal cancer.

Methods

Study participants and recruitment

The complete methods and procedures of the Working After Cancer Study (WACS) have previously been described.[3, 7] In brief, a prospective, population-based study enrolled middle-aged (45-64 years) men and women who were in the paid workforce and newly-diagnosed with colorectal cancer. Participants resided in Queensland, Australia, and had a histologically-confirmed diagnosis of colorectal cancer reported to the Queensland Cancer Registry between January 2010 and September 2011. Informed consent was obtained from all individual participants included in the study. Ethics approval for the study was obtained from the Human Ethics Research Committee of QIMR Berghofer Medical Research Institute, Griffith University and the Queensland Health Research Ethics and Governance Unit.

Data collection

Outcome measures

Participants completed structured telephone interviews at 6 and 12 months post-diagnosis. At the 6-month data collection time point, participants recalled work-related information at the time they were diagnosed with cancer (baseline) while at 12 months they recalled work information since the 6-month data collection. Interviews were conducted by trained and experienced

interviewers. Work information was assessed by a validated measure used by the Household Income and Labour Dynamics in Australia (HILDA) Survey,[8] which asks about employment status, and usual and preferred weekly hours of work. From this measure, we determined our primary outcome variables of interest: whether participants had left the workforce, or reduced their work hours (by more than four hours per week) at 12 months post-diagnosis (yes/no); and, the length of time between diagnosis and work re-entry (days).

Health behaviours

To supplement the data collected by telephone interview, participants completed postal surveys that included a variety of measures assessing health behaviours. Physical activity and sitting time were assessed by the International Physical Activity Questionnaire (short form);[9] tobacco use and alcohol intake were assessed using standard items used by the National Drug Strategy Household Survey.[10] The postal survey also asked participants to record how many hours of sleep typically gained over a 24 hour period, and how many daily serves of fruit and vegetables they consumed. Health behaviours were categorised according to American Cancer Society guidelines for cancer survivors (physical activity: ≥ 150 minutes per week, < 150 minutes per week; fruit and vegetables: ≥ 5 serves per day, < 5 serves per day; alcohol: none, 1 to 2 drinks per day, ≥ 3 drinks per day; and, smoking: never, former, current),[Rock et al, 2012] or using cutpoints employed in previous studies (sleep: < 7 hours per day, 7 to < 9 hours per day, ≥ 9 hours per day;[11] sitting time: < 4 hours per day, 4 to < 8 hours per day, ≥ 8 hours per day).[12]

Covariates

Data were collected from pathology reports on tumor site (colon, rectum), histopathological tumor type, degree of differentiation or grade, degree of metastasis, and stage of disease (American Joint Committee of Cancer [AJCC] staging). The Queensland Cancer Registry also supplied participants' age and sex. Standard sociodemographic information (marital status, educational attainment, household income) as well as medical information (cancer therapies received, comorbid conditions, height, body mass) were collected during the telephone interviews.

Analyses

Multiple imputation was employed to handle missing data: the pattern of missingness was checked, the predictor variables were selected (having <5% missing values themselves, and where possible significantly correlated with the variables to be imputed), and the number of imputations set according to the rule of thumb (to be similar to the percentage of cases that are incomplete).[13] Variables with higher than 30% missing values were not imputed (these were excluded from analysis). For binary, categorical and ordinal variables the imputed values were rounded to the nearest valid value.

Sociodemographic and cancer-related characteristics, and health behaviours, were described as median (25^{th} and 75^{th} percentile) for continuous variables, or frequency and percentage for categorical variables. Logistic regression was used to determine health behaviours significantly associated with employment change (maintained work participation vs retired/reduced work by >4 hrs/week) at 12 months post-diagnosis. Cox proportional hazards modelling assessed health

behaviours associated with the hazard of work re-entry (where a hazard ratio of <1 is associated with a longer time to return to work). Where a person worked continually through their treatment, we assumed one day was taken off work to enable these individuals to have an 'event' (work resumption), and be captured in the returned workers category. The number of days off work was entered as the time variable in the model, and those permanently retired were excluded from the analysis.

For multivariable analyses (logistic and Cox proportional hazards models), only predictor variables with a univariable p-value of ≤0.20 were initially included in the model. Collinearity between predictor variables was assessed prior to model building. Final multivariable models were derived manually, using the $p<0.05$ criteria. Assumptions of the logistic regression (linearity of log-odds of the outcome with covariates) and the Cox regression (proportional hazards assumption) were checked for the final multivariable models.

STATA SE (Version 13.1) was used for all analyses, and statistical significance was set at the $p < 0.05$ level.

Results

The overall response rate for the study was 34%.[3] Compared to eligible non-respondents, study participants were slightly younger, more likely to be male, and more likely to have early stage disease (AJCC stage I or II)(data previously reported).[3] Sociodemographic and cancer-related characteristics of participants are presented in Table 1.

--- Insert Table 1 about here ---

Table 2 presents the results of logistic regression examining associations between health behaviours and having left the workforce (or reduced hours by more than four hours per week) at 12 months post-diagnosis. Bivariate and multivariate analyses found no statistically significant associations of vegetable and fruit consumption, alcohol consumption, smoking status, physical activity, or sitting time with work cessation. A statistically significant association was found with sleep duration: relative to participants who reported sleeping for an optimal 7 to < 9 hours per day, participants with longer sleep duration had 2.69-times greater odds of ceasing employment or reducing work hours (95% CI: 1.06, 6.87; p=0.038), when controlling for type of cancer treatment.

--- Insert Table 2 about here ---

Similar results emerged when the associations of health behaviours and number of days off work until work re-entry were examined (Table 3). Only sleep duration was statistically significantly associated with time to work re-entry: participants with longer than recommended sleep duration had longer time off-work (HR = 0.47; 95% CI: 0.22, 1.00; p=0.049), adjusted for education and cancer treatment.

--- Insert Table 3 about here ---

Discussion

To our knowledge, the role of health behaviours in facilitating return to work has not previously been considered, despite the seemingly plausible association and the important role that employment plays in rehabilitation following cancer treatment. Within our sample of middle-aged (45 to 64 years) colorectal cancer survivors, we found that only excessive sleep duration at six months post-diagnosis was predictive of poorer return to work (or reduced work hours), and delayed work re-entry, 12 months after diagnosis. The causal direction of this association is unknown, and cannot be ascertained from our longitudinal study design. It is possible that longer sleep duration is indicative of underlying health problems, such as depression, or inadequate rehabilitation post cancer therapy. Alternatively, cancer survivors who purposefully spend longer periods of time sleeping may be inadvertently compromising their health. Sleep is widely recognised as an important component of healthy lifestyles.[11] Both short and prolonged long sleep duration appear to be important predictors of obesity,[14] weight gain,[15] cardiovascular outcomes,[16] and all-cause mortality.[17] Consequently, behavioural interventions with a focus on establishing positive sleep routines may be a helpful adjunct for colorectal cancer survivors.

Although not statistically significant, our results suggested that a higher than recommended intake of alcohol (3 to 4 standard drinks per day) was associated with shorter work re-entry time. Although previous research has found moderate alcohol consumption can have beneficial quality of life effects in healthy older and middle-aged adults,[18] and even amongst colorectal cancer survivors,[19] we suggest that this unexpected finding reflects reverse causation (participants who were recovered sufficiently to return to work were also more likely to return to drinking alcohol in larger quantities). It is recognised that alcohol consumption is associated with an

increased risk of colorectal cancer,[20] hence continued intake after diagnosis may increase the risk of disease recurrence. Thus, even if associations between alcohol consumption and return to work were not spurious, promoting increased intake would be inadvisable.

Overall, our hypothesis that positive health behaviours (physical activity; fruit and vegetable consumption; optimal sleep duration) would be associated with return to work, whereas negative health behaviours (tobacco smoking; excessive alcohol intake; prolonged sitting time) would be associated with work cessation, was mostly not supported by our findings. However, this research question warrants further consideration in other studies, given that the beneficial effects of positive health behaviours observed in previous studies[21, 6] should lead to better physical functioning, and hence shorter work re-entry time and fewer days off work in colorectal cancer survivors.

The strengths of our study include the prospective design and utilisation of a population-based recruitment method via the Queensland Cancer Registry. However, due to the subjective nature of self-report surveys used to assess health behaviours and work situations, recall error, social desirability influences, and other inherent biases may exist. In our study there were no questions pertaining to cancer recurrence during the study, and whether they had told their employer about their diagnosis, which may have affected their number of days off work. Also, we did not assess personality or motivational factors that have been previously shown to be a possible strong driver for individuals in their return to work following illness.[22]

From the findings of our study we conclude that excessive sleep may be an indicator of inadequate rehabilitation or poor health in colorectal cancer survivors. Interventions to improve sleep duration and/or quality may assist colorectal cancer survivors to return to work and enhance their quality of life.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Table 1: Participant characteristics at six months post-diagnosis (n=187)

	Descriptive statistic
Age (years)[a]	57 (52, 61)
Sex (male)	122 (65%)
Marital status (partnered)	146 (82%)
Education:	
- high school or lower	118 (67%)
- trade or certificate qualification	23 (13%)
- university	36 (20%)
Body mass index (kg/m^2)[a]	27.5 (23.5,30.1)
Comorbidities (balance: none):	
- one	56 (31%)
- two	23 (13%)
- three or more	31 (17%)
Household income:[b]	
- less than $77,999	59 (37%)
- $78,000 – $103,999	41 (25%)
- $104,000 or more	61 (38%)
AJCC Staging (early stage)	67 (64%)
Cancer site (colon)	80 (53%)
Chemotherapy (yes)	105 (57%)
Radiotherapy (yes)	34 (19%)
Vegetable and fruit consumption (≥ 5 serves per day[c])	50 (34%)
Alcohol consumption:	
- none[c]	44 (30%)
- 1 to 2 drinks per day	71 (48%)
- ≥ 3 drinks per day	33 (22%)
Smoking status:	
- never[c]	63 (40%)
- ex-smoker	84 (53%)
- current smoker	12 (8%)
Physical activity (≥ 150 minutes per week[c])	113 (71%)
Sitting time:	
- < 4 hours per day[c]	34 (22%)
- 4 to < 8 hours per day	76 (49%)

- ≥ 8 hours per day	45 (29%)
Sleep duration:	
- < 7 hours per day	42 (27%)
- 7 to < 9 hours per day[c]	87 (55%)
- ≥ 9 hours per day	28 (18%)

[a] median (25th, 75th percentile); [b] Australian Dollars 2010; AJCC = American Joint Committee on Cancer; [c] optimal health behaviour category; frequencies do not always add up to group size due to missing data; % values calculated with number of non-missing values in denominator;

Table 2: Logistic regression of employment change[a] at 12 months post-diagnosis (n=187)

	Bivariate		**Multivariate[d]**	
	OR	95% CI	OR	95% CI
Age (years)	1.04*	0.98-1.10	-	-
Sex: female (ref.: male)	1.22	0.67-2.23	-	-
Marital status: not partnered (ref.: yes)	1.04	0.48-2.24	-	-
Education[b]	1.04	0.72-1.49	-	-
Body mass index (kg/m^2)	0.95*	0.89-1.01	-	-
Comorbidities[b]	1.00	0.77-1.31	-	-
Household income[b]	1.11	0.77-1.59	-	-
AJCC staging: late (ref.: early)	1.80*	0.79-4.08	[e]	[e]
Cancer site: rectum (ref.: colon)	1.44	0.76-2.75	-	-
Cancer therapy: chemo/radio (ref.: none)	3.17***	1.71-5.87	3.06***	1.61-5.80
Vegetable/fruit cons. (ref.: ≥ 5 serves p.d.[c])	1.20	0.60-2.37	-	-
Alcohol cons. (ref.: none[c])				
- one or two standard drinks p.d.	0.87	0.41-1.84	-	-
- 3 or more standard drinks p.d	0.65	0.26-1.62	-	-
Smoking status (ref.: never[c])	1.23	0.65-2.33	-	-
Physical activity (ref.: ≥ 150 min per week[c])	0.99	0.50-1.96	-	-
Sitting time (ref.: < 4 hrs p.d.[c])	1.32	0.61-2.84	-	-
Sleep duration (ref.: 7 to < 9 hrs p.d.[c])			-	-
- less than optimal	0.92	0.43-1.94	1.18	0.55, 2.53
- more than optimal	2.85**	1.16-7.02	2.69**	1.06-6.87

** p<0.2; ** p < 0.05; *** p<0.01; [a] employment change categorised as: 0 = maintained work participation (including change of up to ±4 hrs/week) or increased work by >4 hrs/week; 1 = retired or reduced work by >4 hrs/week; [b] entered in model as continuous variable, greater values associated with greater levels of the covariate; ref = referent category; [c] optimal health behaviour category; cons = consumption; p.d. = per day; hyphen = not entered into or removed from multivariate model; [d] missing values of 'sleep duration' filled using multiple imputation; AJCC = American Joint Committee on Cancer; [e] not entered into multivariate model due to too many missing values for multiple imputation;*

Table 3: Cox regression of returning to work (n=187)

	Bivariate		**Multivariate[a]**	
	HR	95% CI	HR	95% CI
Age (years)	1.04**	1.00-1.07	-	-
Sex: female (ref.: male)	0.97	0.65-1.45	-	-
Marital status: not partnered (ref.: yes)	0.61*	0.35-1.06	-	-
Education[b]	1.26**	1.01-1.58	1.28**	1.02-1.61
Body mass index (kg/m^2)	1.05**	1.00-1.09	-	-
Comorbidities[b]	0.93	0.78-1.11	-	-
Household income[b]	1.09	0.87-1.37	-	-
AJCC staging: late (ref.: early)	0.51**	0.29-0.90	[d]	[d]
Cancer site: rectum (ref.: colon)	0.70*	0.44-1.09	-	-
Cancer therapy: chemo/radio (ref.: none)	0.33***	0.22-0.50	0.35***	0.23-0.53
Vegetable/fruit cons. (ref.: ≥ 5 serves p.d.[c])	0.91	0.58-1.43	-	-
Alcohol cons. (ref.: none[c])				
- one or two standard drinks p.d.	1.27	0.75-2.13	-	-
- 3 or more standard drinks p.d.	1.70*	0.93-3.08	-	-
Smoking status (ref.: never[c])	0.73*	0.48-1.12	-	-
Physical activity (ref.: ≥ 150 min per week[c])	0.76	0.47- 1.23	-	-
Sitting time (ref.: < 4 hrs p.d.[c])	0.86	0.51-1.45	-	-
Sleep duration (ref.: 7 to < 9 hrs p.d.[c])				
- less than optimal	1.37*	0.86-2.18	1.02	0.64-1.63
- more than optimal	0.37**	0.17-0.82	0.47**	0.22-1.00

** p<0.2; ** p < 0.05; *** p<0.01; HR = hazard ratio, <1 is associated with lower hazard of work re-entry i.e. longer time off work; [a] missing values of 'sleep duration' filled using multiple imputation; [b] entered in model as continuous variable, greater values associated with greater levels of the covariate; [c] optimal health behaviour category; cons = consumption; p.d. = per day; hyphen = not entered into or removed from multivariate model; AJCC = American Joint Committee on Cancer; [d] not entered into multivariate model due to too many missing values for multiple imputation;*