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Associations between Health-Related Functioning and Return-to-Work Status in Cancer Survivors Following Treatment

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Abstract

This study aimed to investigate the cross-sectional association between return-to-work (RTW) status and health-related quality of life (HR-QOL) among cancer survivors after diagnosis and treatment. A questionnaire-based survey incorporating three validated HR-QOL measures was administered to Japanese cancer survivors during their initial post-discharge follow-up visit. Participants were enrolled by nurse researchers from inpatient wards between 2016 and 2017. The collected data underwent statistical analysis. From 94 completed questionnaires, analyses indicated that RTW status was significantly linked to symptom interference, physical functioning, mental functioning, overall health and functioning, and the variable "work category." In contrast, actual symptoms, subjective well-being, and other sociodemographic factors showed no significant association with RTW status. Multinomial logistic regression further demonstrated that only "work category"—defined by physical versus mental demands of work—exerted a statistically significant independent effect on RTW status. RTW status among cancer survivors was related to work category, symptom-related interference, physical and mental functioning, and general health and functioning; however, work category emerged as the sole significant predictor. These findings highlight the importance of tailoring support for cancer survivors' return to work according to the nature of their job (physical or mental demands). Interventions prioritizing individual health-related functioning, particularly physical and mental aspects, over sociodemographic factors may prove particularly effective.

Keywords: Cancer, Cancer treatment, Cancer survivors, Return-to-work (RTW)

Introduction

A diagnosis of cancer and subsequent treatment often disrupt an individual's ability to remain in paid employment. In Japan, the majority of people diagnosed with cancer either shorten their working hours, take medical leave, or withdraw from employment entirely following diagnosis [1-3]. Data from 2010 indicate that approximately 30% of newly diagnosed cancer patients—equivalent to 244,976 individuals—were within the working-age population (20–64 years) [4]. Evidence from an occupational health registry covering roughly 68,000 employees in Japanese companies shows that, among 1,278 cancer survivors who took sick leave for the first time due to cancer over a 12-year observation period, 47.1% resumed full-time employment within six months, while 62.3% did so within one year [1].

Employment-related changes such as job loss, reduced working hours, or extended sick leave following cancer diagnosis and treatment have been linked to declines in health-related quality of life (HR-QOL) [5, 6]. Moreover, resuming work after completing cancer treatment is frequently experienced by survivors as challenging and stressful. Although various programs aimed at facilitating return to work (RTW) among cancer survivors have been developed—particularly in European countries—most have yet to demonstrate

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statistically significant effectiveness [7]. A review of existing literature examining employment barriers among cancer survivors identified several groups who face greater difficulty returning to work, including non-regular employees, women, and individuals aged 50 years and older [8].

Both the stage of recovery and individual background characteristics appear to influence RTW outcomes. Previous research has shown that determinants of RTW shift as survivors progress through different phases of recovery [9], while other studies suggest that variations in HR-QOL are critical predictors of whether cancer survivors successfully return to employment [10].

Early re-entry into the workforce may provide important benefits for cancer survivors. For instance, a longitudinal study conducted in the Netherlands found that shorter intervals between cancer diagnosis and RTW were associated with sustained work performance over time [11]. Nevertheless, returning to work does not necessarily reflect optimal health status among survivors. A multi-national European study reported that self-employed individuals were more likely to continue working during treatment, yet tended to experience poorer financial outcomes compared with salaried employees [12]. For some survivors, continuing employment is essential for economic survival. Although motivations for working vary across individuals and circumstances, the opportunity to return to work—when considered in relation to HR-QOL—may represent a significant component of the recovery process.

Conceptual framework

This study examined the cross-sectional association between return-to-work (RTW) outcomes and health-related quality of life (HR-QOL) among cancer survivors, with the aim of identifying factors linked to employment status after treatment. In the Japanese healthcare setting, the first outpatient follow-up visit after hospital discharge—typically conducted by the physician who initially diagnosed the cancer—provides a timely opportunity to evaluate both recovery progress and RTW outcomes.

The analytical framework of this study assumed that determinants of RTW status could be categorized into four broad domains: (1) HR-QOL, (2) social background characteristics, (3) medical conditions, and (4) work-related context. HR-QOL refers to components of overall quality of life that are directly influenced by health status and includes individuals' perceptions of physical and psychological health and their related consequences [13]. To capture health status comprehensively, five dimensions of HR-QOL were assessed: symptoms, interference caused by symptoms, physical functioning, mental functioning, and subjective well-being.

At the time of the initial follow-up appointment, cancer survivors' health status may be shaped not only by their medical conditions but also by their social circumstances. In addition, the work-related context was broadly defined to encompass both regular (full-time) and non-regular (part-time or irregular) employment, allowing for a detailed examination of RTW outcomes across different employment arrangements.

Work represents more than a source of income; it is closely tied to personal identity and overall well-being. Henderson characterizes work as a fundamental human need, suggesting that engagement in meaningful activity—including unpaid roles such as volunteer work—can foster a sense of achievement and enhance well-being [14]. In this study, participants reported the type of work in which they were primarily engaged, which was treated as their main occupational activity.

To identify factors associated with RTW status, data were collected on whether and how participants resumed work following treatment, and these data were analyzed statistically. By examining post-treatment health status from multiple perspectives and clarifying the determinants of RTW among Japanese cancer survivors, this study aims to contribute to strategies that support employment reintegration while also enhancing HR-QOL.

Materials and Methods

Procedures and participants

This research employed a descriptive, cross-sectional design using a self-administered questionnaire. Participants were recruited from outpatient clinics at four large tertiary hospitals in Japan that provide specialized cancer care. While these institutions offer a broad spectrum of oncological treatments, patients from the hematology and neurosurgery departments were not included, as health-related quality of life (HR-QOL) profiles in these specialties were expected to differ substantially from those of other cancer populations.

Eligible participants were adults aged 20 to 75 years. Individuals with a known history of psychiatric illness or current affective disorders, as assessed by the attending physician or primary nurse, were excluded from

participation. Between June 2016 and November 2017, nurse investigators approached potential participants during their hospitalization and invited those who were able and willing to take part in the study.

Participants were provided with detailed verbal and written information regarding the study objectives and procedures. They were asked to complete an anonymous questionnaire at home and return it by mail within one week of their first outpatient follow-up visit after discharge. Submission of the completed questionnaire was regarded as implied informed consent.

Prior to data collection, ethical approval was obtained from the institutional review board of the university affiliated with the principal investigator (Approval No. 1040), as well as from the ethics committees of all participating hospitals. The study was conducted in full compliance with ethical standards, ensuring the protection of participants' privacy, confidentiality, and rights throughout the research process.

Questionnaire

The survey instrument was developed in accordance with the conceptual model underlying this study. It comprised two main components: a set of investigator-designed questions and a group of standardized health-related quality of life (HR-QOL) measures. Specifically, 14 original items were created to obtain information on participants' personal characteristics, clinical background, and employment circumstances. In addition, three validated HR-QOL scales, available in Japanese, were administered to capture different dimensions of health status.

Symptoms and the degree to which these symptoms disrupted daily life were assessed using the M.D. Anderson Symptom Inventory (MDASI). Physical and psychological functioning were measured with the SF-8 Health Survey Short Form (SF-8). Subjective quality of life was evaluated using the Ferrans and Powers Quality of Life Index, Cancer Version III (QLI). The QLI conceptualizes overall quality of life through four domains—health and functioning, psychological/spiritual well-being, social and economic conditions, and family relationships [15]. In the present study, scores from each of these domains were treated as indicators of HR-QOL.

Each of the three instruments captures quality of life from a distinct conceptual angle, emphasizing different aspects of health and daily functioning. By integrating these measures, the study aimed to generate a detailed and multidimensional profile of cancer survivors' HR-QOL, thereby improving the ability to detect factors linked to return-to-work (RTW) outcomes.

Investigator-developed measures

Participants provided information on age, sex, marital status, educational attainment, household income, perceived financial strain related to medical costs, and coverage by employment insurance. Age was dichotomized into "younger than 50 years" and "50 years or older," reflecting earlier findings that older age may hinder RTW among cancer survivors [8]. Educational level was grouped according to total years of schooling: completion of compulsory education (9 years), intermediate education (12–15 years), and higher education (16 years or more).

Household income was categorized into three brackets: less than 3.3 million yen, between 3.3 and 9 million yen, and greater than 9 million yen. These thresholds were informed by national statistics indicating a mean annual income of 4.2 million yen in Japan in 2016. Perceived burden of medical expenses was assessed subjectively, with respondents selecting one of the following options: "high," "too high," or "no opinion." Employment insurance status was also recorded; in the Japanese system, the absence of such insurance generally applies to individuals who are unemployed, self-employed, employed on a daily basis, or engaged in farming.

Information related to disease and treatment included time elapsed since diagnosis, cancer site, and treatment status at the time of survey completion. Time since diagnosis was divided into two periods: fewer than 100 days and 100 days or more. This distinction was based on the work of Weisman and Worden [16], who proposed that the intense existential distress following a cancer diagnosis typically diminishes after approximately 100 days. Lee later described this phenomenon as the "exacerbation of thoughts about one's existence and potential for nonexistence following a diagnosis of cancer" [17].

Cancer types were grouped into three prognostic categories using five-year relative survival rates reported for Japanese patients by the Center for Cancer Control and Information Services of the National Cancer Center (2016–2018 data) [18]. Category A included cancers with survival rates below 40% (esophagus, bladder, liver, pancreas, and lung). Category B comprised cancers with survival rates between 50% and 80% (stomach, colorectal, kidney, uterus, ovary, and bladder). Category

C consisted of cancers with survival rates exceeding 90% (breast and prostate).

Participants were asked to describe their main occupational role at the time of the survey, with illustrative examples such as "company employee," "teacher," and "homemaker" provided for clarification. Based on these descriptions, employment was subsequently classified as either "regular" or "irregular." Return-to-work status was assessed using four response categories: "I am working as usual," "I am working less than usual," "I am on sick leave," and "I am not engaged in work."

Additional work-related characteristics were collected by asking participants to identify whether their primary job involved predominantly "physical work" or "mental work," and to rate their perceived level of occupational stress as either "high" or "low."

HR-QOL measures

The M.D. Anderson Symptom Inventory (MDASI) is composed of two subscales: a 13-item symptom severity component (MDASI-S) and a 6-item symptom interference component (MDASI-I) (National Cancer Center, Japan, n.d.). The symptom severity subscale captures the presence and intensity of commonly experienced and distressing symptoms, whereas the interference subscale evaluates the extent to which these symptoms disrupt daily functioning. Responses for both subscales are scored on an 11-point numeric rating scale ranging from 0 to 10, with higher values reflecting greater symptom intensity or interference over the preceding 24 hours. Previous studies have confirmed the reliability of the Japanese versions of both MDASI-S and MDASI-I, and their criterion validity has been demonstrated through correlations with the EORTC QLQ-C30 [19].

The SF-8 Health Survey is an abbreviated version of the SF-36 and provides a profile of functional health across eight domains [20]. Each item is rated using an ordinal response format, and weighted scoring is applied based on standardized norms derived from a Japanese reference population [21]. From these items, norm-based summary scores for physical functioning (Physical Component Summary; PCS) and mental functioning (Mental Component Summary; MCS) are calculated. Use of the Japanese version of the SF-8 in this study was authorized under a licensing agreement with iHope International [20].

The Ferrans and Powers Quality of Life Index, Cancer Version III (QLI), evaluates quality of life by assessing both satisfaction with, and perceived importance of, different life domains using paired items rated on a 6-point scale. The instrument includes 33 item pairs and generates five outcome scores: overall quality of life, health and functioning, psychological/spiritual well-being, social and economic well-being, and family well-being [22]. Final scores range from 0 to 30, with lower scores indicating a greater negative impact on subjective well-being. The Japanese version of the QLI has undergone cultural adaptation using cognitive interviews with cancer patients [23], and its psychometric properties have been further validated through survey-based research [24].

Statistical analysis

Participants who selected "I am not engaged in work" when reporting their RTW status, as well as those who identified "homemaker" as their current occupation, were excluded from the analytical sample. This decision was made because individuals in the former group were not anticipated to reenter the workforce, and RTW classification criteria were not clearly applicable to the latter group. Statistical analyses were therefore conducted on participants classified into one of three RTW categories: "working as usual," "working less than usual," and "on sick leave."

Group differences across these RTW categories were examined for sociodemographic characteristics, clinical variables, work-related factors, and HR-QOL scores. Owing to the limited sample size, Chi-square tests and Kruskal–Wallis tests were used as appropriate. To inform subsequent regression modeling, post-hoc residual analyses were performed following Chi-square tests, while Bonferroni corrections were applied to multiple comparisons derived from Kruskal–Wallis tests in order to control for Type I error.

In the final analytical step, multinomial logistic regression analysis was conducted to assess the independent effects of relevant variables on RTW status. All statistical procedures were carried out using SPSS Statistics version 28 (IBM, New York, NY, USA). Statistical significance was determined using two-tailed tests, with a P-value of less than 0.05 considered indicative of significance.

Results and Discussion

Sample characteristics

During the data collection period, 293 questionnaires were distributed, and 176 were returned, yielding a response rate of 60.1%. Of the returned questionnaires, 30 were excluded because of substantial data quality issues: 15 contained extensive missing data, 17 lacked a response to the return-to-work (RTW) status question, and 2 were identified as duplicate submissions. An additional 52 questionnaires were excluded because respondents either selected "I am not engaged in work" as their RTW status (29 cases) or reported "homemaker" as their primary occupation (23 cases). Consequently, data from 94 participants—representing 32.1% of the originally distributed questionnaires—were included in the final analyses.

The demographic, clinical, and occupational characteristics of the analyzed sample are summarized in **Table 1**. The mean participant age was 60.1 years (SD = 8.7) (data not shown), and slightly more than half of the sample was male (n = 52, 55.3%). With respect to household income, the most frequently selected category was "3.3–9 million yen" (n = 43, 45.7%), followed by "over 9 million yen" (n = 30, 31.9%). Regarding perceived financial burden related to medical expenses, 7 participants (7.4%) reported that costs were "too high," whereas the majority (n = 65, 69.1%) selected "no opinion."

The average time elapsed since cancer diagnosis was 236.0 days (SD = 635.7) (data not shown), and 42 participants (44.7%) reported that they were still undergoing treatment at the time of the survey. Most respondents were employed in regular positions (n = 80, 85.1%). In terms of RTW status, 25 participants (26.6%) indicated that they were "working as usual," 27 (28.7%) reported "working less than usual," and 42 (44.7%) stated that they were "on sick leave." When asked to classify the nature of their work, 47 participants (50.0%) identified their job as "physical work," while 45 (47.9%) described it as "mental work."

Table 1. Characteristics of study sample

Variable	%	n
Age group (years)		
> 50	87.2	82
≤ 50	12.8	12
Sex		
Women	44.7	42
Men	55.3	52
Educational attainment (years)		
Missing	1.1	1
≥ 16	26.6	25
12–15	66.0	62
9	6.4	6
Marital status		
Unmarried	13.8	13
Married	86.2	81
Annual household income (JPY)		
Missing	8.5	8
> 9 million	31.9	30
3.3–9 million	45.7	43
< 3.3 million	13.8	13
Perceived burden of medical expenses		
Missing	2.1	2
No opinion	69.1	65
Excessively high	7.4	7
High	21.3	20
Time since diagnosis (days)		
> 100	53.2	50
≤ 100	43.6	41

Missing	3.2	3
Employment insurance coverage		
Missing	1.1	1
Not covered	44.7	42
Covered	54.3	51
Treatment status		
Ongoing treatment	44.7	42
Follow-up only	54.3	51
Missing	1.1	1
Cancer site category		
Category A	11.7	11
Category B	47.9	45
Category C	35.1	33
Missing	5.3	5
Employment type		
Non-regular employment	14.9	14
Regular employment	85.1	80
Return-to-work status		
Working reduced hours	28.7	27
Working as usual	26.6	25
On medical leave	44.7	42
Work-related stress level		
Low	55.3	52
High	42.6	40
Missing	2.1	2
Nature of work		
Primarily physical	50.0	47
Primarily mental	47.9	45
Missing	2.1	2

N = 94. C sites = breast and prostate; B sites = colon, gastric, uterus, renal, bladder, ovary; A sites = gallbladder, esophagus, pancreas, liver, lung.

Determinants of return-to-work status

A wide range of factors was evaluated, including sociodemographic characteristics (such as age, gender, marital status, educational duration, household income, perceived financial burden from medical costs, and employment insurance coverage), clinical characteristics (time since diagnosis, cancer type, and treatment status), and occupational factors (employment arrangement, job demands, and work-related stress). Of all variables assessed, only job demands—classified as physically oriented versus mentally oriented work—showed a statistically significant difference across the three return-to-work (RTW) categories ($\chi^2 = 13.70$, df = 2; P = 0.001). Specifically, survivors engaged in mentally demanding occupations were more likely to have fully resumed their usual work duties and less likely to remain on sick leave than those whose jobs involved physical labor **(Table 2).**

Table 2. Association between type of work and return-to-work status

Work category	On sick leave (n)	Residual	Working less than usual (n)	Residual	Working as usual (n)	Residual
Mental work	14	−2.5	11	−0.8	20	3.6
Physical work	27	2.5	15	0.8	5	−3.6

N = 92. Residual = Adjusted residuals

Table 3 displays the statistical findings on health-related quality of life (HR-QOL) measures in relation to return-

to-work (RTW) status among cancer survivors, revealing a clear trend where scores decline from highest in those maintaining full work duties, to moderate in those with reduced duties or hours, and lowest in those absent on sick leave. Statistically significant variations across the three groups, based on Kruskal–Wallis testing, emerged solely in four domains: symptom interference (MDASI-I; $H = 17.25$, $p < 0.001$), physical component summary (SF-8 PCS; $H = 10.62$, $p = 0.005$), mental component summary (SF-8 MCS; $H = 13.98$, $p < 0.001$), and health/functioning subscale (QLI-HF; $H = 8.10$, $p = 0.017$). Subsequent pairwise comparisons highlighted that symptom interference and mental health scores were markedly better in the full-work group than in both the reduced-work group ($p = 0.030$ and $p = 0.001$, respectively) and the sick-leave group ($p < 0.001$ and $p = 0.013$, respectively), whereas physical health and health/functioning scores showed notable superiority in the full-work group only when compared to the sick-leave group ($p = 0.007$ and $p = 0.013$, respectively).

Table 3. Means, standard deviations, and statistical comparisons of health-related quality of life scale scores according to return-to-work status.

Variable	Statistic	Total (N=94)	Working less than usual (N=27)	Working as usual (N=25)	H	On sick leave (N=42)	p-value
MDASI Symptom Interference	Mean	2.82	2.68	1.46	17.25	3.73	< 0.001
	SD	2.32	1.95	1.84		2.41	
MDASI Symptom Severity	Mean	2.11	2.27	1.50	5.57	2.37	0.062
	SD	1.58	1.50	1.33		1.69	
SF-8 Mental Component Summary (MCS)	Mean	45.52	44.56	50.03	13.98	43.45	< 0.001
	SD	7.52	5.88	5.27		8.52	
SF-8 Physical Component Summary (PCS)	Mean	42.88	43.93	46.54	10.62	40.02	0.005
	SD	8.55	9.11	6.18		8.58	
QLI Health/Functioning Subscale	Mean	17.59	17.67	19.42	8.10	16.45	0.017
	SD	4.02	4.73	3.81		3.25	
QLI Family Subscale	Mean	21.74	22.03	22.65	3.79	21.01	0.150
	SD	4.18	3.40	5.37		3.76	
	N	93	26	25		42	
Quality of Life Index (QLI) Total	Mean	18.52	18.58	19.60	3.31	17.85	0.191
	SD	3.36	3.97	3.73		2.51	
QLI Psychological/Spiritual Subscale	Mean	17.64	17.99	18.14	1.17	17.11	0.557
	SD	3.99	5.06	3.93		3.18	
	N	93	27	25		41	
QLI Social/Economic Subscale	Mean	19.06	19.09	19.25	0.13	18.94	0.937
	SD	3.15	3.16	3.89		2.71	
	N	93	26	25		42	

The Kruskal–Wallis H statistics were obtained through nonparametric testing to compare differences across groups.

MDASI-S, symptom severity scale of the M.D. Anderson Symptom Inventory; MDASI-I, symptom interference scale of the M.D. Anderson Symptom Inventory; PCS, Physical Component Summary of the SF-8; MCS, Mental Component Summary of the SF-8; QLI, overall Quality of Life Index score; QLI-HF, Health and Functioning subscale; QLI-SOC, Social and Economic subscale; QLI-PS, Psychological/Spiritual subscale; QLI-FAM, Family subscale.

Predictors of return-to-work status

A multinomial logistic regression analysis was conducted, incorporating work category (physical vs. mental) and the health-related quality of life (HR-QOL) measures that had shown significant associations with return-to-work (RTW) status in prior analyses as independent variables. Results indicated that work category was the only predictor exerting a statistically significant influence on RTW status **(Table 4).** The overall model demonstrated good fit, confirmed by a significant chi-square test ($\chi^2 = 34.60$, df = 10, $p < 0.001$), with pseudo-R^2 values of 0.31 (Cox & Snell), 0.36 (Nagelkerke), and 0.18 (McFadden). Using "working as usual" as the reference outcome category, individuals whose jobs involved primarily physical labor had substantially higher odds of adverse RTW outcomes compared to those in primarily mental/intellectual roles: they were 4.98 times more likely (95% CI: 1.29–19.15) to be working reduced hours or duties and 7.07 times more likely (95% CI: 1.87–26.79) to be on sick leave.

Table 4. Independent variables significantly associated with return-to-work status in multinomial logistic regression analysis.

Independent Variable	On sick leave						Working less than usual					
	df	B	p-value	OR	95% CI Upper	95% CI Lower	p-value	OR	95% CI Upper	95% CI Lower	df	B
MDASI-I	1	0.17	0.272	1.27	1.95	0.83	0.462	1.18	1.84	0.76	1	0.24
Intercept	1	4.49	0.103	—	—	—	0.289	—	—	—	1	6.78
MCS	1	−0.10	0.093	0.91	1.02	0.81	0.106	0.91	1.02	0.81	1	−0.10
PCS	1	0.01	0.587	0.97	1.08	0.88	0.885	1.01	1.12	0.91	1	−0.03
Work Category	1	1.60	0.004	7.07	26.79	1.87	0.020	4.98	19.15	1.29	1	1.96
QLI-HF	1	−0.06	0.283	0.90	1.09	0.74	0.515	0.94	1.14	0.77	1	−0.11

N = 92. In the multinomial logistic regression analysis, the reference category was "working as usual."

MCS: Mental functional health summary score from the SF-8; PCS: Physical functional health summary score from the SF-8; QLI-HF: Functioning and Health subscale from the Powers and Ferrans Quality of Life Index.995msFast; MDASI-I: Interference scale from the M.D. Anderson Symptom Inventory.

Previous research conducted in Japan has shown that return to work (RTW) following cancer is often delayed. In a cohort study by Endo *et al*., 47.1% of cancer survivors resumed work within six months after their first sick leave, increasing to 62.3% by 12 months [1]. Consistent with these findings, participants in the present study—regardless of whether they held regular or non-regular employment—experienced difficulty returning to their usual work roles shortly after hospital discharge. At the time of the first outpatient follow-up, only 26.6% had resumed their normal work duties, while nearly half (44.7%) remained on sick leave.

Earlier studies have identified irregular employment, female sex, and age 50 years or older as barriers to RTW after cancer treatment [7]. In contrast, these factors were not associated with RTW status in the current study. Additionally, findings from a large European multicountry investigation indicated that self-employed cancer survivors were more likely to continue working during treatment compared with salaried workers [12]. However, no such association was observed in this study, as neither possession of employment insurance—which excludes sole proprietors—nor household income level was related to RTW outcomes.

Health-related quality of life (HR-QOL) has been widely recognized as an important correlate of RTW among cancer survivors. Prior studies have demonstrated that resuming work can improve HR-QOL [25], whereas prolonged sick leave may contribute to declines across multiple HR-QOL domains [6]. Although overall symptoms and subjective well-being did not differ significantly across RTW categories in this study, symptom-related interference and mental functioning showed significant differences not only between

survivors working as usual and those on sick leave, but also between those working as usual and those working reduced hours. Furthermore, physical functioning and overall health and functioning differed significantly between survivors working as usual and those on sick leave. Despite these associations, multinomial logistic regression analysis identified only work category as a significant predictor of RTW status. Thus, while HR-QOL—particularly physical and mental functioning—was related to RTW status, it did not independently predict RTW outcomes. Instead, engagement in physically demanding work emerged as the decisive factor influencing RTW.

Cancer survivors employed in physically demanding jobs were nearly five times more likely to be working less than usual or to remain on sick leave compared with those engaged in mentally oriented work. The relationship between job type and RTW has been documented previously. For example, Handschel *et al*. reported that blue-collar workers returned to work less frequently and after longer delays than white-collar workers [26]. Similarly, Takahashi *et al*. found that the most common reason for job resignation after returning to work following a cancer diagnosis was an inability to meet the physical demands of the job [3]. Because changing occupational categories is often unrealistic for cancer survivors, nurses may play an important role in supporting RTW by advising patients on strategies to modify work tasks or reduce physical strain.

A gradual approach to RTW may be particularly beneficial, beginning with reduced hours or lighter duties before attempting a full return. Evidence suggests that workplace accommodations, such as shorter working hours or reduced workload, can yield health benefits for cancer survivors [27]. In the present study, RTW status was more strongly linked to symptom-related interference, physical functioning, mental functioning, and health and functioning than to sociodemographic or disease- and treatment-related characteristics. Notably, symptom-related interference and mental functioning were significantly associated with the RTW category of working less than usual. These findings suggest that RTW support should be individualized, with careful consideration of each survivor's functional capacity, symptom burden, and mental health, rather than relying solely on demographic or clinical indicators.

In Japan, cancer treatment is predominantly delivered in general or specialized cancer hospitals, where survivors increasingly have access to employment-related counseling and social insurance guidance provided by nationally certified labor and social security attorneys. Comprehensive assessment of HR-QOL—particularly symptom-related interference and mental functioning—may enhance collaboration between nurses and other professionals, including pharmacists, dietitians, and labor specialists, thereby improving the coordination and effectiveness of RTW support. Moreover, specialist nursing interventions, such as wound, ostomy, continence, and lymphedema care, may alleviate symptom-related interference; however, access to such specialized services remains largely limited to large hospitals in Japan.

Overall, this study contributes to the understanding of employment challenges faced by cancer survivors by identifying work category as a central determinant of RTW. Survivors engaged in physically demanding occupations were disproportionately affected by the consequences of cancer diagnosis and treatment. Given the importance of work category, multidisciplinary collaboration involving physicians, nurses, and physical and occupational therapists may be essential in preparing survivors for RTW. Open communication among survivors, healthcare providers, and employers to develop tailored workplace reintegration strategies could further facilitate successful RTW. Employer-focused guidance, such as that issued by the Japanese Ministry of Health, Labour and Welfare [28], which recommends adjustments like assigning less physically demanding tasks, may also be effective. As emphasized by Endo *et al.*, strengthening workplace RTW support systems is crucial for cancer survivors [1]. Ultimately, enabling survivors to return to work while maintaining favorable physical and mental health requires multidimensional assessment of HR-QOL, with particular attention to symptom-related interference and mental functioning. The detailed insights provided by the three HR-QOL instruments used in this study underscore the value of such comprehensive evaluation.

Research limitations

This study employed convenience sampling at large cancer centers in Japan, which may limit the transferability of the results to other groups, such as individuals who received cancer care at smaller community or rural hospitals. The relatively small sample size further restricts the extent to which the findings can be generalized. Moreover, participants varied widely in terms of sociodemographic

characteristics, cancer types, disease stages, and treatment modalities. To strengthen the robustness and applicability of future findings, studies involving larger samples with more uniform characteristics are warranted.

Conclusion

This investigation assessed return-to-work (RTW) status and health-related quality of life (HR-QOL) among cancer survivors at their initial outpatient visit following hospital discharge. The results demonstrated that RTW status was linked to several factors, including occupational type, symptom-related interference, physical functioning, mental functioning, and overall health and functioning. Among these, job type emerged as the most influential determinant of RTW outcomes, while symptom-related interference and mental functioning were particularly associated with partial RTW, characterized by working fewer hours or reduced capacity.

These findings highlight the importance of accounting for occupational demands when supporting cancer survivors' reintegration into employment. Support strategies that prioritize functional health—especially physical and psychological capacity—rather than sociodemographic characteristics alone may be more effective in facilitating successful and sustainable return to work among cancer survivors.

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