



# Work Transitions in Breast Cancer Survivors and Effects on Quality of Life

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## Abstract

**Purpose** Work transitions among breast cancer survivors remain an underexplored area. We aimed to examine prevalence and determinants of changes in work status, and the effect of these changes on quality of life of breast cancer survivors. **Methods** A cross-sectional study of 410 female breast cancer survivors randomly drawn from a larger study sample pool ( $n = 2644$ ), members of “Leumit” healthcare fund, who were diagnosed with primary nonmetastatic invasive breast cancer in the years 2002–2012. The study questionnaire included questions on work characteristics and health-related quality-of-life and was completed by all women contacted. Work transition was defined as a downgrade (from full-time to part-time), termination, or retirement, and was contrasted to no change in work status (retention of full-time or part-time). Work transition was assessed at two intervals: between breast cancer diagnosis and treatment, and between breast cancer diagnosis and time of the survey. **Results** A total of 206 breast cancer survivors (50%) were employed prior to their diagnosis, of whom 12% stopped working, and 79% downgraded to part-time during treatment. At the time of survey (mean  $8 \pm 3$  years post-diagnosis), 33% of those employed prior to their diagnosis stopped working or retired, 48% downgraded to part-time, and 19% had no change in their work situation. Work transition between diagnosis and time of the survey was significantly associated with poorer quality-of-life. In multivariable analyses, work transition between diagnosis and time of the survey was positively associated with being immigrant compared to native-born Israeli (odds ratio (OR) 4.65; 95% confidence interval (CI) 1.91–11.37;  $P = .001$ ), and inversely with education level of college or over compared to high school or less (OR 0.27; 95% CI 0.09–0.86;  $P = .026$ ). **Conclusions** Breast cancer survivors with characteristics pointing at underprivileged social circumstances more often experienced changes in work status after surviving breast cancer, irrespective of diagnosis, comorbidity or treatment. Breast cancer patients with immigrant status and/or lower educational attainment need more support to be able to keep their job.

**Keywords** Breast cancer · Work · Employment · Survivorship · Quality of life

## Abbreviations

BCS	Breast cancer survivors
CI	Confidence interval
Dx	Diagnosis
INCR	Israel National Cancer Registry
LHS	Leumit Health Services

OR	Odds ratio
$P$	$P$ value
QOL	Quality-of-life
SD	Standard deviation
SER	Standardized employment ratio
SF-36	36-Item short-form health survey
WT	Work transition
$\chi^2$	Chi square

**Disclaimer** The results, conclusions, view and opinions contained herein are those of the authors and not to be construed as the official policy of Israel’s Ministry of Health, or of Leumit Health Organization.

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## Introduction

Early detection and advancements in treatment have resulted in a dramatic increase in the lifespan of breast cancer survivors (BCS) [1]. Cancer survivorship is a blessing acknowledged by a bevy of BCS [2]. However, for some, it is a mixed blessing due to a plethora of ongoing physical and emotional

challenges related to breast cancer or its treatment these BCS may experience in their new normal reality [2, 3], and which may adversely impact everyday functioning, including work.

Returning to and maintaining employment after treatment may be important, not only from a societal perspective but also for the rehabilitation of BCS [1, 4], many of whom view returning to work as a milestone, regain of a sense of normalcy after a protracted struggle with illness [5]. Work also provides social connection and financial support [6], but more importantly, it may assist with identity construction and personal satisfaction [7], and may profoundly impact a survivor's overall well-being [3], since being a productive individual who can perform social and occupational roles to the fullest can be very meaningful to one's health [2, 8].

The work experience of BCS, however, remains an underexplored area and is still insufficiently addressed in the continuum of cancer care [3, 9]. Further research in this realm is vital for several reasons. First, improvements in early detection, due to a national screening policy targeted to working-age women, coupled with the evident global increase of female participation in the labor force, and the constant increase in retirement age, may be translated to a growing number of BCS of working-age and with promising prognosis [5, 10, 11]. At the society level, the financial burden of cancer is projected to increase by the growing needs, absenteeism and the lost productivity of BCS [10, 12]. Second, despite favorable rates of return to work after breast cancer have been reported in the literature [1, 13–15], the issue of job scope change after returning to work [14, 16, 17], which may indicate a deterioration in functional capacity [9, 17], is frequently overlooked. Third, most studies have investigated work status at two points in time: before diagnosis and after treatment completion, usually within 3 years after diagnosis [4, 9, 11, 17, 18]. Few have focused on the long-term experience of BCS as some may quit working at a later stage of survivorship [12, 19], limiting the understanding of the natural history of labor force participation. It is precisely this chapter in the life of BCS when treatment after-effects surface [2], prompting BCS to reevaluate their life-work trade-off [2, 32]. Fourth, extant literature suggests that sociodemographic characteristics, health status, cancer stage and treatment, and work environment may influence the likelihood of returning to work; however, evidence is heterogeneous and not entirely comparable [10, 13, 15, 16], due in part to different settings (private health insurance vs. national health services), and length of follow-up.

Currently, most research is limited to a number of countries, including the UK and Germany, whereas little is known regarding the work-related outcomes of BCS in Israel, a country with a national health service and equal treatment opportunities for all [20]. Notwithstanding, Israel has evidenced a steep increase in breast cancer incidence rates over the past 20 years [21], has enacted legislation,

both to protect cancer survivors from employers' discriminatory actions and to financially support those with physical impairment [22], yet it has not invested efforts to understand the etiology and impact of work outcomes among BCS, so that vocational rehabilitation strategies, aimed at facilitating work reintegration or retention among patients with high risk of workforce dropout, can be undertaken. Given the limited research from Israel, the current study intended to investigate (1) which changes in work status take place during the survivorship trajectory, (2) prevalence of work changes at two intervals: between breast cancer diagnosis and treatment, and between breast cancer diagnosis and time of survey, and (3) potential determinants of work changes between breast cancer diagnosis and time of survey, and the effect of these changes on earnings and quality of life of BCS.

## Methods

### Instruments

A cross-sectional study aimed to explore work transitions that Israeli BCS experience 3–14 years postdiagnosis. This is part of a larger longitudinal case-cohort study estimating long-term treatment health-related adverse outcomes among BCS. The study utilized automated data from Leumit Health Services (LHS), a nonprofit Israeli healthcare fund covering around 10% of the total population. Based on the National Health Insurance Law (1995), all Israeli citizens are insured by one of four healthcare funds, at their discretion. LHS electronic databases capture detailed information on medical encounters, pharmacy claims, diagnoses, and procedures. Linkage to the Israel National Cancer Registry (INCR) provided ascertainment of breast cancer cases and supplementary information on cancer characterization and treatment. Patient personal characteristics that could not be assessed directly or accurately from administrative databases were attained through telephone questionnaires in 2016. These data sources have been described in detail and validated in a previous report [23].

The study protocol was reviewed and approved by the Institutional Review Boards of LHS and the University of Haifa. Participants were fully informed of the study objectives and procedures, and oral informed consent was obtained from each.

### Participants

Subjects were female members of LHS, at least 1-year BCS, who were treated for early-stage or regionally advanced invasive breast cancer between January 1, 2002, and December 31, 2012. Patients were considered ineligible if they (i) had in-situ or metastatic breast cancer, (ii) had a previous history

of any type of cancer, or (iii) did not survive or disenrolled from LHS during the first year after diagnosis. 5142 female patients with a diagnosis of breast cancer were initially identified from LHS administrative databases. By linkage with the Israel National Cancer Registry (INCR), and a careful review of medical records for case ascertainment, 5085 patients were confirmed to have a true diagnosis of breast cancer, of whom 2644 matched the inclusion criteria. For means of time and cost efficiency, a 20% random sample ( $n = 529$ ) of eligible candidates for the administration of a constructed questionnaire was selected by invoking the SAS SURVEYSELECT procedure and employing the simple random sampling method. 119 subjects were not contacted due to death, leaving a total 410 women who were contacted, and all completed the survey (100% response rate of the living survivors).

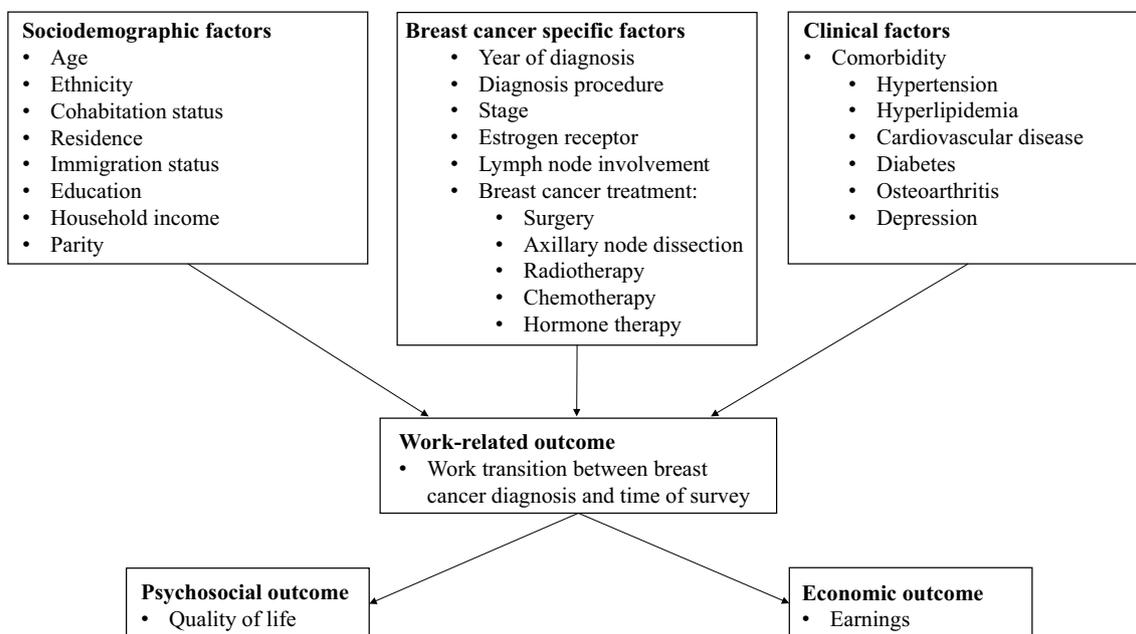
## Procedures

Questionnaires were used to obtain information on work history and related outcomes. Topics included: (1) employment status (full-time, part-time, not working/looking after family or home, or retiree), that was assessed at three points in time: prior to breast cancer diagnosis, during treatment, and at the time of the survey; (2) effect of diagnosis and treatment on earnings (increased, decreased, remained the same); and (3) quality-of-life (QOL) self-assessment using the Hebrew version of the Medical Outcomes Study 36 Item Short Form Survey (SF-36). This is a widely used instrument that evaluates physical and mental health across eight dimensions,

using a 4-week recall period. Each subscale is standardized on a scale from 0 to 100, with lower scores indicating less favorable QOL [24].

The main work outcomes were first, prevalence of work transition (WT) at two intervals: between breast cancer diagnosis and treatment, and between breast cancer diagnosis and time of the survey (WT:Dx-Survey). WT was defined as a downgrade (transition from full-time to part-time), termination (stop working full-time or part-time), or retirement, and was contrasted to no change in work status (retention of a full-time or part-time job). Women could have attained full retirement age irrespective of cancer treatment or other factors, thus grouping retirement with other work shifts could be inadequate. However, because we lacked information on age and reasons for retirement, we speculated that cancer treatment could be a catalyst [3] to early and involuntary retirement in some women.

The second outcome was the identification of determinants of WT:Dx-Survey, and the effect of WT:Dx-Survey on earnings and quality of life of BCS. Figure 1 depicts a framework model, including a range of independent sociodemographic, disease-specific and clinical factors that have guided assessment of this outcome. These factors, excluding immigration status and breast cancer diagnosis procedure, have been established as important determinants of return to work in the relevant literature [14, 15, 18, 25]; however, their contribution in relation to WT has been scantily studied. As to immigration status, we presumed that racial disparities, such as religion, upbringing, education, and language barriers might differentially influence WT among immigrants



**Fig. 1** Model of independent factors and outcome criteria related to work transition in breast cancer survivors

and natives. Breast cancer diagnosis procedure was hypothesized to indirectly affect WT based on the observations that disease with aggressive features is more often detected by clinical breast examination than by self-detection [26], and practice of the latter well correlates with tertiary education [27] and younger age [28]. Demographics (age at the time of the survey, cohabitation status, ethnicity, birthplace, education, parity) were self-reported. Data on breast cancer characterization were extracted from the INCR, and included: breast cancer diagnosis date, age at diagnosis, clinical stage at diagnosis, type of surgery, and axillary lymph node dissection. Supplementary information on the region of residence, mean household income (derived from census data based on subject's residence), comorbid conditions at the time of diagnosis, receipt of adjuvant treatment, estrogen receptor status, and lymph node involvement were abstracted from LHS registries.

Assessment of the work-related outcomes was restricted to BCS who were in paid employment at the time of diagnosis.

## Data Analysis

Differences between the sample and the total cohort were compared using Pearson's  $\chi^2$  test for categorical variables and Mann–Whitney test or *t* test for continuous variables, where appropriate. Multinomial logistic regression models were fitted to examine the effect of potential predictors of WT:Dx-Survey, with patients who did not experience a change in work status set as the reference. Variables permitted to enter the regression model were required to precede the time of diagnosis or to occur during breast cancer treatment. Analyses were performed utilizing a stepwise elimination method with  $P < .05$  for entry and retention in at least one of the comparison groups. Age at breast cancer diagnosis was forced into all models. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each independent covariate.

With the aim of comparing the health-related QOL among WT:Dx-Survey subgroups, SF-36 mean scores were calculated, and differences were tested using generalized linear models adjusted for age at the time of survey and time elapsed since breast cancer diagnosis, with no change in work status regarded as the reference.

We compared employment at the time of survey to normative data in the current population survey of the Israeli Census Bureau, 2016 [29]. Standardized employment ratios (SERs) were taken as the ratio of the observed number of employed BCS (full-time and part-time) to the expected number, which was obtained by assuming that these BCS experienced the same employment rates as the corresponding general female population. The number of

employed women observed for each age stratum was multiplied by the employment rate for the Israeli female population. The corresponding products were summed over all ages to yield the total number of expected employees. Confidence intervals of SERs were computed assuming a Poisson distribution for the observed employment.

Statistical significance was defined as a two-tailed  $P < .05$ . All data were analyzed using the SAS, version 9.4 (SAS Institute Inc, Cary, NC) statistical software package.

## Results

### Sample Characteristics

410 survivors were randomly sampled and enrolled in this survey. In general, the sample participants had similar characteristics to the entire cohort, except for the year of diagnosis and type of surgery (Table 1). The sample mean age at diagnosis and at the time of the survey was 56.9 (SD, 12.6 years), and 65.1 (SD, 12.6 years), respectively, and the mean time elapsed since diagnosis was 8.3 (SD, 3.0 years). Overall, sample participants were predominantly Jewish (92.9%), married (67.3%), immigrants (54.1%), with an education level of high school or less (56.3%), and all completed treatment (not including hormonal therapy) at least 2 years prior to the survey.

Compared to Israel born BCS, immigrants had less income but more comorbidity, were less educated, and resided more in the peripheral and less privileged southern district (Online Appendix Table 1). In total, 206 (50.2%) women were working at diagnosis, 182 (44.4%) during treatment, and 144 (35.1%) at the time of the survey.

### Employment Status Compared to the General Population

Compared to age- and gender-adjusted national averages in 2016, the SER of BCS was 0.86; however, the confidence interval included unity (95% CI 0.72–1.01;  $P = .067$ ). After stratification by type of work at time of survey, and comparison to the general population of women aged 25–54 years (prime working age), full-time prevalence was significantly lower in our study (Crude ratio, 0.58 (95% CI 0.38–0.88;  $P = .009$ ), whereas part-time prevalence was markedly higher than the expected norms (Crude ratio, 1.88; 95% CI 1.40–2.54;  $P < .001$ ).

**Table 1** Characteristics of the total cohort and the 410 sample of breast cancer survivors alive at the time of the survey

	Total cohort (n = 2644) No. (%) <sup>a</sup>	Sample (n = 410) No. (%) <sup>a</sup>	Sig.
Baseline (time of breast cancer D <sub>x</sub> )			
Demographics			
Ethnicity			
Jews	2413 (91.3)	381 (92.9)	.261
Arabs	231 (8.7)	29 (7.1)	
Cohabitation status <sup>b</sup>			
Married/living with a spouse	1838 (69.5)	276 (67.3)	.370
Unmarried	806 (30.5)	134 (32.7)	
District of residence			
Northern	609 (23.0)	80 (19.5)	.393
Central	881 (33.3)	139 (33.9)	
Southern	790 (29.9)	127 (31.0)	
Jerusalem	364 (13.8)	64 (15.6)	
Immigration status			
Non-Israel born	1504 (56.9)	222 (54.1)	.298
Israel born	1140 (43.1)	188 (45.9)	
Household income (median = 7387 NIS)			
< Median	1347 (51.0)	212 (51.7)	.774
≥ Median	1297 (49.1)	198 (48.3)	
Breast cancer characterization			
Breast cancer D <sub>x</sub> year			
2002–2005	882 (33.4)	107 (26.1)	.012
2006–2009	940 (35.6)	157 (38.3)	
2010–2012	822 (31.1)	146 (35.6)	
Age distribution at breast cancer D <sub>x</sub> , years			
≤ 39	217 (8.2)	40 (9.8)	.366
40–49	522 (19.7)	84 (20.5)	
50–61	713 (27.0)	119 (29.0)	
≥ 62 years	1192 (45.1)	167 (40.7)	
Stage (SEER)			
Localized	1547 (58.5)	242 (59.0)	.844
Regional	1097 (41.5)	168 (41.0)	
Laterality			
Right	1290 (48.8)	200 (48.8)	.941
Left	1332 (50.4)	206 (50.2)	
Bilateral	22 (1.0)	4 (1.0)	
Lymph node involvement			
Yes	1072 (40.5)	167 (40.7)	.943
No	1572 (59.5)	243 (59.3)	
Estrogen receptor			
Positive	2088 (79.0)	328 (80.0)	.861
Negative	545 (20.6)	80 (19.5)	
Not examined	11 (0.4)	2 (0.5)	
Comorbidity at breast cancer D <sub>x</sub>			
Hypertension	1040 (39.3)	152 (37.1)	.383
Hyperlipidemia	973 (36.8)	157 (38.3)	.560
Cardiovascular disease	402 (15.2)	62 (15.1)	.966
Osteoarthritis	488 (18.5)	87 (21.2)	.183
Diabetes	398 (15.1)	54 (13.2)	.318
Depression	160 (6.1)	26 (6.3)	.819

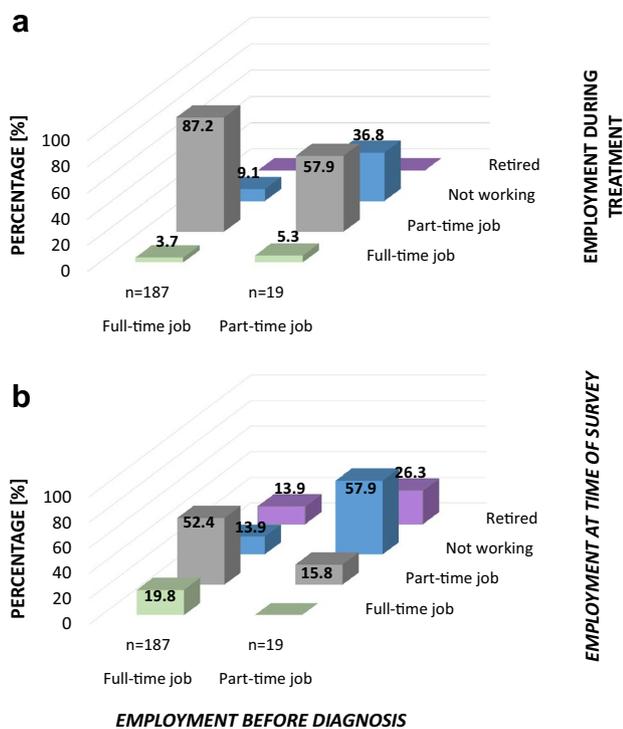
**Table 1** (continued)

	Total cohort (n = 2644) No. (%) <sup>a</sup>	Sample (n = 410) No. (%) <sup>a</sup>	Sig.
During breast cancer treatment			
Surgery			
Breast conserving	1894 (71.6)	310 (75.6)	.010
Mastectomy	628 (23.8)	94 (22.9)	
No surgery	122 (4.6)	6 (1.5)	
Axillary lymph node dissection			
Radiotherapy	1507 (67.5)	279 (68.0)	.841
Chemotherapy	2032 (76.9)	321 (78.3)	.519
Hormone therapy	1380 (52.2)	222 (54.1)	.461
	2084 (78.8)	329 (80.2)	.510

SD standard deviation, NIS new Israeli shekel, D<sub>x</sub> diagnosis, SEER Surveillance, Epidemiology, and End Results

<sup>a</sup>Data are presented as no. (%) unless otherwise noted; percentages may not sum to 100 due to rounding

<sup>b</sup>Unmarried category comprised of all women not married: divorced, separated, widowed, or single



**Fig. 2** Dynamics of transition in employment status between the time of breast cancer diagnosis and: **a** treatment; **b** time of the survey

**Prevalence of Work Transitions**

Of 206 women employed at diagnosis, 18 (8.7%) had no change in their work status during treatment, 163 (79.1%) downgraded, 24 (11.7%) stopped working and none retired. Notably, one woman (0.5%) had an upgrade in her work situation (Fig. 2a). By the time of the survey, 40 (19.4%) women of those employed at baseline sustained full-time

or part-time jobs; 98 (47.6%) downgraded from full-time to part-time employment, 37 (18.0%) stopped working, and 31 (15.0%) retired (Fig. 2b).

**Determinants of WT:Dx-Survey**

Relative to no change in work status, change in employment status tended to be associated with older age, being an immigrant, education of high school or less, and comorbid conditions (Table 2). In adjusted models stratified by the WT subgroups, immigration status continued to be significantly associated with the likelihood of transition in all WT subgroups, whereas education of high school or less and older age were retained as independent predictors of work termination and retirement, correspondingly (Table 3). The results were largely sustained after controlling for time elapsed since breast cancer diagnosis in a separate model without the year of breast cancer diagnosis to avoid collinearity, and after stratification by the time elapsed since breast cancer diagnosis (categorized as < 5, 5–10 and > 10 years) (Online Appendix Tables 2 and 3).

To explore whether the relationship between explanatory variables, particularly age at diagnosis, and WT varied for women who reached the retirement age and those who were at working age at the time of the survey, we repeated analyses after stratifying by the official retirement age for women in Israel (62 years). We conjectured that nearing the retirement age at diagnosis could influence work preferences and decisions. Table 4 lists the stratification results by age of retirement. Two women under 62 years went on early retirement and were excluded from further analyses. The multi-variable results for women < 62 years were appreciably comparable to those observed and outlined in Table 3, whereas for women 62+ years, previous associations were largely corroborated in the univariable analysis, but did not reach

**Table 2** Characteristics of BCS in paid employment at the time of diagnosis, stratified by the change in employment status between breast cancer diagnosis and time of the survey

	No change (n=40) No. (%) <sup>a</sup>	Change (n= 166) No. (%) <sup>a</sup>
Baseline (time of breast cancer D <sub>x</sub> )		
Demographics		
Ethnicity		
Jews	39 (97.5)	164 (98.8)
Arabs	1 (2.5)	2 (1.2)
Cohabitation status <sup>b</sup>		
Married/living with a spouse	30 (75.0)	130 (78.3)
Unmarried	10 (25.0)	36 (21.7)
District of residence		
Northern	5 (12.5)	31 (18.7)
Central	22 (55.0)	51 (30.7)
Southern	7 (17.5)	64 (38.6)
Jerusalem	6 (15.0)	20 (12.0)
Parity (at least one child)	36 (90.0)	152 (91.6)
Immigration status		
Non-Israel born	7 (17.5)	89 (53.6)
Israel born	33 (82.5)	77 (46.4)
Education, mean (SD), years	15.8 (1.6)	14.0 (2.9)
Education level		
High school or less ( $\leq 12$ years)	4 (10.0)	60 (36.1)
College or over ( $> 12$ years)	36 (90.0)	106 (63.9)
Household income (median = 7387 NIS)		
< Median	13 (32.5)	83 (50.0%)
$\geq$ Median	27 (67.5)	83 (50.0%)
Breast cancer characterization		
Breast cancer D <sub>x</sub> year		
2002–2005	10 (25.0)	50 (30.1)
2006–2009	16 (40.0)	56 (33.7)
2010–2012	14 (35.0)	60 (36.1)
Time elapsed since breast cancer D <sub>x</sub> , years		
< 5	8 (20.0)	25 (15.1)
5–10	20 (50.0)	82 (49.4)
> 10	12 (30.0)	59 (35.5)
Age at breast cancer D <sub>x</sub> , mean (SD), years	46.4 (6.9)	50.8 (8.5)
Age distribution at breast cancer D <sub>x</sub> , years		
$\leq 39$	6 (15.0)	23 (13.9)
40–49	20 (50.0)	48 (28.9)
50–61	13 (32.5)	71 (42.8)
$\geq 62$	1 (2.5)	24 (14.5)
Breast cancer D <sub>x</sub> procedure		
Breast self-detection	23 (57.5)	71 (42.8)
Regular mammography	12 (30.0)	82 (49.4)
Clinical breast exam by a doctor	5 (12.5)	13 (7.8)
Stage (SEER)		
Localized	23 (57.5)	87 (52.4)
Regional	17 (42.5)	79 (47.6)
Laterality		
Right	23 (57.5)	79 (47.6)
Left	16 (40.0)	84 (50.6)
Bilateral	1 (2.5)	3 (1.8)

**Table 2** (continued)

	No change (n=40) No. (%) <sup>a</sup>	Change (n= 166) No. (%) <sup>a</sup>
Lymph node involvement		
Yes	15 (37.5)	64 (38.6)
No	25 (62.5)	102 (61.4)
Estrogen receptor		
Positive	37 (92.5)	134 (80.7)
Negative	3 (7.5)	31 (18.7)
Not examined	0 (0.0)	1 (0.6)
Comorbidity		
Hypertension	1 (2.5)	38 (22.9)
Hyperlipidemia	7 (17.5)	55 (33.1)
Cardiovascular disease	2 (5.0)	9 (5.4)
Osteoarthritis	3 (7.5)	17 (10.2)
Diabetes	1 (2.5)	9 (5.4)
Depression	1 (2.5)	13 (7.8)
During breast cancer treatment		
Surgery		
Breast-conserving	32 (80.0)	135 (81.3)
Mastectomy	8 (20.0)	30 (18.1)
No surgery	0 (0.0)	1 (0.6)
Axillary lymph node dissection	12 (30.0)	51 (30.7)
Radiotherapy	34 (85.0)	146 (88.0)
Chemotherapy	25 (62.5)	105 (63.3)
Hormone therapy	37 (92.5)	134 (80.7)
At time of the survey		
Age at time of the survey, mean (SD), years	54.5 (7.5)	59.3 (8.6)
Age distribution at time of the survey, years		
≤ 39	0 (0.0)	2 (1.2)
40–49	13 (32.5)	21 (12.7)
50–61	17 (42.5)	81 (48.8)
≥ 62	10 (25.0)	62 (37.3)
Elapsed time since D <sub>x</sub> , mean (SD), years	8.2 (3.1)	8.5 (3.1)

SD standard deviation, NIS new Israeli shekel, D<sub>x</sub> diagnosis, SEER Surveillance, Epidemiology, and End Results, BCS Breast Cancer Survivors

<sup>a</sup>Data are presented as no. (%) unless otherwise noted; percentages may not sum to 100 due to rounding

<sup>b</sup>Unmarried category comprised of all women not married: divorced, separated, widowed, or single

statistical significance in adjusted models (except for age), probably being hampered by the small sample size. In addition, a new association emerged among women < 62 years, with lymph node involvement increasing the likelihood of work termination.

Multiple sensitivity analyses were undertaken to test the robustness of WT results, including (i) reanalysis without the retirement subgroup, (ii) restriction to women who were working full time prior to diagnosis, and (iii) accumulation of subgroups that exhibited transition into a distinct group, and comparison with women whose employment status was sustained using binary logistic regression. The significance level of all variables in relation to WT persisted in the model

without the retirement group and the model that combined the subgroups. Restriction to full-time at diagnosis exhibited slightly different results; education of high school or less was now linked with the downgrade transition as well, whereas the strength of association between work termination and immigration status did not reach the previous statistical significance (Table 5).

### Effect of WT:Dx-Survey on QOL and Earnings

Work transition presented substantial QOL challenges for BCS. Compared to women whose employment status was

**Table 3** Factors associated with work transitions between breast cancer diagnosis and time of the survey

Explanatory factors	Univariable analysis <sup>a</sup>				Multivariable analysis <sup>b</sup>			
	Downgrade (versus no change)	Termination (versus no change)	Retirement (versus no change)	Sig.	Downgrade (versus no change)	Termination (versus no change)	Retirement (versus no change)	Sig.
	OR (95% CI)	OR (95% CI)	OR (95% CI)	Sig.	OR (95% CI)	OR (95% CI)	OR (95% CI)	Sig.
Age at diagnosis	1.02 (0.97–1.08)	1.11 (1.04–1.19)	1.35 (1.22–1.49)	<.001	1.00 (0.95–1.06)	1.05 (0.98–1.13)	1.33 (1.19–1.50)	<.001
Immigration status								
Country birth Israel	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Country birth not Israel	4.17 (1.68–10.32)	4.97 (1.76–14.07)	16.15 (5.00–52.15)	<.001	4.05 (1.63–10.12)	4.15 (1.38–12.44)	11.38 (3.03–42.75)	<.001
Education level								
High school or less	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
College or over	0.36 (0.12–1.13)	0.08 (0.02–0.26)	0.12 (0.03–0.41)	<.001	0.39 (0.12–1.28)	0.11 (0.03–0.40)	0.61 (0.13–2.78)	.523

OR odds ratio, CI confidence interval

<sup>a</sup>Number of survivors: no change, n = 40; downgrade, n = 98; termination, n = 37; retirement, n = 31

<sup>b</sup>Adjusted for: ethnicity, cohabitation status, district of residence, income, parity, comorbidity at time of diagnosis (hypertension, hyperlipidemia, cardiovascular disease, diabetes, osteoarthritis, depression), year of breast cancer diagnosis (categorized as 2010–2012, 2006–2009 vs. 2002–2005), stage at breast cancer diagnosis, diagnosis procedure, lymph node involvement, surgery type, axillary node dissection, radiotherapy, chemotherapy, and hormone therapy. To avoid collinearity with hormone therapy, estrogen receptor status was not introduced in all adjusted models

sustained, those who downgraded, stopped working, or retired, scored lower on all QOL measures (Fig. 3).

205 (99.5%) of women who worked prior to their diagnosis, reported a decrease in their earnings attributed to diagnosis and treatment, regardless of their sociodemographic and clinical profile or whether they underwent transitions in employment or not.

### Discussion

The present study demonstrates that workforce participation drops by 11.7% during breast cancer treatment, and by 33.0% on average 8 years post-diagnosis. All in all, full-time work participation was likely to be lower than the national norms, whereas part-time was above the expected standards. This kept in mind, together with the finding that more than half of women working full-time at baseline shifted to part-time, may allude to the difficulty in maintaining a full-time schedule that meets with the cancer pressing needs, or may reflect a reevaluation in women’s perception of life priorities. It is also conceivable but unlikely that baseline full-time or part-time employment was, in the first place, lower or higher than the national standards, respectively. However, we were unable to compare to population data for earlier years as they were lacking.

In our study, 67% of women, who were working when they were diagnosed, were still working on average eight years post-diagnosis. This finding builds on and reinforces a recent report by Bradley and Bednarek who studied employment patterns of 253 long-term BCS and found a return to work rate of 67%, 5–7 years post-diagnosis [19]. Spelten et al. compiled a review of the literature regarding return to work of cancer survivors, and determined a comparable rate of return, approximating 62% (range 30–93%) [30].

### Determinants of WT:Dx-Survey

Increasing age was a prominent factor related to WT, which has been consistently referred to as a strong barrier to return to work and a risk factor for job loss and delayed re-employment due to ill health [4, 10, 16, 18]. Some expect old age to be associated with retirement [18], specifically when breast cancer comes at a late stage in life when an individual is nearing retirement and has already been rethinking the life-work balance, valuing career goals less, and turning more attention to other personal preferences, such as family and enjoyment of life [4, 31]. The stratification by age of retirement in our study further supports this interpretation, inasmuch as the association between increasing age and work termination or retirement was exclusive to women 62+ years at the time of the survey. It is worthy of note that some of the women who worked at baseline and reached the mandatory

**Table 4** Factors associated with work transitions between breast cancer diagnosis and time of the survey, stratified by the retirement age at the time of the survey

Explanatory factors	Univariable analysis <sup>a</sup>						Multivariable analysis <sup>b</sup>					
	Downgrade (versus no change)		Termination (versus no change)		Retirement (versus no change)		Downgrade (versus no change)		Termination (versus no change)		Retirement (versus no change)	
	OR (95% CI)	Sig.	OR (95% CI)	Sig.	OR (95% CI)	Sig.	OR (95% CI)	Sig.	OR (95% CI)	Sig.	OR (95% CI)	Sig.
<b>&lt;62 years</b>												
Age at diagnosis	1.06 (0.99–1.14)	.088	1.05 (0.95–1.15)	.335	–	–	1.05 (0.97–1.13)	.222	1.01 (0.91–1.12)	.894	–	–
Immigration status												
Country birth Israel	1 [Reference]		1 [Reference]				1 [Reference]		1 [Reference]			
Country birth not Israel	4.22 (1.47–12.10)	.007	2.92 (0.77–11.12)	.117	–	–	3.91 (1.35–11.39)	.012	3.65 (0.87–15.28)	.077	–	–
Education level												
High school or less	1 [Reference]		1 [Reference]				1 [Reference]		1 [Reference]			
College or over	0.32 (0.07–1.51)	.151	0.10 (0.02–0.54)	.007	–	–	0.43 (0.09–2.13)	.302	0.08 (0.01–0.49)	.007	–	–
LN involvement												
No	1 [Reference]		1 [Reference]				1 [Reference]		1 [Reference]			
Yes	0.74 (0.32–1.73)	.488	3.66 (1.05–12.79)	.042	–	–	0.90 (0.37–2.21)	.822	5.69 (1.41–22.92)	.014	–	–
<b>≥62 years</b>												
Age at diagnosis	1.11 (0.92–1.35)	.290	1.26 (1.04–1.52)	.021	1.35 (1.11–1.63)	.002	1.11 (0.92–1.35)	.290	1.26 (1.04–1.52)	.021	1.35 (1.11–1.63)	.002
Immigration status												
Country birth Israel	1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		–	–
Country birth not Israel	4.57 (0.72–29.13)	.108	8.00 (1.28–50.04)	.026	12.57 (2.15–73.63)	.005	–	–	–	–	–	–
Education level												
High school or less	1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		–	–
College or over	0.22 (0.03–1.39)	.108	0.07 (0.01–0.48)	.007	0.23 (0.04–1.29)	.096	–	–	–	–	–	–

OR odds ratio, CI confidence interval, LN lymph node

<sup>a</sup>Number of survivors < 62 years: no change, n = 30; downgrade, n = 83; termination, n = 19; retirement, n = 2. Number of survivors 62+ years: no change, n = 10; downgrade, n = 15; termination, n = 18; retirement, n = 29

<sup>b</sup>Adjusted for: ethnicity, cohabitation status, district of residence, income, parity, comorbidity at time of diagnosis (hypertension, hyperlipidemia, cardiovascular disease, diabetes, osteoarthritis, depression), year of breast cancer diagnosis (categorized as 2010–2012, 2006–2009 vs. 2002–2005), stage at breast cancer diagnosis, diagnosis procedure, lymph node involvement, surgery type, axillary node dissection, radiotherapy, chemotherapy, and hormone therapy

**Table 5** Multivariable results of sensitivity analysis of work transitions between breast cancer diagnosis and time of the survey

Explanatory factors	Model 1 <sup>a</sup>			Model 2 <sup>b</sup>			Model 3 <sup>c</sup>					
	Downgrade (versus no change)	Termination (versus no change)	Downgrade (versus no change)	Termination (versus no change)	Downgrade (versus no change)	Termination (versus no change)	Retirement (versus no change)	Change (versus no change)				
	OR (95% CI)	Sig.	OR (95% CI)	Sig.	OR (95% CI)	Sig.	OR (95% CI)	Sig.				
Age at diagnosis	1.00 (0.95–1.06)	.997	1.04 (0.97–1.12)	.234	1.00 (0.95–1.06)	.890	1.07 (0.98–1.13)	.120	1.33 (1.18–1.51)	<.001	1.03 (0.98–1.09)	.238
Immigration status												
Country birth Israel	1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]	
Country birth not Israel	4.01 (1.61–10.01)	.003	4.03 (1.33–12.17)	.014	3.62 (1.44–9.15)	.006	2.56 (0.76–8.56)	.128	7.80 (2.01–30.18)	.003	4.65 (1.91–11.37)	.001
Education level												
High school or less	1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]		1 [Reference]	
College or over	0.40 (0.12–1.32)	.131	0.11 (0.03–0.40)	.001	0.20 (0.04–0.95)	.043	0.06 (0.01–0.34)	.001	0.41 (0.06–2.68)	.354	0.27 (0.09–0.86)	.026

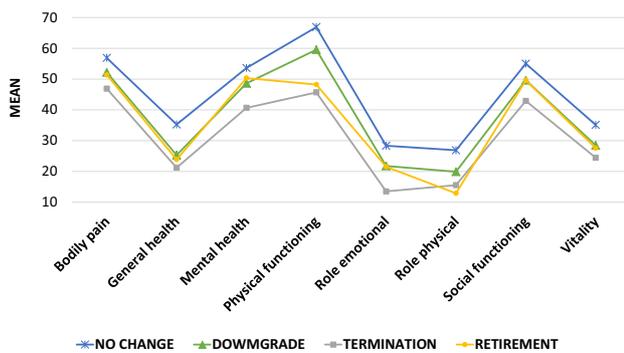
All models were adjusted for: ethnicity, cohabitation status, district of residence, income, parity, comorbidity at time of diagnosis (hypertension, hyperlipidemia, cardiovascular disease, diabetes, osteoarthritis, depression), year of breast cancer diagnosis (categorized as 2010–2012, 2006–2009 vs. 2002–2005), stage at breast cancer diagnosis, diagnosis procedure, lymph node involvement, surgery type, axillary node dissection, radiotherapy, chemotherapy, and hormone therapy

OR odds ratio, CI confidence interval

<sup>a</sup>Model 1: reanalysis without the retirement group (no change, n = 40; downgrade, n = 98; termination, n = 37)

<sup>b</sup>Model 2: restriction to women who were working full time at diagnosis (no change, n = 37; downgrade, n = 98; termination, n = 26; retirement, n = 26)

<sup>c</sup>Model 3: grouping the downgrade, termination and retirement subgroups in one transition group (no change, n = 40; change, n = 166)



**Fig. 3** SF-36 Health-Related Quality of Life mean scores, by work transition between breast cancer diagnosis and time of the survey (adjusted  $P < .05$  for all pairwise comparisons, except for bodily pain, mental health, role emotional and physical, and social functioning in the downgrade subgroup)

full retirement age, did not retire. Some continued to work, possibly to enlarge their retirement savings, while others stopped working. Those who stopped working were mostly immigrants, who usually do not have pension savings in Israel, or were part-time employees before dropping out of the workforce. Working part-time may not bestow retirement benefits, particularly if the work was intermittent and the employee did not reach the seniority required by law. We must underscore the Israeli system of social protection that offers monthly income for elderly residents, regardless of their employment status, which may shed more light on the association between old age and work termination. Knowing they have a financial safety net anyway, may abrogate women's need to remain wage earners and lead them to afford to drop out of the workforce.

In line with other research [10, 15, 16], lower levels of education was predictive of work termination or non-initiation. It has been suggested that lower levels of educational achievement correlate with physically demanding blue-collar type of jobs, such as heavy lifting, which may be tiring for women suffering from arm functional impairment [15]. The finding that lymph node involvement was a significant predictor of work termination may substantiate the link between the lower level of education and work termination and may equally imply an adverse effect on employment attributed to the reduced capacity from axillary treatment that does not abate over time.

The major finding of the current investigation is that immigration status added to the explanation of WT, even after controlling for education (which was significant on its own). The implications of an immigration background not only relate to socio-economic status (as reflected by income and education), but also to other aspects, including the cultural background, alienation, and language barriers, which collectively may limit the job types available to immigrants

to involve predominantly physical demanding tasks with fewer benefits that may ultimately encumber work reintegration [32]. Employment difficulties are typical of many ethnic and racial minorities and should not be restricted to the Israeli BCS immigrant minority. Latina American women with breast cancer, for example, are more likely to experience job loss compared to White American women [33]. Generally, most minority women in western countries tend to be marginalized and disproportionately represented in low-skilled and poorly paying positions [34].

Interestingly, unlike personal features that explained variations in WT, time elapsed since breast cancer diagnosis seems not to be an important driver for changes in work status. The evidence reported here is discordant with the assumption that the chance of a return to work increases if more time passes since diagnosis or end of treatment [30]. Whether longer time periods reflect a trajectory of recovery that has positive effects on work outcomes, or permanent functional impairment that impedes work reintegration remains a question for future research.

### Effect of WT:Dx-Survey on QOL and Earnings

All women with a job at baseline, regardless of being immigrants or having a transition in their work career, were under financial strain attributed to diagnosis and treatment. This may indicate deterioration in work conditions, which is an unnecessary burden for BCS already suffering from medical and existential distresses.

Beyond the economic burden, WT had a profound effect on QOL. In fact, due to the cross-sectional nature of this report, the relationship with QOL may be bidirectional; WT may negatively affect QOL, or conversely, it could be itself driven by impaired self-assessment of QOL. Whatever the direction is and consistent with other reports [8, 16], women who had a transition in employment, whether voluntarily or not, were at increased odds of suffering from inferior physical and mental health.

### Limitations and Strengths

The study findings should be placed in the context of certain methodological limitations. Aside from the drawbacks of a cross-sectional design that does not allow inferences about causality, the random sample in our study cannot ensure an accurate reflection of work transitions for the entire study population. If anything, the complete response rate of women who were sampled independently of work status, compounded with the fact that the sample parallels the key variables and characteristics related to work transitions, including age, immigration status, and lymph node involvement, increase the likelihood that the sample more accurately reflects what exists in the corresponding

population. Moreover, our sample was drawn from one of four healthcare funds in Israel. The results may, therefore, not reflect the experiences of the general population of BCS in Israel. However, the National Health Insurance Law in Israel allows all citizens to be registered with and move between any of these healthcare funds without preliminary conditions, which reduces the potential for a selection bias. Our study could be subject to survival bias, inasmuch survivors could be in better health to work than those who succumbed to the disease. Interpretation of results may also be limited by the shortcomings inherent in the self-report of employment, which may be further hampered by the extended recall period. However, cancer and treatment are life-altering events and most probably women would reliably recall their employment status in relation to them [11, 12]. We also ordered the work questions chronologically, so that women could more easily establish a sequence of events, a method known to aid recall [4]. Finally, residual confounding of unknown determinants of WT, such as psychosocial factors and work characteristics (e.g. workload, accommodations, discrimination), could potentially bias the results.

With these limits in mind, we believe the results of our study make pivotal contributions to the limited information available on the work experience of BCS in Israel and in other countries with similar national health insurance and social systems. The high response rate, the robustness of the findings, and the long interval from diagnosis at which treatment late effects are likely to infringe the capability of working, allow us to integrate the employment snapshots taken in this study into a collage that mirrors the work experience of a broader population of BCS.

## Conclusion

This study has provided insight into the work dynamics along the survivorship trajectory and pinpointed to a potentially vulnerable group of BCS with low educational attainment and immigration background at risk of dropping out of the labor market. New research needs to clarify the type of jobs and whether precarious work is more common in this disadvantaged group. Clinicians and/or employers must be vigilant in noting changes in productivity of BCS and develop preventive interventions tailored to their specific needs. Strategies may include clinical rehabilitation for women who underwent an axillary dissection, supportive environment settings and effective vocational programs that attend to the cultural, linguistic and educational gaps to improve the employability of underprivileged BCS.

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**Author Contributions** RH had full access to all of the data in the study, performed the statistical analysis, interpreted the data, and drafted the manuscript. HH participated in the study concept and design, helped in data acquisition, evaluated the manuscript, and acted as the corresponding author. IM was responsible for data acquisition, participated in the statistical analysis, and helped to evaluate and edit the manuscript. LKB had substantial contribution to the study concept, its formalization and development, interpreted the data, and assisted in the drafting and refinement of the manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis, have read and approved the final manuscript. This work has been done in partial fulfillment of the requirements for a PhD degree of RH (supervised by LKB) in the School of Public health, in the University of Haifa.

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**Data Availability** The datasets generated during and/or analyzed during the current study are not publicly available to preserve the privacy of participants; but are available from the corresponding author on reasonable request.

## Compliance with Ethical Standards

**Conflict of interest** The authors report no conflicts of interest.

**Ethical Approval** All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional review boards of LHS and University of Haifa and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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