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Unemployment following breast cancer diagnosis: A population-based study

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ABSTRACT

Objectives: The population of breast cancer survivors is growing. In Western societies, many of these women are working age, and therefore, potentially desire to return to the work force. We aimed to evaluate the unemployment risk for up to 8 years following a breast cancer diagnosis and identify contributing socio-economic factors.

Methods: This historical prospective study included baseline measurements from the Israeli Central Bureau of Statistics 1995 National Census, with follow-up to 2011. We retrieved data on employment from the Israeli Tax Authority database and cancer status from the National Cancer Registry. A control group without cancer was selected to match the patients. Analyses were controlled for socio-economic factors and the baseline employment status 2 years prior to diagnosis.

Results: We retrieved data for 2341 patients with breast cancer and 6837 age-matched women without cancer. We found an elevated risk of unemployment during the 8 years after breast cancer diagnosis (2-year OR 1.82, 95%CI: 1.59–2.075; 8-year OR 1.26, 95%CI: 1.07–1.47). Age and all examined socio-economic variables were correlated to increased risk of unemployment. The strongest predictor was pre-diagnosis unemployment (2-year OR 18.95, 95%CI: 16.68–21.52; 8-year OR 4.92, 95%CI: 4.07–5.96). Surprisingly, patients with axillary involvement were associated with less risk of unemployment than other patients.

Conclusions: Breast cancer survivorship was associated with long-term risk of unemployment. Older patients and patients with lower socio-economic status were at increased risk of unemployment.

1. Introduction

Breast cancer (BC) is a worldwide public health problem. The incidence of BC has increased steadily from the 1970's in Western countries [1]. In Israel, the incidence of BC is among the highest among Western countries (96.8/100,000 age-adjusted cases) [2].

Although survival rates are improving, the standard BC treatment for non-metastatic patients typically includes various combinations of surgery, radiotherapy, endocrine therapy, and chemotherapy. This multimodal approach produces significant sequelae in survivors, both physical and mental [3]. Survivors may suffer from different symptoms which in turn, have major effects on the employment and work capacity of survivors; fatigue, depression, cognitive impairment, shoulder dysfunction [4–7]. Although the prevalence of these limiting symptoms is decreasing during the years following the completion of cancer treatment, some may last up to 5 or even 10 years post diagnosis [5,8,9]. Moreover, according to the cited literature, while most of the symptoms exist several years, their effects on employment are much more prolonged. For example, a Dutch study discovered adverse employment outcomes up to 10 years after BC with various impact of different treatment modalities on work-related issues [8]. The greatest loss of income was associated with axillary lymph node dissection. Interestingly, adjuvant hormonal therapy had no effect on income or any work-related event (e.g., disability or unemployment benefits). On the other hand, a recent meta-analysis of over 46,000 breast cancer patients showed that only breast surgery and chemotherapy had detrimental effect on employment [10]. Worth mentioning that this meta-analysis discovered that

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survivors in a country without universal health system (such as USA) are motivated and are more likely to return to work since their medical coverage is through the employers.

In recent years, the field of BC survivorship has evolved, and the rise in survivor numbers has attracted attention. Indeed, multiple studies have covered many aspects of work-related outcomes in this growing population. A classic meta-analysis showed that BC survivors had 1.28-fold higher risk of becoming unemployed compared to the general population [11]. However, most previous studies have focused on treatment-related prognostic factors rather than socio-economic variables. Furthermore, a large proportion of studies was performed in Scandinavian countries [12–14], which have a unique combination of several distinctive features, including an extraordinary awareness of women's rights, a generous welfare system, and substantial numbers of women that participate in the work force. Consequently, findings in Scandinavia may not be representative of other Western countries with more heterogeneous populations and economies.

The present study aimed to clarify the associations between unemployment risk, socio-economic factors, and burden of disease at diagnosis. The unemployment risk was measured up to 8 years following a BC diagnosis in this population-based study. We hypothesized that the risk of unemployment in survivors of BC is constantly increasing, compared to a reference population, after controlling for disease extent, demographics, and socio-economic variables.

2. Materials and methods

2.1. Study population

This historical prospective study included baseline measurements acquired from the Israeli Central Bureau of Statistics 1995 census. For this study, we selected a representative sample of the whole population of individuals that completed a comprehensive interview (1,113,420 individuals, which represented 20% of the population in Israel).

2.2. Cancer diagnosis and mortality

Data on cancer incidence was ascertained, based on the Israel National Cancer Registry, updated to 2011. The Israel Cancer Registry was established in 1960, and since 1982, all cancer incidences have been recorded in the Registry by law. The Registry receives data from numerous sources, including pathology reports, discharge summaries, and death certificates. The completeness of the registry was found to be about 95% for solid tumors [15]. The current study included patients diagnosed with BC that were up to age 60 years old at the time of interview (1995).

A control group, sampled from the population without BC that completed the comprehensive interview in the census, was selected to match the patient group at a ratio of 3:1. Each individual in the control group was matched to a single patient with BC, according to a 5-year age group and ethnicity (Jewish vs. non-Jewish). Individuals were stratified according to ethnicity, because the non-Jewish population had a lower socio-economic status and more negative health outcomes than the Jewish population [16]. Individuals diagnosed with any cancer were not included in the matched control group.

Mortality was determined, based on the Israel Population Registry, Central Bureau of Statistics - Cause of Death File. Patients with BC and healthy control participants free of cancer were excluded if they died during the study period.

Patients with BC were staged as follows: carcinoma in-situ, cancer with or without axillary lymph node involvement, and distant metastases.

2.3. Study variables

We assessed variables related to unemployment risk and decreasing income after a BC diagnosis, including age, socio-economic position, BC stage at diagnosis, and status of employment at baseline. Non-specific symptoms that appeared in the year prior to a cancer diagnosis can increase the risk of unemployment. Thus, employment status at baseline was defined as 2 years prior to the BC diagnosis (and in that same year for the matched, cancer-free control participants). Baseline employment was ascertained by linking to the Israeli Tax Authority database. For detailed summary see Table S1.

2.4. Study outcomes

The study outcomes were employment statuses at 2, 4, 6, and 8 years (as dichotomous variables) after the BC diagnosis. Employment was defined as any income reported above $0. Decreased income was assessed only for individuals that were employed at baseline.

Data between the years 1998 and 2011 were available for the current study. To include employment status 2 years prior to diagnosis and up to 8 years after diagnosis (the latest time at which data existed), we included patients diagnosed with BC between 2000 and 2007.

2.5. Statistical analyses

Study population characteristics were compared with the Student's *t*-test for continuous variables and with the χ^2 test for categorical variables. Unadjusted analyses were constructed to predict the risk of unemployment and to evaluate changes in income between two time points. We used multivariable logistic regression to generate odds ratios (OR) and 95% confidence interval (CI) to examine the associations between the independent variables (age, ethnicity, years of education, and residential socioeconomic position) and the study's outcomes (unemployment and decreased income). All analyses are conditional on patients and controls surviving until 8 years beyond diagnosis. In addition, secondary analyses were conducted according to patient staging at diagnosis; i.e., carcinoma in-situ, invasive cancer without axillary lymph node involvement, invasive cancer with axillary lymph node involvement, metastasis, or unknown stage. All statistical tests were two-sided, and p-values <0.05 were considered statistically significant. Statistical analyses were performed with the SPSS program (18th version; Chicago, Illinois).

3. Results

The final study population comprised 2341 patients with BC (females only) and 6837 age-matched women without cancer (Table 1), aged 53.1 ± 9.4 and 53.2 ± 9.5, respectively ($p > 0.05$). Two years prior to the cancer diagnosis, unemployment was observed in 36.5% patients with BC and 40% of controls ($p = 0.002$). In addition, significantly higher levels of socio-economic status and education were observed among patients with BC than among individuals without cancer.

During the first five years following the BC diagnosis, the unemployment rate was significantly elevated in the patient group compared to the cancer-free group (Table 2). However, between 6 and 8 years, the difference was not significant. On the other hand, throughout the study period (8 years of follow-up), the odds ratio (OR) for unemployment remained statistically significant, although

Table 1
Baseline characteristics of patients with/without breast cancer.

	Patients with breast cancer (n = 2341)	Individuals without cancer (n = 6837)	P-value
Age, mean (±SD), years	53.1 ± 9.4	53.2 ± 9.5	NS
Non-Jewish Ethnicity, no. (%)	234 (10%)	571 (8.3%)	0.02
Education, mean (±SD), years	12.39 ± 3.98	11.7 ± 4.11	<0.005
Socio-economic status, mean (±SD)[a]	6.30 ± 1.9	6.19 ± 1.9	0.001
Unemployed 2 years prior to diagnosis, no. (%)[b]	856 (36.5%)	2737 (40%)	0.002
Disease stage Ductal Carcinoma in-situ	273 (12%)		
Axillary Lymph node negative	900 (38%)		
Axillary lymph node involvement	601 (26%)		
Metastatic	17 (1%)		
Unknown	550 (23%)		

NS: not significantly different.
[a] Ordinal variable, based on town or city of residence, according to national classification of 10 clusters by geographical units (1, lowest; 10, highest).
[b] Includes students, soldiers, housewives, and unemployed.

Table 2
Overall unemployment rates of patients with/without breast cancer during follow-up.

Group	Years post-diagnosis						
	2	3	4	5	6	7	8
Patients with breast cancer, %	47.6	47.1	47.9	50.1	49.2	49.5	50.6
Individuals without cancer, %	43	44	45.2	46.2	47.7	47.5	48.9
P-value[a]	<0.001	0.008	0.023	0.003	0.283	0.214	0.346

All data includes students, soldiers, housewives and unemployed.
[a] Significance is based on Pearson or chi-square tests, as appropriate.

it declined from an OR of 1.84 (95%CI 1.61–2.10) at 2 years post-diagnosis to an OR of 1.26 (95%CI 1.05–1.51) at 8 years post-diagnosis (Table 3).

Logistic regression analyses indicated that the following parameters were significantly associated with unemployment at all time points (2, 4, 6, and 8 years after diagnosis): previous unemployment, low socio-economic status, few years of education, and non-Jewish ethnicity. Furthermore, an analysis of disease stage (i.e., carcinoma in-situ, cancer with or without axillary lymph node involvement, or distant metastases) revealed that unemployment after the cancer diagnosis varied during follow-up (Table 4). Non-invasive cancer (carcinoma in-situ) was not associated with unemployment at any time. On the other hand, BC without axillary involvement was significantly associated with unemployment throughout the follow-up period. Interestingly, patients with metastatic and lymph-node-positive cancer displayed an earlier normalization of unemployment risk (at 6 years post-diagnosis). All patients with metastatic BC had the highest OR's of unemployment compared to the lower stages. Yet, the OR's were not significant due to the small number of patients at this group (full description in Table S2).

The effects of all socio-economic variables on unemployment persisted steadily during the 8-year follow-up (socio-economic status, years of education, and Jewish ethnicity).

4. Discussion

The BC survivor population is growing. In Western societies, many women that survive BC are of working age, and therefore, they potentially desire to return to the work force. In the USA and Israel, nearly 60% of women diagnosed with BC are below the age of retirement, and hence, run the risk of a harmful impact on work [17,18]. Studies have shown that working has many beneficial effects on quality of life [19]; therefore, this issue is a valuable focus of research and improvement. On the other hand, BC and its treatments, including chemotherapy, mastectomy, or axillary lymph node dissection, were shown to have detrimental outcomes on a woman's ability to work, due to several potential mechanisms related to emotional, physical, and social statuses [19,20].

Our data partially confirmed the study hypothesis. We found that BC survivors were at increased risk of unemployment for up to 8 years after the BC diagnosis, in adjusted analyses controlled for potential confounders. However, when we compared unemployment rates between the BC survivor and cancer-free groups, we found that significant differences disappeared at 6 years post-diagnosis. This interesting finding was probably due to the fact

Table 3
Multivariate analysis of odds ratios (95% CI) for unemployment during the indicated years after breast cancer diagnosis[a].

Contributing factors	Years post-diagnosis			
	2	4	6	8
No. of individuals with/without cancer, N	2341/6837	2341/6837	1936/5646	1258/3693
Age	1.08 (1.07–1.09)	1.09 (1.09–1.10)	1.12 (1.11–1.13)	1.13 (1.12–1.15)
Jewish Ethnicity	0.41 (0.32–0.52)	0.38 (0.30–0.46)	0.40 (0.29–0.54)	0.29 (0.19–0.44)
Socio-economic status[b]	0.96 (0.95–0.98)	0.96 (0.94–0.97)	0.96 (0.94–0.98)	0.97 (0.95–0.99)
Years of education	0.91 (0.89–0.92)	0.92 (0.90–0.93)	0.93 (0.91–0.95)	0.94 (0.92–0.97)
Unemployed 2 years prior to diagnosis	18.99 (16.68–21.52)	12.67 (11.24–14.28)	9.45 (8.15–10.94)	6.89 (5.75–8.28)
Breast cancer	1.84 (1.61–2.10)	1.49 (1.32–1.70)	1.34 (1.15–1.56)	1.26 (1.05–1.51)

[a] Adjusted for age, ethnicity, education years, residential socio-economic position, status of employment at baseline and breast cancer at diagnosis.
[b] Ordinal variable, based on town or city of residence, according to national classification of 10 clusters by geographical units (1, lowest; 10, highest).

Table 4
Adjusted odds ratios (95% CI) for unemployment following breast cancer diagnosis[a].

	Years of follow up			
	2	4	6	8
No. of patients with breast cancer	2341	2341	1936	1258
Age	1.08 (1.07–1.09)	1.09 (1.09–1.10)	1.09 (1.08–1.09)	1.09 (1.09–1.11)
Jewish Ethnicity	0.39 (0.31–0.51)	0.37 (0.29–0.47)	0.41 (0.32–0.53)	0.43 (0.30–0.60)
Socio-economic status[b]	0.94 (0.90–0.97)	0.92 (0.89–0.95)	0.93 (0.90–0.96)	0.93 (0.89–0.97)
Years of education	0.90 (0.89–0.92)	0.91 (0.89–0.92)	0.95 (0.93–0.96)	0.95 (0.93–0.97)
Unemployed 2 years prior to diagnosis[b]	19.16 (16.92–21.69)	12.77 (11.33–14.39)	6.39 (5.60–7.29)	4.63 (3.94–5.45)
Disease extent on diagnosis				
DCIS	0.98 (0.69–1.39)	0.81 (0.58–1.13)	0.89 (0.64–1.23)	0.99 (0.67–1.47)
LN NEG	1.72 (1.41–2.09)	1.49 (1.24–1.79)	1.42 (1.18–1.71)	1.26 (1.00–1.58)
LN POS	2.23 (1.78–2.79)	1.80 (1.45–2.24)	1.21 (0.97–1.50)	1.12 (0.86–1.48)
MX	5.60 (1.60–19.59)	6.68 (1.88–23.69)	1.51 (0.45–5.04)	4.09 (0.43–39.12)
unknown stage	2.08 (1.64–2.65)	1.52 (1.20–1.92)	1.10 (0.88–1.39)	1.20 (0.91–1.59)

Abbreviations: DCIS: ductal carcinoma in-situ; LN NEG: negative spread to axillary lymph nodes; LN POS: tumor in axillary lymph nodes; MX: metastasis.
[a] Adjusted for age, ethnicity, education years, residential socio-economic position, status of employment at baseline and breast cancer stage at diagnosis.
[b] Ordinal variable, based on town or city of residence, according to national classification of 10 clusters by geographical units (1, lowest; 10, highest).

that the baseline employment rates were different between the groups; reported unemployment rates were 36.5% in the BC group and 40% in the cancer-free group ($p = 0.002$). Thus, the OR in the adjusted model for unemployment remained significant, despite the loss of a significant difference between groups in the sixth year. Indeed, this phenomenon has been described among persons who were diagnosed with screening-associated cancers [21].

Our data suggests that the impact of BC on further unemployment depended on the disease extent at diagnosis. This finding is not new and correlates with previous publications [22,23]. Yet, in patients with positive lymph nodes at diagnosis, the risk of unemployment declined earlier than in patients with negative nodes. This result suggested that, after a BC diagnosis, it takes about 6 years to overcome the milieu of physical, social, and emotional effects of BC and BC treatment. On the other hand, our data might be conflicted with previous publications which showed that patients that received more intensive treatment experienced worse work-related outcomes [8,22]. This contradiction might potentially be explained by a selection bias that favored a specific patient population. Indeed, at earlier time points (2 and 4 years) patients with positive nodes experienced worse outcomes, but by six years after diagnosis, patients that survived had excellent treatment responses and no fatal disease recurrences. Interestingly, the current results might emphasize the need for interventions also focused on survivors of BC that received minimal treatment. Thus, when planning an effective intervention, policymakers must be alert to this issue and consider all survivors of BC. Indeed, a Cochrane systematic review also found that only multi-disciplinary interventions enhanced returns to work, compared to medical or psychological interventions alone [24]. These observations implied that physical treatment-related sequelae are not the only issues among survivors of BC.

The data presented in this study emphasized the fact that unemployment risk is impacted by various important variables, including age, sex, education, ethnicity, socio-economic status, and employment at baseline. A high socio-economic status is a well-known risk factor for BC, but it also predicts a better prognosis [25]. On the other hand, low socio-economic status and previous unemployment were previously described as a risk factors for unemployment following a BC diagnosis [10,26,27]. In our data, all variables related to higher socio-economic status were shown to protect from unemployment during the first 8 years after diagnosis; this association persisted across all subgroups (i.e., high socio-economic status and more years of education). We also found that increasing age at diagnosis had a weak, but significant association with unemployment, consistent with previous studies [28]. As shown previously [26,27], among the studied socio-economic variables, the strongest predictor of prolonged unemployment was unemployment two years prior to cancer diagnosis; the predictive value ranged from an OR of 19.16 (95%C.I. 16.92–21.69) at 2 years to an OR of 4.63 (95%C.I. 3.94–5.45) at 8 years of follow-up. Perhaps the lack of a workplace represents a specific milieu of biopsychosocial conditions that strongly predicts long term unemployment.

The current study have several strengths. First, the study design did not permit a recall bias, which is common in classical case-control designs. In addition, we acquired data from a high-quality dataset with linkage to highly validated databases (Israel Cancer Registry, Israeli Tax Authority database, and Death Registry), which supported the internal validity of the current study. Additionally, our population-based inception cohort supported the external validity of the study. These large datasets allowed us to dissect the overall effect of BC survival on unemployment by analyzing the individual effects of several modifying factors (i.e., age, ethnicity, socio-economic status, education, and occupation at baseline). Moreover, the long-term follow-up enabled a complete, homogenous ascertainment of unemployment risk at 8 years after diagnosis. Nevertheless, certain limitations deserve to be mentioned. Information on treatment modalities was not available. Thus, we could not conduct sub-analyses on specified unique subpopulations that received different treatments for BC. In addition, we based employment status on data recorded by the Tax Authority. Therefore, our subjects were limited to those that reported income to the Tax Authority. Consequently, individuals with unreported income were considered unemployed in the current study. Next, analyses according to stages at diagnosis include multiple tests, which increase the chance for type I error. Furthermore, it might be suggested that lack of data on recurrences influenced the results of our study. Thus, higher rates of unemployment among BC patients may be due to active disease. Despite including only persons who were alive at the end of 2011 in the current study (median follow up of 7.4 years), the possibility of higher rates of unemployment secondary to active or recurrent disease cannot be excluded. Lastly, residual confounding such as job characteristics, social support and survivors' ability or intent to work may also have influenced our findings.

In this study, we found an important sub-population that requires treatment and special attention, due to a high risk of unemployment after surviving BC. This subpopulation included older women that were unemployed at BC diagnosis and had low socio-

economic status. In conclusion, our results suggested that women that survive BC, but are vulnerable to unemployment, deserve particular attention, education, tools, and guidance to facilitate their return to the work force. Additional research is inevitably required to develop optimal intervention methods.

Ethical approval

All procedures performed in this study that involved human participants were in accordance with the ethical standards of the Hadassah-Hebrew University institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study, formal consent was not required.

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Disclosure of potential conflicts of interest

No competing financial interests existed during completion of the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.breast.2018.12.013.

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