

Health-related quality of life 18 months after breast cancer: comparison with the general population of Queensland, Australia

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Abstract

Goals of work Health-related quality of life (HRQoL) was compared between urban breast cancer survivors (BCS) and the general female population in urban Queensland, and correlates were identified.

Materials and methods HRQoL data were collected at 6, 12, and 18 months post-diagnosis from a population-based sample of 287 women, aged 74 years or younger, diagnosed with breast cancer in 2002. The urban comparison group was drawn from a population-based survey conducted in 2004 and included 675 women aged 30–74 years with no prior history of breast cancer. The Functional Assessment of Cancer Therapy-General questionnaire was used to measure HRQoL in both groups.

Main results Younger (<50 years) BCS reported lower HRQoL at 6 months (mean, 80.2 vs 86.8) but were comparable to the general population by 12 months post-diagnosis (mean=87.3). In contrast, HRQoL of older (50+ years) BCS at 6 months (mean=87.1) was comparable to their general population peers (mean=86.0) and was clinically better 18 months post-diagnosis (mean=91.0). Compared with the general population, physical and emotional well-being among younger BCS was impaired at 6 months post-diagnosis (mean, 24.9 vs 21.0 and 21.0 vs 18.0, respectively) and did not improve over time for emotional well-being (mean=18.8). These results persisted after adjustment for treatment-related factors, although receiving chemotherapy was an important correlate of

HRQoL among younger BCS at 6 months post-diagnosis (−14.9).

Conclusions This study not only shows that the HRQoL of BCS improves between 6 and 18 months post-diagnosis but also suggests that emotional well-being among younger BCS may benefit from targeted intervention.

Keywords Breast cancer · General population comparisons · Longitudinal study · Oncology · Quality of life

Introduction

Approximately 1 in 11 Australian women [1] will be diagnosed with breast cancer before the age of 75. The incidence of breast cancer has been increasing since the 1980s [2], and at the end of 2002, breast cancer was the most commonly diagnosed cancer in Queensland (QLD) for women [3]. Partly due to earlier detection and improved treatment, 87% of women diagnosed with breast cancer in QLD between 1996 and 2000 were expected to survive at least 5 years, compared with 71% for the period 1982–1985 [4]. The rising incidence, in association with improved survival rates, ensure that women with breast cancer are one of the largest, and growing, groups of cancer survivors in Australia, similar to the USA [5].

While treatment successfully eliminates malignancies and saves lives, many survivors experience a range of disabilities that adversely affects their health-related quality of life (HRQoL). HRQoL is a subjective and multidimensional concept that is composed of broad domains, generally including physical, social, emotional, and functional well-being. While many women with breast cancer gradually regain function, others experience a decline in HRQoL up to 12 months post-diagnosis, despite, at times,

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receiving supportive care services [6]. Furthermore, a qualitative study of 24 QLD women with breast cancer found that returning to normal activities after surgery took longer than personal or physician expectations [7]. To ensure that realistic recovery expectations can be disclosed to women with breast cancer, research documenting the prevalence and severity of problems is warranted.

Investigating HRQoL as an outcome is challenging. HRQoL is dynamic and may change as patients adapt to living with cancer. Without a benchmark, such as population norms, it is often difficult to ascribe meaning to a given HRQoL score. In Australia, normative scores are available for a commonly used generic HRQoL instrument, the Medical Outcomes Study Short Form-36 (SF-36) [8, 9]. However, this instrument was not specifically developed for cancer populations and may therefore be insensitive to changes in cancer patients' well-being [10, 11]. Recently, normative values for one of the most commonly used, cancer-specific HRQoL instruments, the Functional Assessment of Cancer Therapy-General (FACT-G), have become available for the QLD general population.

The present study is the first to describe the HRQoL of a sample of breast cancer survivors in the medium-term, as measured by the FACT-G instrument, in comparison to the larger general population. The aim of this paper is to describe the HRQoL among urban breast cancer survivors at 6, 12, and 18 months post-diagnosis compared to the general female population in urban QLD and to identify demographic, general health, and clinical correlates of breast cancer survivors' overall HRQoL at 6 months post-diagnosis relative to norms.

Materials and methods

HRQoL data for the breast cancer group were available from 287 urban women who participated in a study entitled "Pulling Through: A Breast Cancer Recovery Study" (PTS). Eligible women were randomly selected through the Queensland Cancer Registry, were diagnosed with unilateral breast cancer in 2002, aged 74 years or younger, and resided within 100 km of Brisbane, the capital city and major population center of QLD. The unilateral breast cancer eligibility criterion was necessary for physical assessments comparing the treated and untreated sides for diagnosis of lymphedema. In accord with Queensland Cancer Registry protocols, written consent was obtained from notifying medical practitioners for 417 of 511 women (81.6%). Informed consent was obtained from 287 of 417 women (68.8%). HRQoL data were collected over a 12-month period, at 3-month intervals, from 6 months after diagnosis of breast cancer. Details of the PTS data collection procedures have been described elsewhere [12].

Information from the 6-, 12-, and 18-month time-points is presented in this study.

The female general population comparison group for these analyses was sourced from HRQoL data collected by The Cancer Council Queensland as part of the Queensland Cancer Risk Study (QCRS) [13]. The QCRS involved a population-based survey conducted in 2004 to explore cancer risk behaviors among English-speaking residents of QLD, aged 20–75 years. HRQoL data were available from 2,727 QLD adult residents who were reasonably representative of the QLD population, although respondents tended to have a somewhat higher level of education, were more likely to have had cancer in the past, and less likely to be of indigenous heritage [13]. The comparison group for the analyses reported in this paper included women aged 30–74 years, living in urban QLD, and with no prior history of breast cancer ($n=675$). This includes women who reported cancer other than breast and morbidities including heart conditions, high blood pressure, high cholesterol, stroke, diabetes, lung conditions, stomach or duodenal ulcer, migraine or headaches, arthritis, depression, and other prolonged or serious illness. Details of the QCRS methods have been described elsewhere [13].

Both studies were approved by the university human research ethics committee before data collection, and, for the PTS, the local cancer registry also gave approval. Data collection procedures for both studies required participants to complete a mailed, self-administered questionnaire that obtained information on demographics (e.g., age, education level, marital status, and private health insurance status), general health [e.g., smoking status, morbidities, physical activity, and body mass index (BMI)], and general HRQoL status. General HRQoL was measured among breast cancer survivors using the FACT-G questionnaire. The FACT-G is comprised of 27 items rated on a five-point Likert scale (ranging from 0=not at all to 4=very much) and includes four subscales measuring physical, social, emotional, and functional well-being. The QCRS comparison group received the general population FACT instrument (FACT-GP), which is identical to the FACT-G but excludes six illness items inappropriate for the general population [14, 15]. Overall FACT-GP summary scores and subscales were pro-rated as per the FACT manual to obtain scores comparable to the FACT-G [16], resulting in total scores for both study groups ranging from 0–108 for the overall FACT-G, 0–28 for the physical, social, and functional well-being subscales, and 0–24 for the emotional well-being subscale. For overall HRQoL and within all subscales, higher scores represent better well-being. The FACT-G has excellent reliability [17], validity [17], and trans-cultural applicability [18, 19] and has been used in several studies to measure HRQoL among the general population [14, 15] and among breast cancer survivors [6, 12].

In the PTS, to ensure adequate numbers in various age groups, women with breast cancer diagnosed before age 50 years were over-sampled; therefore, descriptive results presented in this study have been adjusted to correct for sampling methods using SPSS [20]. Descriptive analyses on the general population comparison group were weighted by age based on Australian Bureau of Statistics data; therefore, results reflect the actual QLD resident population [21]. As distributions of HRQoL scores were approximately normal, scores have been summarized as means with 95% confidence intervals (95% CI). Information for the breast cancer group was available on disease and treatment characteristics, including tumor size, histological grade, and extent of surgery. However, only characteristics that were available for and differed between the PTS and the general population comparison group (i.e., potential confounding factors) were adjusted for either using a separate general linear model for each of the two study groups, or in models of a relative HRQoL outcome (described below). *T* tests (two-sided) were used to statistically compare HRQoL mean scores between the general population and the breast cancer group at 6, 12, and 18 months post-diagnosis. A raw score difference between groups of five points on the FACT-G or two points on the subscales reflects a clinically meaningful difference [14].

To identify correlates that contributed to differences in overall HRQoL at 6 months post-diagnosis between younger and older breast cancer survivors, general linear models containing demographic, general health, and clinical characteristics were run for the group as a whole and separately for the two age groups. Clinical characteristics specific to the breast cancer group included extent of surgery, number of lymph nodes removed, and current treatment with chemotherapy or radiotherapy. A new measure that reflected relative HRQoL for cases was used as the outcome variable. Expected HRQoL values were calculated for each 5-year age-stratum of the general population comparison group and subtracted from the observed HRQoL score within the breast cancer group (i.e., case FACT-G—normative 5-year FACT-G). Positive scores indicate higher HRQoL, and negative scores indicate lower HRQoL among cases relative to age-matched (within 5 years) peers.

As statistical significance is largely dependent on sample size, clinically significant results were deemed more appropriate and are highlighted throughout, with five-point differences for overall HRQoL again considered clinically important [14].

Results

The demographic and disease characteristics were similar for the women participating in the PTS and those in the

target sample identified at the Queensland Cancer Registry [12]. A comparison of the two study groups indicates that women with and without breast cancer differed significantly by demographic and general health characteristics (Table 1). Breast cancer survivors tended to have a higher proportion of women who were older, attained a lower educational level, were not married, had private health insurance, had never smoked, and had no morbidities other than breast cancer, when compared with the general population comparison group. Although the majority of women in each group reported participating in sufficient physical activity levels and were categorized as being in the underweight to healthy BMI category, there was a higher proportion of sedentary and obese breast cancer survivors compared with the general population.

Table 2 presents the adjusted overall and subscale mean HRQoL scores among breast cancer survivors at 6, 12, and 18 months post-diagnosis compared with women from the general population. After adjusting for potential confounders, younger breast cancer survivors reported clinically lower overall HRQoL at 6 months compared with their general population peers (80.2 vs 86.8, respectively; p value<0.01) but were comparable to the general population by 12 months post-diagnosis (87.3 vs 86.8; p value=0.76). In contrast, older breast cancer survivors' HRQoL at 6 months was comparable to their general population peers (87.1 vs 86.0, respectively; p value=0.41), and they reported scores that were clinically better by 18 months post-diagnosis (91.0 vs 86.0; p value<0.01).

Younger breast cancer survivors reported clinically lower physical well-being at 6 months (21.0 vs 24.9; p value<0.01) but were comparable to the general population by 12 months post-diagnosis (25.0 vs 24.9; p value=0.78). Younger breast cancer survivors consistently reported clinically worse emotional well-being compared to women from the general population, which persisted over time; emotional well-being was still clinically lower at 18 months post-diagnosis (19.1 vs 21.0; p value<0.01; Fig. 1). In contrast, older women with breast cancer reported physical and emotional well-being scores similar to their general population counterparts, even at 6 months post-diagnosis. Regardless of age, breast cancer survivors reported clinically better social well-being at 6 (22.7 vs 19.9; p value<0.01) and 12 months (22.6 vs 19.9; p value<0.01) post-diagnosis compared with the general population. By 18 months post-diagnosis, social well-being remained similar to population norms for younger survivors (21.1 vs 20.0, respectively; p value=0.13) and continued to be higher among older women (23.4 vs 19.8; p value<0.01) when compared to population peers.

Survivors also reported functional well-being comparable to the general population at 6 months post-diagnosis (20.6 vs 20.5, respectively; p value=0.78), and this was

Table 1 Demographic and general health characteristics by cancer status

| Characteristics | General population comparison group ^a (<i>n</i> =675) | | Breast cancer survivors ^b (<i>n</i> =287) | | <i>p</i> value |
|--|---|---------|---|---------|----------------|
| | Number | Percent | Number | Percent | |
| Socio-demographic characteristics | | | | | |
| Age (years) | | | | | |
| <50 | 298 | 57.0 | 94 | 26.5 | <0.01 |
| 50+ | 377 | 43.0 | 193 | 73.5 | |
| Education level | | | | | |
| Low (Grade 10 or below) | 219 | 30.2 | 126 | 45.4 | <0.01 |
| Moderate | 278 | 42.5 | 101 | 34.4 | |
| High (University degree or higher) | 178 | 27.3 | 60 | 20.2 | |
| Marital status | | | | | |
| Married, or living as married | 520 | 77.6 | 197 | 67.2 | <0.01 |
| Not married | 155 | 22.4 | 90 | 32.8 | |
| Private health insurance status | | | | | |
| No | 277 | 42.0 | 85 | 29.1 | <0.01 |
| Yes | 398 | 58.0 | 202 | 70.9 | |
| General health characteristics | | | | | |
| Smoking status | | | | | |
| Never smoked | 364 | 52.9 | 172 | 60.4 | 0.16 |
| Past smoker | 216 | 31.7 | 85 | 29.4 | |
| Current smoker | 95 | 15.3 | 30 | 10.2 | |
| Physical activity ^c | | | | | |
| Sedentary | 94 | 13.7 | 49 | 16.8 | 0.16 |
| Insufficient activity | 194 | 29.4 | 67 | 23.3 | |
| Sufficient activity | 387 | 57.0 | 171 | 59.9 | |
| Body mass index | | | | | |
| Underweight/healthy weight (≤ 24.9) | 335 | 50.7 | 123 | 42.0 | <0.01 |
| Overweight (25–29.9) | 203 | 29.6 | 80 | 28.0 | |
| Obese (30+) | 106 | 14.9 | 56 | 19.7 | |
| Missing | 31 | 4.7 | 28 | 10.3 | |
| Morbidities ^d | | | | | |
| None | 126 | 21.4 | 148 | 51.0 | <0.01 |
| One | 158 | 24.7 | 54 | 18.7 | |
| Two | 133 | 19.2 | 38 | 13.3 | |
| Three or more | 258 | 34.7 | 47 | 17.0 | |

^a Column percentages are standardized to the 2003 Queensland population by age.

^b Baseline characteristics; column percentages have been weighted to correct for sampling.

^c ‘Sedentary’ is defined as no activity. ‘Insufficient’ time is defined as participating in some activity but less than 150 min per week, using the sum of walking, moderate activity and vigorous activity (weighted by 2). ‘Sufficient’ time is defined as 150 min per week, using the sum of walking, moderate activity and vigorous activity (weighted by 2).

^d Morbidities include heart conditions, high blood pressure, high cholesterol, stroke, diabetes, lung conditions, stomach or duodenal ulcer, migraine or headaches, arthritis, cancer other than breast, depression, and other prolonged or serious illness

clinically better than the general population among breast cancer survivors aged 50 years or older at 12 (22.6 vs 20.2; *p* value<0.01) and 18 months (22.5 vs 20.2; *p* value<0.01) post-diagnosis.

Table 3 presents the adjusted mean FACT-G scores for women with breast cancer at 6 months post-diagnosis relative to age-matched norms (i.e., relative HRQoL). Results from these analyses were similar to those obtained from case-comparison results; that is, overall relative FACT-G scores at 6 months post-diagnosis among all

breast cancer survivors were comparable to general population peers (−1.8). While similar findings were observed among older breast cancer survivors (+1.2), younger breast cancer survivors reported clinically lower FACT-G scores than age-matched peers (−7.8), even after adjustment for treatment-related factors. Age-stratified results revealed few differences by factors of interest for older breast cancer survivors, with those reporting no private health insurance (−4.7), or three or more morbidities (−5.6), having substantially lower FACT-G scores than their peers. In

Table 2 Adjusted^a mean HRQoL scores for women with breast cancer at 6, 12, and 18 months post-diagnosis compared with the general population

| | General population comparison group (n=672) | | Breast cancer survivors, six months post-diagnosis (n=287) | | | Breast cancer survivors, 12 months post-diagnosis (n=277) | | | Breast cancer survivors, 18 months post-diagnosis (n=272) | | |
|-----------------------|---|------------|--|------------|----------|---|------------|----------|---|------------|----------|
| | Mean | 95% CI | Mean | 95% CI | Clinical | Mean | 95% CI | Clinical | Mean | 95% CI | Clinical |
| FACT-G (0–108) | | | | | | | | | | | |
| Age <50 | 86.8 | 85.2, 88.4 | 80.2 | 77.0, 83.4 | ✓ | 87.3 | 84.6, 90.0 | ✗ | 87.0 | 84.6, 89.5 | ✗ |
| 50+ | 86.0 | 84.5, 87.5 | 87.1 | 85.1, 89.1 | ✗ | 90.2 | 88.2, 92.3 | ✗ | 91.0 | 88.9, 93.1 | ✓ |
| All | 86.3 | 85.2, 87.4 | 84.8 | 83.1, 86.5 | ✗ | 89.3 | 87.6, 91.0 | ✗ | 88.7 | 88.1, 91.3 | ✗ |
| PWB (0–28) | | | | | | | | | | | |
| Age <50 | 24.9 | 24.5, 25.3 | 21.0 | 19.8, 22.3 | ✓ | 25.0 | 24.4, 25.6 | ✗ | 24.8 | 24.2, 25.4 | ✗ |
| 50+ | 24.9 | 24.6, 25.1 | 23.2 | 22.6, 23.8 | ✗ | 24.4 | 23.8, 24.9 | ✗ | 24.7 | 24.1, 25.3 | ✗ |
| All | 24.9 | 24.6, 25.1 | 22.5 | 21.9, 23.1 | ✓ | 24.6 | 24.2, 25.0 | ✗ | 24.7 | 24.3, 25.2 | ✗ |
| SWB (0–28) | | | | | | | | | | | |
| Age <50 | 20.0 | 19.3, 20.7 | 22.0 | 21.1, 23.0 | ✓ | 21.5 | 20.3, 22.7 | ~ | 21.1 | 20.0, 22.3 | ✗ |
| 50+ | 19.8 | 19.1, 20.5 | 23.0 | 22.2, 23.8 | ✓ | 23.0 | 22.2, 23.9 | ✓ | 23.4 | 22.6, 24.2 | ✓ |
| All | 19.9 | 19.4, 20.4 | 22.7 | 22.0, 23.3 | ✓ | 22.6 | 21.8, 23.3 | ✓ | 22.7 | 22.0, 23.3 | ✓ |
| EWB (0–24) | | | | | | | | | | | |
| Age <50 | 21.0 | 20.6, 21.4 | 18.0 | 17.1, 18.9 | ✓ | 18.8 | 18.0, 19.6 | ✓ | 19.1 | 18.4, 19.8 | ~ |
| 50+ | 21.0 | 20.6, 21.3 | 19.6 | 19.0, 20.1 | ✗ | 20.4 | 19.9, 21.0 | ✗ | 20.2 | 19.7, 20.8 | ✗ |
| All | 21.0 | 20.7, 21.3 | 19.0 | 18.6, 19.5 | ✓ | 19.9 | 19.4, 20.4 | ✗ | 19.9 | 19.4, 20.3 | ✗ |
| FWB (0–28) | | | | | | | | | | | |
| Age <50 | 20.8 | 20.1, 21.4 | 19.2 | 17.9, 20.4 | ✗ | 21.8 | 20.9, 22.8 | ✗ | 21.9 | 20.9, 22.8 | ✗ |
| 50+ | 20.2 | 19.5, 20.9 | 21.3 | 20.5, 22.1 | ✗ | 22.6 | 21.9, 23.3 | ✓ | 22.5 | 21.7, 23.2 | ✓ |
| All | 20.5 | 20.0, 20.9 | 20.6 | 19.9, 21.2 | ✗ | 22.4 | 21.8, 22.9 | ~ | 22.3 | 21.7, 22.9 | ~ |

FACT-G Functional Assessment of Cancer Therapy-General; *PWB* physical well-being; *SWB* social well-being; *EWB* emotional well-being; *FWB* functional well-being; ✓ clinically significant difference between groups; ✗ no clinically significant difference between groups, ~ approaching a clinically significant difference between groups

^a Adjusted for age, education level (low, moderate, high), marital status (married or living as married, not married), private health insurance status (no, yes), smoking status (never smoked, past smoker, current smoker), physical activity (sedentary, insufficient, sufficient), body mass index (underweight/healthy, overweight, obese, missing), and morbidities (none, one, two, three or more)

Fig. 1 Adjusted mean emotional well-being scores for younger (<50 years) women with breast cancer from 6 to 18 months post-diagnosis compared with their general population peers (<50 years). Scores were adjusted for education level (low, moderate, high), marital status (married or living as married, not married), private health insurance status (no, yes), smoking status (never smoked, past smoker, current smoker), physical activity (sedentary, insufficient, sufficient), body mass index (underweight/healthy, overweight, obese, missing), and morbidities (none, one, two, three, or more)

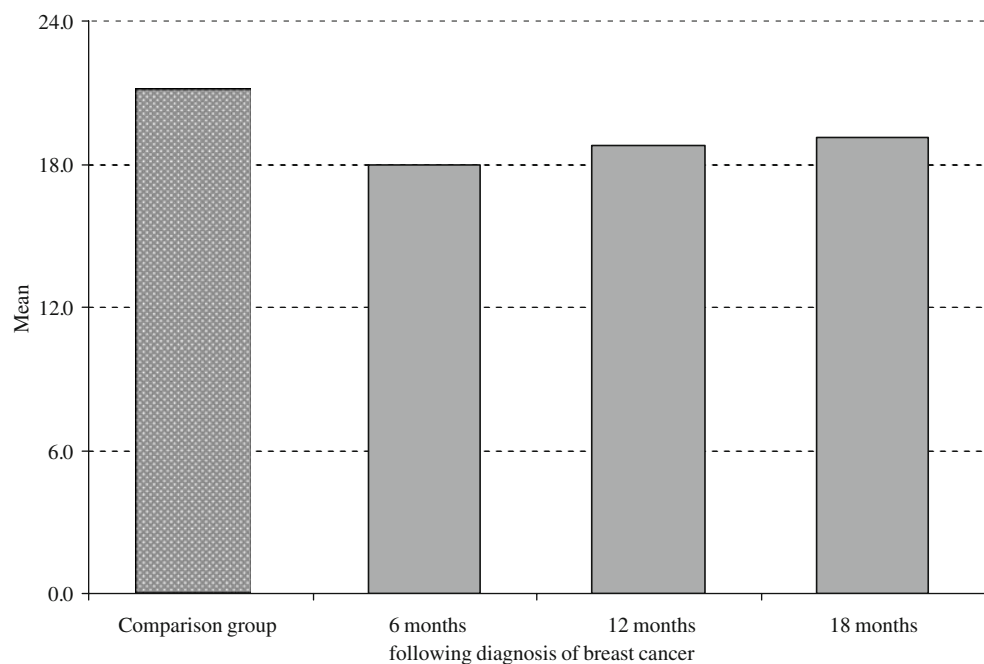


Table 3 Adjusted^a mean relative^b overall HRQoL scores for women with breast cancer at 6 months post-diagnosis

| | All women (n=287) | | | Women aged <50years (n=94) | | | Women aged 50+ years (n=193) | | |
|--------------------------------------|--------------------|-------------|----------|----------------------------|-------------|----------|------------------------------|-------------|----------|
| | Mean difference | 95% CI | Clinical | Mean difference | 95% CI | Clinical | Mean difference | 95% CI | Clinical |
| FACT-G | -1.8 | -3.5, -0.1 | ✗ | -7.8 | -11.0, -4.7 | ✓ | +1.2 | -0.8, +3.2 | ✗ |
| Age | +0.6 ^{c*} | - | ✗ | 0.0 ^c | - | ✗ | +0.7 ^{c*} | - | ✗ |
| Education | | | | | | | | | |
| Low (Grade 10 or below) | -3.0 | -5.7, -0.3 | ✗ | -11.0 | -17.6, -4.4 | ✓ | +0.6 | -2.4, +3.6 | ✗ |
| Moderate | -2.4 | -5.4, +0.5 | ✗ | -9.2 | -14.2, -4.3 | ✓ | +0.9 | -2.9, +4.8 | ✗ |
| High (University degree or higher) | +1.6 | -2.3, +5.4 | ✗ | -2.5 | -9.1, +4.0 | ✗ | +3.4 | -1.7, +8.5 | ✗ |
| Marital status | | | | | | | | | |
| Married or living as married | -0.2 | -2.3, +1.9 | ✗ | -6.2 | -10.1, -2.4 | ✓ | +2.9* | +0.2, +5.5 | ✗ |
| Not married | -5.4* | -8.6, -2.2 | ✓ | -11.9 | -18.4, -5.4 | ✓ | -2.1 | -6.0, +1.8 | ✗ |
| Private health insurance | | | | | | | | | |
| No | -5.9* | -9.1, -2.5 | ✓ | -9.0 | -14.9, -3.0 | ✓ | -4.7* | -9.0, -0.4 | ~ |
| Yes | -0.2 | -2.2, +1.9 | ✗ | -7.2 | -11.4, -3.1 | ✓ | +3.3 | +0.9, +5.7 | ✗ |
| Smoking status | | | | | | | | | |
| Never smoked | -2.6 | -4.8, -0.3 | ✗ | -8.4 | -12.9, -3.8 | ✓ | +0.7 | -1.9, +3.4 | ✗ |
| Past smoker | -1.0 | -4.1, +2.1 | ✗ | -7.8 | -13.9, -1.7 | ✓ | +2.1 | -1.8, +5.9 | ✗ |
| Current smoker | +0.2 | -5.7, +6.2 | ✗ | -5.6 | -15.9, +4.7 | ✓ | +1.7 | -6.2, +9.5 | ✗ |
| Physical activity ^d | | | | | | | | | |
| Sedentary | -3.3 | -7.7, +1.0 | ✗ | -13.3 | -20.8, -5.8 | ✓ | +1.5 | -4.4, +7.3 | ✗ |
| Insufficient | -3.2 | -6.9, +0.4 | ✗ | -3.2 | -10.8, +4.3 | ✗ | -2.3 | -6.6, +2.0 | ✗ |
| Sufficient | -0.8 | -3.1, +1.4 | ✗ | -7.6 | -12.0, -3.3 | ✓ | +2.6 | -0.1, +5.3 | ✗ |
| Body mass index (kg/m ²) | | | | | | | | | |
| Underweight/Healthy | -0.9 | -3.6, +1.7 | ✗ | -7.5 | -12.2, -2.9 | ✓ | +1.9 | -1.6, +5.4 | ✗ |
| Overweight | -2.5 | -5.8, +0.8 | ✗ | -9.6 | -16.3, -2.9 | ✓ | +1.5 | -2.5, +5.5 | ✗ |
| Obese | -3.8 | -7.7, 0.0 | ✗ | -6.1 | -14.2, +1.9 | ✓ | -1.8 | -6.5, +2.9 | ✗ |
| Missing | +0.5 | -5.3, +6.4 | ✗ | -7.2 | -24.2, +9.9 | ✓ | +3.5 | -2.9, +9.9 | ✗ |
| Morbidities ^e | | | | | | | | | |
| None | -0.6 | -3.0, +1.8 | ✗ | -6.5 | -10.9, -2.1 | ✓ | +2.3 | -0.6, +5.3 | ✗ |
| One | +2.1 | -1.9, +6.2 | ✗ | -7.3 | -15.3, +0.6 | ✓ | +6.4* | +1.3, +11.5 | ✓ |
| Two | -4.7 | -9.6, +0.1 | ~ | -9.4 | -19.9, +1.1 | ✓ | -0.2 | -5.9, +5.5 | ✗ |
| Three or more | -8.2* | -12.7, -3.8 | ✓ | -15.1 | -27.3, -2.9 | ✓ | -5.6* | -10.6, -0.6 | ✓ |
| Surgery | | | | | | | | | |
| Complete local excision | -0.9 | -3.1, +1.3 | ✗ | -6.9 | -11.4, -2.3 | ✓ | +2.2 | -0.4, +4.7 | ✗ |
| Mastectomy | -3.4 | -6.4, -0.4 | ✗ | -9.3 | -14.8, -3.7 | ✓ | -0.7 | -4.4, +3.1 | ✗ |
| Lymph node removal | | | | | | | | | |
| None | -1.3 | -6.4, +3.7 | ✗ | -2.5 | -12.3, +7.2 | ✗ | -1.1 | -7.4, +5.1 | ✗ |
| <10 | -3.0 | -6.2, +0.2 | ✗ | -8.8 | -14.9, -2.6 | ✓ | -0.1 | -4.0, +3.9 | ✗ |
| 10–19 | -0.6 | -3.2, +2.0 | ✗ | -7.8 | -12.8, -2.9 | ✓ | +3.4 | +0.1, +6.6 | ✗ |
| 20+ | -3.6 | -8.3, +1.1 | ✗ | -12.2 | -22.8, -1.6 | ✓ | -0.5 | -5.9, +4.9 | ✗ |
| Currently undergoing chemotherapy | | | | | | | | | |
| Yes | -7.1* | -11.4, -2.8 | ✓ | -14.9* | -22.5, -7.2 | ✓ | -2.7 | -8.4, +3.0 | ✗ |
| No | -0.7 | -2.6, +1.1 | ✗ | -5.8* | -9.6, -2.0 | ✓ | +1.9 | -0.4, +4.1 | ✗ |

Table 3 (continued)

| | All women (<i>n</i> =287) | | | Women aged <50 years (<i>n</i> =94) | | | Women aged 50+ years (<i>n</i> =193) | | |
|-----------------------------------|----------------------------|------------|----------|--------------------------------------|-------------|----------|---------------------------------------|------------|----------|
| | Mean difference | 95% CI | Clinical | Mean difference | 95% CI | Clinical | Mean difference | 95% CI | Clinical |
| Currently undergoing radiotherapy | | | | | | | | | |
| Yes | -0.2 | -5.3, +5.0 | ✗ | -7.5 | -18.1, +3.1 | ✓ | +2.9 | -3.6, +9.4 | ✗ |
| No | -2.0 | -3.8, -0.2 | ✗ | -7.9 | -11.3, -4.4 | ✓ | +1.0 | -1.2, +3.2 | ✗ |

FACT-G Functional Assessment of Cancer Therapy-General; ✓ clinically significant difference between groups; ✗ no clinically significant difference between groups, ~ approaching a clinically significant difference between groups

^a Adjusted for age, education level (low, moderate, high), marital status (married or living as married, not married), private health insurance status (no, yes), smoking status (never smoked, past smoker, current smoker), physical activity (sedentary, insufficient, sufficient), body mass index (underweight/healthy, overweight, obese, missing), morbidities (none, one, two, three or more), surgery (complete local excision, mastectomy), lymph node removal (none, <10, 10–19, 20+), currently undergoing chemotherapy (yes, no), and currently undergoing radiotherapy (yes, no).

^b *FACT-G* score for breast cancer cases relative to their age-matched normative value (i.e., case *FACT-G*—normative *FACT-G* (within 5-year age-strata)).

^c Mean change in HRQoL for each year of ageing.

^d ‘Sedentary’ is defined as no activity. ‘Insufficient’ time is defined as participating in some activity but less than 150 min per week, using the sum of walking, moderate activity and vigorous activity (weighted by 2). ‘Sufficient’ time is defined as 150 min per week, using the sum of walking, moderate activity and vigorous activity (weighted by 2).

^e Morbidities include heart conditions, high blood pressure, high cholesterol, stroke, diabetes, lung conditions, stomach or duodenal ulcer, migraine or headaches, arthritis, cancer, depression and other prolonged or serious illness.

**p*≤0.05

contrast, most characteristics showed clinically important associations with relative HRQoL among younger breast cancer survivors. In particular, relative HRQoL scores differed by more than five points from the overall mean for younger women reporting three or more morbidities (−15.1) or current chemotherapy (−14.9). Conversely, those with a university degree or higher education (−2.5) or no lymph nodes removed (−2.5) reported relative HRQoL scores only slightly lower than their age-matched peers and substantially better than other young women with breast cancer.

Discussion

This study is the first to describe in detail the HRQoL of breast cancer survivors between 6 and 18 months post-diagnosis, as measured by the *FACT-G* instrument, in comparison to the general population. Overall, HRQoL among urban breast cancer survivors followed in this longitudinal, population-based study improved over time, and by 12 months post-diagnosis was comparable to women from the general QLD population. However, younger breast cancer survivors had reduced emotional well-being at 6 months post-diagnosis, continued to report deficits in emotional well-being at 12 months post-diagnosis, and remained inferior at 18 months post-diagnosis, compared to their general population peers. In contrast, by 18 months post-diagnosis, older breast cancer

survivors reported clinically better social and functional well-being compared to their general population peers.

These results may represent a true reflection of the breast cancer experience, namely, that breast cancer survivors experience similar overall HRQoL to that reported by the general population within 12 months of diagnosis. Supporting this research demonstrating that following diagnosis of a life-threatening disease, survivors have reported noting positive outcomes, including hopefulness, improved social support and close relationships, and a greater appreciation of health and life [22, 23]. Moreover, the HRQoL of people within the general population is far from perfect, with a large proportion of adults in Australia (78%) living with one or more long-term medical conditions, such as psychological distress (37%), arthritis (15%), asthma (10%), or circulatory conditions (18%) [24], which have been shown to significantly impair HRQoL within the Queensland general population (M. Janda, personal communication) and other populations [15, 25]. Hence, these results may show that modern cancer treatment can prolong life with good subsequent HRQoL, comparable to that experienced by individuals without cancer, some of whom experience other chronic medical conditions.

Alternatively, changes in perceptions over time may bias these results. A response shift, or adaptation to the demands of breast cancer among survivors, may result in what appears to be a more positive HRQoL among patients than the general population. This may occur as women with

breast cancer alter the way they respond to the questions measuring HRQoL because of recalibration, reprioritization, or reconceptualization during the recovery period [26]. New approaches to measuring this phenomenon are emerging and include individualized methods, preference-based methods, successive comparison methods, design approaches, statistical approaches, and qualitative approaches [26]. There is no consensus, as yet, to the best approach to quantify the effects of response shift; therefore, it is acknowledged in this study when interpreting HRQoL results.

Our results reaffirm that younger women have more difficulty adjusting to the disease than older women [27–29]. Younger women tend to be diagnosed with more advanced disease [30], requiring more aggressive treatment. It is therefore noteworthy that the disparities in HRQoL between breast cancer survivors and the general population persisted after adjustment for treatment factors, as did the differences between older and younger women with breast cancer. Analyses examining the potential relationships of demographic, general health, and clinical characteristics with HRQoL of women with breast cancer relative to their peers demonstrated that at 6 months post-diagnosis, having three or more morbidities was an important correlate of poorer HRQoL for both older and younger women. Beyond that, only the lack of health insurance was also important for older women. In contrast, younger women with breast cancer appear to experience impaired HRQoL relative to their peers (i.e., relative HRQoL <−5.0) for most characteristics studied, with receiving chemotherapy being one of the strongest correlates of mean HRQoL (−15 points). However, as current treatment, in both age groups, diminished substantially over time to 4% and 1% at 12 and 18 months, respectively, adverse effects on HRQoL are also likely to decline, suggesting other explanations are necessary for the ongoing deficit observed at 18 months among younger breast cancer survivors.

One such explanation for the longer-term differences in HRQoL observed between younger and older women with breast cancer is because younger women consider cancer as an anomalous event to a greater degree than older women. The point in the lifecycle at which the cancer occurs for young women means that their roles as mothers, wives, and career women are prematurely threatened [31]. This is reflected in research conducted both in Australia and overseas, highlighting the unique concerns and unmet needs of younger women, such as survival concerns (e.g., for self and children), reproductive consequences of treatment (e.g., fertility, early menopause), body image and sexuality problems, limitations placed on career, and difficulty finding age-appropriate supportive care [32–35].

The results of the present study diverge from previous overseas research in the consistency with which Australian breast cancer survivors report HRQoL comparable to their

general population peers. German research involving use of the European Organization of Cancer Therapy Quality of Life Questionnaire-C30 (EORTC QLQ-C30) observed that women with breast cancer had comparable overall HRQoL to the general population [36]. However, detrimental effects of breast cancer on role, emotional, cognitive, and social functioning 12 months post-diagnosis compared with the general population, which predominately affected younger patients, also were found [36]. Using the EORTC QLQ-C30, reduced cognitive and social well-being has been reported among Norwegian women 12 months post-surgery as well [37]. Impairments to social well-being also were seen among Austrian women with breast cancer who were, on average, 4.5 years post-diagnosis, using the FACT-G [15]. However, although HRQoL was reduced on some subscales, all three studies reported that overall HRQoL was comparable to general population normative values [15, 36, 37].

Recently, the comparability of HRQoL measured utilizing different quality of life questionnaires was investigated. Significant differences in the concepts measured by the FACT-G and EORTC QLQ-C30 instruments have been noted, with correlation coefficients ranging between $r=0.77$ for physical well-being to $r=0.09$ for social well-being [38]. The authors concluded that concordance between the two social well-being subscales is not sufficient to allow equation [38]. This could explain some of the differences observed in relation to social well-being, which improved among breast cancer patients in our sample while remaining impaired among breast cancer patients in other studies. Alternatively, standard practices or cultural differences regarding recovery after treatment may influence differences observed among countries. For example, patients in Australia may receive more or better social support compared to patients in other countries. This may be due, in part, to the significant role played by the breast care nurse and/or the significant media attention by high-profile celebrities, which may have reduced an adverse social stigma for the disease in Australia compared with elsewhere.

The population-based nature of the samples suggests that the conclusions derived from this work are likely to be generalizable to the wider population of women with unilateral breast cancer, aged 74 years or younger and residing in Southeast Queensland. Furthermore, the present study is one of the first to adjust for other health-related factors, which could influence patients' HRQoL, such as BMI, physical activity levels, and other morbidities.

Advances in breast cancer management in Australia have conferred distinct advantages, with survivors now able to expect to live longer, healthier lives than previously. However, our findings may describe a somewhat optimistic scenario if non-responding breast cancer survivors also are more likely to experience reduced HRQoL, indicating opportunity for further improvement. These results will be useful for

clinicians to help counsel women regarding what to expect during recovery from breast cancer and its treatment. In addition, consideration should be given to improving supportive care services, particularly for emotional well-being among women diagnosed when younger than 50 years.

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