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Patient-reported outcomes in survivors of breast cancer one, three, and five years post-diagnosis: a cancer registry-based feasibility study

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Abstract

Introduction and aims The burden of treatment toxicities in breast cancer requires longitudinal assessment of patient-centered outcomes. The current study aimed to assess the feasibility of collecting general and breast cancer-specific quality of life (QoL), ongoing symptoms and unmet needs, in patients identified from a population-based cancer registry, and to assess the contribution of demographic, disease, and care-related factors.

Methods Eligible patients were identified from the Victorian Cancer Registry (Victoria, Australia) using the ICD-10 code C50, diagnosed during 2013, 2011, and 2009. Data included age, area of residence, cancer diagnosis, date of diagnosis, treatment modality, and staging. Patients completed a number of validated tools including the EQ-5D-5L and FACT-B, symptom items, and unmet needs.

Results Of 1006 eligible patients, the overall response rate was 45.6%. Survivors 1 year post-diagnosis had significantly greater problems with pain or discomfort (59.2%) and with anxiety or depression (51.3%) compared with survivors 5 years post-diagnosis (45.1% with pain or discomfort, $p<0.05$, and 32.7% with anxiety or depression, $p<0.01$). For the 5 years group, pain or discomfort and anxiety or depression were significantly higher than for the general population (32.2% and 21.6%, respectively). Improved quality of life was found in those who did not receive chemotherapy (coefficient = 0.2269, $p=0.0409$) and those who did not have a longstanding health condition (coefficient = 0.6342, $p<0.001$). Poorer quality of life was associated with those who were not certain what was happening with their breast cancer (coefficient = −0.3674, $p=0.0094$) and those whose cancer had not been treated, had been treated but was still present, or had returned after treatment (coefficient = −0.5314, $p=0.0136$). Across the total cohort, women were bothered by changes in weight (21.3%) and concerned about the effects of stress on their cancer (19.6%). Fear of cancer recurrence was commonly reported and did not diminish over time (60.7%, 52.2%, and 56.9% at 1, 3, and 5 years, respectively).

Conclusion Collecting patient-reported outcomes from a population-based sample of breast cancer survivors was feasible. Physical symptoms and psychosocial issues are common and are persistent. Use of chemotherapy was the only treatment modality that significantly impacted on QoL.

Keywords Breast cancer · Patient-reported outcomes · Survivorship

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Introduction

Breast cancer is the most commonly diagnosed cancer in women in Australia. An estimated 17,730 people were newly diagnosed with breast cancer in Australia in 2017 [1, 2]. The mortality rate is decreasing, likely a result of improvements in screening and treatment. The 5-year relative survival rate for breast cancer in women is 90.2%, contributing to a substantial population of survivors of breast cancer; the 31-year prevalence of breast cancer in Australia at the end of 2012 (start of the study period) was reported to be 193,730 [1].

Given the growing number of long-term survivors, the assessment of the burden of treatment-related toxicities is important [3]. There is a paucity of robust population-based data regarding the lived experience of breast cancer survivors, particularly in an era of improved local and distal failure rates and decreased mortality [4, 5].

Population-level studies to assess the patient-reported outcomes measures (PROMs), including health-related quality of life (QoL), have been explored in cancer survivors. In 2011, the National Health Service (NHS) in the UK conducted a survey to assess the feasibility of assessing quality of life of cancer survivors using PROMs [6]. It was the largest study to have been conducted in Europe and included multiple cancer types. Four PROMs surveys were developed for the NHS pilot for survivors of breast, prostate and colorectal cancer and non-Hodgkin lymphoma (NHL). Questionnaires included the generic QoL measure, EuroQol-5D (which consists of five items about mobility, personal care, usual activities, pain or discomfort, and anxiety or depression) [2], cancer-specific measures (Functional Assessment of Cancer Therapy (FACT) scales), the Social Difficulties Inventory (SDI), and a number of questions relating to additional symptoms and unmet needs. Based on the high response rate (66%), the NHS concluded that the survey approach was feasible for the majority of cancer survivors.

A similar questionnaire comprising the EuroQol-5D, disease-specific FACT measure, the SDI, and questions relating to treatment were explored in a study in colorectal cancer in 34,467 patients in the UK [7]. With a response rate of 63.3%, the key findings were that 65% of respondents identified one or more generic health problems, and 10% of patients identified problems in all five domains covered by the EuroQol-5D. Factors associated with a higher number of problems included having other long-term conditions, living with active or recurrent disease, the presence of a stoma after treatment, and those younger than 55 or older than 85.

Another study in the UK explored QoL in men following prostate cancer in 58,930 men had a response rate of 60.8% [8]. This study also used the EuroQol-5D in conjunction with urinary functional outcomes. This study identified patients from the cancer registry and accurate disease stage was available in 85.6% of Stage 1 disease but only 12.8% of Stage IV. Despite this, the study showed that sexual dysfunction was an issue for the majority (81%) regardless of stage and identified that only 50% of men had any intervention offered for this issue, thus recognizing a significant unmet need. It also found that 23.5% of men with Stage 4 disease did not report any issues.

There are several tools available to assess QoL after breast cancer treatment including the EORTC generic core instrument, the QLQ-C30 [9] and the breast cancer-specific measure, and the Functional Assessment Chronic Illness Therapy General questionnaire (FACIT-G) [10] and its breast cancer module [11, 12]. These have identified the issues and impacts from different types of treatment for breast cancer, including surgery, chemotherapy, and adjuvant hormonal treatments. Long-term anxiety and depression are well known to persist after treatment. Use of PROMs in a clinical setting may also improve care after breast cancer. Mertz et al. explored the proactive use of screening tools to act as dialogue tools to facilitate intervention [13]. Using individually tailored nurse interventions, based on PROMs, patients reported increased satisfaction after treatment and rehabilitation and lower levels of distress (mean 2.7 vs. 5.1, $p<0.01$), anxiety (mean 5.1 vs. 7.8, $p=0.02$), and depression (mean 2.2 vs. 4.4, $p=0.04$) after 12 months compared to the control group.

In 2013, The Victorian Comprehensive Cancer Center (VCCC), a conglomerate of 10 institutions (Peter MacCallum Cancer Center, The Royal Melbourne Hospital, The University of Melbourne, The Royal Children's Hospital, The Royal Womens Hospital, The Walter and Eliza Hall Institute, St Vincent's Hospital, The Murdoch Children's Research Institute, Western Health and Austin Health) dedicated to cancer prevention and management, undertook a similar study, using the same tools previously validated in the NHS based on the Victorian Cancer Registry (VCR).

The objectives of the study were to:

(1) Assess feasibility of capture of overall and breast cancer-specific QoL, symptoms and unmet information needs, in breast cancer survivors in Victoria 1, 3, and 5 years post-diagnosis.
(2) Assess the contribution that demographic-, disease-, and care-related factors have on QoL.

Methods

Study design and participants

A cross-sectional study was undertaken of individuals with a diagnosis of breast cancer 1, 3, and 5 years earlier and were aged 18 years or over and were a Victorian resident at the time of diagnosis. Cases were excluded if they were deceased, had been previously approached by the Victorian Cancer Registry (VCR) recruitment service, invited to participate in another Cancer Council Victoria study, had multiple invasive primary cancers, did not meet certain morphological or histopathological criteria, or if their treating doctor advised participation was not appropriate. General population data were sourced from the Dual-frame Omnibus Survey, a population-wide survey of Australian residents aged 18 years and over, conducted in 2012 [14].

Cohort identification and survey process

Cases that met the study inclusion criteria were extracted from the VCR database. Each case was reviewed to verify the diagnosis and screened against the exclusion criteria above. The VCR first approached the treating doctor for each eligible case to seek their advice on the suitability of the case for research. A passive response model indicating that cases would be approached in approximately 3 weeks time was used. Suitable cases were then approached by post during the month corresponding to the anniversary of their diagnosis. These initial approaches took place between February and August 2014. A reminder was sent to non-responders 3 weeks following the initial approach. Eligible participants were sent a copy of the participant information sheet, a blank copy of the questionnaire and a reply-paid envelope. Subjects were advised that, if they wished to participate, their consent was implied by return of the questionnaire. No incentive payments were offered. All data were anonymized.

Questionnaire design and content

Questionnaires were the same as those used by the NHS in their assessment of breast cancer survivors in England, and development of the survey tools has been described previously [6]. Data provided by the VCR included age, area of residence, cancer diagnosis, date of diagnosis, and staging. Phenotypic subtype was not available from histology. Patients completed a number of validated tools, as detailed below. Patients' self-reported symptom items, unmet needs, response to treatment and disease status, presence or absence of long-term conditions other than cancer, care-related factors such as having a written care plan, and demographic information are not covered in the above instruments.

Quality of life (EQ-5D-5L and FACT-B)

The EuroQoL 5-Dimension 5-Level (EQ-5D-5L) and Functional Assessment of Cancer Therapy-Breast (FACT-B) questionnaires were used [10, 15]. The EQ-5D-5L comprises five items related to mobility, personal care, usual activities, pain or discomfort, and anxiety or depression scored at five levels (no problems, slight problems, moderate problems, severe problems, and I am unable/extreme problems). Each respondent was assigned a state based on their responses to these items and an index value was then calculated. The calculation of index values relies on country-specific weights. The EQ-5D-3L weights for Australia were obtained from Viney et al. [16] and those for EQ-5D-5L were obtained from Norman et al. [17]. The nominal range of index values is 0 (denoting death) to 1 (representing perfect health). Negative values are possible, however, since some quality of life scenarios was less preferred than death.

Breast cancer-specific QoL was measured using nine items from the additional breast cancer-specific items from the FACT-B [18] pertaining to domains such as pain, body image, and perceived stress. Each item is scored at five levels (not at all, a little bit, somewhat, quite a bit, very much).

Feasibility

The feasibility of the study was determined by the ability to access the state-wide data, contact patients via mail-based survey and the response rates.

Statistical analysis

Sample size

The sample size for breast cancer was based on estimating a population proportion of 50% with a margin of error of ± 5%, assuming a 95% confidence interval. The total required sample size was 384, calculated using the standard formula $n = Z^{2} \propto /2p(1-p)/\epsilon^{2}$. This yielded a target of 128 respondents for each of the 1, 3, and 5 years post-diagnosis cohorts. The margin of error within each cohort was expected to be ± 8.7%. The assumptions of a population proportion of 50% and a small sampling fraction resulted in a conservatively large sample size.

Weighting, estimation, and significance testing

To ensure the survey results were representative of the population of eligible cases, weights were calculated for each respondent in the dataset. This involved first adjusting for non-response among selected cases and then aligning respondents with the population on the available demographic characteristics. The method used to calculate weights was iterative proportion fitting (also called raking or rim-weighting). The characteristics used for adjustment were age at diagnosis, stage at diagnosis, years since diagnosis, and geographic location. Weights were used in calculating estimates of item proportions and averages, together with their standard errors and confidence intervals. Statistical significance was determined through the application of survey-weighted χ^2 and *t*-tests [19]. These methods account for the stratified nature of the sample, within years since diagnosis, and subsequent weighting to population characteristics. Results were considered significant if the *p*-values, adjusted for multiple comparisons [20], were 0.05 or less.

Regression modelling

Relationships between demographic-, disease-, and care-related variables and QoL (measured using EQ-5D-5L) were examined by multilevel regression analysis. The grouping variable was year since diagnosis (1 year, 3 years, 5 years) and the intercept was allowed to vary for each group. The variables included in the model were age at diagnosis, stage of cancer, treatment received, having a written care plan, having a named nurse, response of cancer to treatment, presence of other longstanding health conditions, language spoken at home, living arrangements, and socioeconomic status (using quartiles of the SocioEconomic Indexes for Areas, SEIFA, derived from postcode). Regression models were conducted both with and without the use of weights, to assess their impact.

Results

Response rates

From a total number of 1006 eligible cases, 459 (45.6%) responses were received (Table 1). For each cohort, response rates were 47.3% (158/334) at 1 year, 48.1% (161/335) at 3 years, and 41.5% (140/337) at 5 years.

Overall quality of life (EQ-5D-5L)

Quality of life was assessed using the EQ-5D-5L across five domains: mobility, personal care, usual activities, pain or discomfort, and anxiety or depression (Table 2). While the focus here is on weighted results, since these reflect the population of cancer survivors, we also included unweighted results for completeness. Comparisons were made between one cohort compared to the two remaining cohorts, for example, year 1 compared to years 3 and 5. Mobility was reported as highest at 3 years but there were no significant differences seen with personal care and usual activities.

Compared to the general population, a greater proportion of survivors of breast cancer reported problems with all QoL domains. Survivors 1 year post-diagnosis had significantly greater problems with pain or discomfort (59.2%)

Table 1 Demographic data of eligible and responding cases by years since diagnosis

	1 year				3 years				5 years			
	Eligible cases		Responding cases		Eligible cases		Responding cases		Eligible cases		Responding cases	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Age at diagnosis												
< 40	28	8.4	12	7.6	9	2.9	3	2.0	7	2.0	3	2.2
40–49	32	9.6	15	9.5	17	5.4	8	5.4	29	8.5	13	9.4
50–59	53	15.8	27	17.1	64	20.3	29	19.7	66	19.3	25	18.1
60–69	92	27.5	41	25.9	92	29.2	57	38.8	84	24.6	44	31.9
70–79	83	24.8	39	24.7	88	27.9	36	24.5	102	29.8	37	26.8
> 79	47	14.0	24	15.2	45	14.3	14	9.5	54	15.8	16	11.6
Stage at diagnosis												
1	143	42.8	71	43.8	165	49.3	80	49.4	173	51.3	69	48.6
2	143	42.8	69	42.6	110	32.8	49	30.2	125	37.1	56	39.4
3	45	13.5	19	11.7	55	16.4	29	17.9	37	11.0	16	11.3
4	1	0.3	1	0.6	5	1.5	3	1.9	2	0.6	1	0.7
Unknown	2	0.6	2	1.2	0	0.0	1	0.6	0	0.0	0	0.0
Total	334	100	158	100	335	100	161	100	337	100	140	100

Table 2 Frequencies and proportions of breast cancer survivors reporting problems (slight, moderate, severe, extreme/unable), by EQ-5D-5L items with comparison to the general population

EQ-5D-5L item	General population (%)	Unweighted frequencies (proportions)				Weighted frequencies (proportions)			
		All cohorts	1 year	3 years	5 years	All cohorts	1 year	3 years	5 years
Mobility	16.6	108 (23.5)	33 (20.9)	46 (28.6)	29 (20.7)	238 (23.7)	70 (21.0)	100 (29.8)	69 (20.4)
Personal care	4.5	29 (6.3)	10 (6.3)	11 (6.8)	8 (5.7)	67 (6.7)	22 (6.7)	24 (7.2)	20 (6.1)
Usual activities	14.8	143 (31.2)	59 (37.3)	50 (31.1)	34 (24.3)	314 (31.3)	125 (37.4)	106 (31.7)	83 (24.8)
Pain or discomfort	32.2	237 (51.6)	95 (60.1)	80 (49.7)	62 (44.3)	519 (51.6)	198 (59.2*)	169 (50.5)	152 (45.1)
Anxiety or depression	21.6	201 (43.8)	83 (52.5)	73 (45.3)	45 (32.1)	436 (43.4)	171 (51.3**)	155 (46.2)	110 (32.7**)

*$p < 0.05$, **$p < 0.005$

and anxiety or depression (51.3%) compared with survivors 3 and 5 years post-diagnosis ($p<0.05$). Fewer women experienced anxiety and/or depression at 5 years (32.7%) compared to years 1 and 3 post-diagnosis ($p<0.01$). Problems with usual activities were highest in those 1 year post-diagnosis (37.4%) compared with 3 years (31.7%) and 5 years (24.8%); however, this was not statistically significant. Problems with usual activities were approximately double in the survivor group compared to the general population (31.3% vs 14.8%).

Variables associated with quality of life (EQ-5D-5L)

Relationships between demographic-, disease-, and care-related variables and QoL (measured using EQ-5D-5L, standardized to have a mean of 0 and a standard deviation of 1) were examined by multilevel regression analysis, with years since diagnosis serving as the grouping variable. Coefficients, standard errors, and *p*-values are presented in Table 3. After adjusting for other characteristics, several variables were found to be significantly associated with EQ-5D-5L QoL. Improved quality of life was found in those who did not receive chemotherapy (coefficient = 0.2269, SE 0.1106, $p=0.0409$) and those who did not have a long-standing health condition (coefficient = 0.6342, SE 0.0955, $p<0.001$) . The following were associated with a worse quality of life. Those who were not certain what was happening with their breast cancer (coefficient = – 0.3674, SE 0.1408, $p=0.0094$) and those whose cancer had not been treated, had been treated but was still present or had returned after treatment (coefficient = – 0.5314, SE 0.2143, $p=0.0136$). The intra-class correlation for the model was 0.009, indicating low correlation of EQ-5D-5L scores within groups.

Breast cancer-specific quality of life (FACT-B)

Assessment of breast cancer-specific QoL revealed substantial proportions of women experiencing problems up to 5 years following their diagnosis (Table 4). Approximately one third of women did not feel sexually attractive at each time point, with 34.0% responding "not at all" to the item "I feel sexually attractive." Just over a quarter (25.7%) worried that other family members may also develop breast cancer, with a slightly greater prevalence of worry at 1 year (29.2%) compared to 5 years (21.3%) post-diagnosis. Across all time points, women were bothered by changes in weight (21.3%), were concerned about the effects of stress on their cancer (19.6%), and reported pain (18.6%).

Fear of cancer recurrence and unmet needs

Fear of cancer recurrence was most commonly reported and did not diminish over time (60.7%, 52.2%, and 56.9% at 1, 3, and 5 years, respectively) (Table 5). Approximately half of respondents at each time point reported trouble sleeping (59.6%, 49.9%, and 53.0% at 1, 3, and 5 years, respectively). Fear of cancer spread, fear of dying, fatigue, and cognitive and emotional problems were reported by between 29.2 and 50.6% of women at 1 year, and remained high (21.9% to 42.2%) at 5 years.

With regard to unmet needs, only about a half of all respondents (46.4% to 50.6%) reported "I have all the information and advice I need" (Table 6). Most issues appear to decrease between the time periods. However, the clear unmet needs which persisted or indeed increased at 5 years was the need to have information or advice for family and friends (11.4%), the need for information regarding support groups (14.8%), and dealing with the psychological and emotional aspects of living with cancer (30.8%).

Approximately one third of survivors desired more information regarding physical, psychological and emotional aspects of living with and after cancer, and approximately one fifth reported needs for information regarding diet, lifestyle, physical activity, and exercise.

Table 3 Multilevel model results, predicting EQ-5D-5L from selected characteristics, grouping by years since diagnosis ($n=459$)

Characteristic (reference category)	Estimate	SE	*t*	d*f*	*p*
(Intercept)	−0.3071	0.1758	−1.747	58.1	0.0859
Age (ref: 60–69 years)					
<40 years	−0.2175	0.2497	−0.871	414.1	0.3841
40–49 years	−0.1972	0.1456	−1.354	424.5	0.1765
50–59 years	−0.0946	0.1165	−0.812	427.9	0.4172
70–79 years	−0.0039	0.1419	−0.027	429.9	0.9781
>79 years	−0.1530	0.2419	−0.633	429.4	0.5273
Stage of cancer (ref: stage 1)					
Stage 2	−0.0129	0.1079	−0.120	429.4	0.9047
Stage 3/stage 4	0.2610	0.1507	1.732	429.4	0.0840
Treatments received: radiotherapy (ref: yes)					
Did not receive radiotherapy	0.0567	0.1141	0.497	428.2	0.6197
Treatments received: chemotherapy (ref: yes)					
Did not receive chemotherapy	0.2269	0.1106	2.051	429.2	0.0409*
Treatments received: hormone therapy (ref: yes)					
Did not receive hormone treatment	0.0081	0.0938	0.087	428.9	0.9310
Treatments received: surgery (ref: yes)					
Did not receive surgery	−0.2365	0.1585	−1.492	429.3	0.1363
Written care plan (ref: no)					
Yes, definitely	−0.0031	0.1623	−0.019	428.5	0.9846
Yes, I think so	−0.0564	0.1955	−0.288	428.4	0.7731
I do not need a care plan	0.1145	0.1038	1.104	428.6	0.2703
Not stated	−0.4017	0.2109	−1.905	428.4	0.0575
Named nurse (ref: no)					
Yes	0.0042	0.0991	0.043	296.2	0.9660
Not stated	0.0610	0.1950	0.313	429.9	0.7545
Response to treatment (ref: responded fully)					
I am not certain what is happening with my breast cancer	−0.3674	0.1408	−2.609	401.4	0.0094**
Other (not treated, treated but still present, Returned after treatment)	−0.5314	0.2143	−2.479	428.2	0.0136*
Not stated	−0.4213	0.2105	−2.002	427.9	0.0459*
Longstanding health condition (ref: yes)					
Does not have a longstanding health condition	0.6342	0.0955	6.641	430.0	0.0000***
Not stated	0.4229	0.1784	2.370	428.4	0.0182*
Language spoken at home (ref: English)					
Speaks a language other than English at home	0.0548	0.2373	0.231	427.9	0.8176
Not stated	0.1040	0.2311	0.450	427.9	0.6531
Living arrangements (ref: with partner, family or friends)					
Another arrangement (alone, In a nursing home, hospital or long-term care home, other)	0.1384	0.1198	1.155	429.5	0.2487
Socioeconomic status (ref: highest quartile)					
Lowest quartile (most disadvantaged)	−0.2734	0.1420	−1.925	428.2	0.0549
Second quartile	0.0536	0.1211	0.443	428.9	0.6583
Third quartile	−0.0176	0.1138	−0.155	428.0	0.8773

A positive estimate represents an improved quality of life. Reference categories were set as the most frequently occurring for each characteristic

*$0.01<p\leq 0.05$, **$0.001<p\leq 0.01$, ***$p\leq 0.001$

Table 4 Weighted and unweighted frequencies (and proportions) of breast cancer survivors reporting problems with FACT-B items

FACT-B item	Unweighted frequencies (proportions)				Weighted frequencies (proportions)			
	All cohorts	1 year	3 years	5 years	All cohorts	1 year	3 years	5 years
I have been short of breath								
Not at all	299 (65.1)	110 (69.6)	95 (59.0)	94 (67.1)	657 (65.3)	235 (70.3)	193 (57.5)	229 (68.0)
A little bit/somewhat	130 (28.3)	41 (25.9)	54 (33.5)	35 (25.0)	286 (28.4)	85 (25.3)	119 (35.6)	82 (24.3)
Quite a bit/very much	15 (3.3)	5 (3.2)	5 (3.1)	5 (3.6)	32 (3.2)	11 (3.2)	10 (2.9)	12 (3.6)
I am self-conscious about the way I dress								
Not at all	292 (63.6)	92 (58.2)	107 (66.5)	93 (66.4)	639 (63.5)	194 (57.9)	221 (66.1)	224 (66.5)
A little bit/somewhat	105 (22.9)	52 (32.9)	20 (12.4)	33 (23.6)	229 (22.7)	111 (33.3)	41 (12.2)	77 (22.7)
Quite a bit/very much	33 (7.2)	8 (5.1)	19 (11.8)	6 (4.3)	74 (7.4)	16 (4.9)	42 (12.6)	16 (4.7)
One or both of my arms are swollen or tender								
Not at all	315 (68.6)	101 (63.9)	109 (67.7)	105 (75.0)	695 (69.0)	215 (64.4)	226 (67.5)	253 (75.2)
A little bit/somewhat	90 (19.6)	42 (26.6)	28 (17.4)	20 (14.3)	196 (19.5)	88 (26.3)	59 (17.7)	49 (14.5)
Quite a bit/very much	25 (5.4)	6 (3.8)	12 (7.5)	7 (5.0)	52 (5.2)	13 (3.7)	24 (7.2)	16 (4.6)
I feel sexually attractive								
Not at all	157 (34.2)	54 (34.2)	55 (34.2)	48 (34.3)	342 (34.0)	115 (34.6)	114 (33.9)	113 (33.6)
A little bit/somewhat	186 (40.5)	69 (43.7)	61 (37.9)	56 (40.0)	413 (41.0)	144 (43.3)	130 (38.9)	138 (40.8)
Quite a bit/very much	66 (14.4)	22 (13.9)	24 (14.9)	20 (14.3)	146 (14.5)	46 (13.8)	49 (14.7)	50 (15.0)
I am bothered by hair loss								
Not at all	298 (64.9)	94 (59.5)	107 (66.5)	97 (69.3)	654 (65.0)	199 (59.7)	218 (65.1)	236 (70.2)
A little bit/somewhat	89 (19.4)	37 (23.4)	27 (16.8)	25 (17.9)	199 (19.7)	78 (23.4)	62 (18.4)	59 (17.5)
Quite a bit/very much	35 (7.6)	15 (9.5)	12 (7.5)	8 (5.7)	75 (7.4)	31 (9.3)	25 (7.4)	19 (5.6)
I worry that other members of my family might someday get the same illness I have								
Not at all	109 (23.7)	39 (24.7)	37 (23.0)	33 (23.6)	241 (24.0)	86 (25.7)	76 (22.7)	79 (23.6)
A little bit/somewhat	209 (45.5)	65 (41.1)	74 (46.0)	70 (50.0)	457 (45.4)	136 (40.7)	154 (45.8)	167 (49.7)
Quite a bit/very much	119 (25.9)	47 (29.7)	42 (26.1)	30 (21.4)	258 (25.7)	98 (29.2)	89 (26.6)	72 (21.3)
I worry about the effect of stress on my illness								
Not at all	163 (35.5)	48 (30.4)	59 (36.6)	56 (40.0)	357 (35.5)	103 (30.9)	119 (35.5)	134 (39.9)
A little bit/somewhat	183 (39.9)	62 (39.2)	65 (40.4)	56 (40.0)	400 (39.7)	131 (39.2)	138 (41.0)	131 (38.9)
Quite a bit/very much	89 (19.4)	41 (25.9)	26 (16.1)	22 (15.7)	197 (19.6)	85 (25.3)	57 (17.0)	56 (16.5)
I am bothered by a change in weight								
Not at all	203 (44.2)	68 (43.0)	78 (48.4)	57 (40.7)	442 (43.9)	146 (43.6)	157 (46.9)	139 (41.3)
A little bit/somewhat	135 (29.4)	44 (27.8)	42 (26.1)	49 (35.0)	299 (29.7)	92 (27.6)	93 (27.6)	114 (33.9)
Quite a bit/very much	98 (21.4)	40 (25.3)	32 (19.9)	26 (18.6)	215 (21.3)	83 (24.8)	67 (20.1)	65 (19.2)
I have certain parts of my body where I experience pain								
Not at all	142 (30.9)	48 (30.4)	49 (30.4)	45 (32.1)	309 (30.7)	104 (31.1)	101 (30.0)	105 (31.1)
A little bit/somewhat	214 (46.6)	75 (47.5)	68 (42.2)	71 (50.7)	470 (46.7)	156 (46.6)	140 (41.8)	174 (51.6)
Quite a bit/very much	85 (18.5)	28 (17.7)	37 (23.0)	20 (14.3)	187 (18.6)	59 (17.8)	80 (23.9)	48 (14.1)

Discussion

This unique study in Australian breast cancer survivors aimed to use two validated tools for patient- reported outcomes measures to assess overall QoL and disease-specific measures at 1, 3, and 5 years post-breast cancer diagnosis. It also additionally added unmet needs and ongoing symptoms into the questionnaire. It provides a cross-sectional analysis of survivors in both regional and metropolitan centers in the state of Victoria as survivors were identified from the state's cancer registry rather than institutions. The study highlights the unmet needs, which persist at 5 years, such as fear of cancer recurrence and fear for the family members' risk of cancer. Long-term pain and sexual attractiveness also remain an issue.

In Australian breast cancer patients, PROMs have been reported in institutional studies [21, 22] but units are only now addressing the feasibility of routine capture. There are a myriad of tools which are cancer-specific or breast cancer-specific attempting to assess QoL measures, but their implementation to date has been ad hoc and frequently institution-based rather that population-based. Many of the tools are

Table 5 Frequencies and proportions of breast cancer survivors reporting "strongly agree" or "agree" with the following symptom items

Symptom	Unweighted frequencies (proportions)				Weighted frequencies (proportions)			
	All cohorts	1 year	3 years	5 years	All cohorts	1 year	3 years	5 years
Fear of cancer spreading	189 (41.2)	76 (48.1)	61 (37.9)	52 (37.1)	415 (41.3)	161 (48.1)	132 (39.4)	122 (36.4)
Fear of recurrence	259 (56.4)	97 (61.4)	81 (50.3)	81 (57.9)	569 (56.6)	203 (60.7)	175 (52.2)	192 (56.9)
Fear of dying	127 (27.7)	47 (29.7)	49 (30.4)	31 (22.1)	275 (27.3)	98 (29.2)	103 (30.9)	74 (21.9)
Trouble sleeping	248 (54.0)	96 (60.8)	79 (49.1)	73 (52.1)	545 (54.1)	199 (59.6)	167 (49.9)	178 (53.0)
Trouble concentrating	160 (34.9)	67 (42.4)	55 (34.2)	38 (27.1)	350 (34.8)	138 (41.4)	120 (35.9)	91 (27.1)
Memory loss	185 (40.3)	77 (48.7)	59 (36.6)	49 (35.0)	411 (40.8)	159 (47.5)	133 (39.8)	119 (35.2)
Always tired	210 (45.8)	81 (51.3)	70 (43.5)	59 (42.1)	462 (45.9)	169 (50.6)	151 (44.9)	142 (42.2)
Mood swings	149 (32.5)	59 (37.3)	51 (31.7)	39 (27.9)	327 (32.5)	122 (36.5)	108 (32.3)	97 (28.9)
Often irritable	127 (27.7)	48 (30.4)	44 (27.3)	35 (25.0)	281 (27.9)	98 (29.4)	95 (28.4)	87 (25.9)

Table 6 Unmet information needs of breast cancer survivors at 1, 3, and 5 years

Advice or information domain	Unweighted frequencies (proportions)				Weighted frequencies (proportions)			
	All cohorts	1 year	3 years	5 years	All cohorts	1 year	3 years	5 years
Diet and lifestyle	97 (21.1)	38 (24.1)	32 (19.9)	27 (19.3)	215 (21.4)	81 (24.2)	68 (20.2)	67 (19.8)
Physical activity and exercise	81 (17.6)	34 (21.5)	23 (14.3)	24 (17.1)	180 (17.9)	71 (21.3)	49 (14.7)	59 (17.7)
Financial help or benefits	67 (14.6)	28 (17.7)	20 (12.4)	19 (13.6)	145 (14.4)	57 (17.0)	42 (12.7)	45 (13.5)
Cost of prescriptions	61 (13.3)	22 (13.9)	23 (14.3)	16 (11.4)	131 (13.0)	46 (13.7)	47 (14.2)	38 (11.2)
Returning to or staying in work	34 (7.4)	15 (9.5)	10 (6.2)	9 (6.4)	77 (7.6)	31 (9.2)	22 (6.7)	23 (6.9)
Information/advice for family/friends/carer	43 (9.4)	12 (7.6)	16 (9.9)	15 (10.7)	99 (9.8)	25 (7.4)	35 (10.6)	38 (11.4)
Information about support groups	55 (12.0)	18 (11.4)	16 (9.9)	21 (15.0)	124 (12.3)	37 (11.2)	37 (11.0)	50 (14.8)
Pain management and control	48 (10.5)	21 (13.3)	16 (9.9)	11 (7.9)	104 (10.3)	44 (13.0)	34 (10.2)	26 (7.8)
The physical aspects of living with and after cancer	141 (30.7)	52 (32.9)	50 (31.1)	39 (27.9)	317 (31.5)	108 (32.3)	110 (32.8)	99 (29.5)
The psychological or emotional aspects of living with and after cancer	124 (27.0)	40 (25.3)	42 (26.1)	42 (30.0)	278 (27.6)	82 (24.7)	92 (27.3)	104 (30.8)
I have all the information and advice I need	224 (48.8)	72 (45.6)	83 (51.6)	69 (49.3)	488 (48.5)	155 (46.4)	170 (50.6)	163 (48.4)

not survivorship-specific. This study demonstrated a feasible approach for a population-wide study from the cancer registry and removes potential biases from the impact of tertiary cancer centers and insurance status.

Internationally, an attempt to address feasibility in capturing PROMs was shown in the NHS study which had an overall response rate of 68.4% in breast cancer survivors and the presence of long-term comorbidities, self-reporting disease status, and undertaking little physical activity were associated with poorer QoL [3]. Of 854 patients, two-thirds reported pain issues, high QoL in 24% and low in 8.9%. The presence of long-term comorbidities, self-reporting disease status, limited physical activity, and a high fear of cancer recurrence (47%) [3] were associated with a lower quality of life. The NHS study also showed having recurrence of disease or being uncertain of disease status and being from a deprived region in the UK, were associated with poorer outcomes across all three measures while increased physical activity was associated with higher QoL scores. Similarly, long-term comorbidities influenced QoL and fear of cancer recurrence was high in our study [23].

This study had a similar response rate to other studies [23] especially for a mail-out study. Limitations include the lack of PROMs at baseline and that the tools are intended for use during the treatment phase only and not in survivorship. Issues such as enduring fear of cancer recurrence, insomnia, and fatigue are not captured. Baseline QoL is important to address unmet needs and the impact of disease on QoL. The lack of specific treatment information, histological subtypes, and cancer outcomes data such as local recurrence and survivorship issues beyond the 5 years of follow-up, is also a limitation. Intensity and combinations of treatment may affect patients at different time points and for a longer duration beyond 5 years.

This study has its strength in demonstrating that a population-wide study from the cancer registry is feasible and removes potential biases from the impact of tertiary cancer centers and insurance status. However, going forward, these factors are important in assessing value-based care.

Future directions and conclusions

At the time of commencement of this study, there was minimal robust data providing population-level outcomes research in breast cancer. Routine collection of PROs is preferred and future studies need to assess feasibility of routine capture in breast cancer patients. Defining appropriate PROMs for assessment remains a challenge but a working party initiative, the International Consortium for Health Outcomes Measurement (ICHOM) group, is one group seeking to address this. A list of outcomes were validated in 1225 international breast cancer survivors and input from both patients and the working group members was sought to assess feasibility of selected PROs [3]. Twenty-six outcomes were selected focusing on survival and cancer control, acute treatment complications and QoL, functioning, and long-term adverse events [24–28]. All PROMs are to be collected at baseline, 1 year, and 10 years post-diagnosis. An international approach is ideal but needs implementation and feasibility studies.

Conclusions

Population-based data in breast cancer survivors can be achieved and this study identified fear of cancer recurrence, fatigue, and insomnia as long-term issues and pain. Routine prospective collection of PROMs is a challenge particularly to bridge the treatment and survivorship phases. The key features to any future approach is for collection of PROMs to be routine, to be analyzed in the dynamic setting of active supportive care input and in the context of disease-free survival and overall survival rates. Only then can the value of breast cancer treatments be truly assessed.

Author contributions All authors have contributed at each stage of the project.

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Data availability The data are stored in a deidentified database in the VCCC.

Compliance with ethical standards

Conflict of interest There are no conflicts of interest/competing interests.

Ethical approval Ethical approval to conduct the study was granted on September 30, 2013, by the Cancer Council Victoria Human Research Ethics Committee (Project No: HREC 1307).

Informed consent All patients consented to participate as per PROJECT HREC1307). All authors have consented for publication.

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