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ORIGINAL REPORT

# Trends in Health-Related Quality of Life After a Diagnosis of Ductal Carcinoma In Situ

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## ABSTRACT

### Purpose

Studies of quality of life (QoL) are scarce among survivors of ductal carcinoma in situ (DCIS). The objective of this study was to assess long-term QoL in DCIS survivors in relation to age at diagnosis, time since diagnosis, and treatments received.

### Methods

We assessed physical and mental measures of health-related QoL in 1,604 patients with DCIS diagnosed in 1997 to 2006 with up to four follow-up interviews. We further compared baseline QoL to 1,055 control patients without DCIS. QoL was measured using the validated Medical Outcomes Study Short Form 36 Health Status Survey questionnaire. Among patients with DCIS, we examined trends in QoL over time since diagnosis using generalized linear regression models, adjusting for confounders. We tested for effect modification by surgical treatment choice, post-treatment endocrine therapy use, and age at diagnosis.

### Results

Both physical and mental measures of QoL among DCIS survivors at fewer than 2 years after diagnosis were comparable to controls. Mental measures of QoL among patients with DCIS declined at ≥ 10 years after diagnosis and were significantly lower than at less than 2 years after diagnosis (47.4 *v* 52.0; $P < .01$). In the first 5 years after a DCIS diagnosis, mental QoL was significantly higher among women diagnosed at ages 50 to 74 years compared with those diagnosed at ages 28 to 49 years, although this difference was not sustained in later time periods.

### Conclusion

QoL after a DCIS diagnosis was generally comparable to that of women of similar age without a personal history of DCIS. Our findings suggest that DCIS survivors, and particularly those diagnosed at a younger age, may benefit from support for mental QoL.

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## INTRODUCTION

Ductal carcinoma in situ (DCIS) is a noninvasive form of breast cancer that accounts for approximately 20% of current US breast cancer diagnoses.[1] Studies of quality of life (QoL) in exclusively DCIS populations are scarce, despite differences in treatment and prognosis compared with invasive breast cancer that suggest that QoL in DCIS survivors may be unique. Prior studies have found that both physical and mental QoL for DCIS survivors may decline shortly after treatment[2-4] but may improve to the level of control participants of similar age.[2,5,6] However, these results are not consistent,[7,8] and few studies have examined QoL in DCIS survivors at more than 5 years after diagnosis.[3,7]

Treatment and demographic factors may influence QoL after a DCIS diagnosis. Studies among invasive breast cancer survivors indicate that those treated with mastectomy reported lower QoL compared with those treated with breast-conserving surgery.[10,11] However, one study comparing QoL by treatment type in DCIS survivors found no difference in physical or psychological QoL between treatment types.[7] This study was based on a single QoL assessment and did not examine changes in QoL over time. Women diagnosed with invasive breast cancer at a younger age have reported lower psychological QoL than those diagnosed at a more advanced age.[13,14] No studies to our knowledge have investigated QoL by age at diagnosis in a DCIS population.

We investigated physical and mental QoL in the Wisconsin In Situ Cohort (WISC), a population-based cohort with up to 17 years of postdiagnosis follow-up. We examined trends in QoL over time since diagnosis and compared QoL for patients with DCIS at baseline to controls. We further examined differences in QoL among patients with DCIS by treatment type, post-treatment endocrine therapy use, and age at DCIS diagnosis.

## METHODS

### Patients With DCIS

The WISC includes women with a first diagnosis of DCIS reported to the mandatory Wisconsin Cancer Reporting System.[15] The cohort is composed of 1,925 incident patients with DCIS who were originally recruited for a series of case-control studies during 1997 to 2006. Participants were female residents of Wisconsin, age 20 to 74 years at diagnosis. Eligibility criteria for the WISC included a known date of diagnosis and a listed telephone number. Women recruited during 1997 to 2001 were also required to hold a Wisconsin driver's license for comparability with controls in the original case-control study. All women provided verbal consent to participate in the WISC, and the study was approved by the University of Wisconsin Health Sciences Institutional Review Board.

Of the women eligible for enrollment, 76% participated in the baseline telephone interview, which occurred at an average of 1.3 years after diagnosis (range, 0.3 to 4.0 years). Follow-up data collection was performed at intervals of 2 years or more. Because patients with DCIS were enrolled continuously throughout the recruitment period, not all women were eligible for every follow-up interview (ie, follow-up occurred at $< 2$ years since enrollment or last previous interview). Figure 1 details the recruitment and follow-up timeline for the patients with DCIS.

### Controls

Community controls ages 20 to 69 years were randomly selected from lists of licensed Wisconsin drivers during 2002 to 2006. Controls were selected at random within 5-year age strata to yield an age distribution similar to the age of patients with DCIS at diagnosis. Eligible controls had no personal history of breast cancer and had a listed telephone number. Of the 1,668 potential controls approached for participation, six (0.4%) were deceased, 135 (8.1%) could not be located, and 442 (26.5%) refused to participate. Interviews were obtained for 1,085 (65.0%) of potential controls. Controls were only interviewed once as part of the original set of case-control studies, with no follow-up data collection.

### QoL Assessment

QoL was assessed using the validated Medical Outcomes Study Short Form 36 Health Status Survey (SF-36).[16] The SF-36 uses a standard scoring procedure to convert responses to 36 questions into summary scores for eight domains of physical and mental health. These domain scores are summarized into physical component summary (PCS) and mental component summary (MCS) scores. Higher scores on the summary measures indicate better QoL. The PCS and MCS are normalized to a standard population on the basis of the National Survey of Functional Health Status (1998), which was designed to represent the US population in terms of age, income, and household size. Standardized scores are transformed to a mean of 50 and standard deviation of 10 to facilitate comparison between scales and to US population norms.[16] Previous investigations have established a difference of five in standardized scores as a clinically meaningful variance in QoL.[16] In our analysis, we compared standardized scores between patients with DCIS and a control population as opposed to US norms, because our controls reflected the specific age range, sex, and location of our patients with DCIS. Details of the standard scoring procedure, as well as reliability and validity information for the SF-36, are described in detail elsewhere.[16]

### Covariate Assessment

Covariate information was assessed at baseline and, for patients with DCIS, at each follow-up data collection. Covariates were selected a priori on the basis of known predictors of QoL and availability within the WISC data. The following covariates were assessed at baseline and considered static in our analysis: age at diagnosis, family history of breast cancer, education, number of mammograms in the 5 years before baseline, and surgical treatment type. Covariates that were considered time-varying included: age at interview, menopausal status, number of comorbidities, body mass index (kg/m$^2$), postmenopausal hormone use, average household income, living with a partner, insurance type, and post-treatment endocrine therapy use (tamoxifen, raloxifene, or aromatase inhibitors). Number of comorbidities was calculated on the basis of diagnoses included in the Charlson Comorbidity Index.[17] The distribution of the time-varying covariates in the patients with DCIS changed over time

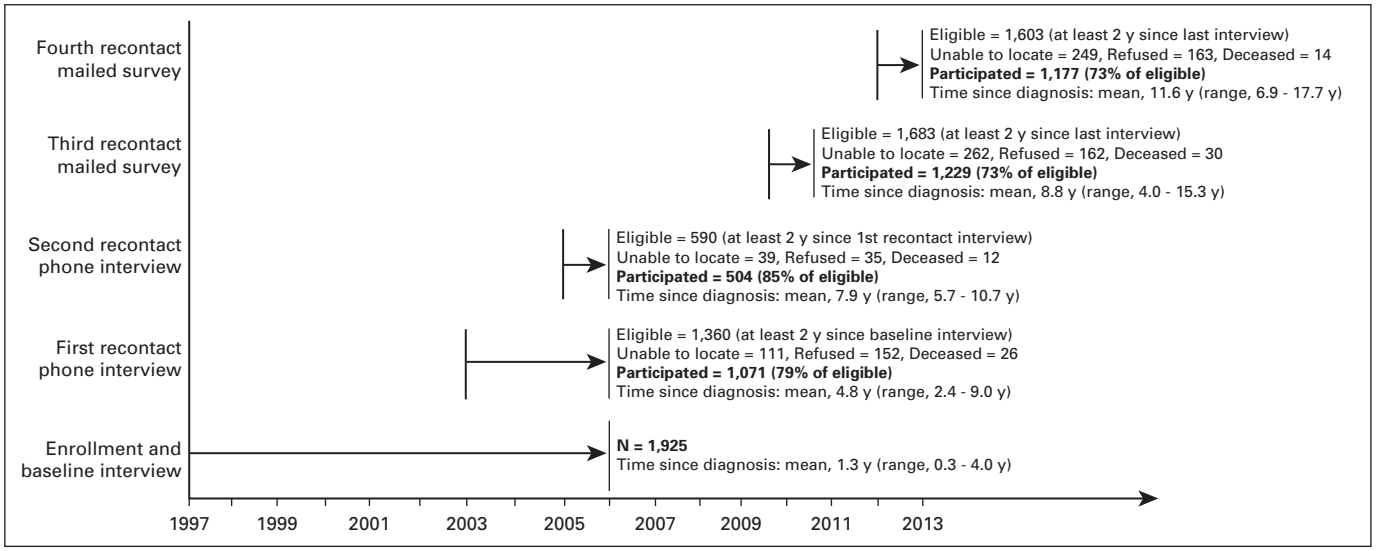


**Fig 1.** Recruitment and follow-up timeline for patients with ductal carcinoma in situ (DCIS) in the Wisconsin In Situ Cohort, 1997 to 2013. y, years.

  

**Table 1.** Selected Characteristics of Patients With DCIS at Baseline and Controls: Wisconsin In Situ Cohort, 1997 to 2013

| | Patients With DCIS (n = 1,604) | Controls (n = 1,055) | *P** |
|---|---|---|---|
| Age at diagnosis (patients with DCIS) or reference (controls), years | | | |
| 20-44 | 199 (12.4) | 125 (11.9) | .17 |
| 45-54 | 580 (36.1) | 403 (38.2) | |
| 55-64 | 503 (31.4) | 374 (35.5) | |
| 65-74 | 322 (20.1) | 153 (14.5) | |
| Menopausal status | | | |
| Premenopausal | 513 (34.8) | 304 (31.7) | .11 |
| Postmenopausal | 962 (65.2) | 656 (68.3) | |
| First degree family history of breast cancer | | | |
| No | 1,174 (76.4) | 860 (83.6) | < .01 |
| Yes | 362 (23.6) | 169 (16.4) | |
| No. of comorbidities† | | | |
| 0 | 687 (70.5) | 743 (72.7) | .63 |
| 1 | 119 (12.2) | 121 (11.9) | |
| 2 | 130 (13.3) | 118 (11.6) | |
| ≥ 3 | 39 (4.0) | 39 (3.8) | |
| BMI,‡ kg/m$^2$ | | | |
| < 18.5 | 16 (1.1) | 14 (1.4) | < .01 |
| 18.5-4.9 | 700 (45.8) | 383 (36.2) | |
| 25-29.9 | 479 (31.3) | 331 (31.2) | |
| ≥ 30 | 333 (21.8) | 301 (28.2) | |
| Education | | | |
| < High school diploma | 74 (4.6) | 47 (4.5) | .87 |
| High school diploma | 644 (38.1) | 420 (39.8) | |
| Some college | 442 (27.6) | 270 (25.6) | |
| College degree | 477 (29.7) | 317 (30.1) | |
| Annual household income | | | |
| < $15,000 | 63 (5.6) | 58 (6.2) | .09 |
| $15,000-50,000 | 475 (42.3) | 441 (47.3) | |
| $50,001-99,999 | 424 (37.8) | 312 (33.4) | |
| ≥ $100,000 | 161 (14.3) | 122 (13.1) | |
| Living with a partner | | | |
| No | 292 (18.2) | 242 (23.0) | .03 |
| Yes | 1,312 (81.8) | 812 (77.0) | |
| Insurance type | | | |
| No insurance | 8 (0.8) | 35 (3.5) | < .01 |
| Private insurance | 737 (77.3) | 798 (80.4) | |
| Medicare (with or without supplement) or Medicaid | 208 (21.9) | 159 (16.1) | |
| No. of mammograms in the past 5 years | | | |
| 0-4 | 433 (28.0) | 338 (37.6) | .01 |
| ≥ 5 | 1,111 (72.0) | 651 (62.4) | |
| Postmenopausal hormone use | | | |
| No | 858 (53.6) | 570 (54.2) | .75 |
| Yes | 743 (46.4) | 481 (45.8) | |
| Post-treatment endocrine therapy use, patients with DCIS | | | |
| No | 913 (57.9) | NA | NA |
| Yes | 665 (42.1) | | |
| Surgical treatment type, patients with DCIS | | | |
| Ipsilateral mastectomy | 545 (35.1) | NA | NA |
| Bilateral mastectomy | 77 (5.0) | | |
| Breast-conserving surgery without radiation | 146 (9.4) | | |
| Breast-conserving surgery with radiation | 743 (47.9) | | |
| Biopsy only | 40 (2.6) | | |
| Time between diagnosis and first QoL observation, patients with DCIS, years | | | |
| < 2 | 984 (61.1) | NA | NA |
| 2-4 | 196 (12.5) | | |
| 5-9 | 413 (25.7) | | |
| ≥ 10 | 11 (0.7) | | |

NOTE. Categories may not sum to total N because of missing values.
Abbreviations: BMI, body mass index; DCIS, ductal carcinoma in situ; NA, not applicable; QoL, quality of life.
**P* values from $\chi^2$ test comparing patients with DCIS and controls among those with known covariate status.
†Comorbidity data not collected at baseline interviews from 1997 to 2001 (603 patients with DCIS).
‡BMI at 1 year prediagnosis recalled at baseline (patients with DCIS).

as women grew older. The distribution at increasing time intervals since diagnosis and a comparison with the one-time assessment of covariates among the controls is presented in Appendix Table A1 (online only).

### *Statistical Analysis*

QoL information was not collected at the baseline interview for the 838 patients with DCIS recruited during 1997 to 2001. However, these women were able to contribute QoL information at subsequent follow-ups. A total of 166 women did not contribute QoL information at baseline or any follow-up and were therefore excluded from our analysis. An additional 155 women reported a second breast cancer event during follow-up and were also excluded. Because the control group did not include women in the oldest age category (≥ 75 years), we excluded patient observations in this age group (423 observations) to ensure overlapping age distributions between controls and patients with DCIS at each time interval during follow-up. These exclusions resulted in 1,604 patients with DCIS who contributed 4,119 observations (mean, 2.6; range, one to four observations per woman). Thirty of the controls did not report complete QoL information and were excluded from the current analysis, leaving 1,055 controls. Women excluded from the study did not differ from the remaining women with regard to baseline characteristics.

We performed a descriptive analysis of demographic, reproductive, and medical history factors for the patients with DCIS at baseline and for the controls. We used generalized linear regression to calculate predicted mean QoL scores (PCS and MCS) for patients with DCIS and controls. Mean QoL scores were adjusted for all of the covariates listed above, and patients with DCIS were stratified by time since diagnosis categories (< 2 years, 2 to 4 years, 5 to 9 years, ≥ 10 years). The Wald $\chi^2$ test was used to determine statistically significant differences at $P < .05$. We tested for effect modification using cross-product terms. We incorporated repeated measures to account for within-woman correlations among women who contributed observations at more than one time interval.

Among patients with DCIS, we calculated adjusted mean QoL scores (PCS and MCS) by time since diagnosis using a similar generalized linear regression model with additional adjustment for age at interview. Because age at diagnosis, choice of surgical treatment, and post-treatment endocrine therapy have been shown to be associated with QoL after invasive breast cancer, we tested for effect modification by these factors and stratified our results as appropriate. Age at diagnosis was dichotomized as younger than 50 years versus ≥ 50 years. Surgical treatment type was dichotomized as survivors (with or without radiation) versus mastectomy (ipsilateral or bilateral).

Because of the WISC recruitment timeline and variable response rates, not all women contributed observations to all time since diagnosis categories. We therefore performed a sensitivity analysis limited to women who contributed at least one observation to each time since diagnosis category (ie, women with tracking from < 2 years to ≥ 10 years since diagnosis).

All statistical analysis was performed using SAS version 9.4.

## RESULTS

On average, patients with DCIS were 55.4 years old at baseline, and 65% were postmenopausal (Table 1). A majority (57%) of patients with DCIS had some education beyond high school, and 71% reported no comorbidities at baseline. Controls were 54.4 years of age on average, and 68% were postmenopausal. Similar to the patients with DCIS, 56% had education beyond high school, and 73% were free from comorbidities. Fewer controls than patients with DCIS had a family history of breast cancer (16% *v* 24%) or were living with a partner at baseline (77% *v* 82%).

In the multivariable adjusted model, we observed no trend in PCS scores over time since diagnosis for patients with DCIS and no significant differences from controls (Fig 2A). MCS scores were consistent up to 10 years since diagnosis but were significantly lower at ≥ 10 years after diagnosis than for women at earlier time intervals and controls (47.4 at ≥ 10 years after diagnosis *v* 52.0 at < 2 years after diagnosis and 51.5 for controls; $P < 0.01$ for each comparison; Fig 2B).

We observed a significant interaction in MCS between time since diagnosis and age at diagnosis ($P < .01$) but did not observe a similar interaction in PCS ($P = .14$). When stratified by age at diagnosis, women who were diagnosed at age 50 years or older reported significantly higher MCS in time periods close to diagnosis than women diagnosed at a younger age, although neither group was significantly different from controls (< 2 years after diagnosis: 49.0 for women age < 50 years at diagnosis *v* 54.2 for women age ≥ 50 years at diagnosis; $P = .01$; Fig 3A). The difference by age at diagnosis decreased in later time periods, and MCS was similar for all women at ≥ 10 years since diagnosis (47.4 for women age < 50 years at diagnosis and 49.8 for women age ≥ 50 years at diagnosis; $P = .21$). We observed no difference in either PCS or MCS according to treatment type (Fig 3B) or to post-treatment endocrine therapy use (Fig 3C; $P > .25$ for all tests of interaction).

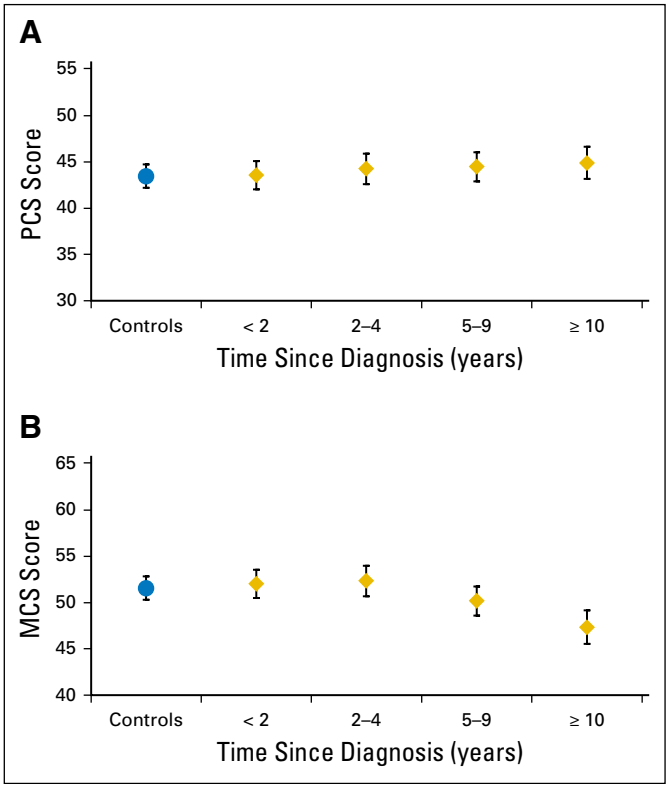


**Fig 2.** Predicted values of (A) physical component summary (PCS) and (B) mental component summary (MCS) scores by time since diagnosis; higher scores indicate better quality of life (N = 1,604): Wisconsin In Situ Cohort, 1997 to 2013. Adjusted for age at interview, menopausal status, family history of breast cancer, number of comorbid conditions, body mass index, education, income, living with a partner, insurance status, mammogram history, postmenopausal hormone use, post-treatment endocrine therapy use, and surgical treatment type.

  

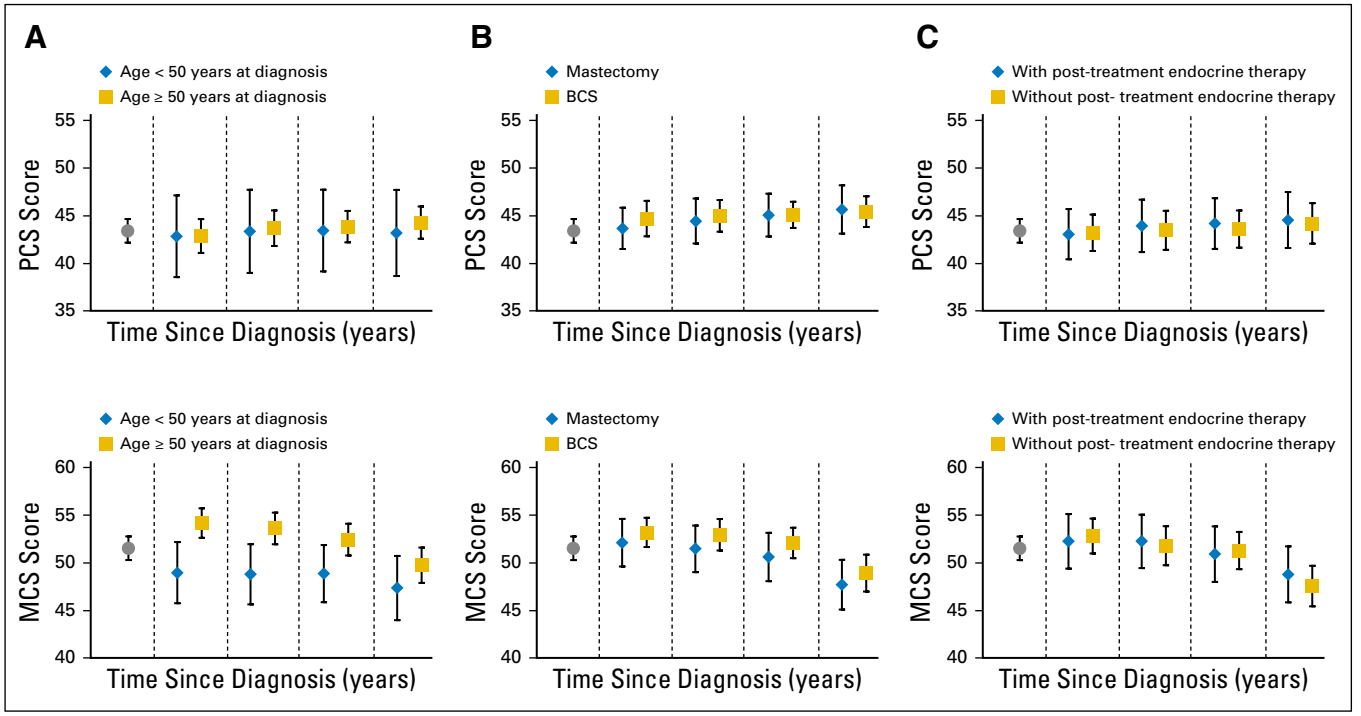


**Fig 3.** Predicted values of physical component summary (PCS) and mental component summary (MCS) scores by time since diagnosis, stratified by (A) age at diagnosis, (B) surgical treatment type, and (C) post-treatment endocrine therapy use; higher scores indicate better quality of life (N = 1,604): Wisconsin In Situ Cohort, 1997 to 2013. Adjusted for age at interview, menopausal status, family history of breast cancer, number of comorbid conditions, body mass index, education, income, living with a partner, insurance status, mammogram history, postmenopausal hormone use, post-treatment endocrine therapy use (A, B), and surgical treatment type (A, C). BCS, breast-conserving surgery.

When stratified by age at interview, PCS scores for patients with DCIS were comparable to controls, regardless of time since diagnosis (Fig 4A). Likewise, MCS scores for patients with DCIS did not significantly differ from controls (Fig 4B). Women at ≥ 10 years since diagnosis had consistently, but not significantly, lower MCS regardless of age at interview.

Among the 675 women who contributed QoL observations in each time since diagnosis interval, we observed similar trends to those seen in the full study population, although confidence intervals were wider (Table A2).

## DISCUSSION

We observed that mental QoL was significantly lower for women at ≥ 10 years after diagnosis than at earlier time periods. In the first 5 years after diagnosis, mental QoL for women diagnosed at an older age was higher than for women diagnosed at a younger age, but this difference was not sustained beyond 5 years after diagnosis. We observed no significant differences in physical QoL between patients with DCIS and controls and no significant trends in physical QoL over time since DCIS diagnosis.

Although we observed statistically significant differences in mental QoL among subsets of our study population, these differences were relatively modest. A difference in standardized PCS and MCS scoring of five is accepted as clinically meaningful.[16] In our analysis, the difference in mental QoL between women at fewer than 2 years since diagnosis compared with those at ≥ 10 years since diagnosis was approximately 5 (52.0 *v* 47.4), as was the difference in mental QoL in the 2 years after diagnosis for women diagnosed at younger than 50 years of age compared with those diagnosed at ≥ 50 years of age (54.2 *v* 49.0). Although these differences are statistically significant, they may be of borderline clinical significance.

Our findings of no difference in physical QoL between DCIS survivors and controls of similar age is consistent with previous literature. Physical impairment has been shown among women in the 6 weeks[2] and up to 6 months[3] after diagnosis, with recovery to the level of controls typically after 1 to 3 years.[2,3,7] The first assessment of QoL in our study population was taken at an average of 1.3 years since diagnosis, meaning that immediate physical impacts of surgical treatment were likely not captured.

We observed that mental QoL was significantly lower among women at ≥ 10 years since diagnosis compared with women at fewer than 2 years or at 2 to 4 years since diagnosis and compared with controls. However, because controls were surveyed once and not followed over time, some caution should be taken in interpreting this comparison. Furthermore, controls in our study were required to hold a Wisconsin driver's license, which was a requirement for patients with DCIS recruited from 1997 to 2001 but not for those recruited from 2002 to 2006. Therefore, controls may have had fewer health limitations than the overall patient population. However, we did not observe a significant difference in mental QoL at ≥ 10 years since diagnosis between women with DCIS recruited earlier and those recruited later, indicating that the impact of the driver's license requirement in terms of biasing the QoL distribution is likely to be small.

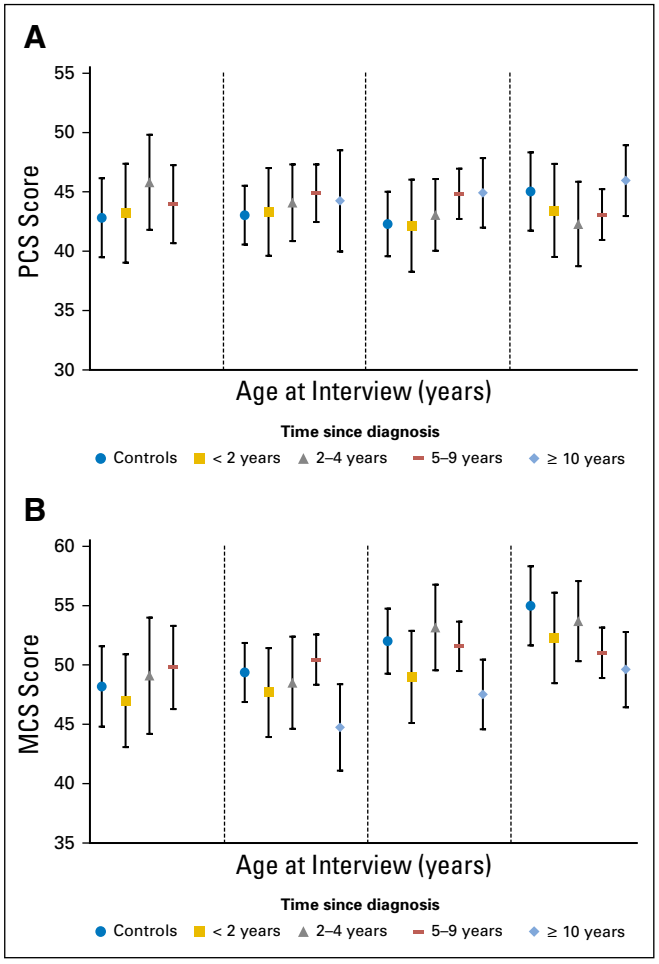


**Fig 4.** Predicted values of (A) physical component summary (PCS) and (B) mental component summary (MCS) scores by age and time since diagnosis; higher scores indicate better quality of life (N = 1,604 patients with ductal carcinoma in situ [DCIS], 1,055 controls): Wisconsin In Situ Cohort, 1997 to 2013. Adjusted for menopausal status, family history of breast cancer, number of comorbid conditions, body mass index, education, income, living with a partner, insurance status, mammogram history, postmenopausal hormone use, post-treatment endocrine therapy use (patients with DCIS), and surgical treatment type (patients with DCIS).

Some studies have found that SF-36 scores decline with age in healthy populations[18,19]; however, others have reported an improvement in feelings of well-being with age,[20] which was the trend in our control population. Response rates in the WISC are high, and it is unlikely that women with high QoL at more than 10 years after diagnosis were less likely to respond to our survey; instead, it is more plausible that women with poorer mental QoL at later time periods were more likely to decline follow-up surveys. Our results could reflect changes in the WISC data collection methods. The baseline and first two data collections (1 to 9 years after diagnosis) were performed via telephone interview, whereas the following two data collections (4 to 17 years after diagnosis) were performed via mailed survey. Research suggests that participants may feel less inhibited about reporting low QoL on a mailed survey rather than in the presence of an interviewer.[21-23] However, a similar decline was not observed for PCS in our study. Furthermore, in a sensitivity analysis among responses at 5 to 9 years since diagnosis, neither physical nor mental QoL scores differed significantly by interview type (data not shown). Analysis of health-related behaviors in the WISC indicates that women may gain weight and decrease physical activity after DCIS diagnosis.[24] Although we adjusted for comorbidity in our analysis, it is possible that long-term psychological distress associated with conditions such as diabetes,[25] heart disease,[26] and hypertension[27] also may be reflected in our results.

Studies of QoL in the 2 years after treatment of invasive breast cancer have reported lower mental QoL among women diagnosed at a younger age compared with those diagnosed when older.[13,14,28] Younger women may experience greater distress than older women regarding body image, sexuality and fertility, and family disruption.[13,29] Our findings of lower mental QoL in the 5 years after diagnosis for women diagnosed with DCIS at a younger age is consistent with these results. Few studies have investigated QoL by age at diagnosis in long-term invasive breast cancer survivors. Cimprich et al[29] examined QoL in women who were 5 years past treatment of invasive breast cancer and found significantly lower social QoL among women diagnosed at 27 to 44 years of age compared with those diagnosed at age ≥ 65 years. It is possible that although older women may experience less immediate psychological impact from a DCIS diagnosis, this difference lessens over time as all women experience the long-term effects of anxiety or negative health behavior changes associated with breast cancer.[15]

Our analysis was strengthened by our large cohort of DCIS survivors with up to 17 years of follow-up and our ability to compare QoL to controls. We also benefited from the ability to control for factors that may influence QoL over time. However, our results may be affected if women with lower or higher QoL differentially participated in follow-up surveys, although response rates in the WISC are high, and no difference in baseline QoL was observed between women who did and did not participate in follow-up. We were able to control for factors such as number of comorbidities, living situation, prior mammography use, and income, but it remains possible that unmeasured factors could confound associations between a DCIS diagnosis and QoL measures. Our analysis did not control for multiple comparisons, and therefore caution should be applied in interpreting the significance of our findings.

Finally, the SF-36 is not specifically designed for cancer survivors and may not be sensitive to disease-specific impacts on QoL. One methodological review of the SF-36 in a breast cancer population found that it was a valid indication of general health status[30]; however, another found that ceiling effects in the physical functioning domain and floor effects in the emotional and social functioning domains made the SF-36 less effective among breast cancer surviviors.[31] These range limitations may have made it harder for us to detect changes in QoL over time and may therefore impact the interpretation of our results.

Overall, we found physical QoL was consistently comparable to controls, regardless of age or time since DCIS diagnosis. Our results suggest that women diagnosed at a younger age might benefit from monitoring for low mental QoL. Our finding that mental QoL declined over time since diagnosis is provocative, but future research will be needed to compare these results with controls of a more similar age distribution. Research is also needed among DCIS populations of diverse racial and ethnic

  

backgrounds, as the WISC represents a population of primarily European ancestry, and thus caution must be used in generalizing the results.

## AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Disclosures provided by the authors are available with this article at www.jco.org.

## AUTHOR CONTRIBUTIONS

**Conception and design:** Vicki Hart, Brian L. Sprague, Amy Trentham-Dietz
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**Manuscript writing:** All authors
**Final approval of manuscript:** All authors

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## AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

**Trends in Health-Related Quality of Life After a Diagnosis of Ductal Carcinoma In Situ**

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## Appendix

**Table A1.** Comparison of Selected Characteristics of the Study Population Between Patients With DCIS and Controls Over Time Since Diagnosis: Wisconsin In Situ Cohort, 1997-2013

| | | < 2 Years Since Diagnosis | | 2-4 Years Since Diagnosis | | 5-9 Years Since Diagnosis | | 10+ Years Since Diagnosis | |
|---|---|---|---|---|---|---|---|---|---|
| | Controls (N = 1,055) | Patients With DCIS (obs = 1,006) | *P** | Patients With DCIS (obs = 706) | *P** | Patients With DCIS (obs = 1,874) | *P** | Patients With DCIS (obs = 956) | *P** |
| Age at interview (patients with DCIS) or ref age (controls), years | | | | | | | | | |
| 20-44 | 125 (11.9) | 98 (9.8) | .07 | 34 (4.8) | .01 | 34 (1.8) | < .01 | 2 (0.2) | < .01 |
| 45-54 | 403 (38.2) | 353 (35.2) | | 216 (30.5) | | 370 (19.7) | | 74 (7.7) | |
| 55-64 | 374 (35.5) | 327 (32.6) | | 249 (35.4) | | 712 (38.1) | | 358 (37.8) | |
| 65-74 | 153 (14.5) | 222 (22.1) | | 174 (24.6) | | 552 (29.4) | | 342 (35.6) | |
| ≥ 75† | | 4 (0.4) | | 33 (4.7) | | 206 (11.0) | | 180 (18.7) | |
| Menopausal status | | | | | | | | | |
| Premenopausal | 304 (31.7) | 304 (30.2) | .54 | 176 (24.9) | .01 | 403 (21.5) | < .01 | 56 (5.8) | < .01 |
| Postmenopausal | 656 (68.3) | 702 (69.8) | | 530 (75.1) | | 1,471 (78.5) | | 900 (94.2) | |
| No. of comorbidities‡ | | | | | | | | | |
| 0 | 743 (72.7) | 714 (71.1) | .76 | 473 (67.1) | .02 | 1,190 (63.6) | < .01 | 537 (56.4) | < .01 |
| 1 | 121 (11.9) | 124 (12.3) | | 102 (14.4) | | 313 (16.7) | | 187 (19.5) | |
| 2 | 118 (11.6) | 130 (13.0) | | 86 (12.1) | | 228 (12.1) | | 130 (13.5) | |
| ≥ 3 | 39 (3.8) | 36 (3.6) | | 45 (6.4) | | 143 (7.6) | | 102 (10.6) | |
| BMI,§ kg/m$^2$ | | | | | | | | | |
| < 18.5 | 14 (1.4) | 12 (1.2) | .04 | 6 (0.8) | .22 | 19 (1.0) | .84 | 13 (1.4) | .38 |
| 18.5-24.9 | 383 (36.2) | 452 (44.8) | | 278 (39.6) | | 692 (37.1) | | 349 (36.8) | |
| 25-29.9 | 331 (31.2) | 321 (32.0) | | 243 (34.3) | | 616 (32.8) | | 300 (31.2) | |
| ≥ 30 | 301 (28.2) | 221 (22.0) | | 179 (25.3) | | 547 (29.1) | | 324 (30.6) | |
| Postmenopausal hormone use | | | | | | | | | |
| No | 570 (54.2) | 520 (51.8) | .27 | 624 (88.4) | < .01 | 1,479 (79.0) | < .01 | 775 (81.2) | < .01 |
| Yes | 481 (45.8) | 484 (48.2) | | 82 (11.6) | | 395 (21.0) | | 181 (18.8) | |
| Annual household income | | | | | | | | | |
| < $15,000 | 58 (6.2) | 43 (4.9) | .05 | 29 (4.7) | .01 | 95 (5.8) | .02 | 40 (4.7) | .06 |
| $15,000-50,000 | 441 (47.3) | 350 (40.1) | | 240 (39.1) | | 673 (40.8) | | 365 (43.3) | |
| $50,001-99,999 | 312 (33.4) | 344 (39.4) | | 229 (37.3) | | 590 (35.8) | | 298 (35.4) | |
| ≥ $100,000 | 122 (13.1) | 136 (15.6) | | 116 (18.9) | | 292 (17.7) | | 140 (16.6) | |
| Living with a partner | | | | | | | | | |
| No | 242 (23.0) | 185 (18.4) | .01 | 123 (17.4) | < .01 | 366 (25.9) | .09 | 214 (22.7) | .87 |
| Yes | 812 (77.0) | 819 (81.6) | | 585 (82.6) | | 1,047 (74.1) | | 731 (77.3) | |
| Insurance type | | | | | | | | | |
| No insurance | 35 (3.5) | 9 (1.0) | < .01 | 7 (1.1) | < .01 | 29 (1.7) | < .01 | 9 (1.0) | < .01 |
| Private insurance | 798 (80.4) | 745 (78.0) | | 447 (68.6) | | 959 (56.2) | | 334 (39.8) | |
| Medicare or Medicaid | 159 (16.1) | 201 (21.0) | | 198 (30.3) | | 717 (42.1) | | 497 (59.2) | |

NOTE. Categories may not sum to total N because of missing values.
Abbreviations: BMI, body mass index; DCIS, ductal carcinoma in situ; obs, observations.
**P* values from $\chi^2$ test comparing patients with DCIS and controls among those with known covariate status.
†Because of the lack of control data in the ≥ 75 year age group, observations from women age ≥ 75 years were excluded from the analysis.
‡Comorbidity data not collected at baseline interviews from 1997 to 2001 (603 patients with DCIS).
§BMI at 1 year prediagnosis recalled at baseline (patients with DCIS).

**Table A2.** Predicted Values of Physical and Mental Component Summary Scores by Time Since Diagnosis Among Women With at Least One Observation in Each Time Interval: Wisconsin In Situ Cohort 1997-2013

| | N (observations) | Adjusted Mean* | 95% CI |
|---|---|---|---|
| Physical component summary | | | |
| Controls | 1,055 | 43.4 | 42.2 to 44.6 |
| Patients with DCIS, time since diagnosis, years | | | |
| < 2 | 262 | 43.4 | 40.8 to 46.0 |
| 2-4 | 355 | 44.0 | 41.4 to 46.6 |
| 5-9 | 757 | 44.0 | 41.4 to 46.7 |
| ≥ 10 | 720 | 44.2 | 41.5 to 47.0 |
| Mental component summary | | | |
| Controls | 1,055 | 51.5 | 50.3 to 52.8 |
| Patients with DCIS, time since diagnosis, years | | | |
| < 2 | 262 | 52.1 | 50.0 to 54.2 |
| 2-4 | 355 | 52.7 | 50.7 to 54.8 |
| 5-9 | 757 | 51.8 | 49.7 to 53.8 |
| ≥ 10 | 720 | 47.6 | 45.5 to 49.7 |

NOTE. Higher scores indicate better quality of life (N = 675).
Abbreviations: DCIS, ductal carcinoma in situ.
*Adjusted for age at interview, menopausal status, family history of breast cancer, number of comorbid conditions, body mass index, education, income, living with a partner, insurance status, mammogram history, postmenopausal hormone use, post-treatment endocrine therapy use, and surgical treatment type.