

Cardiovascular Disease Risk and Breast Cancer Outcomes: A Pilot Study

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Breast cancer and cardiovascular disease (CVD) are two important health problems in women. The American Cancer Society, the American Heart Association, and the American Diabetes Association joined forces in 2004 to promote health and reduce risk factors for cancer, CVD (including stroke), and diabetes—the three most common causes of death in the United States (Eyre, Kahn, & Robertson, 2004). Evidence suggests that these diseases share common risk factors. Interventions directed at primary prevention, including public awareness of healthy lifestyles, should reduce morbidity and mortality for all three diseases (Eyre et al., 2004).

Emerging data are suggestive that breast cancer and CVD share more risk factors than previously believed. For example, diabetes, a well-established risk factor for CVD, is associated with an increased risk of breast cancer and poor outcomes (Coughlin, Calle, Teras, Petrelli, & Thun, 2004; Larsson, Mantzoros, & Wolk, 2007). In addition, inflammation, a long-known risk factor for CVD, has emerged as a risk factor for cancer (Colotta, Allavena, Sica, Garlanda, & Mantovani, 2009). Promotion of a healthy lifestyle to reduce what were once considered traditional CVD risk factors may actually prevent breast cancer or improve breast cancer survival. However, no comprehensive study has been conducted on shared multiple risk factors for these two diseases and a potential relationship with breast cancer outcomes. To fill the gap, the aim of this pilot study was to begin exploring multiple CVD risk factors and breast cancer outcomes in women who have been diagnosed with breast cancer.

The objectives of this study were (a) to assess the feasibility of using the health record for profiling prevalence of multiple CVD risk factors (increased age, dyslipidemia, high body mass index [BMI], diabetes, smoking, hypertension, family history of premature coronary artery disease, estrogen therapy, sedentary lifestyle, inflammation, and depression) in women at

Purpose/Objectives: To assess feasibility of using electronic health records for profiling multiple cardiovascular disease (CVD) risk factors in women with breast cancer at diagnosis and five years post-treatment, and to explore relationships among CVD risk factors and breast cancer outcomes.

Design: Retrospective, descriptive.

Setting: A comprehensive cancer center in the southwestern United States.

Sample: 200 women with stage 0–III breast cancer.

Methods: A record review using an instrument to profile multiple CVD risk factors and breast cancer outcomes.

Main Research Variables: CVD risk factors, such as blood pressure (BP) and hemoglobin A1C (HbA1C), and breast cancer outcomes, such as metastasis.

Findings: Most data on CVD risk factors were undocumented. Even BP values to assess hypertension were missing in 35% of women at breast cancer diagnosis. Women with poor outcomes had trends toward higher blood glucose and HbA1C than women with good outcomes.

Conclusions: The study failed to comprehensively capture CVD risk factors in women with breast cancer because of missing data. Glucose control may be associated with breast cancer outcomes.

Implications for Nursing: Better documentation of shared risk factors for CVD and breast cancer is needed. Prospective studies are needed to evaluate shared CVD risk factors and breast cancer outcomes because of missing health record information.

Key Words: cardiovascular disease risk; breast cancer; breast cancer outcomes; electronic health records

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the time of the initial diagnosis and five years post-treatment, and relate these to breast cancer outcomes (tumor recurrence, stage progression, metastasis, and death) at five years post-treatment; and (b) to explore possible relationships among multiple CVD risk factors and breast cancer outcomes.

Methods

Design, Sample, and Settings

Using a descriptive design, a retrospective health record review of 200 women diagnosed with breast cancer at a comprehensive cancer center in the southwestern region of the United States was conducted. Records of women who initially were diagnosed with stage 0–III breast cancer from 2002–2005 and had five years of follow-up care at the study site or died within the five years following the initial diagnosis were included. Women who initially were diagnosed with stage IV breast cancer were excluded because of associated poor outcomes (e.g., average survival of 2.5–3.5 years), which was significantly different than those with stage 0–III breast cancer. Those younger than age 21 years were not included because childhood breast cancer and CVD are extremely rare and are not representative of these diseases. No women were excluded on the basis of ethnicity. Data were collected after institutional review board approval was obtained through the Human Subjects Protection Program at the University of Arizona.

Instruments

Based on a review of the literature (Chobanian et al., 2003; National Cancer Institute, 2014; Radford et al., 2005), two of the authors (SFW and CJM) developed a data collection instrument to profile prevalence of multiple CVD risk factors and breast cancer outcomes. Variables related to CVD risk factors were identified and operationally defined (see Table 1). These variables were obtained from health record entries closest to initial breast cancer diagnosis and at five years post-treatment. Other variables included stage of breast cancer at initial diagnosis and five years post-treatment, as well as treatment modalities. Poor outcomes were defined as tumor recurrence, stage progression, metastasis, and death within the five-year window after initial breast cancer diagnosis. Additional variables

Table 1. Operational Definitions of Cardiovascular Disease Risk Factors

Risk Factor	Definition
Age	Chronological age in years at breast cancer diagnosis and at disease progression (recurrence, stage progression, metastasis, death) was obtained.
Depression	Depression was defined as presence or absence of this diagnosis and/or treatment with antidepressants. Depressive symptoms included feeling down, depressed, or hopeless; loss of pleasure; trouble falling and staying asleep; sleeping too much; poor appetite or overeating; feeling badly about self or feeling worthless; trouble concentrating; and thoughts of self harm or being better off dead.
Diabetes	Diabetes was defined as a history of diabetes and/or treatment with antidiabetic agents, or a fasting blood glucose of greater than 126 mg/dl, HbA1C of 6.5% or greater, or a random glucose of 200 mg/dl or greater. HbA1C was the primary target for glycemic control, and optimal diabetes control was defined as HbA1C of less than 7%. A fasting plasma glucose of 70–130 mg/dl was defined as optimal glycemic control for non-pregnant adults with diabetes.
Dyslipidemia	Dyslipidemia was defined as a presence or absence of this diagnosis and/or treatment with lipid-lowering agents. Criteria included total cholesterol greater than 200 mg/dl, or LDL of 130 mg/dl or greater, or HDL of less than 35 mg/dl, or use of lipid-lowering therapy. Optimal lipid control was defined as total cholesterol less than 200 mg/dl, triglycerides less than 150 mg/dl, and LDL less than 100 mg/dl.
Hypertension	Hypertension was defined as a history of hypertension and/or treatment with antihypertensive medication, BP greater than 140 mmHg systolic or greater than 90 mmHg diastolic, or BP greater than 130 mmHg systolic or 80 mmHg diastolic for patients with diabetes. Optimal BP control was defined as BP lower than 140/90 mmHg (or lower than 130/80 if diabetes is present).
Inflammation	C-reactive protein levels and use of anti-inflammatory medications, such as aspirin, statins, nonsteroidal anti-inflammatory drugs (salicylates, indoles, propionic acids, fenamates, pyrazolines, oxicams, cyclooxygenase inhibitors), were obtained.
Obesity	Height and weight were used to calculate BMI in kg/m ² . Underweight, normal, overweight, and obese were defined as BMI lower than 18.5, 18.5–24.9, 25–29.9, and 30 kg/m ² or greater, respectively.
Sedentary lifestyle	Sedentary lifestyle was defined as prolonged sitting or inactivity both at work and during leisure time, not achieving 30 minutes of moderate intensive physical activity most days of the week. Number of minutes per day of physical activity was obtained.
Smoking	Smoking status was defined as current or previous use of any tobacco product, including cigarettes, cigars, pipes, and/or chewing tobacco. Smoking status was categorized as <ul style="list-style-type: none">• Current: smoking within one month of initial breast cancer diagnosis• Former: stopped smoking more than one year prior to breast cancer diagnosis• Never: never smoked• Recent: stopped smoking between one month and one year before breast cancer diagnosis For current or former smokers, total pack years was obtained.

BMI—body mass index; BP—blood pressure; HbA1C—hemoglobin A1C; HDL—high-density lipoprotein; LDL—low-density lipoprotein

Note. Based on information from American Diabetes Association, 2010; Grundy et al., 2005; National Cholesterol Education Program Expert Panel on Detection and Treatment of High Blood Cholesterol, 2002; Radford et al., 2005.

included tumor characteristics, menopausal status, hereditary cancer (i.e., *BRCA1* and *BRCA2* mutation status), and years of overall and disease-free survival.

Content validity of this data collection instrument was supported by two doctorally prepared nurse researchers, a nurse practitioner board certified in cardiac care, and two doctorally prepared nurse researchers in cancer nursing, who reviewed and judged the instrument to be a measure of CVD risk factors and breast cancer outcomes.

Records were identified using the International Classification of Disease 9th edition clinical modification (ICD-9-CM) category 174.9, malignant neoplasm of breast (female), unspecified. Once women with breast cancer were identified, the authors randomly selected 200 records for review using a systematic sampling method. If a randomly selected woman had an initial diagnosis of stage IV breast cancer, another record was randomly selected for review.

Statistical Analysis

SPSS®, version 16.0, was used for data entry and statistical analysis. To ensure that all data were collected in the same manner, the authors used the created instrument to collect data on the same seven subjects to determine the percentage of agreement among data collectors. Once agreement among data collectors was greater than 95% in more than two consecutive agree-

ment checks, data collection began. Before data were analyzed, the data were checked for outliers by inspecting the values in a frequency distribution, with scrutiny of the highest and lowest values.

Feasibility of using the health record for profiling prevalence of multiple CVD risk factors was determined by presence or absence of documentation of relevant CVD risk factors. A priori to data collection for this study, feasibility of using the health record for presence of CVD risk factors was defined as information being documented at least 90% of the time. Descriptive statistics and frequencies were used to describe the prevalence of multiple CVD risk factors in women with breast cancer. Exploratory analytic techniques, including multiple and logistic regression analyses, were used to explore the relationships between multiple CVD risk factors and breast cancer outcomes. A level of significance of $p < 0.05$ was considered statistically significant.

Results

Sample Characteristics

Records from 200 women with stage 0–III breast cancer were reviewed. The ages of these women at breast cancer diagnosis ranged from 25–88 years, with a mean age of 55.7 years (SD = 12.8). The sample included 35 women in stage 0 (18%), 53 in stage I (27%), 76 in stage II (38%), and 16 in stage III (8%). Two (1%) were invasive (stage unknown) and 18 (9%) were missing stage information (see Table 2). Of the 200 women, information on race or ethnicity was only available on 108 (54%). The racial or ethnic composition of these 108 women was 90 Caucasians (83%), 13 Hispanics (12%), 3 Asians (3%), and 2 Native Americans (2%).

Feasibility of Profiling Cardiovascular Disease Risk Factors Using Health Records

The authors defined feasibility of using the health record for profiling multiple CVD risk factors as information being documented at least 90% of the time. Using this definition, information related to CVD risk factors at breast cancer diagnosis did not achieve 90% in any category (see Table 3). Even parameters used to calculate BMI and blood pressure (BP) values for hypertension were missing in 75 (38%) and 70 (35%) women, respectively, at breast cancer diagnosis. At five years after breast cancer diagnosis, presence of multiple CVD risk factors in health records was determined to be feasible for only two of the risk factors, BMI and hypertension. Here, information on height, weight, and BP was found in the health records of more than 90% of the women.

The records reviewed had other important deficiencies. First, information pertaining to lipids was

Table 2. Breast Cancer Stage at Diagnosis and Race or Ethnicity (N = 200)

Characteristic	At Diagnosis		At Five Years	
	n	%	n	%
No evidence of disease	–	–	174	87
Stage 0	35	18	3	2
Ductal carcinoma in situ	24	12	2	> 1
Lobular	11	6	1	> 1
Stage I	53	27	1	> 1
Stage II	76	38	1	> 1
IIA	42	21	1	> 1
IIB	32	16	–	–
Substage unidentified	2	1	–	–
Stage III	16	8	–	–
IIIA	13	7	–	–
IIIB	2	1	–	–
IIIC	1	> 1	–	–
Stage IV	–	–	19	10
Invasive (stage unknown)	2	1	–	–
Missing stage information	18	9	2	1
Race or ethnicity (n = 108)				
Caucasian	90	83	–	–
Hispanic or Latino	13	12	–	–
Asian	3	3	–	–
American Indian	2	2	–	–

Note. Because of rounding, percentages may not total 100.

deficient, which is significant because, historically, lipid values have served as standard measures of CVD risk. All lipid measures were documented in 42 (20%) and 81 (40%) women at breast cancer diagnosis and at five years after breast cancer diagnosis, respectively, although at least 81 women had a history of dyslipidemia. Secondly, although diabetes is a well-established risk factor for CVD, information on fasting and random blood glucose was documented in 7 (4%) and 99 (50%) women at breast cancer diagnosis, respectively. These, however, improved to 10 (5%) and 162 (81%) at five years after breast cancer diagnosis. Despite at least 28 women (14%) having a history of diabetes, hemoglobin A1C (HbA1C) levels were only available in 6 (3%) and 19 (10%) women at breast cancer diagnosis and at five years after breast cancer diagnosis, respectively.

Chronic inflammation is considered to be a fundamental mechanism underlying CVD. C-reactive protein (CRP), a common clinical inflammatory marker and a strong predictor of CVD risk (Libby, Ridker, & Hansson, 2009), was only documented in three women (2%). Use of anti-inflammatory medications, such as nonsteroidal anti-inflammatory drugs and statins, was reported in 24 (12%) and 4 (2%) women at breast cancer diagnosis, respectively. Documentation of anti-inflammatory medication use was reported in 111 (56%) and 19 (10%) women at five years after breast cancer diagnosis.

Physical activity level was documented in 8 (13%) and 77 (39%) women at breast cancer diagnosis and at five years after breast cancer diagnosis, respectively. The descriptors used to characterize physical activity became more diverse and better elucidated at five years after breast cancer diagnosis. Finally, two relevant CVD risk factors, history of smoking and depression, were well documented (169 [85%] and 86 [43%], respectively) in the health records.

Relationships Among Cardiovascular Disease Risk Factors and Breast Cancer Outcomes

Control of modifiable cardiovascular disease risk at breast cancer diagnosis: Among the 44 women with available lipid values, many did not have optimally controlled lipids levels (see Table 4). Optimally controlled total cholesterol, low-density lipoprotein (LDL), and triglycerides were found in 18 (41%), 10 (23%), and 30 (71%) women, respectively. All women had optimal high-density lipoprotein (HDL). Among the 126 women with available parameters to calculate BMI, 70 (56%) were overweight or obese. With limited availability of fasting blood glucose values (n = 7), all were below 125 mg/dl (range = 68–111 mg/dl). Random blood glucose values were available in 99 women. These values were below 200 mg/dl in 97 (98%) of the women. HgA1C values were only available in six women (values range

Table 3. Information on Cardiovascular Disease Risk Factors Documented at Breast Cancer Diagnosis and Five Years After Treatment (N = 200)

Risk Factor	At Diagnosis		At Five Years	
	n	%	n	%
Lipids				
Total cholesterol	44	22	83	42
LDL	44	22	86	43
HDL	44	22	81	41
Triglyceride	42	21	83	42
Treatment with lipid-lowering agents				
Yes	16	8	58	29
No	88	44	85	42
Unknown or missing	96	48	57	29
Height and weight for BMI				
Height	128	64	182	91
Weight	134	67	189	95
BMI	126	63	177	89
Diabetes				
Yes	28	14	–	–
No	156	78	–	–
Unknown	16	8	–	–
Fasting blood glucose	7	4	10	5
Random glucose	99	46	162	81
HbA1C	6	3	19	10
Treatment with antidiabetic agents				
Yes	19	10	–	–
No	152	76	–	–
Unknown or missing	29	15	–	–
Smoking				
Information documented	169	84	170	85
Unknown or missing	31	16	30	15
Hypertension history				
Yes	96	48	–	–
No	95	48	–	–
Unknown or missing	9	5	–	–
Treatment with antihypertensive agents				
Yes	82	41	–	–
No	89	45	–	–
Unknown or missing	29	14	–	–
Blood pressure values	130	65	190	95
Inflammation				
C-reactive protein	3	2	7	4
Use of NSAIDs	24	12	111	56
Use of statins	4	2	19	10
Activity levels				
Yes	8	4	–	–
No	97	49	–	–
Unknown or missing	95	48	–	–
Physical activity description	26	13	77	39
History of depression				
Yes	86	43	–	–
No	84	42	–	–
Unknown or missing	30	15	–	–
Use of antidepressants				
Yes	29	15	78	39
No	115	58	90	45
Unknown or missing	56	28	32	16

BMI—body mass index; HbA1C—hemoglobin A1C; HDL—high-density lipoprotein; LDL—low-density lipoprotein; NSAID—nonsteroidal anti-inflammatory drug

Note. Because of rounding, percentages may not total 100.

of 5.4%–7.8%), and four of these women had optimal HbA1C control of less than 7%. The majority of women either never smoked (n = 108, 64%) or were former smokers (n = 43, 25%). Fifteen women (9%) were current smokers with three (2%) abstaining from smoking between one month and one year before breast cancer diagnosis. Of the 129 women with available BP values, 40 (31%) had suboptimal control of hypertension. Finally, out of only 29 women with documentation, 23 women (79%) reported having 30 minutes of moderate activity most days of week. Of note, this information was unknown or missing in 85% of women.

Breast cancer outcomes: Outcome data at five years after breast cancer diagnosis were available in 185 women. Among these, 22 (11%) had poor outcomes, defined as progression to stage IV breast cancer/metastatic disease (n = 20, 11%) and/or death within five years postdiagnosis (n = 11, 6%).

The authors compared multiple CVD risk factors at both breast cancer diagnosis and at five years after diagnosis with breast cancer outcomes (see Table 5). Although the authors used a small sample size, women with poor outcomes had indicators of poor glucose control as well as increased triglyceride levels at breast cancer diagnosis. At breast cancer diagnosis, the authors identified a trend for associations between poor outcomes and increased fasting blood glucose (p = 0.074) and elevated fasting triglycerides (p = 0.092). Women with good outcomes (n = 6) had a mean fasting blood glucose level of 86.83 mg/dl (SD = 9.95) as compared to the one woman with a poor outcome who had a fasting blood glucose of 111 mg/dl (p = 0.054). Mean triglyceride level was 227 mg/dl (SD = 205.06) among women with poor outcomes (n = 2) compared to 133.1 mg/dl (SD = 68.18) in women with good outcomes (n = 39) (p = 0.092). At five years after breast cancer diagnosis, a trend was noted for associations between poor outcomes and increased fasting blood glucose (p = 0.054) and elevated HbA1C (p = 0.074). Mean fasting blood glucose level was 111.25 mg/dl (SD = 15.65) among women with poor outcomes (n = 4) compared to 89.33 mg/dl (SD = 14.67) in women with good outcomes (n = 6) (p = 0.054). Mean HbA1C level was 7.3% (SD = 1%) among women with poor outcomes (n = 2) compared to 6.25% (SD = 0.7%) in women with good outcomes (n = 16) (p = 0.074).

Variables that did not reach statistical significance for poor outcomes for breast cancer, with the small sample size, included BMI, BP values, and other lipid parameters. Of note, regarding BMI, the authors did not detect a statistically significant difference between women with poor and good outcomes (p = 0.764); however, both groups had higher than normal BMIs (\bar{X} = 27.39 kg/m², SD = 5.1, n = 14; \bar{X} = 26.8 kg/m², SD = 7.07, n = 106, respectively).

Discussion

Using this retrospective study in which data on CVD risk factors were extracted from health records of 200 women at breast cancer diagnosis and at five years after diagnosis, the authors reached two important conclusions. First, most data relevant to CVD risk factors were undocumented in women diagnosed with breast cancer. Secondly, evidence suggests that some CVD risk factors, such as fasting blood glucose and HbA1C, may be associated with breast cancer outcomes.

Feasibility of Profiling Cardiovascular Disease Risk Factors Using Health Records

In the current study, data were completed on the staging of breast cancer and age as a demographic

Table 4. Documentation of Controlled Cardiovascular Disease Risk Factors in Health Records at Breast Cancer Diagnosis

Risk Factor	n	%
Total cholesterol (N = 44)		
Less than 200 mg/dl	18	41
200 mg/dl or greater	26	59
LDL (N = 44)		
Less than 100 mg/dl	10	23
100 mg/dl or greater	34	77
HDL (N = 44)		
35 mg/dl or greater	44	100
Triglycerides (N = 42)		
Less than 150 mg/dl	30	71
150 mg/dl or greater	12	29
BMI (N = 126)		
Underweight (less than 18.5 kg/m ²)	5	4
Normal (18.5–24.9 kg/m ²)	51	41
Overweight (25–29.9 kg/m ²)	45	36
Obese (30 kg/m ² or greater)	25	20
Fasting blood glucose (N = 7)		
125 mg/dl or less	7	100
Random blood glucose (N = 99)		
Less than 200 mg/dl	97	98
200 mg/dl or greater	2	2
HbA1C (N = 6)		
Less than 7%	4	67
7% or greater	2	33
Smoking (N = 169)		
Never	108	64
Former	43	25
Recent	3	2
Current	15	9
Hypertension (N = 129)		
Optimal BP control	89	69
Suboptimal BP control	40	31
30 minutes of moderate activity most days of the week (N = 29)		
Yes	23	79
No	6	21

BMI—body mass index; BP—blood pressure; HbA1C—hemoglobin A1C; HDL—high-density lipoprotein; LDL—low-density lipoprotein

Note. Because of rounding, percentages may not total 100.

variable; however, race and ethnicity information is surprisingly low. The authors found that most data relevant to CVD risk factors were undocumented. Increased obesity, hypertension, and increased inflammation are well-documented risk factors for CVD; however, these data were missing in the health records reviewed. At breast cancer diagnosis, parameters used to calculate BMI and BP values for hypertension and obesity were missing in 35% of women. Physical activity level was only documented in 13% and 39% of women at breast cancer diagnosis and at five years after breast cancer diagnosis, respectively. CRP data, which serve as clinical markers for inflammation, were documented in only three of 200 women. Therefore, a prospective study on CVD risk factors in women with breast cancer is needed to comprehensively capture CVD risk profiles in women with breast cancer. Although the health records are not a feasible method to extract CVD risk factors, which the authors defined as information being documented at least 90% of the time, individual CVD risk factors warrant further comments and discussions.

Blood sugar and diabetes: Data from large prospective epidemiologic studies have shown that diabetes is a risk factor for breast cancer development (Coughlin et al., 2004) and, in some studies, a risk factor for mortality from breast cancer (Coughlin et al., 2004; Jee et al., 2005). To re-emphasize, in the current study, women with poor breast cancer outcomes had trends toward higher fasting blood glucose and HbA1C, an indicator of poor blood sugar control, compared to women with good outcomes. The mean HbA1C level in women with poor outcomes was 7.3% (SD = 1) compared to 6.25% (SD = 0.71) in those with good outcomes when measured at five years after breast cancer diagnosis. Findings, however, from a large study from Sweden (Miao Jonasson et al., 2012) did not show an association between high HbA1C and incidences of all cancers, including breast cancer. In that study, an HbA1C cutoff value of 7.5% was used to correlate the incidence of cancers, although the American Diabetes Association (2010) recommended that the opti-

mal HbA1C level be equal to or less than 7%, as these levels have been associated with reduced microvascular and neuropathic complications. Additional research is warranted to determine if high HbA1C level or poor blood sugar control is related to breast cancer outcomes.

Dyslipidemia: The authors of the current study found that, in this group of women with breast cancer, of those with reported laboratory values, the majority did not have well-controlled total cholesterol and LDL levels: 59% had a cholesterol level of 200 mg/dl or greater and 77% had an LDL level of 100 mg/dl or greater. The findings of the current study are consistent with the work of Abdelsalam, Hassan, and Sadig (2012), who showed that elevated total cholesterol and LDL levels are associated with all stages of breast cancer. Of note, in the current study, all women had HDL levels of 35 mg/dl or greater, which is known to have protective effects against CVD. Elevated HDL levels also were reported in women with breast cancer in the study by Abdelsalam et al. (2012), although they did not find this to be associated with breast cancer risk.

The current study also revealed potentially useful information regarding elevated triglyceride levels at breast cancer diagnosis and poor breast cancer outcomes, although the relationship between triglyceride level and poor breast cancer outcomes only approached

Table 5. Comprehensive Cardiovascular Disease Risk Profile and Outcomes

Risk Factor	Poor Outcomes			Good Outcomes			p
	n	\bar{X}	SD	n	\bar{X}	SD	
At Diagnosis							
Fasting blood glucose (mg/dl)	1	111	—	6	86.83	9.95	0.074
HbA1C (%)	1	6.4	—	5	6.38	1.06	0.987
BMI (kg/m ²)	14	27.39	5.1	106	26.8	7.07	0.764
Systolic BP (mmHg)	11	132.27	17.14	115	129.49	18.33	0.629
Diastolic BP (mmHg)	11	81.45	6.49	114	76.93	10.46	0.162
Fasting LDL (mg/dl)	3	125	41.22	40	122.1	29.25	0.872
Fasting HDL (mg/dl)	3	51	21.93	40	60.43	18.91	0.414
Fasting total cholesterol (mg/dl)	3	215	50.03	40	205.8	36.62	0.683
Fasting triglycerides (mg/dl)	2	227	205.06	39	133.1	68.18	0.092
At Five Years							
Fasting blood glucose (mg/dl)	4	111.25	15.65	6	89.33	14.67	0.054
HbA1C (%)	2	7.3	0.99	16	6.25	0.71	0.074
BMI (kg/m ²)	19	26.85	5.28	148	26.97	6.21	0.938
Systolic BP (mmHg)	20	123.5	13.21	159	124.99	14.52	0.663
Diastolic BP (mmHg)	20	75.9	9.9	159	74.31	10.18	0.511
Fasting LDL (mg/dl)	4	129	89.34	80	110.94	29.45	0.297
Fasting HDL (mg/dl)	3	51	7.21	76	60.14	18.77	0.405
Fasting total cholesterol (mg/dl)	3	175	11	78	193.47	35.55	0.374
Fasting triglycerides (mg/dl)	4	172.5	79.89	76	135.72	120.09	0.548

BMI—body mass index; BP—blood pressure; HbA1C—hemoglobin A1C; HDL—high-density lipoprotein; LDL—low-density lipoprotein

Note. Poor outcomes include tumor recurrence, stage progression, metastasis, or death within five years postdiagnosis.

Knowledge Translation

Better documentation of cardiovascular disease (CVD) risk factors is needed in patients with breast cancer because of the emerging role of shared risks—many linked to inflammation—between these two diseases.

Some CVD risk factors, such as blood glucose and triglyceride control, may contribute to breast cancer outcomes.

Descriptors used to characterize physical activity were diverse. Quantification of these descriptors to better evaluate the relationship between physical activity and breast cancer outcomes would be beneficial.

statistical significance ($p = 0.092$). This trend is consistent with an epidemiology study on metabolic syndrome and outcomes following early-stage breast cancer, suggesting an increase in risk of a second primary breast cancer with high triglyceride levels (Calip et al., 2014). Calip et al. (2014) hypothesized a mechanism involving the lipoprotein lipase, but recommended continued studies in larger samples to further elucidate the mechanisms.

Physical activity: A meta-analysis of 12,108 patients with breast cancer showed that physical activity pre- and postdiagnosis reduced mortality from breast cancer (Ibrahim & Al-Homaidh, 2011). However, in the current study, physical activity level was only documented in 8 (13%) and 77 (39%) women at breast cancer diagnosis and at five years after breast cancer diagnosis, respectively. Therefore, associating physical activity with breast cancer outcomes was difficult, particularly because the descriptors used to characterize physical activity were diverse and better elucidated in the health record at five years after breast cancer diagnosis. Descriptors ranged from “does not exercise” to “excessive exercise,” with walking as the most frequently reported activity. Specific descriptors, such as tennis, kickboxing, horseback riding twice a week, and golfing 60 rounds per year, were provided in the reviewed health records. Standardization and quantification of these physical activities to better evaluate the relationship between physical activity and breast cancer outcomes in these women would be beneficial.

Inflammation: Inflammation is an important mechanism underlying development of atherosclerosis and progression of CVD. Inflammation has now emerged as an important risk factor for the development and progression of many cancers (Colotta et al., 2009; Mantovani, Allavena, Sica, & Balkwill, 2008). A hypothesis from Howe, Subbaramaiah, Hudis, and Dannenberg (2013) suggested that inflammation mediates the effects of obesity and increased adiposity on breast cancer development and poor outcomes. Unfortunately, despite

current scientific investigation on inflammation, the important inflammatory CVD marker, CRP, was only measured in 3 of 200 women in the current study. In addition, because statin drugs have anti-inflammatory properties, its use in only 4 of 81 women with a history of dyslipidemia is of particular concern.

Obesity: The authors did not detect a statistically significant difference between BMI and breast cancer outcomes ($p = 0.764$); however, women in this study, regardless of having poor or good outcomes, had higher than normal BMIs. Although hypotheses have been proposed to explain the relationship between obesity and breast cancer via inflammation, as mentioned earlier, current data are not consistently supportive of obesity as a risk factor for development of breast cancer and poor outcomes (Cheraghi, Poorolajal, Hashem, Esmailnasab, & Doosti Irani, 2012; de Azambuja et al., 2010; Ladoire et al., 2014; Protani, Coory, & Martin, 2010). For example, Ladoire et al. (2014) suggested that obesity has no impact on breast cancer prognosis when modern adjuvant chemotherapy, at the appropriate dose intensity, is delivered. In contrast, a meta-analysis by Protani et al. (2010) showed poorer survival among obese compared with non-obese women with breast cancer, which was similar for overall and breast cancer-specific survival.

Conclusions

Breast cancer is the most commonly diagnosed cancer, excluding skin cancer, in women in the United States (Siegel, Miller, & Jemal, 2015). Improvements in early detection and treatment have resulted in significant survival gains, with the current five-year survival rate reported to be 91% (Siegel et al., 2015). Ongoing chronic illness management across major diseases is warranted; however, few studies have been designed to address this. Based on the known substantial incidence of CVD in women, which is typically underdiagnosed, and the potential for cardiovascular-related adverse effects of breast cancer therapy, evaluating CVD risk factors in women with breast cancer is particularly important. Data suggest that women with early-stage breast cancer are more likely to die of CVD than recurrent cancer (Schairer, Mink, Carroll, & Devesa, 2004). Therefore, prevention and optimal management of CVD risk factors prior to and after receiving breast cancer treatment are of paramount importance.

An important limitation in the current study was the lack of data on African American women, which was consistent with the ethnic composition of the community studied. In addition, the authors found that their retrospective electronic health record review failed to comprehensively capture CVD risk factor profiles in women with breast cancer because of missing pertinent

data. For example, CRP reports were documented in only three patients. However, the importance of inflammation and cancer has only been emphasized in recent years and, therefore, a record review conducted at present time and five years from now on follow-up may yield better documented data on inflammation and CVD risk factor in these patients.

Despite the limitations of this study, the authors have obtained evidence suggesting some CVD risk factors, such as fasting blood glucose and HbA1C, may contribute to breast cancer outcomes. Although electronic records were not a feasible source for profiling multiple CVD risk factors in women with breast cancer in this retrospective review, the study provides supportive evidence for the need to perform a prospective study, which has important implication for nursing. A significant implication of this work is that assessment and documentation of emerging CVD risk factors, such as

markers of inflammation and blood glucose control, may be critical in the evaluation of patients with breast cancer to ensure optimal care. Better documentation of information related to shared risk factors for CVD and breast cancer should be included in the health records.

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