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Carriene Roorda · Annette J. Berendsen · Feikje Groenhof · Klaas van der Meer · Geertruida H. de Bock

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Abstract
Purpose Little is known about the current role of the general practitioner (GP) in breast cancer follow-up care. This study explores primary healthcare use in the period after completion of primary breast cancer treatment.
Methods A total of 336 women with a history of early-stage breast cancer treated with curative intent were identified in the primary care database of the Registration Network Groningen (RNG) (1998–2007) and matched with a reference population of 983 women without breast cancer on birth year and GP.
Results Over the entire follow-up period (starting 1 year post-diagnosis), the median numbers of face-to-face contacts, drug prescriptions, and referrals in the patient group were significantly higher than those in the reference group: 4.0 vs. 3.2/year, 12.3 vs. 8.4/year, and 0.4 vs. 0.3/year, Mann–Whitney (M–W) test $p<0.001$ for all differences. At least one annual face-to-face contact was observed for 96.7 % of patients and 92.9 % of women from the reference population (Chi-square test $p=0.011$). More patients than women from the reference population had face-to-face contacts for reasons related to breast cancer or were prescribed hormone antagonists and aromatase inhibitors to treat breast cancer. The main predictor of higher rates of face-to-face contacts and drug prescriptions was a higher age at diagnosis.
Conclusions This study shows increased primary healthcare utilisation among women with a history of breast cancer, especially among the elderly. When follow-up is transferred to the primary care setting, new responsibilities of GPs might be incorporated into existing primary healthcare delivery.

Keywords Breast cancer · Healthcare utilisation · General practice · Follow-up care · Primary care database

C. Roorda (✉) · A. J. Berendsen · F. Groenhof · K. van der Meer
Department of General Practice, University of Groningen,
University Medical Center Groningen,
P.O. Box 196, 9700 AD Groningen, The Netherlands
e-mail: c.roorda-lukkien@umcg.nl

C. Roorda · G. H. de Bock
Department of Epidemiology,
University of Groningen, University Medical Center Groningen,
P.O. Box 30001, 9700 RB Groningen, The Netherlands

Introduction

Breast cancer is the most common malignancy and the leading cause of cancer-related death in women worldwide, accounting for 23 % of new cancer cases and 14 % of cancer deaths in 2008 [1]. Survival of breast cancer patients has increased in many countries as a result of early detection through mammography and improved treatment [1]. In The Netherlands, it is expected that further improvements in cancer screening and treatment, together with the ageing of the population, will lead to an increase in the prevalence of cancer survivors. In the coming years, this growing group of survivors will impose a burden on the Dutch healthcare system by their demand for cancer surveillance after completion of primary treatment and general medical care for co-morbid conditions [2]. This highlights the need for an effective resource allocation between primary care and hospital care in the future, and possible substitution of routine cancer follow-up to the general practitioner (GP) [2]. However, transfer of breast cancer follow-up to the primary care setting has to be accepted by all parties involved. While the majority of GPs and other primary care physicians (PCPs) are willing to accept responsibility for follow-up [3–5], most patients prefer this to be cared for by specialists [6–9]. Furthermore, patients [10–12] and oncologists [3, 13, 14],

as well as PCPs [14], have concerns about the amount of knowledge and skills, and time involved for PCPs to provide adequate follow-up care.

It is important to know to what extent GPs are already involved in breast cancer follow-up care. Two studies using general practice case records, cancer registry data, and health insurance data showed that contact rates with PCPs increased during the second and third years after breast cancer diagnosis when compared to the pre-diagnostic period [15, 16]. Unfortunately, contact rates of women with a history of breast cancer were not compared with those of women without breast cancer. In three cross-sectional surveys, contact with the GP did not differ between breast cancer survivors 5 years or more after diagnosis and age-matched controls, or compared with women from the general population [17–19]. However, these studies do not elucidate why patients with a history of breast cancer consult their PCP. Therefore, the present study explores the reasons for primary healthcare use among women with a history of breast cancer compared with women without breast cancer and investigates patient characteristics associated with this healthcare use in the period after completion of primary breast cancer treatment.

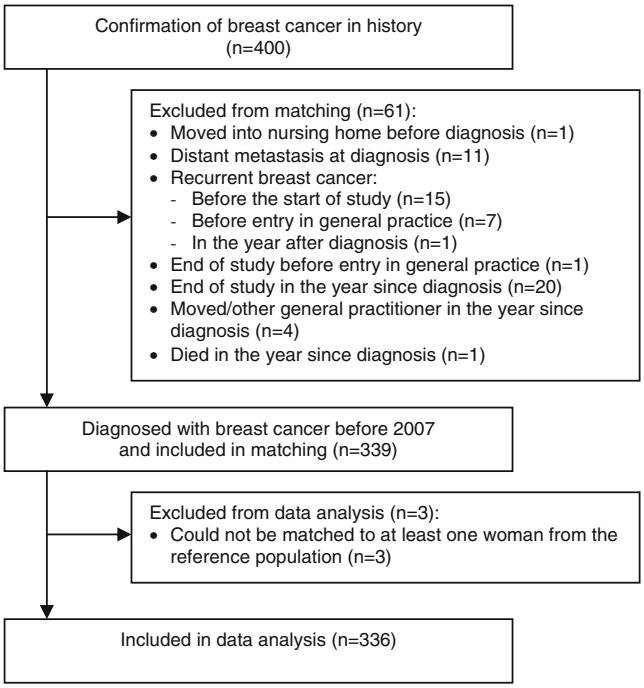

Fig. 1 Flow diagram of the inclusion of patients with a history of early-stage breast cancer (≥1 year post-diagnosis)

Patients and methods

Participants and data collection

An analysis of healthcare use (1998–2007) was performed using the primary care database of the Registration Network Groningen (RNG). The process of identification of patients in this database and the collection of additional information in participating general practices has recently been published [20]. Confirmation of breast cancer in history was obtained for 400 patients. Of these patients, 339 with a history of early-stage breast cancer and treated with curative intent were included in the matching process. The remaining 61 patients were excluded for several reasons (Fig. 1). Eligible patients were individually matched to three women from a reference population without breast cancer on birth year (±1 year) and GP. Women from the reference group were eligible if they were registered with the same GP as the corresponding patients at the matching date. Three patients could not be matched to at least one woman from the reference population; these three patients were excluded. Finally 336 patients and 983 women from the reference group were available for data analysis.

Patients and women from the reference population were observed for the entire follow-up period, defined as the period starting 1 year post-diagnosis, as most patients would have completed their primary treatment in the first year since diagnosis. Furthermore, patients and women from the reference group were observed for the first 5 years of the follow-up period, when enlisted with their GP in these years. As in our previous analysis [20], data collected by the RNG between 1998 and 2007 were entered into an anonymous database. Extracted were: patient contacts recorded by participating GPs using the International Classification of Primary Care (ICPC) version 1 [21], prescribed medication automatically classified according to the Anatomical Therapeutical Chemical (ATC) classification, and referrals by specialty [22].

Data analysis

Annual healthcare utilisation rates in general practice were calculated by dividing the number of face-to-face contacts, drug prescriptions, and referrals in the entire follow-up period (starting 1 year post-diagnosis) by the observation time in this period. Face-to-face contacts included consultations in general practice and home visits carried out by GPs and other general practice workers [20]. Observation time was calculated as time since matching date until the endpoints (e.g., breast cancer recurrence, death, and departure) (Table 1). Frequencies of women with at least one annual face-to-face contact, drug prescription, and referral during the entire follow-up period were also determined. To examine reasons for primary healthcare use, frequencies of women with any face-to-face contact by an ICPC chapter or an ATC chapter and any referral by specialty per year were calculated. Furthermore, subgroups were identified based on

Table 1 Characteristics of women with a history of breast cancer (n=336) and women from the reference population (Ref.; n=983)

	Patients	Ref.	p value
Age at diagnosis (years)			0.829[c]
Median (range)	54.9 (23.0–96.0)	54.8 (21.0–94.8)	
Categories, n (%)	116 (34.5)	348 (35.4)	
≤50.0	120 (35.7)	353 (35.9)	
50.1–65.0	100 (29.8)	282 (28.7)	
>65.0			
T stage, n (%)			
Tis	22 (7.9)		
T1	138 (49.8)		
T2/T3/T4	117 (42.2)		
Unknown	59		
N stage, n (%)			
N0	198 (65.1)		
N+	106 (34.9)		
Unknown	32		
Surgery, n (%)			
None	5 (1.6)		
Lumpectomy	1 (0.3)		
Lumpectomy + radiation therapy	121 (38.7)		
Mastectomy[a]	135 (43.1)		
Mastectomy[a] + radiation therapy	51 (16.3)		
Unknown	23		
Systemic treatment, n (%)			
None	177 (56.0)		
Chemotherapy	38 (12.0)		
Endocrine therapy	53 (16.8)		
Chemotherapy + endocrine therapy	48 (15.2)		
Unknown	20		
Source of matching date, n (%)[b]			
1 year since diagnosis of patient	178 (53.0)		
Start study (01/01/1998)	113 (33.6)		
Later entry in general practice of patient	45 (13.4)		
Time since diagnosis until matching date (years), median (range)	1.0 (1.0–36.4)		
Observation time since matching date (years), median (range)[b]	3.8 (0.1–10.0)	5.2 (0.0–10.0)	<0.001[c]
Endpoints during observation, n (%)			
Recurrent breast cancer	53 (15.8)		
Departure	39 (11.6)	126 (12.8)	
Death	40 (11.9)	115 (11.7)	
Other	4 (1.2)	22 (2.2)	

[a] Including patients treated with lumpectomy followed by mastectomy

[b] ≥ 1 year post-diagnosis

[c] Mann–Whitney test

three-digit ICPC codes and three- to seven-digit ATC codes. During the follow-up period, 199 face-to-face contacts (3.1 %) among patients and 525 face-to-face contacts (2.4 %) among women from the reference group could not be linked to any ICPC code. In addition, 48 (5.4 %) and 85 (3.0 %) referrals, respectively, were classified as 'unknown specialty referral' or 'other specialty referral'.

Primary healthcare use in the first 5 years of the follow-up period was assessed by calculating frequencies of women with at least one annual face-to-face contact, drug prescription, and referral in this period. Based on the results of a previous study [23], primary healthcare use for psychological reasons and endocrine therapy-related reasons was also assessed. Due to small numbers, ICPC chapters and ATC chapters were analysed instead of subgroups. To analyse differences in characteristics, rates, and frequencies between patients and women from the reference population, non-parametric tests were used, including the Chi-square (χ^2) test and the Mann–Whitney (M–W) test. A p value of ≤0.05 was considered to be statistically significant. Furthermore, logistic regression analysis was used to evaluate which patient characteristics were associated with rates of face-to-face contacts and drug prescriptions in the entire follow-up period.

Results

Table 1 presents descriptive characteristics of patients with a history of breast cancer (n=336) and women from the reference population (n=983). Median age at diagnosis among patients was 54.9 (range 23.0–96.0) years. T stage and N stage were known for 277 patients (82.4 %) and 304 patients (90.5 %), respectively. Regional lymph node involvement was found in 198 patients (65.1 %). Almost 60 % of patients underwent mastectomy (n=186), while 44 % received systemic treatment (n=139). Time since diagnosis until the matching date ranged from 1.0 to 36.4 years among patients. Median observation time during the entire follow-up period (starting 1 year post-diagnosis) was significantly shorter for patients than for women from the reference group (3.8 vs. 5.2, M–W test p<0.001). This is mainly due to the fact that recurrent breast cancer was taken as an endpoint in 53 patients (15.8 %).

Over the follow-up period, the median numbers of face-to-face contacts (4.0 vs. 3.2/year), drug prescriptions (12.3 vs. 8.4/year), and referrals (0.4 vs. 0.3/year) in the patient group were significantly higher than those in the reference group (M–W test p<0.001 for all differences) (Table 2). At least one annual face-to-face contact was observed for 96.7 % of patients and 92.9 % of women from the reference population (χ^2 test p=0.011). More than six face-to-face contacts per year were found in 31.0 % of patients and

Table 2 Annual primary healthcare use during the entire follow-up period (starting 1 year post-diagnosis) among women with a history of breast cancer (n=336) and women from the reference population (Ref.; n=983)

	Patients	Ref.
Face-to-face contacts per year		
Median (range)***	4.0 (0.0–36.5)	3.2 (0.0–70.7)
Any face-to-face contact, *n* (%)*	325 (96.7)	913 (92.9)
Categories, *n* (%)		
≤1.0	30 (8.9)	151 (15.4)
1.1–3.0	94 (28.0)	323 (32.9)
3.1–6.0	108 (32.1)	284 (28.9)
>6.0	104 (31.0)	225 (22.9)
Drug prescriptions per year		
Median (range)***	12.3 (0.0–191.2)	8.4 (0.0–122.0)
Any drug prescription, *n* (%)	322 (95.8)	918 (93.4)
Categories, *n* (%)		
≤1.0	27 (8.0)	137 (13.9)
1.1–8.0	101 (30.1)	334 (34.0)
8.1–20.0	103 (30.7)	297 (30.2)
>20.0	105 (31.3)	215 (21.9)
Referrals per year		
Median (range)***	0.4 (0.0–8.1)	0.3 (0.0–6.1)
Any referral, *n* (%)**	257 (76.5)	671 (68.3)
Categories, *n* (%)		
≤1.0	259 (77.1)	805 (81.9)
1.1–2.0	58 (17.3)	145 (14.8)
>2.0	19 (5.7)	33 (3.4)

Mann–Whitney test or Chi-square test

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

22.9 % of women in the reference group. Significantly more patients than women from the reference population had any face-to-face contact for reasons related to the female genital system in total (48.2 vs. 38.8 %, χ^2 test p=0.002) (Table 3). When this ICPC chapter was divided by subgroups, significant differences were found for breast cancer (19.6 vs. 0.0 %, χ^2 test $p<0.001$) but not for breast symptoms and vulvar/vaginal symptoms/diagnoses (data not shown). Fewer patients had any contact for ear problems (29.2 vs. 36.2 %, χ^2 test p=0.023), including excessive ear wax (15.8 vs. 21.1 %, χ^2 test p=0.036). Significantly more patients than women from the reference population were prescribed anti-neoplastic/immuno-modulating agents (25.6 vs. 1.6 %, χ^2 test $p<0.001$), including hormone antagonists (tamoxifen) and aromatase inhibitors (23.2 vs. 0.1 %, χ^2 test $p<0.001$). Fewer patients were prescribed drugs for conditions concerning the genitourinary system in total (16.7 vs. 24.7 %, χ^2 test p=0.002). When this ICPC chapter was divided by subgroups, significant differences were observed for non-breast cancer-related sex hormones (6.5 vs. 19.4, χ^2 test $p<0.001$). Also, fewer patients than women from the reference population were prescribed drugs for conditions concerning the sensory organs (26.2 vs. 33.9 %, χ^2 test p=0.009), including ophthalmological preparations (19.9 vs. 28.4, χ^2 test p=0.002). No significant differences between patients and reference population were observed for frequencies of women with any referral to exercise therapy, mental healthcare, non-surgical specialties, and surgical specialties.

When analyses were restricted to women in the first 5 years of the follow-up period, frequencies of women with at least one annual face-to-face contact, drug prescription, and referral in the patient group decreased gradually towards that of the reference group. Frequencies of women prescribed nervous system drugs (e.g., analgesics and psycholeptics) and antineoplastic/immunomodulating agents (mainly hormone antagonists and aromatase inhibitors) remained higher among patients until the third and the fifth years, respectively (Table 4). Univariate logistic regression analysis showed that a higher age at diagnosis was related to a higher face-to-face contact rate (odds ratio, OR 1.06, 95 % CI 1.04–1.08) and a higher drug prescription rate (OR 1.07, 95 % CI 1.05–1.09) during the entire follow-up period (Table 5). This was illustrated by more patients in the oldest age group (>65.0 years) than patients in the younger age groups having >4.0 face-to-face contacts and >12.3 prescriptions per year. Treatment with chemotherapy after diagnosis was associated with a lower face-to-face contact rate (OR 0.56, 95 % CI 0.34–0.93) and a lower drug prescription rate (OR 0.52 95 % CI 0.31–0.86) during the follow-up period. Treatment with endocrine therapy was associated with a higher drug prescription rate (OR: 1.64, 95 % CI 1.02–2.65) in this period. Multivariate logistic regression analysis was not performed since only age at diagnosis reached a p value ≤0.01.

Discussion

This study explored reasons for primary healthcare use among women with a history of breast cancer compared with women without breast cancer and identified patient characteristics associated with this healthcare use in the period after completion of primary breast cancer treatment. Over the entire follow-up period (starting 1 year post-diagnosis), healthcare utilisation rates in the patient group were significantly higher than those in the reference group, indicating current involvement of GPs in breast cancer follow-up care.

More patients than women from the reference population had face-to-face contacts for reasons related to breast cancer or were prescribed hormone antagonists and aromatase inhibitors to treat breast cancer. In The Netherlands, hormone antagonists and aromatase inhibitors are initially prescribed by

Table 3 Reasons for primary healthcare use during the entire follow-up period (starting 1 year post-diagnosis) among women with a history of breast cancer (n=336) and women from the reference population (Ref.; n=983)

	Patients	Ref.
Any face-to-face contact by ICPC chapter/3-digit ICPC code, *n* (%)		
General and unspecified (A)	180 (53.6)	501 (51.0)
Blood, blood-forming organs, and immune mechanism (B)	43 (12.8)	130 (13.2)
Digestive (D)	142 (42.3)	458 (46.6)
Eye (F)	93 (27.7)	309 (31.4)
Ear (H)*	98 (29.2)	356 (36.2)
Excessive ear wax (H81)*	53 (15.8)	207 (21.1)
Cardiovascular (K)	177 (52.7)	564 (57.4)
Musculoskeletal (L)	249 (74.1)	708 (72.0)
Neurological (N)	101 (30.1)	331 (33.7)
Psychological (P)	117 (34.8)	297 (30.2)
Respiratory (R)	202 (60.1)	574 (58.4)
Skin (S)	209 (62.2)	625 (63.6)
Endocrine, metabolic, and nutritional (T)	80 (23.8)	245 (24.9)
Urological (U)	95 (28.3)	281 (28.6)
Pregnancy, childbearing, and family planning (W)	11 (3.3)	37 (3.8)
Female genital (X)**	162 (48.2)	381 (38.8)
Breast cancer (X76)***	66 (19.6)	0 (0.0)
Social problems (Z)	63 (18.8)	204 (20.8)
Any drug prescription by ATC chapter/3–7-digit ATC code, *n* (%)		
Alimentary tract and metabolism (A)	189 (56.3)	508 (51.7)
Blood and blood-forming organs (B)	102 (30.4)	305 (31.0)
Cardiovascular system (C)	185 (55.1)	541 (55.0)
Dermatologicals (D)	179 (53.3)	503 (51.2)
Genitourinary system and sex hormones (G)**	56 (16.7)	243 (24.7)
Sex hormones and modulators of the genital system (G03)***	22 (6.5)	191 (19.4)
Hormonal contraceptives for systemic use (G03A)***	3 (0.9)	81 (8.2)
Progestogens and estrogens, fixed combinations (G03AA)***	3 (0.9)	71 (7.2)
Levonorgestrel and estrogen (G03AA07)***	3 (0.9)	55 (5.6)
Progestogens (G03D)*	3 (0.9)	35 (3.6)
Progestogens and estrogens in combination (G03F)*	1 (0.3)	19 (1.9)
Systemic hormonal preparations, excl. sex hormones and insulins (H)	88 (26.2)	266 (27.1)
Anti-infectives for systemic use (J)	255 (75.9)	696 (70.8)
Antineoplastic and immunomodulating agents (L)***	86 (25.6)	16 (1.6)
Endocrine therapy (L02)***	80 (23.8)	2 (0.2)
Hormone antagonists and related agents (L02B)***	78 (23.2)	1 (0.1)
Anti-estrogens (L02BA)***	66 (19.6)	1 (0.1)
Tamoxifen (L02BA01)***	66 (19.6)	1 (0.1)
Aromatase inhibitors (L02BG)***	28 (8.3)	0 (0.0)
Musculoskeletal system (M)	184 (54.8)	560 (57.0)
Nervous system (N)	220 (65.5)	595 (60.5)
Respiratory system (R)	160 (47.6)	466 (47.4)
Sensory organs (S)**	88 (26.2)	333 (33.9)
Ophthalmologicals (S01)**	67 (19.9)	279 (28.4)
Anti-infectives (S01A)**	32 (9.5)	169 (17.2)
Antibiotics (S01AA)**	32 (9.5)	167 (17.0)
Fusidic acid (S01AA13)**	18 (5.4)	111 (11.3)
Any referral by specialty, *n* (%)		
Exercise therapy[a]	98 (29.2)	294 (29.9)
Mental healthcare[b]	23 (6.8)	78 (7.9)
Non-surgical specialties[c]	151 (44.9)	424 (43.1)
Surgical specialties[d]	162 (48.2)	458 (46.6)

Chi-square test

Subgroups (based on 3-digit ICPC codes and 3–7-digit ATC codes) with no significant differences between patients and reference population or with an expected count of less than five are not shown in this table

[a]Including physical therapy, Cesar therapy, and Mensendieck therapy

[b]Including general social work, psychology, and psychiatry

[d]Including cardiology, dermatology, internal medicine, geriatrics, pulmonology, gastroenterology, neurology, psychiatry, rheumatology, and rehabilitation medicine

[c]Including general surgery, dental surgery, otolaryngology, neurosurgery, gynaecology, ophthalmology, orthopaedics, plastic surgery, urology, and vascular surgery

*p<0.05; **p<0.01; ***p<0.001

Table 4 Timing of primary healthcare use during the first 5 years of the follow-up period among women with a history of breast cancer (n=336) and women from the reference population (Ref.; n=983)

	Any, *n* (%)	
	Patients	Ref.
Follow-up year 1	n=200	n=584
Face-to-face contact	176 (88.0)**	454 (77.7)
Psychological (P)	33 (16.5)**	50 (8.6)
Female genital (X)	56 (28.0)**	108 (18.5)
Drug prescriptions	175 (87.5)	477 (81.7)
Antineoplastic/immunomodulating agents (L)	68 (34.0)***	2 (0.3)
Nervous system (N)	94 (47.0)**	205 (35.1)
Referrals	72 (36.0)*	162 (27.7)
Follow-up year 2	n=174	n=536
Face-to-face contacts	148 (85.1)	425 (79.3)
Psychological (P)	23 (13.2)	48 (9.0)
Female genital (X)	42 (24.1)**	76 (14.2)
Drug prescriptions	156 (89.7)*	441 (82.3)
Antineoplastic/immunomodulating agents (L)	57 (32.8)***	2 (0.4)
Nervous system (N)	82 (47.1)**	193 (36.0)
Referrals	58 (33.3)	172 (32.1)
Follow-up year 3	n=160	n=512
Face-to-face contacts	131 (81.9)	407 (79.5)
Psychological (P)	21 (13.1)	52 (10.2)
Female genital (X)	37 23.1*	74 14.5
Drug prescriptions	135 (84.4)	432 (84.4)
Antineoplastic/immunomodulating agents (L)	42 (26.3)***	2 (0.4)
Nervous system (N)	76 (47.5)**	181 (35.4)
Referrals	62 (38.8)	167 (32.6)
Follow-up year 4	n=138	n=485
Face-to-face contacts	106 (76.6)	379 (78.1)
Psychological (P)	17 (12.3)	45 (9.3)
Female genital (X)	25 18.1	81 16.7
Drug prescriptions	114 (82.6)	410 (84.5)
Antineoplastic/immunomodulating agents (L)	34 (24.6)***	3 (0.6)
Nervous system (N)	52 (37.7)	187 (38.6)
Referrals	43 (31.2)	155 (32.0)
Follow-up year 5	n=133	n=480
Face-to-face contacts	97 (72.9)	371 (77.3)
Psychological (P)	16 (12.0)	56 (11.7)
Female genital (X)	24 (18.0)	54 (11.2)
Drug prescriptions	104 (78.2)	386 (80.4)
Antineoplastic/immunomodulating agents (L)	23 (17.3)***	6 (1.3)
Nervous system (N)	51 (38.3)	181 (37.7)
Referrals	18 (33.3)	60 (26.8)

Chi-square test

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

oncologists. Although not mentioned in the Dutch breast cancer guidelines [24, 25], patients may receive these drugs on repeat prescription in general practice [26], on request of the oncologist. This repeat prescription usually occurs without direct doctor–patient contact [27]. Fewer patients than women from the reference population were prescribed non-breast cancer-related sex hormones. This result is in line with the guideline from the Dutch College of General Practitioners [28] that strongly advises against treating menopausal symptoms with hormones in women with a history of breast cancer.

Analyses restricted to women in the first 5 years of the follow-up period showed that healthcare use in the patient group decreased gradually towards that of the reference group, while frequencies of women prescribed nervous system drugs (e.g., analgesics and psycholeptics) and antineoplastic/immunomodulating agents (mainly hormone antagonists and aromatase inhibitors) remained higher among patients until the third and the fifth years, respectively. Other studies have reported on the long-term psychological impact of breast cancer and its treatment [29, 30]. Recently, an increased prescription of psychotropic medication was found in breast cancer patients on endocrine therapy [23]. In our study, no significant differences between patients and reference population were observed for frequencies of women with any referral to mental healthcare. Anxiety and depression are usually managed in primary care by GPs and their teams, which may include psychologists and counsellors [31].

The main predictor of higher rates of face-to-face contacts and drug prescriptions throughout the entire follow-up period was a higher age at diagnosis. This might indicate the presence of co-morbid conditions in older women with a history of breast cancer. As co-morbidity is associated with decreased overall survival and increased mortality among older breast cancer patients [32], there is a need to integrate cancer surveillance, preventive care, and general medical care for those co-morbid conditions [2, 33]. Comprehensiveness of care is one of the important potential benefits of primary care-based follow-up [34]. When follow-up is transferred to the primary care setting, new responsibilities of GPs might be incorporated into existing primary healthcare delivery to patients with a history of breast cancer. In that case, however, GPs have to move from a reactive to a proactive role in follow-up care [2]. Training of GPs might be necessary to ensure that they have adequate knowledge and feel confident to provide this care [14, 35]. Moreover, they require additional practice supports in order to effectively manage their new responsibilities that come with caring for breast cancer survivors.

A major strength of the present study is the use of a primary care database to analyse healthcare utilisation rates among women with a history of breast cancer and women without breast cancer from the same population [20]. As the presentation of health problems was recorded by GPs, our

Table 5 Rates of face-to-face contacts and drug prescriptions during the entire follow-up period (starting 1 year post-diagnosis) by characteristics of patients with a history of breast cancer (n=336). Univariate analysis, odds ratios (OR), and 95 % confidence intervals (95 % CI) estimated with logistic regression analysis

	Univariate		
	≤ median	> median	OR (CI)
Outcome: annual face-to-face contact rate	≤4.0 (n=168)	>4.0 (n=168)	
Age at diagnosis (years)			1.06 (1.04–1.08)***
Categories, *n* (%)			
≤50.0	79 (47.0)	37 (22.0)	
50.1–65.0	60 (35.7)	60 (35.7)	
>65.0	29 (17.3)	71 (42.3)	
T stage, *n* (%)			
Tis/T1	84 (60.0)	76 (55.5)	1
T2/T3/T4	56 (40.0)	61 (44.5)	1.20 (0.75–1.94)
N stage, *n* (%)			
N0	101 (64.7)	97 (65.5)	1
N+	55 (35.3)	51 (34.5)	0.97 (0.60–1.55)
Surgery, *n* (%)			
Lumpectomy[a]	69 (41.8)	52 (31.5)	1
Mastectomy[b]	96 (58.2)	113 (68.5)	1.58 (0.99–2.50)
Chemotherapy, *n* (%)			
No	106 (67.1)	124 (78.5)	1
Yes	52 (32.9)	34 (21.5)	0.56 (0.34–0.93)*
Endocrine therapy, *n* (%)			
No	112 (71.3)	101 (64.3)	1
Yes	45 (28.7)	56 (35.7)	1.38 (0.86–2.22)
Outcome: annual drug prescription rate	≤12.3 (n=168)	>12.3 (n=168)	
Age at diagnosis (years)			1.07 (1.05–1.09)***
Categories, *n* (%)			
≤50.0	78 (46.4)	38 (22.6)	
50.1–65.0	70 (41.7)	50 (29.8)	
>65.0	20 (11.9)	80 (47.6)	
T stage, *n* (%)			
Tis/T1	85 (60.3)	75 (55.1)	1
T2/T3/T4	56 (39.7)	61 (44.9)	1.23 (0.77–1.99)
N stage, *n* (%)			
N0	100 (63.3)	98 (67.1)	1
N+	58 (36.7)	48 (32.9)	0.84 (0.53–1.36)
Surgery, *n* (%)			
Lumpectomy[a]	69 (43.4)	52 (35.1)	1
Mastectomy[b]	90 (56.6)	96 (64.9)	1.42 (0.89–2.24)
Chemotherapy, *n* (%)			
No	107 (66.5)	123 (79.4)	1
Yes	54 (33.5)	32 (20.6)	0.52 (0.31–0.86)*
Endocrine therapy, *n* (%)			
No	117 (73.1)	96 (62.3)	1
Yes	43 (26.9)	58 (37.7)	1.64 (1.02–2.65)*

[a]Including patients treated with lumpectomy, with and without radiation therapy

[b]Including patients treated with lumpectomy followed by mastectomy, with and without radiation therapy

*p<0.05; **p<0.01; ***p<0.001

study is much less prone to recall or non-response bias than surveys with self-reported data on healthcare use [36]. Although some concerns have been raised about the validity of the data in primary care databases [37], the likelihood that the breast cancer code was valid in the patient records increased considerably by going back to the participating general practices for confirmation of the breast cancer diagnosis. A matter of concern might be the completeness or

sensitivity of the data in primary care databases [36, 37]. In the present study, matching was performed on GP to ensure that inaccuracies in recording and prescription were evenly distributed among patients and women from the reference population. The possibility of patients diagnosed with breast cancer without the breast cancer code in their record [38] cannot be ruled out, as the used data pertain to those conditions that were brought to the attention of the GPs and were recorded with ICPC codes. Furthermore, we were not able to compare menopausal status [39] between the patient group and reference group because our primary care database does not include information on this status. Finally, these data apply to a population in the northern part of The Netherlands that might be influenced by local healthcare structures [40].

Dutch GPs have not traditionally played a formal role in breast cancer follow-up care. However, our study showed their informal role in care for patients with a history of breast cancer. This study provides needed data to re-design the follow-up care for women with breast cancer. When follow-up is transferred to the primary care setting, new responsibilities of GPs might be incorporated into existing primary healthcare delivery.

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Conflict of interest None.

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