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EPIDEMIOLOGY

A nationwide analysis of incidence and outcome of breast cancer in the country of Surinam, during 1994–2003

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Abstract In this study, we describe the incidence, treatment, and outcome of breast cancer (BC) during the period 1994–2003 in the South-American country of Surinam and compare these with those of BC in the Netherlands. Pathology reports and hospital charts from all BC cases diagnosed between 1994 and 2004 were retrieved from Surinam's single pathology laboratory and its five hospitals. Data on demographics, tumor characteristics, treatment, and follow-up were gathered. We compared our data to BC statistics of first generation immigrants from Surinam to the Netherlands. 421 patients were diagnosed with BC during the study period. The age-adjusted incidence rate was 26 per 100,000 compared to 65/100,000 in first generation Surinamese women in the Netherlands. The majority had a fairly advanced stage at presentation, with 60% of tumors larger than 2 cm, and 41.6% with lymph node involvement. Because of the absence of radiotherapy facilities, local treatment in most patients was radical mastectomy. Adjuvant hormonal therapy (51.6%) was administered more frequently than adjuvant chemotherapy (20.3%). A significant number of patients were lost to follow-up, resulting in a median follow-up duration of only 23 months. The 5-year overall survival was 79%. BC incidence in Surinam is low compared to that in the western world, but the advanced stage at diagnosis, the low utilization of systemic adjuvant therapy, and the inadequate follow-up may lead to poor outcomes. A number of steps are underway to improve the level of cancer care in Surinam.

Keywords Breast cancer · Surinam · Epidemiology

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Introduction

Breast Cancer (BC) is the most common malignancy experienced by women worldwide. However, the incidence is the highest in developed countries, and relatively low in the developing world [1].

The republic of Surinam is a former Dutch colony situated in South America, which gained independence in 1975. Its history of colonization, of slave labor and contract laborers, has led to great ethnic diversity in its population of almost 500,000 [2]. The major ethnic groups are of Indian descent (the so-called Hindustani 27.4%), or mixed African descent (the so-called Creoles 17.7%), Marroons (descendants of runaway slaves, 14.7%), and Javanese (descendants of Indonesian contract laborers, 14.6%) [3]. In the 1970s and 1980s, after independence and during a period of civil unrest, mass emigration to the Netherlands took place, so that the Netherlands now has a population of almost 350,000 originally from Surinam [4].

In the year 2002, the Gross Domestic Product (GDP) per capita was US $4, 447. The annual per capita health expenditure was US $385, corresponding to an expenditure of 8.6% of the GDP [5]. The equivalent numbers for the USA in 2002 were US $36, 056 for GDP, and US $5,274 or 14.6% of the GDP for health [6].

There are five hospitals in Surinam, four of which are in the capital of Paramaribo. Medical specialists have all been trained, at least partly, in first world hospitals, mostly in the Netherlands. Surinam has one pathology laboratory in Paramaribo, where all biopsies and surgical specimens obtained anywhere in the country are sent. Radiotherapy was not available in Surinam during the study period, and so the patients who were eligible for radiotherapy had to go out of the country to receive it. A substantial part of the population has limited health care coverage, and many patients have to contribute to the cost of health care out of private funds. There is at present no cancer registry.

Because of the paucity of data on BC in Surinam, the aim of this study was to retrospectively investigate the epidemiology, treatment, and outcome of BC over the last decade to establish the baseline situation for future health care planning and evaluation. We compared these data to BC statistics of first generation immigrants from Surinam to the Netherlands.

Methods

Between June 1, 2005 and September 30, 2005, data were collected for all the patients having had a pathological diagnosis of invasive BC between January 1, 1994 and December 31, 2003.

After retrieval from the pathology laboratory archives, the patient charts in the different hospitals were collected and hand-searched for the following data: patient demographics; tumor characteristics (including TNM-stage, grade, and hormone receptor status); treatment characteristics, and follow-up data. The last date of follow-up was the last recorded hospital contact, or death of patient. During the study period, there were no national guidelines for treatment of breast cancer.

This study was approved by the Ministry of Health, the National Medical Ethics Board, the boards of directors and the medical staffs of all the hospitals in Surinam. The medical ethics committee of Surinam granted a waiver for informed consent for this archival study. Data on Surinamese women with breast cancer in the Netherlands were retrieved from the Netherlands Cancer Registry. We used data for the provinces of North-Holland and Flevoland, which host 35% of the Surinamese population in the Netherlands.

Analysis

A database was made in Access© to store all data. The interval between the different therapies was calculated in this program. Kaplan–Meyer curves and survival times were calculated in SPSS©. The age standardized incidence rate was calculated using the World Standard population.

Results

Incidence

From January 1, 1994 until December 31, 2003, 421 patients were diagnosed with BC in Suriname, two were male. The median incidence was 38.5/year with a peak of 70 patients in the year 2000. The crude incidence rate in the study period was 15.7/100,000/year. The age-adjusted incidence rate was 28/100,000/year (Table 1). The age-adjusted incidence rate for first generation Surinamese women in the Netherlands over the same period of time was 65/100,000/year (Table 1).

Patient characteristics

The median age at BC diagnosis was 55 years, with a range of 26–90. BC incidence is higher in Surinamese women in the Netherlands than in Surinamese women in Surinam, and this seems to be especially true for women aged more than 55 (Fig. 1). BC occurs more often in Creoles (35.7/100,000/year), than in Hindustani (18.2/100,000/year), and Javanese women (20.8/100,000/year) (Table 2).

Table 1 Characteristics of breast cancer patients in Surinam and Surinamese women in the provinces North-Holland and Flevoland in the Netherlands, 1994–2003

	Surinam		The Netherlands	
	Number of patients (ASR*)	%	Number of patients (ASR*)	%
Total	419 (28)		196 (65)	
1994–1998	167 (25)		88 (62)	
1999–2003	252 (31)		108 (68)	
Age				
<30	3	0.7	2	1.0
30–39	43	10.3	29	14.8
40–49	108	25.8	42	21.4
50–59	94	22.4	53	27.0
60–69	94	22.4	44	22.4
>70	75	17.9	26	13.3
Unknown	2	0.5	–	

**ASR* age-standardized rate per 100,000 women/year

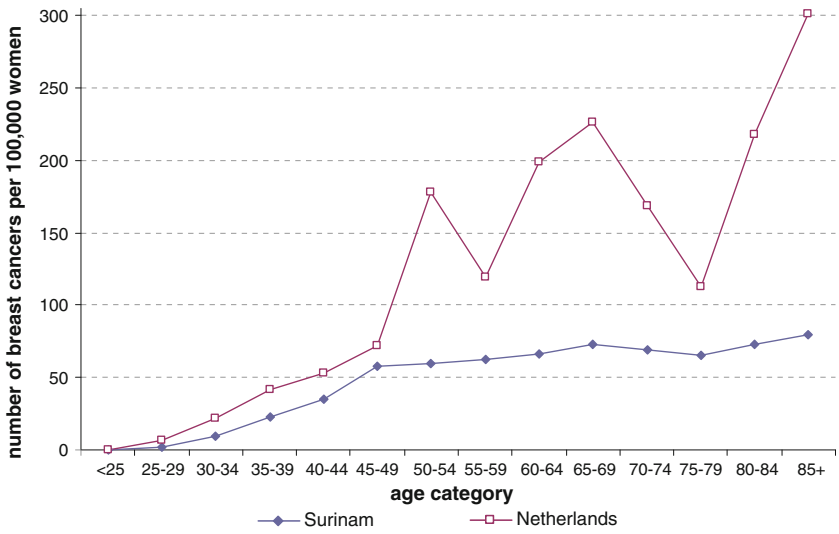

Fig. 1 Age-specific breast cancer incidence in Surinam and in Surinamese women in the Netherlands

Data on parity ($n = 173$) and age at first pregnancy ($n = 61$) were not available for the majority of patients. Data on lactation and duration of lactation were so scarce that they were left out of this report.

Tumor characteristics

In Surinam, ductal cancers were most common (94%), with a minority of lobular tumors (1.7%) and tumors of unknown origin (4.3%) (Table 3).

More than 60% of all tumors were T2 (>20 and <50 mm) and larger, while less than a quarter were T1 (<20 mm). In almost 15% of cases, tumor size was not known, either because the patients never came back after the diagnostic biopsy for further treatment, or because they were not eligible for surgery due to tumor spread at presentation.

The lymph node status was known for 323 patients, with almost equal numbers with tumor-positive (N+) and tumor-negative (N0) axillary nodes. The 96 patients with an unknown axillary node status were either patients who only had a diagnostic biopsy and did not return for further treatment or had an advanced stage at presentation, and hence were not eligible for surgery.

The hormone receptor status was known for 69 patients only (Table 3), 40% of whom had a positive estrogen receptor (ER) and/or progesterone receptor (PgR). All but two of these hormone receptor tests were done after 2000.

At the time of presentation, a small number of patients (5.7%) had distant metastases. The majority of tumors for which the histological grade was known, was poorly differentiated according to the Bloom–Richardson classification. The mitotic activity index (MAI), which was determined in Surinam from the year 2000, was known for

Table 2 Characteristics of breast cancer patients in Surinam 1994–2003

Strata	Number of patients	%	Incidence rate/ 100,000/year
Ethnicity			
Creole	156	37.2	35.7
Marroons	8	1.9	2.2
Hindustani	123	29.4	18.2
Javanese	75	17.9	20.8
Chinese	8	1.9	
Mixed	31	7.4	10.1
Dutch	6	1.4	
Others	12	2.9	
Parity			
0	15	3.6	
1–3	92	22.0	
>3	66	15.8	
Unknown	246	58.7	
Age of first pregnancy			
<20	22	5.3	
20–30	34	8.1	
30–40	5	1.2	
Unknown	358	85.4	

95 tumors, of which 53.7% had a MAI ≤10 mitotic figures/ 10 hpf, and 46.3% had a MAI >10 mitotic figures/10 hpf.

Treatment

A large majority (79.7%) of patients underwent surgery. Modified radical mastectomy was the procedure most often performed, with some form of breast conserving therapy for a minority of patients (Table 4). The 20.3% of patients who did not receive surgery were diagnosed with BC, but they either never came back for further treatment or had had an advanced stage of BC and were thus not eligible for surgery.

Hormone therapy was prescribed for 216 (51.6%) patients. The lymph node status was known for 186 of these patients, and 62% of N+ patients and 52% of N0 patients received hormone therapy.

In the 78 N0 patients who received hormone therapy, the indications for hormone therapy were T1 tumor with BR 3 ($n = 4$), T3 or T4 tumor ($n = 9$), T2 with a BR2 or 3 ($n = 27$). For 38 patients, the indication for hormone therapy was not specified. 18 of 26 patients, who had positive hormone receptors, received hormone therapy. The eight patients with a positive hormone receptor, who did not receive hormone therapy, either had died or were lost to follow-up soon after diagnosis.

Table 3 Tumor characteristics of breast cancer patients in Surinam

Strata	Number of patients	%
Total	419	100
Type of tumor		
Ductal	394	94
Lobular	7	1.7
Unknown	18	4.3
T-size		
T1 (≤20 mm)	98	23.4
T2 (>20, ≤50 mm)	157	37.5
>T3 (>50 mm)	96	22.9
Unknown	68	16.2
Number of involved axillary lymph nodes		
N0	149	35.6
N1(1–3)	93	22.2
N2(4–9)	51	12.2
N3(≥10)	30	7.2
Unknown	96	23.2
Metastases	24	5.7
ER/PgR		
ER+/PgR+	26	6.2
ER−/PgR−	39	9.3
ER+/PgR−	2	0.5
ER−/PgR+	2	0.5
Unknown	350	83.5
Bloom-Richardson differentiation		
Well = grade 1	7	1.7
Moderately = grade 2	52	12.4
Poor = grade 3	181	43.2
Unknown	179	42.7
Mitotic activity index		
≤10	51	12.2
>10	44	10.5
Unknown	324	77.3

One fifth of all the patients received adjuvant chemotherapy. This was not appreciably influenced by the size of the primary tumor. Chemotherapy was given to 35.1% of all node positive (N+) patients. Fifty-one percent of N+ women <50 years, and 20% of N+ women >50 years received chemotherapy. 17% of N0 women <50 years, and 4% of N0 women >50 years received chemotherapy.

Among all patients, 30% of whom were eligible for chemotherapy according to the 2005 Surinam guidelines (obviously not available during the study period) actually received it in our cohort.

Also, 33 patients (of 42 who had breast conserving surgery) were irradiated abroad after lumpectomy. 26 patients received radiotherapy after radical mastectomy. The indication for adjuvant radiotherapy was irradical

Table 4 Therapy characteristics of breast cancer patients in Surinam

	n	%	Lymph node positive	Lymph node negative
Total	419	100		
Surgery	334	79.7		
Mastectomy	292	69.7	150	127
Lumpectomy	42	10.0	14	20
Radiotherapy	59	13.8	33	24
after lumpectomy	33	7.9	20	16
after mastectomy	26	5.9	13	8
Chemotherapy	86	20.5		
CMF	45	10.5	35	4
Anthracycline-containing	31	7.9	21	7
Unknown	10	1.9		
Hormone therapy (Tamoxifen)	216	51.6	107	76

resection in five patients, T3 tumor ($n = 3$), T4 tumor ($n = 3$), age <35 years ($n = 2$), ER−/PgR− ($n = 2$), and grossly positive lymph nodes (>N2 in 7 patients). For four patients who were treated with adjuvant radiotherapy after mastectomy, the indication could not be retrieved from the available records.

Treatment duration

The median time from the date of diagnosis until the date of surgery in Surinam was 17 days, with not much variation between the different hospitals in Paramaribo. The median time between breast conserving surgery in Surinam and radiotherapy abroad was 11 weeks. For the 26 patients who received radiotherapy after mastectomy, the median time between mastectomy and radiotherapy was 11.5 weeks.

The median time between surgery and second treatment modality, either chemotherapy or radiotherapy was 9 weeks. The median time from the end of the first to the start of the second adjuvant treatment modality was 12 weeks.

Outcome

Follow-up data of 384 (91.7%) patients were available, but median follow-up was only 23 months. 5-year follow-up was available for 73 patients. The 5-year overall survival for these patients was 79%, with a median of 110 months (Fig. 2).

During follow-up, 45 patients were diagnosed with distant metastases, 47 with a locoregional relapse, and 27 with both distant spread and locoregional relapse. Patients who received breast conserving therapy developed locoregional relapse in 9.1% of cases, while in patients who underwent mastectomy the locoregional relapse rate was 20.5%.

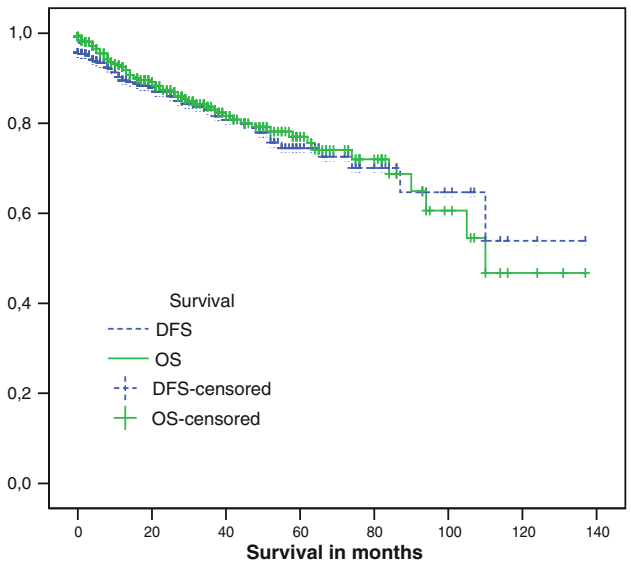

Fig. 2 Overall and disease-free survival of breast cancer patients in Surinam

The mean disease-free survival was 100 months (Fig. 2), and highly correlated to T stage, with 111 months for T1 tumors, 94 months for T2 tumors, 77 months for T3 tumors, and for T4 tumors 44 months. For patients with negative lymph node status, mean survival was 116 months, and for positive lymph node status, it was 78 months (Fig. 3).

Discussion

In this retrospective population-based survey, the incidence of BC in Surinam was studied over a 10-year period. The

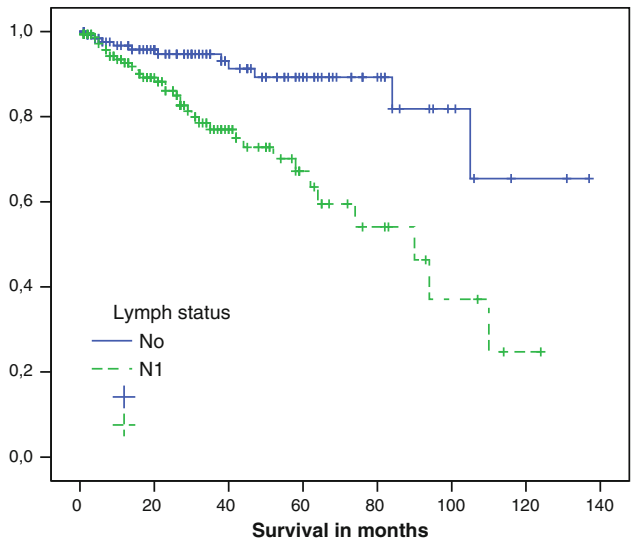

Fig. 3 Overall cumulative survival of breast cancer patients with N0/N+ in Surinam

strength of this study lies in the fact that all pathology-confirmed diagnoses in the country were included in the analysis, and all hospitals participated. The main weakness is the paucity of follow-up data with a median follow-up of less than 2 years, which impedes discussion of outcome. Although all pathologically confirmed BC diagnoses in Surinam during the study period were included in the analyses, it is conceivable that additional women were diagnosed with advanced BC during the study period without tumor biopsies or surgery. The absence of a national cancer registry in the country makes it impossible to estimate or correct for this in any way. However, this is the first population-based study to look at individual demographic, tumor, and treatment data.

The crude cancer incidence rate in Surinam increased from 9.5/100,000 during 1964–1976 [7] to 16.7/100,000 during 1980–2000 [8], which is similar to our results. The rise in BC incidence over the past decades is seen worldwide [9, 10] and has been mostly correlated with changes in reproductive factors. This may to a large degree account for the lower BC incidence in developing countries versus the western world [11, 12]. Although increasing, the mean age at first birth in Surinam is still low at 21 years [5], compared to over 28 years in most western European countries [13]. In addition, mean parity in Surinam was 2.7 children per women in 2000 [3], while in the Netherlands, it was only 1.7 (2001–2003) [13]. Interestingly, the incidence of BC in Surinamese women in Surinam was considerably lower than the incidence of first generation Surinamese women in the Netherlands (Fig. 1). The main possible explanation is thought to lie in demographic changes, with Surinamese women in the Netherlands adapting to Dutch reproductive statistics with less children at a higher age, although increased detection due to public awareness and screening mammography programs may also play a part.

The median age at BC diagnosis was lower than the median age in the western world, albeit being fairly high compared to other low-income countries, underlining the in-between state of development of Surinam society [11, 12, 14]. A confounding factor could be the relatively low life expectancy of women in Surinam (69 years at birth [5], versus 80 in the USA [6]), especially in view of the fact that 43% of new BC cases in the USA are diagnosed in women older than 65 years. The most important competing risk for death in Surinam is cardiovascular disease, which has a high mortality because (preventive) care is not always optimized.

The fact that the proportion of Creole BC patients is higher than that would be expected by the distribution of ethnicities in the population may both be explained by not only genetic factors comparable to the incidence data for e.g., African-Americans in the USA, but also by much higher prevalence of cardiovascular disease in Hindustanis, the largest ethnic group.

Women presented with late stage BC more often than in the western world, e.g., 41.6% of patients had lymph node involvement at time of diagnosis, whereas during the same time period, this was only 30% in the USA and 31% in the Netherlands [15]. More advanced stage at diagnosis is commonly found in developing countries [14], and is thought to be related to lack of universal coverage, lack of screening programs, and fear of cancer in general. Tumor size and stage decreased in the western world since the introduction of mammography in the Netherlands in the last decades of the twentieth century [16–18], and this went hand in hand with increased public awareness and reduced taboo status of the disease [19, 20]. In Surinam, the vivid culture of traditional medicine and taboo status of BC, almost certainly, contribute to a more advanced stage at diagnosis. However, the convergence of both incidence and stage of BC in first generation immigrants from Surinam to the native Dutch population challenges the size of the effect of different attitude and beliefs. It underscores both the relationship between poor socioeconomic status and access to health care, and the positive effect of BC campaigns to enhance BC awareness and possibly of screening [21].

Although data on tumor size and lymph node status were generally available from the pathology lab, other prognostic and predictive factors were harder to interpret. We found a discrepancy between the Mitotic Activity Index (MAI) and Bloom–Richardson grading. The majority of tumors had low MAI (under 10 hpf), but this was paired with high tumor grades according to Bloom–Richardson Grading which is generally considered more subjective and

less reproducible than MAI. According to several authors, MAI is a strong, widely available, easily assessable, inexpensive, well-reproducible prognosticator, if the protocol is carefully followed. Fixation delay for as long as 24 h after extirpation of the tumor does not decrease the accuracy of the MAI, in contrast to BR evaluation [22]. In a country with limited resources, MAI could prove to be more reliable than grading, but short of central pathology revision, there is no way of knowing what was the most accurate or consistent in Surinam.

Because of the absence of immunohistochemistry (IHC) technology in the pathology laboratory in Surinam to determine hormone receptor status, paraffin-embedded archival tissues were sent to the Netherlands to determine the receptor status of the tumor whenever deemed necessary for treatment decisions. Unfortunately, only a minority of patients had tissue sent to the Netherlands, and most of them had a negative receptor status. Is this an accurate estimation? False negatives of hormone receptor are not uncommon, especially with increasing time delay before tissue fixation, increased duration of fixation, and type of fixative, all of which may have been the case in our patient cohort. False negatives increase especially in BC with a low receptor positivity such as is typically seen in patients of African descent [23–26]. At present, it is impossible to say whether this played a part in our study population, but the lack of IHC to determine predictive markers is bound to hamper treatment decision making, and possibly outcome. Thus, since hormone receptor status was known for only 69 patients, prescription of adjuvant hormone therapy was mostly blinded to ER-status. This seems not unreasonable, in view of the uncertainty about the quality of the assessments, and the mild cost and systemic effects of hormone therapy.

The indications for adjuvant systemic therapy for BC have broadened over the past decades. Although regional differences exist, in general adjuvant systemic therapy is prescribed for larger tumors, N+ tumors, and small tumors that are poorly differentiated. No guideline existed in Surinam during the study period, but in 2005, the National Oncology Committee developed a BC treatment guideline based on both Dutch and American (USA) guidelines [27, 28], although, in some cases, the suggested drug regimens differed to suit Surinam's economical situation [5]. Indications for adjuvant systemic therapy according to this government-approved guideline were compared to the proportion of patients receiving such therapy in the study cohort. It should be noted that over the study time period, in western countries, adjuvant chemotherapy practice was also considerably more conservative than it is now. The aim of the comparison was mainly to assist in future health care planning.

A minority of patients who would be eligible for adjuvant chemotherapy according to the guideline actually received it (30%). Based on western experience after the introduction of national guidelines [29], this number could go up to at least 70% for chemotherapy, which means that the number of patients that will receive adjuvant chemotherapy may double or even triple.

The treatment interval between the different treatment modalities is a predictor for outcome, with a long treatment interval as an unfavorable factor. Compared to the Netherlands, the median interval between diagnosis and surgery was shorter (17 days vs. around 28 days), which points to the absence of long waiting lists for surgery so common in the Netherlands. However, treatment intervals between surgery and chemotherapy compared unfavorably to the Netherlands (9 vs. 4 weeks). We speculate that the lack of availability of cytotoxic drugs in Surinam may in some case account for the delay, but the lack of a sense of urgency in both doctors and patients may also play a part.

The time between surgery and radiotherapy was approximately 11 weeks. In the Netherlands, an 8-week interval is considered as the upper limit of what is acceptable, with a preference for 4–6 weeks. Because of the absence of radiotherapy facilities within the country, a longer interval may have been unavoidable in this group. In view of this, it may be worth considering advising radical mastectomy instead of breast conserving therapy for all patients, until radiotherapy will become available in the country.

For a relatively large part of our cohort (20–25%), no data on lymph node status or local treatment were available. Some of these patients may not have received local treatment because of advanced stage of disease at time of diagnosis, but we speculate that others never returned for further treatment. This is consistent with the relatively short length of follow-up, in spite of our concerted efforts to track down the disease course of all patients. We were unable to determine whether patients in general did not return for follow-up because disease was uncontrolled, or because they were asymptomatic. In either case, this may have biased the survival data, which raises doubt about their validity, even though obvious trends such as worse outcome for higher stages could be confirmed.

Conclusion

In this study, we have shown the feasibility of conducting a nationwide epidemiologic survey in Surinam. Most of our findings could be related to the demographics of Surinam and the low-resource status of the economy. The introduction of the Surinam BC treatment guideline, the planned introduction of immunohistochemistry, and the anticipated introduction of radiotherapy in late 2010 are expected to ameliorate diagnosis and treatment of BC

patients in Surinam. The projected start of a national cancer registry, combined with a recently improved continued medical education program will further enhance these goals. Improvement in BC awareness and possible implementation of BC screening programs will take much longer.

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Conflict of interest None.

Appendix

Surinam: Boards of hospitals and medical staffs.
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Internal medicine: H.D. Chee, MD C.H. Adhin, MD, I.J. Lie Kiauw, MD J. Loor, MD, J.E. Anijs, MD
Diakonessenhuis
Surgery: A.E. Bergen MD
Internal medicine: S. Vreden, MD, E. Dams, MD, B.O. Hewitt, MD, M. van Eer, MD
's Lands Hospital
Surgery: J.H. de Bye, MD
Internal medicine: S Nannan Panday†, MD
St Vincentius Hospital
Surgery: M.N. Mohab Ali, MD
Internal medicine: A. Cameron, MD H. Dissels, MD
Nickerie, Surinam:
Streekziekenhuis Nickerie
Surgery: A.S. Li Fo Sjoe, MD
Pediatrics: N. Braafheid, MD
Vu medical center, Amsterdam, The Netherlands
W.R. Gerritsen MD, PhD

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