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Breast cancer screening in the Caribbean: a comparative study across six Caribbean Islands with a transatlantic perspective

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Abstract

Introduction Breast cancer (BC) is the primary cause of cancer-related mortality among women globally, including within the Caribbean Region. This burden of disease underscores the critical need for effective breast cancer screening (BCS) programs yet implementation of BCS varies greatly among Caribbean countries. This study presents a comparative analysis of the similarities, differences, and opportunities of BCS programmes and their implementation on six Caribbean islands to subsequently use the so-called AAAQ-model to evaluate aspects of the programmes more in-depth.

Methods This mixed-methods study combined quantitative and qualitative data from Aruba, Bonaire, Curaçao, Guadeloupe, Jamaica and Sint Maarten – Caribbean islands with different languages (Dutch, Papiamentu, French and English), colonial histories, and governing structures (independent states, affiliated territories or special municipalities of continental European countries). Data was gathered from published and grey literature, input from stakeholders and two discussion sessions.

Results Five of six islands have implemented BCS programs, with clinical breast examinations or mammography. Participation in BCS is free of charge. Start of the programs and age-ranges varied. The target population is reached by invitations by mail and social media. Three islands conduct extensive BCS promoting communication campaigns annually in October. Cultural contextual factors influencing screening uptake and implementation included a limited health-seeking culture, and high turnover of BCS health providers. Lower inclusion of women with limited health literacy, lower education levels, lower socioeconomic status, fear for mammography discomfort or cancer and geographical hurdles were recognized as possibly contributing to lower participation in BCS.

Conclusion Similarities and differences between the BCS programs in the six Caribbean islands were identified, suggesting that exchange of good practices in the Caribbean could play an important role in improving BCS programs. A role of history and (post-)colonial transatlantic relations in shaping contemporary health systems was

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recognized. Multilateral communication and knowledge transfer between the islands and continental European countries can resolve these differences and stimulate best screening practice.

Keywords Breast cancer, Screening, Caribbean, Aruba, Bonaire, Curaçao, Guadeloupe, Jamaica, Sint Maarten

Introduction

The Caribbean consists of more than 25 island states, with notable differences in size, resources, (colonial) history, demography, and health systems [1]. Cancer is a major public health challenge in the region, as it is the second leading cause of the noncommunicable diseases-related deaths [1, 2]. In 2022, an estimated 1.4 million new cases (excluding non-melanoma skin cancer) occurred, and more than 700,000 cancer-related deaths [3, 4]. Among Caribbean women, breast cancer (BC) is the predominant malignancy and the leading cause of cancer-related mortality [5, 6]. In 2022, 14,862 women were diagnosed with BC (of a female population of approximately 22.2 million) representing 26.7% of all cancer diagnoses in women. Furthermore, BC accounted for 19.7% of the total cancer-related deaths among women [6]. A continuing rise in BC-related mortality is projected, which has been largely attributed to the high numbers of late-stage diagnoses and cases beyond stage one but also to an ageing population [2, 3, 7]. One large-scale American based study where race and/or ethnicity was combined and stratified into five mutually exclusive groups (Non-Hispanic-White, Non-Hispanic Black, Non-Hispanic Asian or Pacific Islander, Non-Hispanic American Indian or Alaska Native, Hispanic) showed that black women face a 40% higher mortality rate due to BC compared to white women [8]. This higher mortality in black women may depend on a susceptibility to more aggressive tumors that are less sensitive to treatment and difficult to detect in breast cancer screening (BCS), lack of access to care, and other factors [8]. A large proportion of the population on most but not all Caribbean islands is of African descent, which may add to the need for effective breast cancer screening programmes in the Caribbean, even though the efficacy of BCS may vary from effective to only moderately effective, the efficacy depending on many factors.

Caribbean cancer screening programmes, including BCS programmes, are nationally organized, with varying approaches per island. Certain patterns reflect the colonial histories of the Caribbean islands, through their influence on health care systems structures (hence the term ‘transatlantic’, to indicate both the connection over and separation by the Atlantic Ocean of the programs in the Caribbean region and e.g. European France, Netherlands and the UK) but other contextual factors are also at play resulting in a high degree of heterogeneity in screening approaches. This is illustrated by the varying inception dates: BCS programmes in the French Overseas

Countries and Territories (OCTs) or overseas regions (OR) like Guadeloupe were launched as early as 2004 – at the same time as in Mainland France. In contrast, although in the Netherlands the BCS programme started in 1989, BCS in the Dutch special municipality of Bonaire started in 2021 (Bonaire) and in Saba and St. Eustatius in 2023 [9]. In Curaçao, which is an autonomous country within the Kingdom of the Netherlands since 2010, BCS was established in 2010 [10–12]. Besides initiation dates, other known variations between islands include age-ranges of BCS. At the same time, similarities between these islands exist as well, e.g. related to implementation approaches or challenges experienced.

In 2019 a systematic review on cancer screening programmes in the Caribbean island countries and territories was published [2], omitting however most data of the Dutch Caribbean islands. Therefore, this study aimed to conduct a more comprehensive and comparative analysis of these similarities, differences, and opportunities between the screening programs across six Caribbean islands (Aruba, Bonaire, Curaçao, Guadeloupe (also supervising BCS on the French islands of Saint-Martin and Barthélemy), Jamaica, and Sint Maarten. (see Fig. 1 for a geographical overview).

Specifically for the Dutch Caribbean islands, Aruba, Curaçao, Sint Maarten are independent countries within the Kingdom of the Netherlands, with their own public health legislation. Bonaire, St. Eustatius and Saba are special municipalities withing the Kingdom of the Netherlands, relying on European – Dutch public health legislation. With the exception of Bonaire, all islands are on the list of United Nations Small Island Developing States or Associate Members of United Nations Regional Commissions [13].

We present an overview of general characteristics of the programs, with special reference to how relationships with European countries have shaped these general characteristics. Secondly, a limited number of aspects of these programs, all related to equitable use, were explored in depth. We used the so-called AAAQ (availability, accessibility, acceptability and quality) framework (introduced by the World Health Organization to identify potential barriers to accessing services in humanitarian settings [14]), to focus on (1) strategies to reach the target population, (2) barriers and challenges related to the accessibility and target population coverage, (3) the differences and rationale behind age-ranges for screening and (4) costs of BCS and the organization of follow-up procedures.



Fig. 1 Map of the Caribbean countries and territories. Countries and territories indicated dark green and/or with names indicated in red have a representative in the authors-list. The islands of Aruba, Curaçao and Sint Maarten/Saint Martin (Dutch part: Sint Maarten) are countries within the kingdom of the Netherlands, Bonaire, Saba and St. Eustatius are municipalities within the kingdom. The map was produced using MSEXcel for Microsoft 365, version 2402.

Methods

Mixed methods approach and setting

The mixed-methods study design combined quantitative and qualitative data collection. The methods were defined by the data collection of qualitative and quantitative data from (1) stakeholder group inputs (see supplementary file 1 for an account of all stakeholders, domicile, affiliation and professional role), using both questionnaires and stakeholder meetings, and (2) from the published and grey literature, to maximize the strength of each datatype and realize the most comprehensive approach regarding the aim of this study. The study concerned the BCS programmes of the islands of Aruba, Bonaire, Curaçao, Guadeloupe, Jamaica, and Sint Maarten. These islands were conveniently (i.e. within the network of the authors) and purposefully (to seek more contextual diversity) selected to represent different languages (Dutch, Papiamentu, French and English), colonial histories, cultures and governing structures (independent states, affiliated territories or special municipalities of continental European countries). Contacts were approached as a result of consulting the network and following up leads from the

literature. Data was gathered through reviewing published and grey literature, input from stakeholders and two discussion sessions. For this study an ‘organized screening programme’ is defined as: A program that systematically and actively invites a predefined eligible population, and performs screening tests ensuring reporting results to participants, usually but not necessarily governmentally sanctioned.

AAAQ-model

To provide a theoretical framework for this study we decided to specifically focus on four equity dimensions within the BSC program, based on the Availability, Accessibility, Acceptability and Quality (AAAQ) framework. This framework was introduced by WHO in 2013 [14] and was since then applied widely for comparative studies for health systems. We used the recent description of the AAAQ framework at <https://gbvguidelines.org/wp/wp-content/uploads/2019/11/AAAQ-framework-Nov-2019-WEB.pdf> as a short guide for this study.

Design of study

We initiated this mixed-methods study using a three-step approach that included six islands.

Step 1: organized session

This first step was to organize a session on the implementation of BCS programmes in the Caribbean as part of the 13th European Congress on Tropical Medicine and International Health (ECTMIH) held on November 23rd, 2023 in Utrecht, the Netherlands. This fringe meeting aimed to take stock, share experiences and exchange views as well as to identify various stakeholders as potential study participants. The meeting was announced in the ECTMIH's pre-published programme.

Step 2: desk review of quantitative and qualitative data

Quantitative data collection Data on BCS programme implementation strategies and results were collected from stakeholder sources (e.g. presentations, reports, and personal communications) and published data. Literature (also grey literature) specific to the six Caribbean islands was searched for publications until February 2024. For each island, information on the total population, target population, invitations, participants, participation-rate, referral-rate, incidence, and mortality rates, was summarized in tables and narratively analyzed (see supplementary file 2 for a list of grey sources used in this study).

Qualitative data collection The qualitative data was gathered through desk review of published and grey literature. In addition, data was gathered from stakeholders during two sessions specifically organized for this purpose.

Collection of relevant literature At the start of the study an explorative literature search was conducted to gather both qualitative and quantitative data using the PubMed® literature database, with keywords “Breast cancer screening” and “Caribbean”, limited to publication years 2013–2023, and performed in November 2022 with regular resampling until March 2023, to get a general impression of the current published literature on the state of BCS in the Caribbean region. Based on the results of this search and guided by the AAAQ framework, a set of questions was developed (see ‘Step 3: Virtual round table meeting’ below).

All participants were asked to submit their responses to questions in advance of the sessions, along with any relevant data, grey literature, or articles that could provide additional context or support. In addition, publicly available websites were consulted, including those of the population screening programs of Bonaire, Aruba, and Curaçao, as well as the Global Cancer Observatory (open

data). All literature and websites consulted are listed in supplementary file 1.

Step 3: virtual round table meeting

The meeting was organized to obtain additional information on four main AAAQ-related themes. Prior to the roundtable session questionnaires were distributed to the stakeholders with questions related to BSC, to both prepare the discussions and enable the researchers to collect the responses.

- Question 1 (generally covering AAAQ items: availability, accessibility): How do you reach the target population? Are there specific strategies for harder-to-reach or lower-use populations?
- Question 2 (generally covering AAAQ items: availability, accessibility): Could you elaborate on the rationale behind the chosen age range for BCS? Considering the variations in screening ages between the islands, how do you justify your approach.
- Question 3 (generally covering AAAQ items: availability, accessibility, quality): What do you think are the most important barriers and challenges related to accessibility and coverage of BCS?
- Question 4 (generally covering AAAQ availability, accessibility, quality): How is the follow-up care organized after a BC diagnosis?

Additionally, participants were asked to address the perspective of their islands’ relationship with Europe; were there specific barriers/challenges or enablers/opportunities for the Caribbean islands and for the European countries? The round table meeting was facilitated by the main author (KS), supported by PS. The discussion was recorded and subsequently transcribed ad verbatim.

Selection of stakeholders for step 3: virtual round table meeting

Stakeholders for the Virtual round table meeting were first selected among the 50 international delegates that attended the (Step 1) 2023-ECTMIH fringe meeting on BCS programme implementation in the Caribbean, during the discussion of that session, by asking to come forward or suggest stakeholders. Additionally, through convenience sampling based on contacts within the network the researchers of this study, eventually 20 stakeholders (to assure sufficient representation of all islands) were invited for the (Step 3) virtual round table meeting (see supplementary file 3 for the list of stakeholders).

Data analysis

Quantitative data was narratively analyzed and summarized in tables. Qualitative data was thematically analyzed. Data gathered through the round table meeting

was summarized as a Strengths, Weakness, Opportunities and Threats (SWOT) analysis. The SWOT analysis was included in a debriefing summary e-mail sent to all island representatives. Participants of the round table meeting were invited to provide comments and verification. Relevant and verified parts of the SWOT analysis have been included in Table 3. Illustrative quotes used in the present study were verified and adjusted as needed in consultation with the participants who made the statements. As this study reports on BCS implementation data, and is intended to reflect various practices accurately, all participants of the round table meeting have been offered co-authorship.

Results

As indicated in the Methods-section, a first organized session during the 2023-ECTMIH conference, where two health policy officers and one researcher from Guadeloupe, Jamaica and Curaçao, respectively, presented on the implementation of BCS programmes on their islands, was used to select participating stakeholders for this study. Seventeen of 20 invited stakeholders, including representatives from the six Caribbean Islands that are part of the Kingdom of the Netherlands, visited the Virtual 2,5 h round table meeting held on January 24th, 2024.

Quantitative analysis of BCS programmes in the Caribbean region

Demographic data, cancer incidences and breast cancer screening data

Table 1 provides an overview of demographic data and BCS programme data of the islands of Aruba, Bonaire, Curaçao, Guadeloupe and Jamaica. Data on Sint Maarten has not been included as there is no organized BCS programme on this island. Variations between islands exist in population size (of about 25000 inhabitants of Bonaire to nearly 3 million people on Jamaica), BCS programme implementation indicators such as the number of invitations sent, participation rates and referral rates, and BCS programme results such as incidence and BC mortality.

Self-reported BCS programme participation varied between 40.4% (Guadeloupe) and 75% (Aruba). Referral rates were highest in Guadeloupe (6.4%) and lowest in Curaçao (3.9%). BC incidence and mortality were both highest on Jamaica with an age standardized incidence rate of 71.1 per 100.000 women and an age standardized mortality rate of 35.2 per 100.000 women. However, several implementation indicators or results were not available across all islands.

Organization of breast cancer screening in the Caribbean

An overview of core elements of the organization of the six BCS programmes is presented in Table 2.

Data of Table 2 show that most islands have organized BCS, either privately or governmentally organized.

Table 1 Demographic data and breast cancer screening programme in numbers of the Islands of Aruba, Bonaire, Curaçao, Guadeloupe and Jamaica

	Aruba (2023) See refs [15, 16]	Bonaire (2024) See refs [17, 18]	Curaçao (2021) See refs [16, 19–21]	Guadeloupe (2023) See refs [22, 23]	Jamaica (2022) See refs [23–25]
Total population	107.327	25.133	190.338	384.315	2.827.377
Target population ^a	12.000	3657	45.291	74.971	321.575
Invitations ^b	8065	No data available	18.871	74.971	No invitations sent
Self-reported number of participants (participation rate) ^c	6045 (75%)	1800 (50%)	8483 (45%)	30.341 (40,4%)	No data available
Referral rate ^d	295 (4,9%)	98 (4,5%)	328 (3,9%)	1013 (6,4%)	No data available
Incidence, age standardized rate per 100 000 women	23.0 ^e	No data available	No data available	66.4 ^e	71.1 ^e
Mortality, age standardized rate per 100 000 women	No data available	No data available	No data available	16.7 ^e	35.2 ^e

^aAnnual number of women eligible to participate based on the age limits of the program

^bAnnual number of invitations sent to putative participants (usually by regular mail)

^cAnnual number of participants in the program (self-reported: reported by co-authors or in the cited literature). Between brackets the number of participants as percentage of the number of invitations

^dNumber of participants that received a positive screening result and were referred for diagnosis. Between brackets the number of referrals as percentage of the number of participants

^eData available from 2022 (see ref. [6])

Table 2 Overview of the organization of BCS programmes on Aruba, Bonaire, Curaçao, Jamaica and Sint Maarten

	Aruba (2023) See refs [15, 16]	Bonaire (2021) See refs [17, 18]	Curaçao (2021) See refs [16, 19–21]	Guadeloupe (2022) See refs [22, 23]	Jamaica (2022) See refs [23–26]	Sint. Maarten
Organization (funding)	Stichting BOB Aruba (recently changed to: Stichting Aruba Bevolkingsonderzoek) (Charity/Third Party)	RIVM (Government-Ministry of VWS)	Fundashon Prevenshon (Charity/Third party)	Centre Régional de coordination des Dépistages des Cancers (CRCDC) supported by “Agence de santé” and Caisse générale de sécurité sociale (CGSS) (Government)	The Jamaica Cancer Society (Charity/Third party)	Positive Foundation (Charity/Third party))
Organized BCS programme	Yes (BOB is a on-governmental non-profit organization promoting the early detection of breast cancer in healthy women)	Yes (supervised RIVM by assignment of Ministry of VWS)	Yes (non-governmental, non-profit organization dedicated to population screenings, including cancer)	Yes	Yes (non-profit, non-governmental organization established in 1955, partner of the Ministry of Health and Wellness)	No
Year of start screening	2016	2021	2010	2004	2020	Not started
(Inter) national screening guidelines applying	Unknown	Guidelines mainland Netherlands	Unknown	Screening guidelines Mainland France	evidence-based national guidelines for breast cancer, in 2020,	No guidelines
Age window for participation (years)	45–75	50–75	45–75	50–74	< 40: CBE 40–60: Mammography > 70: screened or CBE	Free CBE - only in October of every year
Screening test/screening interval	Mammography. 2 years	Mammography. 2 years	Mammography. 2 years	CBE and mammography. 2 years	< 40: CBE 40–60: mammography > 70: screened or CBE	Free CBE- only in October of every year
Approach (all programs intended for a-symptomatic women)	Invitation- based approach	Invitation- based approach using data from civil registry. Program initiated by self registration of clients based on mixed information campaigns (see ‘Public Information’). This is currently still possible.	Invitation- based approach	Invitation- based approach	Opportunistic approach (annually organized campaigns)	Opportunistic approach
Mammography capacity (units)	1	2 (On Bonaire and Sint Maarten, to serve Saba and Sint Eustatius)	2	10 (on Guadeloupe and St. Martin)	2 (one in west region and one in south-east region)	none
Public Information	- Dedicated communication campaign each year: October - Website - Social media campaigns - Hoarding by advertising - Radio & TV - Meetings - Stands	- Informative leaflet - Website - Adjusted by needs of population. - Social media and news - GP or medical professionals - Campaigns - Posters	- Informative leaflet - Website - Adjusted by needs of population. - Social media campaigns - Reaching out to neighborhoods and community centers	- Dedicated communication campaign each year: October - Website - Social media campaigns - Hoarding by advertising - Radio & TV - Sports events - Meetings - Stands	- Leaflets and brochures - Dedicated communication campaign each year: October - Website - Social media - Radio & TV - Sports events - Health talks	- Dedicated communication campaign each year: October and offering free CBE - Website - Social media - Posters

Table 2 (continued)

	Aruba (2023) See refs [15, 16]	Bonaire (2021) See refs [17, 18]	Curaçao (2021) See refs [16, 19–21]	Guadeloupe (2022) See refs [22, 23]	Jamaica (2022) See refs [23–26]	Sint. Maarten
Cost of screening	Completely covered by basic insurance with the intention to centralize screening activities, to be prepared when legislation will enable a governmentally sanctioned program. The system is linked to GP practices.	Financed through RIVM and VWS	Free, for Social Insurance Bank (SVB) card holders (islandwide) or private insurance and for target population.	• Free, when insured with Public Health • Insurance Mammography 100% covered by national insurance when part of organized BCS campaign. Individual demands for mammography: 70% covered by national security, 30% costs for patient or by additional health care coverage.	Free, when accessing the public service. In private out-of-pocket.	Free, only during BCS campaign. In private sector not mammography is not free.
Follow up	• Referral from GP to the hospital. • A dedicated department in the hospital arranges all appointments with clinical specialists and treatment. • Follow-up and treatment are all covered through basic health insurance.	• Referral to one of 5 affiliated hospitals (Bonaire, Curacao, Aruba, Netherlands, and (rarely) Colombia). • Follow-up care is covered through basic health insurance • Initial diagnostics, including potential additional radiology/biopsy, are performed locally	• Follow-up diagnostics and treatment take place in the affiliated hospitals. • Referral from GP to breast cancer outpatient clinic in hospital. • Follow-up care and treatment are free and covered through basic or private health insurance. • After 5 years of follow-up in the hospital after diagnosis, patients become candidates for screening every 2 years. • Surveillance, screening, referral and management of long-term effects are part of the follow-up process. • In some cases private funding (Foundations) for undocumented women is available	• Same healthcare system as mainland France. • After diagnosing through national or individual screening, national insurance will cover for 100% of the costs. • Women participate in BCS but are afraid to follow up on these studies and do not go for further testing or treatment. • Various associations at a national or regional level support women with a diagnosis of breast cancer. • One association provides an apartment in Guadeloupe near the University Hospital of Guadeloupe for women coming from Saint Martin who need to go the University Hospital of Guadeloupe for consultation or specific treatment (surgery, radiotherapy etc...).	• Diagnosis, follow-up, and treatment (surgery, chemotherapy, and radiotherapy) all occur in the hospital. Free of cost within the public sector. • Women face long waiting periods in public hospitals to access treatment. • Private treatment costs are prohibitive. • Medications covered under National Health Fund, and compassionate fund.	• Referral from GP to specialist for further treatment. Follow-up care covered by insurance, or a patient must pay. Referral time is short, nevertheless, it can take a long time before you see a specialist because of the rotating specialists at SMMC. • No counselor or professional mental support • Surgery and chemotherapy on the island. For radiotherapy patients must travel abroad. • Foundations will pay for undocumented women

This applies also to funding, that may be governmental or by private parties. BCS, encompassing mammography or CBE, are offered at no cost for the participant, in Aruba, Bonaire, Curaçao, Guadeloupe and Jamaica. The six islands each employ their own implementation strategy. While Bonaire sought to promptly establish a comprehensive screening framework, including regular invitations and defined age criteria for inclusion, Jamaica started opportunistically, recognizing that the system is not fully operational. The rationale behind this approach

was acknowledging the rising mortality rate and imperative to act.

For islands with an invitation-based approach to mammography the age windows for participation are comparable (either 45–75 years or 50–75 years). Aruba, Bonaire, Curaçao and Guadeloupe, all use mammography as primary means for screening. Aruba and Curaçao both screen from 45 to 75 years. Bonaire and Guadeloupe screen women from 50 to 75 years, both adhering to European guidelines [6]. In Jamaica the primary objective for screening depends on the age of the participant. The

opportunistic screening initiatives on Sint Maarten and Jamaica apply less consistent age limits.

The BCS programmes use a variety of means and strategies to inform the public and the target population on the availability of BCS, using leaflets (often in various languages), posters, social media and radio and TV, often in campaign style e.g. on the occasion of the Breast Cancer Screening Awareness Month (October).

Follow-up care, consisting of post-diagnosis services and treatments is covered by basic health insurance on all six islands.

Sint Maarten is the only island of the six investigated without an organized population-based BCS programme. For the past 25 years a non-profit organization, Positive Foundation, has been devoted to the education of women on early symptom recognition of breast cancer awareness. The organization offers free clinical breast examinations (CBE) in October in partnership with the general practitioners (GPs) on the island.

Thematic qualitative analysis of BCS programmes in the Caribbean region

An analysis of the literature, organized session and the stakeholder round table meeting was conducted with a focus on four themes: (1) reaching the target population (2) rationale of the age range of the target population, (3) barriers and challenges related to programme accessibility and (4) follow up and costs of a BCS programme. Table 3 presents the outcomes and a number of quotes related to these questions.

Reaching the target population - Various strategies were used to reach out to the target population. This included websites, social media, TV and radio, and other promotional events, both regularly as well as in campaign style. Preliminary data of Curaçao indicate that invitations by mail are not very effective. Some BCS programmes (Guadeloupe, Curaçao, Bonaire-St. Eustatius-Saba) use written invitations with addresses being obtained from the population register or, in case of Curaçao, the national health insurance data base. This pertains to the AAAQ-item accessibility.

Age range - Detailed age distribution data of participants in the programmes of Bonaire, Curaçao and Guadeloupe all exhibit maximum participation in the 55–60 age group (21–30%). Additionally, Curacao shows notable participation rates in the age group 45–49 years years (18%) (data not shown).

There was a shared understanding on all islands that black women have a higher BC-related mortality as compared to white women under the age of 40, and this was the common rationale behind the relatively young age at which women are eligible for BCS on some islands. October 2023, Curaçao started a pilot screening for women

aged 40–44 years, influencing both the accessibility, availability and acceptability of programmes.

Costs of BCS and follow-up – Combined results show that BCS are usually offered at no cost for women participating and diagnosis and therapy are often covered by basic health insurance. Still, therapeutic resources, e.g. radiotherapy, have limited availability and for various reasons, women with abnormal mammograms sometimes hesitate to be referred. This hampers both the accessibility, availability, acceptability and quality of screening programmes.

Barriers and challenges – The list of perceived and often shared issues was extensive. They were divided into three categories: (1) Insufficient target population coverage, (2) individually experienced barriers and (3) barriers caused by system and providers. On the subject of insufficiently reaching the target population and coverage of the screening program the reported barriers and challenges were: low social economic status (SES) of the population, associated with lower education levels and limited health awareness and health knowledge, geographical inaccessibility and irregular health care and screening assessment, resulting in women participating only occasionally instead of regularly in screening programs. Again, all AAAQ model items are involved here.

Reported individually experienced barriers were: fear of pain during mammography, fear of cancer, prioritizing well-being of others over themselves and being less tended to seek support of the health care system (as part of cultural beliefs), potentially hampering acceptability of BCS.

System- and provider-barriers included: frequent rotations of family physicians or specialists, including radiologists (resulting in lengthy referral times and delayed treatment) and the high costs of buying and operating modern (3D) mammography units. AAAQ model items quality and accessibility are involved here.

Discussion

This comparative analysis of BCS programs across six Caribbean islands showed variation in the BCS screening designs, population outreach methods, age ranges and initiation dates for screening and follow-up procedures. Similarities emerge in barriers regarding BCS (e.g. lower social economic status (SES), lower health literacy, BCS related fears). Furthermore, all islands face challenges in ensuring comprehensive, high quality BCS programs.

Differences between breast cancer screening programmes

Reaching the target population

All the islands actively utilize social media to reach out to their population. This approach, particularly in Bonaire and Guadeloupe, differs from the strategies employed in mainland Netherlands and France, where

Table 3 Mixed- methods findings regarding BCS programmes in the Caribbean. This table provides a summary of the results of two domains and three subthemes each, summarizing the main topics of this study. For each subtheme 1–3 summarizing statements are given and for each statement one or more illustrative quotes are given

Domain	Theme (Domain)	Qualitative	Illustrative quotes
Differences between screening programmes	How is the population reached?	Aruba, Bonaire, Curaçao, and Guadeloupe send invitations. Sint Maarten and Jamaica opt for an opportunistic approach. Social media is actively used by all islands. Communication campaigns dedicated to BCS are implemented by Guadeloupe, Sint Maarten, and Jamaica.	Bonaire: "We sent invitations just like we do in the Netherlands, but at the same time we also make use of the GP, social media, WhatsApp etc." Bonaire: "What is different from the European Netherlands is that in the Netherlands women get an invitation with the time and location, but we also allow women to contact us directly and make an appointment." Curaçao: "We send invitations for the screening programme and then we follow-up with a reminder through WhatsApp". Guadeloupe: "We have posters, social media, TV show, radio and events to promote the campaign and send the invitation automatically with our software every two year, if the mammography was normal" Sint Maarten: "We put up posters and run infomercials on local radio stations reminding women to get checked."
	Different age ranges of screening	Higher incidence and mortality in younger women < 40, with more aggressive subtypes. Black women have a 40% higher mortality compared to white women. Guadeloupe: highest incidence rates between 45–55 years	Curaçao: "I am working in a hospital, and we see really increase of the patient. So, let's say young girls having the breast cancer, the below the 45, I did some small research in my hospital regarding my patient's retrospective the last 10 years and what I saw that's a 40% of them and they had the BIRADS 5." Guadeloupe: "We have the same observations as the rest, that the age of breast cancer diagnoses is lower in our overseas territories. Further formal epidemiological studies are needed to assess it." Jamaica: "In different countries people self-identify and we don't. It's not part of our vocabulary or routine to identify with an ethnic group. Rarely you would find a document in Jamaica asking you about ethnicity. Nevertheless, it is known that the majority are of Afro-Caribbean descent."
	Costs of BCS and follow-up	BCS, encompassing mammography or CBE, are offered at no cost for the women, in Aruba, Bonaire, Curaçao, Guadeloupe and Jamaica. Basis insurance covers the post-diagnosis services and treatments in all six islands. Challenges with follow up are: - The limited availability of radiotherapy, resulting in long waiting times as not all hospitals offer this service. - Women refraining from following up an abnormal mammogram. Apart from Aruba, the islands do not offer mental support during or after treatment.	Aruba: "After a patient gets diagnosed with breast cancer they get directed to the GP and the hospital. In the hospital we have a special department that takes care for that woman to get all the appointments with specialists and her treatment can start. This is all covered by the insurance, so the whole treatment will be free for the patients. We even have free support groups for afterwards." Guadeloupe: "Some women refrain from following up on abnormal mammogram results, possible due to fear and misunderstanding of cancer, despite the fact that follow-up care is organized and fully covered by national insurance."
Barriers and challenges regarding breast cancer screening	Insufficient target population coverage	Lower SES, lower educational levels, limited awareness, and knowledge about BCS and geographic inaccessibility are described as possible barriers. Irregular healthcare engagement could hinder awareness and access to screening.	Curaçao: "We have learned that our population is aware of our BCS programmes, but we are worried about the level of knowledge and illiteracy which may be related to lower social economic status."
	Individual barriers regarding BCS.	Fear for mammography and cancer. Prioritize the well-being of others and work obligations over their own health. Lower awareness about the risk factors. Women prefer comprehensive screenings in hospitals due to cultural preferences, as they offer direct access to additional examinations, which is believed to lead to better care.	Jamaica: "It is the fear for pain and the fatalistic approach towards breast cancer that lowers the screening uptake" Sint Maarten: "We don't really have a health seeking culture. We don't normalize regular checkups."

Table 3 (continued)

Domain	Theme (Domain)	Qualitative	Illustrative quotes
	System and provider's barriers regarding BCS.	Frequent rotations and lower availability of GPs and specialists on the islands, leading to lengthy referral time, delayed treatment. Expensiveness of mammography, making it unaffordable for low-income countries to access it.	Jamaica: "There should be more investing's in mammogram. They should be much cheaper with so many women needing this service." Sint Maarten: "Limited availability of GPs on the island makes it difficult to schedule appointments and have appropriate access to healthcare." Guadeloupe: there is a lack of certified radiologists to perform mammography for all the population resulting in a long waiting time to obtain an appointment. For abnormal mammography, a second analysis by a certified radiologist is needed and there are only a few in Guadeloupe, resulting in delayed report.

communication is limited to sending invitations without additional outreach efforts [27]. Interestingly, anecdotal evidence suggests that as participation rates in mainland Netherlands decline, increased media outreach efforts are being implemented, particularly targeting hard-to-reach groups. This is similar to the Caribbean islands and mainland Netherlands may potentially adopt Caribbean media strategies, realizing cross-atlantic exchange of knowledge from the Caribbean to mainland Netherlands.

Different age ranges in screening

Results highlight significant and initiation dates for screening. Various explanations were discussed during the virtual round table meeting. To explain variations in age ranges stakeholder discussions revolved around lowering the European based starting age of 50. To support this literature was cited indicating higher incidence and mortality rates among the younger women (< 50), predominantly presenting with more aggressive subtypes, particularly among black women, who face a 40% higher mortality rate compared to white women, in light of a large proportion of Caribbean women being of African Carribea decent [5, 8, 28–31] This underscores prudence in applying European directives (advising to start at 50 years of age) to Caribbean contexts.

Costs of BCS and follow-up

On most islands costs for diagnostic services are covered by basic health insurance. This does not guarantee unhindered access to diagnosis and treatment-the participation rate. Part of the population can be uninsured and undocumented inhabitants generally have no access to BCS or diagnostic facilities. Even when insured diagnosis and therapy is available, women refrain from following up on abnormal mammogram results, possibly due to fear and misunderstanding of cancer. The limited availability of radiotherapy causes long delays and patients may travel to neighboring countries, disrupting their every-day live and missing out on income from work. Furthermore, the frequent rotations of specialists pose difficulty for patients in developing a consistent relationship with their healthcare providers.

Barriers and challenges regarding breast cancer screening

Insufficient target population coverage

With the exception of Aruba, target population coverage on the islands is lower than mainland Netherlands (72,5%) and mainland France (48%) [20, 32]. Both screening system and providers barriers could provide explanations.

The outcomes of two recent reviews [33, 34] show that women with a lower SES are less likely to have access to regular medical care, to have risk factors for BC such as obesity, smoking and physical inactivity and are less likely to receive timely and effective BC treatment. Reports on women with lower education or lower SES of Jamaica and Curaçao and Guadeloupe also indicate that these women were less likely to participate in screening [35–38].

Also, Caribbean islands face significant healthcare challenges due to their isolated locations [2], hindering the establishment of screening programmes. In Curaçao, merely 71% of residents of poor neighborhoods can access a hospital within 30 min [39]. Networks of so-called 'mammobuses,' that ensure that BCS is available at reasonable cost in all areas of mainland France and the Netherlands, are not easily transferable to the Caribbean region, for logistic and financial reasons. A recent study that evaluated the colon cancer screening invitation distribution found that only 60% of those invited confirmed their receipt, 32% reported not to have received the invitation, and 8% were uncertain (unpublished data Fundashon Prevension, Curaçao). Limited awareness of screening invitations, limited quality of postal services, or both could thus additionally underly poor screening coverage.

Individual barriers regarding BCS participation

Many of the individual barriers reported by stakeholders are corroborated by data in the literature. In Jamaica, only 6% of the women eligible for BCS actually had mammograms performed in 2019 [35], explained by the incorrect belief that a physician referral is required to qualify for mammography, a limited awareness of the importance of BCS for their health, the fear of suffering discomfort or pain during mammography and fear of cancer [40, 41].

In addition, many women were found to prioritize the wellbeing of their children and/or other family members, and their work obligations over their own health and therefore did not participate in BCS [3].

System and provider barriers regarding BCS

Data of Table 3 in summary indicate that organizations running BCS programmes face challenges in maintaining a stable, expanded pool of accessible specialists, reducing referral times, facilitating easier access to specialist care, and ensuring clear information transfer to increase knowledge levels and hopefully reducing screening fears. Mammography units are very expensive, so in low-income countries there often are not sufficient units available to fully implement the BCS program (e.g. in Jamaica). The general economic state of countries can indeed be a barrier in developing cancer screening programs and that small island developing states suffer cannot easily share health resources, even if part of the same country [2].

To summarize all results of this study in one Figure (Fig. 2), for each island we rated the core elements of BCS: information, invitation, screening test, test results and referral, diagnostic procedures and follow up care, to three step qualitative scales per core element. These were against a three-step qualitative scale of progression or quality, running from limited or absent (red) and sub-optimal or sufficient (orange), to sufficient or best-practice (green). In the red category, provisions should be established or immediately improved, the orange category indicates room for improvement and the green category means that resources can possibly spent elsewhere to improve screening. All steps are related to the AAAQ-model categories acceptability, availability, quality and accessibility (sub-categorized in physical, financial, bureaucratic and administrative, social and information accessibility).

The evaluation shows a color indication orange for diagnostic procedures and follow-up care (availability, quality), indicating that all islands could invest in this core element of screening. The implication of this observation should not be underestimated given that screening without providing diagnostic and therapeutic provisions is deemed unethical. All islands engage in various ways in informing their populations, so this seems an area where less investment is needed (AAAQ-item accessibility). Given that knowledge levels vary widely, investment in effective provision of information is still needed.

Financial accessibility seems to be warranted by most programmes as screening costs are often carried by insurance or government. Still, shortages for funding of equipment and personnel (availability and quality) are reported given that investments in personnel and screening are necessary on some islands.

Addressing the red areas in Fig. 2 is crucial for optimizing screening efficacy. As Mosquera describes [42] *“A cancer screening programme can reduce cancer incidence and mortality if it has high coverage and high quality and can be cost effective and reduce inequity if it is well-organized population-based (with a system of inviting the eligible populations)”*.

The programmes of Aruba, Curaçao, Guadeloupe and Bonaire (and Saba and St. Eustatius) are strongly linked to the well-established programmes of mainland Netherlands and France, with their well-established BCS programmes and have benefitted. Given the cultural and SES differences, a European template is not automatically the best fit for Caribbean programmes. In fact, the mainland Netherlands programme could learn from the vast experience with informing the population using multiple sources of media from the experience on the Dutch Caribbean islands. The fact that BCS on Saba and St. Eustatius is realized using the mammography facility in the SMMC hospital on Sint Maarten poses a special equity issue as at the same time BCS for the women of Sint Maarten itself is not realized. But it is also an example of cross-island use of health facilities.

The mix of emerging and established Caribbean programmes will allow cross-learning among Caribbean partners, with European counterparts also benefiting. Finally, considering the UN's recognition of these islands as part of the SIDS and the WHO's special initiative launched in 2021 to prioritize their health on a global scale, further collaboration with the WHO could be beneficial [13, 43].

Limitations of this study

The in-depth study part of this study was performed using data from a limited number of selected Caribbean islands. The results of the study may therefore not or only to a limited extent apply to other Caribbean islands. In this respect, it is important to note that not all language areas were included in this study, e.g. islands with a Spanish-speaking population. The study did not cover the accessibility of BCS for undocumented women or women illegally residing on the islands [44]. This study has evaluated only a selection of themes in-depth, e.g. not covering whether programs distinguished between high and low risk populations, whether e.g. MRI was used for BCS, if and how programs were evaluated etc. Finally, with the acquisition of more quantitative data, evaluations covering more outcome indicators and more comprehensive models are possible [45].

Conclusion

This study underscores, focusing on the availability, accessibility, acceptability and quality aspects of BCS, the importance of a Caribbean-focused strategy, normalizing



Fig. 2 Overall qualitative assessment of the current BCS framework of the six Caribbean islands. Arrows in blue indicate the core elements of the screening cycle. For every element a rough estimate of the current state of that element is made based on data combined in this study and a color indication is assigned. For every core element the meaning of the color is indicated below

the reputation of screening, enhancing BCS knowledge, providing mental support during and after treatment, and determining the optimal age for screening initiation. Moreover, it highlights the distinction between islands maintaining active transatlantic relations and those that are independent. Although establishing BCS programs may initially seem advantageous for islands with a transatlantic relation, due to the increased funding and collaboration, contextualizing within the Caribbean, which is necessary given their wide geographical and demographic differences, poses considerable challenges, particularly as they adhere to European guidelines. This makes adapting screening protocols, such as the recommended age for screening initiation, significantly more

challenging. More research into contextualising screening programmes to different contexts and populations is needed to ensure ethically acceptable application of screening. This study highlights the need for mutual learning, open communication, and collaborations.

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

K.S. and P.S. designed the study, K.S. performed the literature review, organized the round table, analysed the study results. K.S. and P.S. drafted the manuscript. S.V., J.H., V.L., N.P., D.N., E.v.T., S.L., R.L., S.G., L.G., S.K., C.G., S.A., S.S.-T. and J.B. participated in the round table meeting, provided data, and discussed, reviewed and amended the manuscript. All authors have approved the submitted version and have agreed to be personally accountable for the author's own contribution.

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Data availability

Most of the data generated or analysed during this study are included in this published article and its supplementary information files. The recording of the workshop and verbatim translation as well as some summarizing excel files are not. This remaining data is available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

All participants in the stakeholder meetings are either co-author or, on their own request, were mentioned in the Acknowledgements-section. This manuscript does not report on studies involving human participants, human data or human tissue. In accordance with Dutch law (<https://wetten.overheid.nl/BWBR0009408/2025-01-01>) approval by an ethics committee or IRB is therefore deemed unnecessary.

This manuscript does not report on studies involving human participants, human data or human tissue. Seeking informed consent of participants is therefore not applicable.

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Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Razzaghi H, Martin DN, Quesnel-Crooks S, Hong Y, Gregg E, Andall-Brereton G, et al. 10-year trends in noncommunicable disease mortality in the Caribbean region. *Rev Panam Salud Publica*. 2019;43:e37.
2. Spence D, Dyer R, Andall-Brereton G, Barton M, Stanway S, Argenti MA, et al. Cancer control in the Caribbean Island countries and territories: some progress but the journey continues. *Lancet Oncol*. 2019;20(9):e503–21.
3. Glasgow L, Lewis R, Charles S. The cancer epidemic in the Caribbean region: further opportunities to reverse the disease trend. *Lancet Reg Health - Americas*. 2022;13:100295.
4. Barrios CH, Werutsky G, Mohar A, Ferrigno AS, Müller BG, Bychkovsky BL, et al. Cancer control in Latin America and the Caribbean: recent advances and opportunities to move forward. *Lancet Oncol*. 2021;22(11):e474–87.
5. Samaroo K, Hosein A, Olivier LK, Ali J. Breast Cancer Caribb Cureus. 2021;13(8):e17042.
6. Global Cancer Observatory. International Agency for Research on Cancer Global Cancer Observatory. GLOBOCAN 2022: Caribbean Hub WHO. 2022. Available from: <https://gco.iarc.who.int/media/globocan/factsheets/populations/972-caribbean-hub-fact-sheet.pdf>. Cited 2024 Feb 1.
7. Doede AL, Mitchell EM, Wilson D, Panagides R, Oriá MOB. Knowledge, beliefs, and attitudes about breast cancer screening in Latin America and the Caribbean: an in-depth narrative review. *J Glob Oncol*. 2018;2018:4.
8. Shoemaker ML, White MC, Wu M, Weir HK, Romieu I. Differences in breast cancer incidence among young women aged 20–49 years by stage and tumor characteristics, age, race, and ethnicity, 2004–2013. *Breast Cancer Res Treat*. 2018;169(3):595. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC5955792/>. Cited 2024 Jan 31.
9. Achtergrondinformatie bevolkingsonderzoek Caribisch Nederland | Rijksvaststelling. Available from: https://www.rivm.nl.translate.google/en/population-screening-caribbean-netherlands/background?_x_tr_sl=en&_x_tr_tl=nl&_x_tr_hl=nl&_x_tr_pto=sc. Cited 2024 Jan 11.
10. Duijm LEM, Groenewoud JH, Jansen FH, Fracheboud J, Van Beek M, De Koning HJ. Mammography screening in the Netherlands: delay in the diagnosis of breast cancer after breast cancer screening. *Br J Cancer*. 2004;91(10):1795.
11. Organized cancer screening in France - IGAS - Inspection générale des affaires sociales. Available from: <https://www.igas.gouv.fr/Organized-cancer-screening-in-France.html#>. Cited 2024 Jan 11.
12. Breast Cancer Screening Curaçao » RADventure group. Available from: <https://www.radventure.com/portfolio/bcs-curaçao/#>. Cited 2024 Jan 11.
13. About Small Island Developing States | Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. Available from: <https://www.un.org/ohrls/content/about-small-island-developing-states>. Cited 2024 Nov 19.
14. World Health Organization. Geneva, Global Strategy on Human Resources for Health: Workforce 2030, 2016. Available from: <https://iris.who.int/bitstream/handle/10665/250368/9789241511131-eng.pdf>
15. Population by age and sex – Central Bureau of Statistics Aruba. Available from: <https://cbs.aw/wp/index.php/2022/09/20/population-by-age-and-sex/#>. Cited 2024 Feb 7.

16. Verstraeten SPA, Van Oers HAM, Mackenbach JP. Health policy performance in 16 Caribbean States, 2010–2015. *Am J Public Health*. 2019;109(4):626–32. Available from: <https://ajph.aphapublications.org/doi/https://doi.org/10.2105/AJPH.2018.304733>. Cited 2024 Feb 20.
17. StatLine -. Caribisch Nederland; bevolking; geslacht, leeftijd, burgerlijke staat. Available from: <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83698NED/table?ts=1702286289105>. Cited 2024 Jan 23.
18. Institute for Public Health N. Environment Ministry of Health- Welfare the. Monitor national program for breast cancer screening Bonaire. 2021–2022. <https://www.rivm.nl/en/documenten/monitor-national-program-for-breast-cancer-screening-bonaire-2021-2022>. Cited 2024 Jan 23.
19. Curaçao P. - Worldometer. 2024. Available from: <https://www.worldometers.info/world-population/curacao-population/>. Cited 2024 Jan 30.
20. Resources. – Fundashon Prevensionh. Available from: <https://fundashonprevensionh.com/resources/>. Cited 2024 Jan 23.
21. On our mission – Fundashon Prevensionh. Available from: <https://fundashonprevensionh.com/services/our-mission-vision/>. Cited 2024 Feb 1.
22. Guadeloupe Population. - Worldometer. 2024. Available from: <https://www.worldometers.info/world-population/guadeloupe-population/>. Cited 2024 Jan 30.
23. Cancer Today - International agency for research on cancer - World Health Organisation. Available from: https://gco.iarc.fr/today/online-analysis-table?v=2020&mode=cancer&mode_population=continents&population=900&populations=388&key=asr&sex=2&cancer=39&type=1&statistic=5&prevalence=0&population_group=0&ages_group%5B%5D=0&ages_group%5B%5D=17&group_cancer=1&include_nmsc=0&include_nmsc_other=1#collapse-group-0-1. Cited 2024 Jan 30.
24. Jamaica Population. - Worldometer. 2024. Available from: <https://www.worldometers.info/world-population/jamaica-population/>. Cited 2024 Jan 30.
25. Mid Year Population by Age and Sex. Available from: https://statinja.gov.jm/Demo_SocialStats/newMidYearPopulationbyAgeandSex2008.aspx#. Cited 2024 Jan 30.
26. Ministry of Health and Wellness. Breast Cancer - Non-Communicable Disease & Injury Prevention and Control. Available from: <https://ncdip.moh.gov.jm/resources/page/2/>. Cited 2024 Feb 1.
27. Bevolkingsonderzoek borstkanker Uitnodiging. Available from: <https://www.bevolkingsonderzoekborstkanker.nl>. Cited 2024 Feb 5.
28. Reid S, Donaldson-Davis K, Willie-Tyndale D, Thompson C, Wharfe G, Gibson T, et al. Breast cancer in Jamaica: trends from 2010 to 2014—Is mortality increasing? *JCO Glob Oncol*. 2020;6(6):837–43.
29. Mahase E. Breast cancer screening: Overdiagnosis increases significantly with age, researchers say. *BMJ*. 2023;382:p1823. Available from: <https://www.bmj-com.proxy.library.uu.nl/content/382/bmj.p1823>. Cited 2024 Feb 9.
30. Draft Recommendation. Breast Cancer: Screening | United States Preventive Services Taskforce. Available from: <https://www.uspreventiveservicestaskforce.org/uspstf/draft-recommendation/breast-cancer-screening-adults>. Cited 2024 Jan 31.
31. Deloumeaux J, Gaumond S, Bhakkan B, Manip M, Lafrance W, Lancelot P et al. Incidence, mortality and receptor status of breast cancer in African Caribbean women: Data from the cancer registry of Guadeloupe. *Cancer Epidemiol*. 2017;47:p42–47. Available from: <https://pubmed.ncbi.nlm.nih.gov/28119121/>. Cited 2024 Feb 9.
32. Monitor bevolkingsonderzoek borstkanker. Available from: <https://iknl.nl/kankeersoorten/borstkanker/onderzoek/monitor-bevolkingsonderzoek>. Cited 2024 Feb 8.
33. Klassen AC, Smith KC. The enduring and evolving relationship between social class and breast cancer burden: a review of the literature. *Cancer Epidemiol*. 2011;35(3):p217–234. Available from: <https://pubmed.ncbi.nlm.nih.gov/21470929/>. Cited 2024 Feb 21.
34. Brown CR, Hambleton IR, Hercules SM, Alvarado M, Unwin N, Murphy MM et al. Social determinants of breast cancer in the Caribbean: a systematic review. *Int J Equity Health*. 2017;16(1):60–86. Available from <https://pubmed.ncbi.nlm.nih.gov/28381227/>.
35. Jamaica-Health-, -Lifestyle-Survey. -III-2016-2017. Jamaica: Ministry of Health and Wellness;
36. Salmaan A. Exploring associations of socioeconomic, social, health and healthcare factors with cervical cancer screening participation in Curaçao. A cross-sectional study of the National Health Surveys 2013 and 2017 [Dissertation] Rotterdam (NL): Erasmus University Rotterdam; 2023. 2023.
37. Menvielle G, Dugas J, Richard JB, Luce D. Socioeconomic and healthcare use-related determinants of cervical, breast and colorectal cancer screening practice in the French West Indies. *European Journal of Cancer Prevention*. 2018;27(3):269–73. Available from: <https://www.embase.com/search/results?subaction=viewrecord&id=L613159023&from=export>
38. Bhakkan-Mambir B, Deloumeaux J, Luce D. Geographical variations of cancer incidence in Guadeloupe, French West Indies. *BMC Cancer*. 2022;22(1).
39. Verstraeten SPA. The National Health Survey Curaçao 2017. Theme report Health, Lifestyle and Care Use in the Poor Neighborhoods. (in Dutch). 2018. Available from: <https://www.researchgate.net/publication/327212433>
40. Soares D, Walters N, Frankson M, Kirlew K, Reid M. Sociocultural deterrents to mammographic screening in Jamaica. *West Indian Medical Journal*. 2009;58(1):28–32. Available from: <https://www.embase.com/search/results?subaction=viewrecord&id=L355086225&from=export>
41. Blake SN, Hugtenburg JG, van der Vlugt M, Dekker E, Fransen MP. Decision-making on colorectal cancer screening in Curaçao - interviews with the target population. *BMC Public Health*. 2023;23(1):1–12. Available from: <https://link-springer-com.proxy.library.uu.nl/articles/10.1186/s12889-023-16335-x>. Cited 2024 Feb 6.
42. Mosquera I, Barajas CB, Zhang L, Lucas E, Benitez Majano S, Maza M, et al. Assessment of organization of cervical and breast cancer screening programmes in the Latin American and the Caribbean states: the CanScreen5 framework. *Cancer Med*. 2023;12(19):19935–48.
43. Strategic Actions in Small Island Developing States. Available from: <https://www.who.int/initiatives/strategic-actions-in-small-island-developing-states>. Cited 2024 Nov 19.
44. Aruba & Curacao. UNHCR - The UN Refugee Agency. 2021. Available from: www.unhcr.org. Cited 2024 Feb 9.
45. Sheridan B, Irzaldy A, Heijnsdijk EAM, Dimitrova N, Senore C, Basu P, de Koning HJ. Prioritizing performance and outcome indicators for quality assessment of cancer screening programs in the EU. *Public Health*. 2025;239:185–92. <https://doi.org/10.1016/j.puhe.2024.12.010>.

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