Cancer Causes Control (2018) 29:33–42
https://doi.org/10.1007/s10552-017-0937-4

ORIGINAL PAPER

A situational analysis of breast cancer early detection services in Trinidad and Tobago

Kimberly Badal[1,2] · Fidel Rampersad[3,4] · Wayne A. Warner[4] · Adetunji T. Toriola[5] · Hamish Mohammed[6] · Harold-Alexis Scheffel[7] · Rehanna Ali[1,2] · Murrie Moosoodeen[8] · Siva Konduru[9] · Adaila Russel[2] · Rajini Haraksingh[1,2]

Received: 28 January 2017 / Accepted: 1 August 2017 / Published online: 11 August 2017

Abstract
Purpose A situational analysis of breast cancer (BC) early detection services was carried out to investigate whether Trinidad and Tobago (T&T) has the framework for successful organized national screening.
Methods An online survey was designed to assess the availability, accessibility, quality control and assurance (QC&A), and monitoring and evaluation (M&E) mechanisms for public and private BC early detection. A focus group with local radiologists ($n = 3$) was held to identify unaddressed challenges and make recommendations for improvement.
Results Major public hospitals offer free detection services with wait times of 1–6 months for an appointment. Private institutions offer mammograms for TTD$240 (USD$37) at minimum with same day service. Both sectors report a lack of trained staff. Using 1.2 mammograms per 10,000 women ≥40 years as sufficient, the public sector's rate of 0.19 mammograms per 10,000 women ≥40 years for screening and diagnosis is inadequate. Program M&E mechanisms, QC&A guidelines for machinery use, delays in receipt of pathology reports, and unreliable drug access are further unaddressed challenges.
Conclusion T&T must first strengthen its human and physical resources, implement M&E and QC&A measures, strengthen cancer care, and address other impediments to BC early detection before investing in nationally organized BC screening.

Keywords Breast cancer · Trinidad and Tobago · Screening · Early detection · Health service evaluation · Situational analysis · Primary prevention

✉ Kimberly Badal
kimberly@ccrinitiative.com

1 Caribbean Cancer Research Initiative, San Fernando, Trinidad and Tobago

2 Department of Life Science, Faculty of Science and Technology, The University of the West Indies, St. Augustine, Trinidad and Tobago

3 Faculty of Medical Sciences, The University of the West Indies, St. Augustine, Trinidad and Tobago

4 Department of Cell Biology and Physiology, Medical Oncology, Siteman Cancer Center, Washington University School of Medicine, Saint Louis, MO, USA

5 Division of Public Health Sciences, Washington University School of Medicine, Saint Louis, MO, USA

6 Department of HIV and STIs, National Infection Service, Public Health England, London, UK

7 Department of Geography, York University, Toronto, Canada

8 San Fernando General Hospital, San Fernando, Trinidad and Tobago

9 Sangre Grande General Hospital, Sangre Grande, Trinidad and Tobago

Introduction

Globally, breast cancer (BC) is the most frequent cancer among women with an estimated 1.7 million new diagnoses and 521,900 deaths in 2012 [1]. It is also the leading cause of cancer-related death in women with more than half of cases occurring in developing countries [2]. Developed countries are experiencing increasing or stable incidence rates and decreasing mortality rates while in developing countries both incidence and mortality rates are increasing [3]. In the United States of America (USA), overall 5-year BC survival rates approach 90% [4]. High survival rates have been linked to several factors including

improved lifestyles [5–7], emphasis on education and awareness [8, 9], earlier detection [10, 11], and improved BC treatment and management [11, 12].

Trinidad and Tobago (T&T) has the one of the highest BC mortality rates [13] and the highest BC mortality to incidence ratio in the Americas [14]. BC is the leading cause of cancer-related death in T&T women [15]. Ethnic and geographic disparities in incidence and mortality rates also exist with the majority of cases (~53%) occurring in women of African ancestry [16, 17] and among those living in urban, densely populated areas [16]. Further, in T&T 5-year BC survival for the period 1995–2007 was ~20–30% [16] and age-standardized BC mortality rates increased by 38.9% from 1970 to 2004 [18]. Further, poorer BC survival in Caribbean born and raised women compared to Caribbean born women living in the USA has been reported [19]. Late stage at diagnosis could be contributing to worse patient outcomes as one study reported that 30% of cases were diagnosed at Stage III or IV [17]. This figure may be higher as data on stage at diagnosis in T&T are unavailable for a substantial number (~20%) of cases [16, 17]. T&T's population and health care system has been previously described [16].

Currently, T&T engages in opportunistic BC screening [20] where some public and private centers remind and invite women for screening as part of routine care. Opportunistic screening programs have been shown to increase the detection of early-stage BC in some developing countries [21–24], but is much less cost-effective than organized screening [25]. It also comes at the cost of over diagnosis [26, 27], false positive results [28, 29], and possible radiation-induced cancer [30, 31]. Further, no studies have determined whether opportunistic screening can reduce BC mortality. Organized screening however has been evaluated extensively. A 2011 Cochrane systematic review and meta-analysis concluded that it is currently unclear whether the benefits of screening outweigh the risks of over diagnosis [32]. The unfavorable risk–benefit ratio for organized screening has prompted the Swiss Medical Board to recommend that organized screening be discontinued [33] and the French National Cancer Institute to recommend radical alterations, placing limits on access according to a person's BC risk profile [34]. However, the World Health Organisation (WHO) still recommends organized screening for well-resourced settings with strong health care systems [35]. The Breast Health Global Initiative (BHGI) follows these recommendations and also emphasizes the need to strengthen pathology services in limited resource settings [36].

One prerequisite for determining if T&T can implement and sustain an organized screening program is a situational analysis of current services for BC early detection. In both opportunistic and organized screening settings, there should be standardized professional and technical quality control and assurance (QC&A) protocols as well as program M&E mechanisms. There must also be the requisite health infrastructure and workforce providing equitable and timely service access. Importantly, the entire cancer care continuum from diagnosis to treatment and follow-up care must be robust. Therefore, this study conducted a situational analysis to determine whether the framework for successful administration of BC early detection services exists in T&T.

Methods

An online survey with closed and open-ended questions was designed to assess the availability, accessibility, QC&A, and program M&E mechanisms of BC early detection services in the T&T public and private health sectors. The World Health Organisation (WHO) Service Availability and Readiness Assessment (SARA) [37] and the Cancer Control WHO Guide for Effective Programs [38] were used as guides. Content and face validity were verified by two subject matter experts (oncologists) and two non-subject matter experts. The survey was piloted at one public hospital where it was administered to two independent radiologists. Concordance in responses between radiologists was used to determine survey reliability. Questions that elicited different answers between raters were restructured to improve reliability. Since public BC early detection services are restricted to the general hospitals, only these facilities were contacted. A list of 63 private hospitals, health care facilities, clinics, and non-governmental organizations (NGOs) were compiled using the T&T Yellow Pages [39]. They were initially contacted by phone to determine whether they offered any services for BC detection (breast ultrasounds, mammography, or MRIs). Those with services were invited to participate in the survey confidentially. Responders were required to be those directly involved in BC detection such as radiologists and ultrasonographers or involved in hospital management such as hospital directors.

Using population distribution data from the T&T 2011 Population and Housing Census [40] and the age group for eligible screening as ≥40 years, the number of mammography machines per 10,000 women ≥40 years was calculated. Maps were produced using ArcGIS Version 10.4.

A 1-h focus group of consented consultant radiologists ($n = 3$ of 15 in the public sector) was held. All three radiologists work in both sectors. Using a semi-structured discussion guide, the focus group reviewed the results of the study, identified any unaddressed challenges to BC early detection, made recommendations for improvement, and discussed whether organized national screening is

warranted in T&T at this time. The session was audio recorded and a thematic analysis was performed by identifying consensus statements surrounding strengths, weaknesses, opportunities, and threats to BC early detection. This study was exempted from ethical approval as it was a clinical audit.

Results

Service availability

Health infrastructure

Quantitative results BC detection services are restricted to the five major public hospitals: Port of Spain General Hospital (PSGH), Sangre Grande Hospital (SH), Eric Williams Medical Sciences Complex (EWMSC), San Fernando General Hospital (SFGH), Scarborough General Hospital (SGH), one in each of the 5 Regional Health Authorities (RHA), and St. James Medical Complex (SJMC), a tertiary institution for cancer management (Table 1). The T&T RHA system has been previously described [16]. All institutions except EWMSC responded to the survey. In T&T there are five mammogram machines with one in each major hospital (EWMSC included) (Fig. 1). There are 16 ultrasound machines assigned to the Radiology Departments (EWMSC excluded) with the majority (6) located in SFGH and two MRI machines, each in EWMSC and SFGH. There are 0.19 mammogram machines per 10,000 women aged ≥40 years (0.16 per 10,000 for Trinidad; 0.84 per 10,000 for Tobago) in the public sector. The South West Regional Health Authority (SWRHA) has the least number of mammography units per unit population (0.10 per 10,000 women ≥40 years) (Fig. 1). Further, 40% of institutions indicated that there were periods (>2 days) when machinery was not functioning (Table 1). Reasons cited were lack of scheduled preventative maintenance, requisite technicians, and overworked machinery.

Of the 56 private institutions, 27 (48%) indicated that they offered services while 18 (32%) had no services and 11 could not be contacted. Of the 27 with services, 8 (30%) institutions responded to the survey (Table 1). Among these institutions, there are 8 mammograms and 14 ultrasound machines. There were no cited periods when machinery is not functioning. It is unknown whether these institutions have digital mammograms and whether ultrasound machines are reserved for breast imaging.

Focus group discussion findings In the public sector, mammogram machines are used for both diagnosis and screening and ultrasound machines are not exclusively used for BC diagnostics. Mammography machines need to be updated from computed radiography to digital

Table 1 Summary of the key survey findings with respect to early detection availability, accessibility, monitoring and evaluation, quality control and assurance, and outreach in the T&T public and private sector

	Public (five institutions)	Private (eight institutions)
Cost	Free	Mammograms TTD$240–$400 (USD$36–$62)
		Breast ultrasounds TTD$260–$400 (USD$40–$62)
Access	One in each general hospital (5)	More services than public sector
	Doctor referral necessary	Doctor referral not necessary in some cases
	1–6 months for an appointment	Same day service possible
Health workforce	100% have difficulty recruiting trained staff	50% have difficulty recruiting trained staff
	Consultant medical physicists	Number of medical physicists unknown
	No specialist breast radiologists	No specialist breast radiologists
Health infrastructure	0.19 mammogram machines per 10,000 women aged 40 years and older	Unknown total number and type of mammograms; likely more than the public sector
	One digital mammography machine	Machinery regularly functioning
	40% report that machinery not regularly functioning	
Program monitoring and evaluation	40% measure detection rates	25% measure detection rates
	No other PM&E measures	No other PM&E measures
Quality control and assurance	One institution with guidelines for machinery QC&A	Three institutions with guidelines for machinery QC&A
Target population and outreach	Target population not defined	Target population not defined
	Limited outreach	More outreach than the public sector

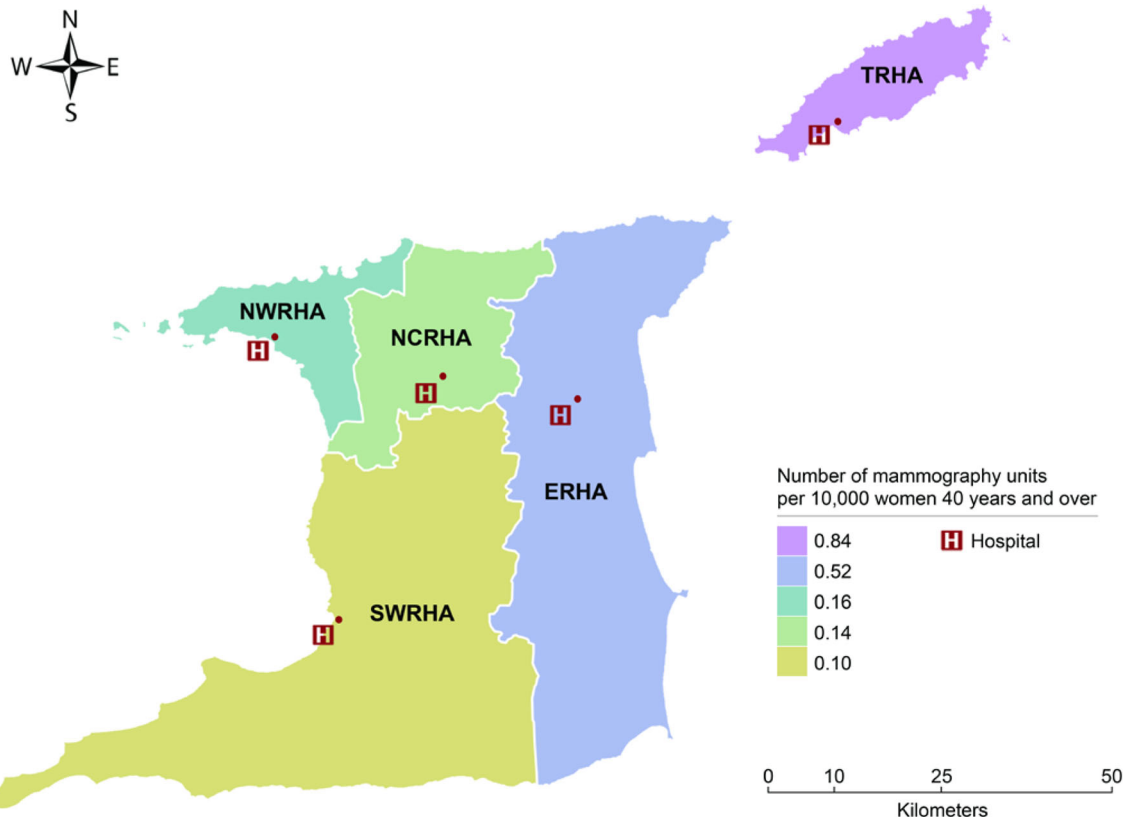

Fig. 1 Number of mammography units per 10,000 women 40 years and over in the Trinidad and Tobago public sector by Regional Health Authority. Hospitals with units are indicated. *NWRHA* Port of Spain General Hospital, *NCRHA* Eric Williams Medical Science Complex, *ERHA* Sangre Grande Hospital, *SWRHA* San Fernando General Hospital, *TRHA* Scarborough General Hospital

mammograms. SGH has the only public sector digital mammogram. When machinery is non-functional, patients are referred to another RHA. Mammogram machines are reported not to be working to capacity, averaging 10–20 mammograms per day per machine in the public sector.

Health workforce

Quantitative results In the public (100%) and private sector (50%), recruitment of trained staff is difficult. Ultrasonographers, specialist breast radiologists, and radiographers are needed. In the absence of radiologists at SJMC, oncologists fill their role. There are 5 full-time medical physicists in the public sector all at SJMC (Table 1).

Focus group discussion findings There are no specialist breast radiologists in T&T and a limited number of breast radiographers. SJMC medical physicists consult for the general hospitals. Understaffing means that health professionals must manage several conditions. Lack of overtime hours limits the number of mammograms done per day. The Faculty of Medical Sciences at the University of the West Indies (UWI) offers the Doctor of Medicine in Radiology program and the College of Science, Technology, Applied Arts and Training (COSTAAT) offers the Bachelor of Science in Radiography program. However, no specialist training in breast radiology or radiography is offered in either institution and posts for specialist radiologists are not created by the MOH.

Service access

Quantitative results

All public institutions limit service access according to the boundaries of their RHA except SJMC. Services are free, however a doctor's referral from a doctor is always needed. There are wait times of 1–6 months for a mammogram or ultrasound appointment, which varies by hospital. Private institutions specified no geographic restrictions for services and 63% indicated that a doctor's referral was not necessary. Here, mammograms cost a range of TTD$240–$400

(USD$36–$62) and breast ultrasounds cost TTD$260–$400 (USD$40–$62) with service within 1–2 days (Table 1).

Focus group discussion findings

The cost of an MRI in the private sector is TTD$3000–$4000 (USD$462–$615). The focus group verified long wait times for appointments in the public sector attributed to large patient volume.

Target population and outreach

Quantitative results

Patient reminders for BC screening are given upon a hospital visit at public (60%) and private (88%) institutions (Table 1). They engage in awareness campaigns that usually take the form of posters, vocal outreach, and brochures. Both sectors recommended increased BC public education. There was no consensus on the target population for BC screening in both sectors. A mobile BC screening unit was a private sector recommendation.

Focus group discussion findings

The utility of a mobile BC screening unit in a small country such as T&T was questioned by the focus group as it has been implemented in the past. Access is only initially improved as patients must visit a hospital for follow-up diagnosis and management. Resources should be used to first address systemic cancer management challenges.

Quality control and assurance and program monitoring and evaluation

Quantitative results

Public institutions were either unsure if QC&A guidelines for machinery use existed ($n = 2$) or indicated that none existed ($n = 2$). Of the private institutions with QC&A guidelines ($n = 3$), only 1 was willing to provide us with a copy of these guidelines. Some public (40%) and private (25%) institutions measure detection rates for program M&E, though this could not be verified (Table 1). There was no consensus in the public or private sector on which professional is responsible for machine QC&A.

Focus group discussion findings

No public hospital engages in M&E of the opportunistic BC screening program, due to a lack of resources. One reason for the lack of QC&A for machinery is the lack of enforcement legislation and the requisite workforce. Therefore, legislation must be followed by the necessary resource allocation needed to meet these standards.

Position on organized mammography screening

Focus group discussion findings

Organized BC screening in the public sector is not feasible at this time as T&T does not have the requisite human and physical resources. Significant challenges across the cancer care continuum (Fig. 2) will undermine early detection efforts. Increasing the volume of patients in this continuum will exacerbate the problem. Any future organized screening program should be based in the health care centers rather than the hospitals, thereby improving access and reserving hospital equipment for diagnostic work. Alternatively, the private sector can be incentivized to run such a program by subsidizing their cost thereby improving access and possibly quality.

Other challenges to cancer management

Focus group discussion findings

There are delays as great as 6 months in receiving a pathology report due to the paucity of pathologists (Fig. 2). A Health Information Systems (HIS) is also needed to provide accurate and timely data for research and M&E. Access to chemotherapy medication is sometimes unreliable. The public health care system cannot manage the current patient load for BC diagnosis and management. Increasing the volume of patients through screening will cause further diagnostic delays for symptomatic women.

These challenges are urgent and important, warranting research and intervention. To this end, we have made research and health service improvement recommendations which have been prioritized according to levels of urgency and importance (Fig. 3). Importance was determined by the size of the problem and the number of people affected. Urgency was determined by the expediency with which the task must be completed.

Discussion

Our study examined the strengths and weaknesses of current BC early detection services in the T&T public and private sector as well as opportunities for improvement and threats that undermine success. This assessment is an important prerequisite for determining whether T&T can implement organized BC screening. Most notably, T&T

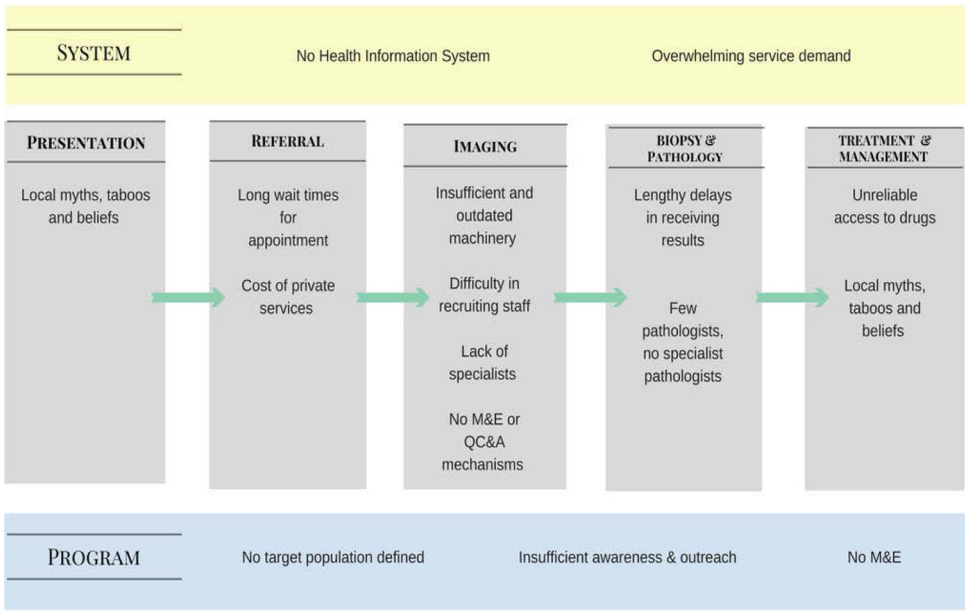

Fig. 2 Summary of key challenges to breast cancer early detection services along the cancer care continuum from presentation to treatment and management in Trinidad and Tobago. The current early detection opportunistic program and health care system in which it operates also has critical challenges

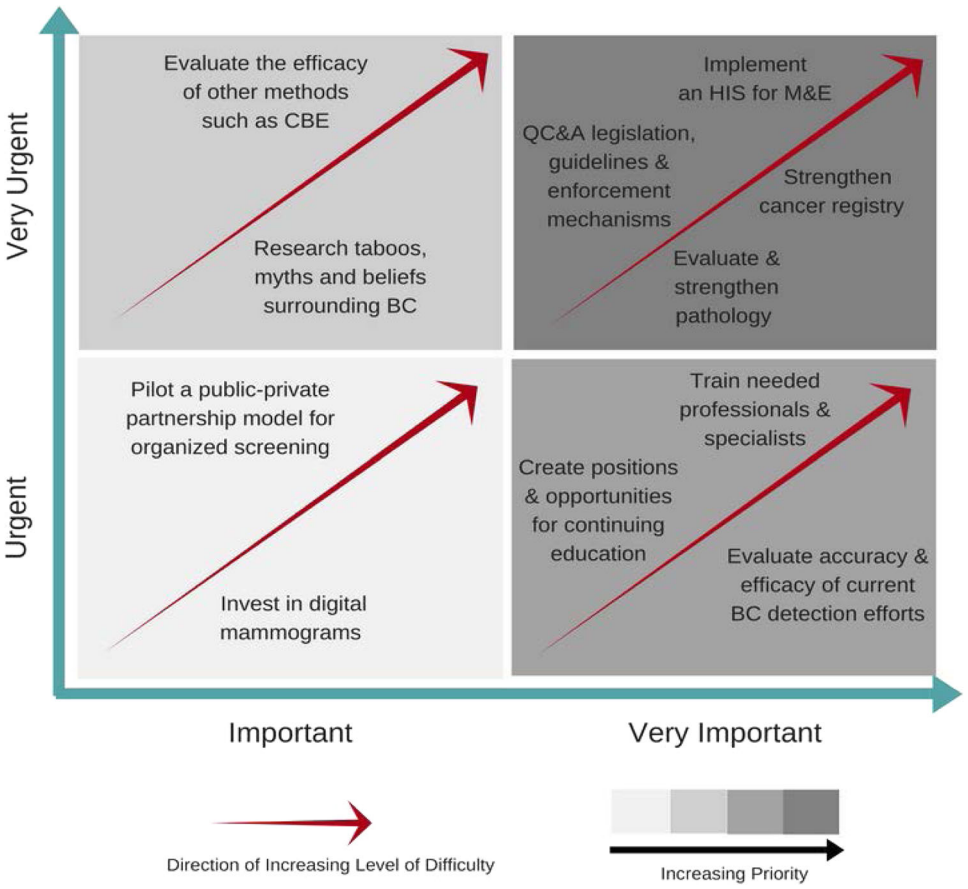

Fig. 3 Prioritization of the health research and health implementation needs based on levels of importance and urgency

has 0.19 mammogram machines per 10,000 women ≥40 years for both screening and diagnosis in the public sector. This is grossly insufficient given that the optimal number to screen 70% of eligible T&T women is 1.2 machines per 10,000 women ≥40 years [41].

A study of 31 countries in Europe, North America, and Asia cited the number of mammogram machines as ranging from 13 per 100,000,000 women in Turkey to 100 per 100,000,000 women in Austria [42] further emphasizing that infrastructural investments are needed to manage BC

diagnosis in T&T. This need for infrastructural investments is a trend across the Caribbean as access to free mammography is only present in Barbados, Guyana, Jamaica, Saint Lucia, and T&T [13]. According to the U.S. Government Accountability Office, an average mammography machine can perform 3 mammograms per hour, 24 mammograms in a day [43], suggesting that machinery is underutilized in both sectors. Increasing the number of mammograms conducted per day can reduce the delays experienced in scheduling an appointment. Ultrasound and MRI machines are also needed, each of which have been shown to be effective in BC detection, with MRIs being the most sensitive and accurate [44–46]. MRIs are also particularly suitable for determining recurrence [47] or for diagnosing young women at high risk [48, 49]. However, the cost of an MRI is generally prohibitive of implementation in limited resource settings. The use of ultrasounds and mammograms in combination has been shown to be as effective as an MRI [45]. However, such infrastructural investments for T&T will simultaneously require significant human resource investments.

Other weaknesses uncovered include understaffing, overworked and outdated machinery, lack of program M&E, machine QC&A or HIS, lengthy delays in receiving appointments and pathology reports, and unreliable access to cancer management drugs (Fig. 2). A strength is the capacity of the T&T private sector to provide timely and more accessible BC detection services, though the cost compromises equitable access. Therefore, an opportunity exists to investigate whether a public–private partnership for organized BC screening can improve quality and access. However, such a model should not be given high priority (Fig. 3) as early detection efforts can only be effective when overall cancer management is strengthened. Strengthening cancer treatment should be a priority over BC screening programs as the benefit of adjuvant therapy in improving patient survival is clear and repeatedly documented [50–53].

Opportunities also exist to train specialists through established programs at local tertiary institutions. The Government of Trinidad and Tobago can also earmark scholarships for specialist training in breast radiology and radiography and medical physics. Specialist positions must also be created as well as opportunities for continuing education. The lack of specialists also calls into question the accuracy of diagnosis which should be urgently investigated. These human resource and research investments are the second highest priority as specialists must be given the requisite technologically advanced infrastructure and guidelines to be optimally effective (Fig. 3).

A significant threat to the success of BC detection services is the lack of systems for QC&A and M&E. Legislation that guides the medical use of radiation is needed. In recognition of this need, The Pan American Health Organisation has developed a manual for mammography quality assurance [54] which should be used as a guide in T&T. Further, systems and resources to monitor and enforce compliance must also be in place. M&E should also be grounded in HIS. The lack of an HIS is likely the most significant threat to effective cancer management. The anticipated resistance to the use of an HIS system threatens the expediency with which an HIS can be implemented. It is the most urgent, most important, and most difficult task to achieve and so is the highest priority (Fig. 3). The MOH should work with local experts in the for-profit and not-for-profit sectors for design, implementation, and management of an HIS. Investment in digital mammograms while necessary, should not be prioritized ahead of implementing mechanisms for QC&A and M&E for what already exists (Fig. 3).

Other notable threats include the influence of local myths, taboos, and beliefs on a decision to and the timelines of seeking medical advice and subsequent adherence [55]. The number of cancer patients who participate in alternative therapy in T&T is unknown; however, it is a growing concern that warrants further study (Fig. 3). Further, there are no current data from which to estimate the overall and age-specific BC incidence rates to determine a target population for organized BC screening. Surveillance data are also needed on the stage and tumor size on presentation. In countries where a significant proportion of cases are late stage or with large tumors, other strategies focused on education and awareness are shown to be more effective [56, 57]. Thus, strengthening the national Dr. Elizabeth Quamina Cancer Registry must be given high priority (Fig. 3).

A limitation of this study is that responses from all public and private institutions with services were not obtained. Further, our list of private institutions may not be exhaustive as one could not be obtained from the MOH. There are likely more services in the private sector than determined here. Further, we could not ascertain details on the type (model, make, and brand) of machinery in each institution, neither could we verify the existence of QC&A and M&E guidelines. This can be addressed through an in-person hospital-based interview as an improved strategy to collect responses for a situational analysis in this setting. It would increase response rates, collect more data points, and immediately validate responses. Further, the small size ($n = 3$) and professional homogeneity of members of the focus group were useful, but may not have facilitated discussion from many different points of view.

Conclusion

A national BC screening program for T&T is not feasible at this time due to inadequate resources and competing needs. All points of the care continuum need to be strong for screening to be effective. Threats to the efficacy of early detection such as diagnostic delays and unreliable drug access remain unaddressed. The T&T private health sector and non-profit institutions is a resource that can aid in improving cancer management. Our findings can be used to guide strategies in improving cancer diagnosis and management in T&T.

Acknowledgments The project was supported by the Caribbean Cancer Research Initiative and Washington University School of Medicine Institute for Public Heath, Public Health Cubed (PH3) Grant, and Washington University School of Medicine (GSAS/CGFP Fund 94028C) (W.A.W.).

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interest.

References

1. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray F (2015) Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer 136(5):E359–E386. doi:10.1002/ijc.29210
2. Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A (2015) Global cancer statistics, 2012. CA Cancer J Clin 65(2):87–108. doi:10.3322/caac.21262
3. DeSantis CE, Bray F, Ferlay J, Lortet-Tieulent J, Anderson BO, Jemal A (2015) International variation in female breast cancer incidence and mortality rates. Cancer Epidemiol Biomark Prev 24(10):1495–1506. doi:10.1158/1055-9965.EPI-15-0535
4. Institute NC SEER cancer statistics factsheets: female breast cancer. http://seer.cancer.gov/statfacts/html/breast.html. Accessed 9 Dec 2016
5. Hashemi SH, Karimi S, Mahboobi H (2014) Lifestyle changes for prevention of breast cancer. Electron Physician 6(3):894–905. doi:10.14661/2014.894-905
6. Colditz G, Bohlke K (2014) Priorities for the primary prevention of breast cancer. CA 00:1–9. doi:10.3322/caac.21225
7. Ga Colditz, Bohlke K (2015) Preventing breast cancer now by acting on what we already know. npj. Breast Cancer 19:19–22. doi:10.1038/npjbcancer.2015.9
8. Hajian S, Vakilian K, Najabadi KM, Hosseini J, Mirzaei HR (2011) Effects of education based on the health belief model on screening behavior in high risk women for breast cancer, Tehran, Iran. Asian Pac J Cancer Prev 12(1):49–54
9. Ceber E, Turk M, Cicekliogluu M (2010) The effects of an educational program on knowledge of breast cancer, early detection practices and health beliefs of nurses and midwives. J Clin Nurs 19(15–16):2363–2371. doi:10.1111/j.1365-2702.2009.03150.x
10. Schopper D, de Wolf C (2009) How effective are breast cancer screening programmes by mammography? Review of the current evidence. Eur J Cancer 45(11):1916–1923. doi:10.1016/j.ejca.2009.03.022
11. Burton R, Bell R (2013) The global challenge of reducing breast cancer mortality. Oncologist 18(11):1200–1202. doi:10.1634/theoncologist.2013-0315
12. Jatoi I, Miller AB (2003) Why is breast-cancer mortality declining? Lancet Oncol 4(4):251–254
13. Luciani S, Cabanes A, Prieto-Lara E, Gawryszewski V (2013) Cervical and female breast cancers in the Americas: current situation and opportunities for action. Bull World Health Organ 91(9):640–649. doi:10.2471/BLT.12.116699
14. Goss PE, Lee BL, Badovinac-Crnjevic T, Strasser-Weippl K, Chavarri-Guerra Y, St Louis J, Villarreal-Garza C, Unger-Saldana K, Ferreyra M, Debiasi M, Liedke PE, Touya D, Werutsky G, Higgins M, Fan L, Vasconcelos C, Cazap E, Vallejos C, Mohar A, Knaul F, Arreola H, Batura R, Luciani S, Sullivan R, Finkelstein D, Simon S, Barrios C, Kightlinger R, Gelrud A, Bychkovsky V, Lopes G, Stefani S, Blaya M, Souza FH, Santos FS, Kaemmerer A, de Azambuja E, Zorilla AF, Murillo R, Jeronimo J, Tsu V, Carvalho A, Gil CF, Sternberg C, Duenas-Gonzalez A, Sgroi D, Cuello M, Fresco R, Reis RM, Masera G, Gabus R, Ribeiro R, Knust R, Ismael G, Rosenblatt E, Roth B, Villa L, Solares AL, Leon MX, Torres-Vigil I, Covarrubias-Gomez A, Hernandez A, Bertolino M, Schwartsmann G, Santillana S, Esteva F, Fein L, Mano M, Gomez H, Hurlbert M, Durstine A, Azenha G (2013) Planning cancer control in Latin America and the Caribbean. Lancet Oncol 14(5):391–436. doi:10.1016/S1470-2045(13)70048-2
15. WHO (2012) Trinidad and Tobago Cancer Profile 2014.2010–2012
16. Wa Warner, Morrison RL, Lee TY, Williams TM, Ramnarine S, Roach V, Slovacek S, Maharaj R, Bascombe N, Bondy ML, Ellis MJ, Toriola AT, Roach A, AaM Llanos (2015) Associations among ancestry, geography and breast cancer incidence, mortality, and survival in Trinidad and Tobago. Cancer Med. doi:10.1002/cam4.503
17. Mungrue K, Ramdath J, Ali S, Cuffie WA, Dodough N, Gangar M, Mohammed L, Mungroo V, Ramsahai J, Shah M (2014) Challenges to the control of breast cancer in a small developing country. Breast Cancer 8:7–13. doi:10.4137/BCBCr.s12780
18. Naraynsingh V, Hariharan S, Dan D, Bhola S, Bhola S, Nagee K (2010) Trends in breast cancer mortality in Trinidad and Tobago-A 35-year study. Cancer Epidemiol. doi:10.1016/j.canep.2009.11.003
19. Taioli E, Attong-Rogers A, Layne P, Roach V, Ragin C (2010) Breast cancer survival in women of African descent living in the US and in the Caribbean: effect of place of birth. Breast Cancer Res Treat 122:515–520. doi:10.1007/s10549-009-0702-9
20. Camacho-Rivera M, Ragin C, Roach V, Kalwar T, Taioli E (2015) Breast cancer clinical characteristics and outcomes in Trinidad and Tobago. J Immigr Minor Health 17(3):765–772. doi:10.1007/s10903-013-9930-5
21. Murillo R, Diaz S, Perry F, Poveda C, Pineros M, Sanchez O, Buitrago L, Gamboa O, Lozano T, Yu H, Wang CY, Duggan C, Thomas DB, Anderson BO (2016) Increased breast cancer screening and downstaging in Colombian women: a randomized trial of opportunistic breast-screening. Int J Cancer 138(3):705–713. doi:10.1002/ijc.29801
22. Lui CY, Lam HS, Chan LK, Tam KF, Chan CM, Leung TY, Mak KL (2007) Opportunistic breast cancer screening in Hong Kong; a revisit of the Kwong Wah Hospital experience. Hong Kong Med J 13(2):106–113
23. Teh YC, Tan GH, Taib NA, Rahmat K, Westerhout CJ, Fadzli F, See MH, Jamaris S, Yip CH (2015) Opportunistic mammography screening provides effective detection rates in a limited resource healthcare system. BMC Cancer 15:405. doi:10.1186/s12885-015-1419-2

24. Hertl K, Primic-Zakelj M, Zgajnar J, Kocijancic I (2006) Performance of opportunistic breast cancer screening in Slovenia. Neoplasma 53(3):237–241
25. de Gelder R, Bulliard JL, de Wolf C, Fracheboud J, Draisma G, Schopper D, de Koning HJ (2009) Cost-effectiveness of opportunistic versus organised mammography screening in Switzerland. Eur J Cancer 45(1):127–138. doi:10.1016/j.ejca.2008.09.015
26. Welch HG, Prorok PC, O'Malley AJ, Kramer BS (2016) Breast-cancer tumor size, overdiagnosis, and mammography screening effectiveness. N Engl J Med 375(15):1438–1447. doi:10.1056/NEJMoa1600249
27. Puliti D, Duffy SW, Miccinesi G, de Koning H, Lynge E, Zappa M, Paci E, Group EW (2012) Overdiagnosis in mammographic screening for breast cancer in Europe: a literature review. J Med Screen 19(Suppl 1):42–56. doi:10.1258/jms.2012.012082
28. Tosteson AN, Fryback DG, Hammond CS, Hanna LG, Grove MR, Brown M, Wang Q, Lindfors K, Pisano ED (2014) Consequences of false-positive screening mammograms. JAMA Intern Med 174(6):954–961. doi:10.1001/jamainternmed.2014.981
29. Hofvind S, Ponti A, Patnick J, Ascunce N, Njor S, Broeders M, Giordano L, Frigerio A, Tornberg S, Project E, Euroscreen Working G, Van Hal G, Martens P, Majek O, Danes J, von Euler-Chelpin M, Aasmaa A, Anttila A, Becker N, Pentek Z, Budai A, Madai S, Fitzpatrick P, Mooney T, Zappa M, Ventura L, Scharpantgen A, Hofvind S, Seroczynski P, Morais A, Rodrigues V, Bento MJ, Gomes de Carvalho J, Natal C, Prieto M, Sanchez-Contador Escudero C, Zubizarreta Alberti R, Fernandez Llanes SB, Ascunce N, Ederra Sanza M, Sarriugarte Irigoien G, Salas Trejo D, Ibanez Cabanell J, Wiege M, Ohlsson G, Tornberg S, Korzeniewska M, de Wolf C, Fracheboud J, Patnick J, Lancucki L, Ducarroz S, Suonio E (2012) False-positive results in mammographic screening for breast cancer in Europe: a literature review and survey of service screening programmes. J Med Screen 19(Suppl 1):57–66. doi:10.1258/jms.2012.012083
30. Yaffe MJ, Mainprize JG (2011) Risk of radiation-induced breast cancer from mammographic screening. Radiology 258(1):98–105. doi:10.1148/radiol.10100655
31. Miglioretti DL, Lange J, van den Broek JJ, Lee CI, van Ravesteyn NT, Ritley D, Kerlikowske K, Fenton JJ, Melnikow J, de Koning HJ, Hubbard RA (2016) Radiation-induced breast cancer incidence and mortality from digital mammography screening: a modeling study. Ann Intern Med 164(4):205–214. doi:10.7326/M15-1241
32. Gotzsche PC, Nielsen M (2011) Screening for breast cancer with mammography. Cochrane Database Syst Rev 1:CD001877. doi:10.1002/14651858.CD001877.pub4
33. Biller-Andorno N, Juni P (2014) Abolishing mammography screening programs? A view from the Swiss Medical Board. N Engl J Med 370(21):1965–1967. doi:10.1056/NEJMp1401875
34. Chantal Cases MDP, Eric Drahi, Sylvie Fainzang (2016) Concertation citoyenne et scientifique. Rapport du comité d'orientation
35. Organization WH (2014) Position paper on mammography screening. WHO, Geneva, p 78
36. Shyyan R, Masood S, Badwe RA, Errico KM, Liberman L, Ozmen V, Stalsberg H, Vargas H, Vass L, Global Summit D, Pathology P (2006) Breast cancer in limited-resource countries: diagnosis and pathology. Breast J 12(Suppl 1):S27–S37. doi:10.1111/j.1075-122X.2006.00201.x
37. Health Statistics and Information Systems W (Revision July 2015) Service availability and readiness assessment (SARA): an annual monitoring system for service delivery. Reference Manual
38. Organisation WH (2007) Cancer control: knowledge into action. WHO Guide for Effective Programmes, Early Detection
39. Trinidad & Tobago yellow pages http://tntyp.com/. 2016
40. Office CS Trinidad and Tobago 2011 Population and Housing Census Demographic Report
41. Elkin EB, Ishill NM, Snow JG, Panageas KS, Bach PB, Liberman L, Wang F, Schrag D (2010) Geographic access and the use of screening mammography. Med Care 48(4):349–356. doi:10.1097/MLR.0b013e3181ca3ecb
42. Autier P, Ouakrim DA (2008) Determinants of the number of mammography units in 31 countries with significant mammography screening. Br J Cancer 99(7):1185–1190. doi:10.1038/sj.bjc.6604657
43. Office USGA mammography: current nationwide capacity is adequate, but access problems may exist in certain locations. U.S. General Accounting Office, Washington, DC
44. Ranger B, Littrup PJ, Duric N, Chandiwala-Mody P, Li C, Schmidt S, Lupinacci J (2012) Breast ultrasound tomography versus MRI for clinical display of anatomy and tumor rendering: preliminary results. AJR Am J Roentgenol 198(1):233–239. doi:10.2214/AJR.11.6910
45. Malur S, Wurdinger S, Moritz A, Michels W, Schneider A (2001) Comparison of written reports of mammography, sonography and magnetic resonance mammography for preoperative evaluation of breast lesions, with special emphasis on magnetic resonance mammography. Breast Cancer Res 3(1):55–60
46. Luparia A, Mariscotti G, Durando M, Ciatto S, Bosco D, Campanino PP, Castellano I, Sapino A, Gandini G (2013) Accuracy of tumour size assessment in the preoperative staging of breast cancer: comparison of digital mammography, tomosynthesis, ultrasound and MRI. Radiol Med 118(7):1119–1136. doi:10.1007/s11547-013-0941-z
47. Shin HJ, Kim HH, Ahn JH, Kim SB, Jung KH, Gong G, Son BH, Ahn SH (2011) Comparison of mammography, sonography, MRI and clinical examination in patients with locally advanced or inflammatory breast cancer who underwent neoadjuvant chemotherapy. Br J Radiol 84(1003):612–620. doi:10.1259/bjr/74430952
48. Warner E, Messersmith H, Causer P, Eisen A, Shumak R, Plewes D (2008) Systematic review: using magnetic resonance imaging to screen women at high risk for breast cancer. Ann Intern Med 148(9):671–679
49. Lehman CD, Blume JD, Weatherall P, Thickman D, Hylton N, Warner E, Pisano E, Schnitt SJ, Gatsonis C, Schnall M, DeAngelis GA, Stomper P, Rosen EL, O'Loughlin M, Harms S, Bluemke DA, International Breast MRICWG (2005) Screening women at high risk for breast cancer with mammography and magnetic resonance imaging. Cancer 103(9):1898–1905. doi:10.1002/cncr.20971
50. Dowsett M, Cuzick J, Ingle J, Coates A, Forbes J, Bliss J, Buyse M, Baum M, Buzdar A, Colleoni M, Coombes C, Snowdon C, Gnant M, Jakesz R, Kaufmann M, Boccardo F, Godwin J, Davies C, Peto R (2010) Meta-analysis of breast cancer outcomes in adjuvant trials of aromatase inhibitors versus tamoxifen. J Clin Oncol 28(3):509–518. doi:10.1200/JCO.2009.23.1274
51. Early Breast Cancer Trialists' Collaborative G, Clarke M, Coates AS, Darby SC, Davies C, Gelber RD, Godwin J, Goldhirsch A, Gray R, Peto R, Pritchard KI, Wood WC (2008) Adjuvant chemotherapy in oestrogen-receptor-poor breast cancer: patient-level meta-analysis of randomised trials. Lancet 371(9606):29–40. doi:10.1016/S0140-6736(08)60069-0
52. Early Breast Cancer Trialists' Collaborative G (2005) Effects of chemotherapy and hormonal therapy for early breast cancer on recurrence and 15-year survival: an overview of the randomised trials. Lancet 365(9472):1687–1717. doi:10.1016/S0140-6736(05)66544-0
53. Early Breast Cancer Trialists' Collaborative G, Coleman R, Powles T, Paterson A, Gnant M, Anderson S, Diel I, Gralow J, von Minckwitz G, Moebus V, Bergh J, Pritchard KI, Bliss J,

Cameron D, Evans V, Pan H, Peto R, Bradley R, Gray R (2015) Adjuvant bisphosphonate treatment in early breast cancer: meta-analyses of individual patient data from randomised trials. Lancet 386(10001):1353–1361. doi:10.1016/S0140-6736(15)60908-4

54. PAH Organisation (2016) Mammography services quality assurance: baseline standards for Latin America and the Caribbean. PAHO, Washington
55. Yip CH, Smith RA, Anderson BO, Miller AB, Thomas DB, Ang ES, Caffarella RS, Corbex M, Kreps GL, McTiernan A (2008) Guideline implementation for breast healthcare in low- and middle-income countries: early detection resource allocation. Cancer 113:2244–2256. doi:10.1002/cncr.23842
56. Devi BC, Tang TS, Corbex M (2007) Reducing by half the percentage of late-stage presentation for breast and cervix cancer over 4 years: a pilot study of clinical downstaging in Sarawak, Malaysia. Ann Oncol 18(7):1172–1176. doi:10.1093/annonc/mdm105
57. Corbex M, Burton R, Sancho-Garnier H (2012) Breast cancer early detection methods for low and middle income countries, a review of the evidence. Breast 21:428–434. doi:10.1016/j.breast.2012.01.002