Breast cancer surgical services in South Africa: Availability and barriers to guideline-concordant care

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Background. Female breast cancer has become the most frequently diagnosed cancer globally. The incidence of cancer in South Africa (SA) is projected to double by 2030, and services to address the growing burden of disease are urgently needed. The distribution and capacity of existing breast cancer surgical services in SA haVE not been reported.
Objective. To provide a quantitative descriptive analysis of the status of breast cancer surgical services in the public healthcare sector in SA.
Methods. A descriptive cross-sectional analysis of breast cancer surgical services was performed, including the burden of disease, stage of diagnosis, available diagnostic and therapeutic modalities, waiting time to surgery and barriers to care. Clinicians at every public sector healthcare facility providing surgical care to breast cancer patients were approached to complete a quantitative survey for the year 2019.
Results. Data from 43 hospitals across all nine SA provinces were included. Clinicians reported a greater proportion of late-stage breast cancer (67%) than early breast cancer (33%) at diagnosis. The less urban provinces had poorer access to diagnostic and staging modalities. Most facilities were able to provide breast-conserving surgery (79%), while fewer facilities could offer sentinel lymph node biopsy (SLNB) (53%) and still fewer could offer breast reconstruction (35%). Clinicians cited the foremost barriers to standard of care as advanced disease at diagnosis, inadequate access to surgical expertise and lack of access to essential equipment. The national average waiting time for surgery (28 days) is within the recommended timeframe from decision to treat. The representation of the multidisciplinary team across facilities does not comply with national staffing recommendations for a breast unit.
Conclusion. Broad disparities exist in access to essential staging and diagnostic modalities between facilities in different provinces. In many settings, there is limited capacity to provide key surgical interventions, particularly SLNB and breast reconstruction. These findings suggest that breast cancer care in most settings within the public healthcare sector is not concordant with proposed national guidelines. There is an urgent need to address the deficits in the distribution and capacity of breast cancer surgical services in SA.

Keywords: breast cancer surgery, health system capacity, South Africa, healthcare disparities

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Breast cancer is recognised as a growing global health concern.[1] In 2020, female breast cancer surpassed lung cancer as the most frequently diagnosed cancer globally, accounting for 11.7% of all new cancer cases, and was the leading cause of cancer-related death in women.[2] Early detection and multimodal therapy have markedly improved the prognosis of breast cancer patients, as demonstrated by the 5-year age-standardised relative survival rates of 85 - 95% in high-income countries. However, marked socioeconomic disparities persist for individuals with breast cancer in low- and middle-income countries (LMICs). Sub-Saharan Africa has the lowest worldwide 5-year age-standardised survival rate at 66%.[3] The increasing incidence of breast cancer is projected to have a significant impact on outcomes in LMICs, making the development of robust health systems an urgent priority.[4,5] Projections from a multinational sub-Saharan study looking at disparities in cancer outcomes show that one-third of breast cancer deaths could be prevented if cases were diagnosed at an earlier stage and improved treatment was available, including the quality of surgery and the completion of systemic therapy.[6]

In 2017, South Africa (SA)'s National Department of Health (NDoH) released the Breast Cancer Prevention and Control Policy.[7] This document aims to establish a standard of care for managing breast conditions, outlining referral pathways and treatment guidelines, and developing a framework for audit. This guideline advocates for the development of specialist breast units (SBUs) as a 'one-stop clinic' for the diagnosis and management of breast disease.[8] SBUs may receive patients directly from the primary care system or non-specialist centres, bypassing the traditional referral model. This would assist in accelerating patient care pathways by optimising ease of access to specialist care.

Since publication, the Breast Cancer Prevention and Control Policy guidelines have yet to be implemented in most settings within the public healthcare system. There are a small number of SBUs within urban settings in SA; however, the care provided is not standardised. The distribution and capacity of breast cancer surgical services outside these few centres remain unreported. This study aims to provide a quantitative descriptive analysis of the current status of breast cancer surgical services in the public healthcare sector in SA. It describes the distribution of services, available diagnostic and therapeutic resources, waiting time for surgery and access to multidisciplinary team (MDT) members, and identifies key barriers to the standard of care. These findings can be used to recognise current gaps and inequities in service delivery, and to identify opportunities to strengthen the provision and quality of breast cancer care across SA.

Methods

Study design and setting

A questionnaire-based cross-sectional analysis of all SA public healthcare facilities providing breast cancer surgical services was undertaken. For the purposes of this study, such a facility was defined

as a hospital at which at least one mastectomy was performed within the study period (1 January - 31 December 2019). Within the SA public healthcare system, health facilities are classified by increasing levels of care, from primary, district, regional, provincial and tertiary to national central hospitals.[9] A hospital list was compiled from the World Health Organization (WHO)'s sub-Saharan health facilities master list in collaboration with SA's NDoH.[10] The initial data pool included all national central, provincial tertiary and regional hospitals in the public healthcare sector, as well as any district hospitals identified by their referral hospital to be providing breast cancer surgical services. Ethical approval was obtained from the University of Cape Town Health Research Ethics Committee (ref. no. 324/2021). Informed consent was obtained from all participants prospectively.

Data collection

A surgical clinician at each facility was contacted to determine whether breast cancer surgical services were provided at their facility during the study period. Facilities that reported performing at least one mastectomy in the study period were included. The head of the department or most senior surgical clinician at the included facilities was then asked to complete a quantitative 12-item questionnaire via a digital survey. The questionnaire was specifically designed for use in the study, in consultation with three specialist breast surgeons based at an academic institution in SA. It required participants to provide estimated data regarding the annual number of breast cancer cases and surgeries, stage of disease at diagnosis, availability of diagnostic and therapeutic resources, barriers to surgical services, waiting times to surgery and access to members of an MDT.

Statistical analysis

Data were entered into an Excel (Microsoft, USA) spreadsheet and analysed using SPSS version 28 (IBM, USA). Cross-tabulations, frequency distributions and graphical representations were used as descriptive statistical methods. Where data were reported as a range, the midpoint of the range was used. Geographical representations of the facilities were created using Stata version 17 (StataCorp, USA).

Results

Facility characteristics

A total of 72 healthcare facilities were surveyed, of which 46 were identified as providing breast cancer surgical services. Three facilities were excluded, as two respondents did not complete the questionnaire, and one respondent could not participate owing to significant staffing changes during the study period. Therefore, data from 43 facilities were represented in the analysis, with a response rate of 93%. The distribution across the nine provinces and level of care is represented in Fig. 1.

Clinicians reported that an estimated 33% of breast cancer patients presented with early breast cancer (stage I - II disease), and 67% presented with advanced breast cancer (stage III - IV disease). The estimated number of annual breast cancer cases and breast cancer surgeries per facility are represented in Figs 2 and 3, respectively, and summarised by province in Fig. 4.

The availability of diagnostic modalities, staging modalities and specific surgical services is represented in Table 1.

Reported barriers to breast-conserving surgery (BCS), sentinel lymph node biopsy (SLNB) and breast reconstruction are represented in Table 2.

The mean national reported waiting time for breast cancer surgery from the decision to operate was 28 days. Waiting times for surgery by province are represented in Appendix Fig. S1. Seventy-nine per cent (34/43) of facilities reported access to input from an MDT. Access to specific members of the MDT is represented in Appendix Fig. S2.

Discussion

Access to services and stage of diagnosis

In this study, breast cancer surgical services are shown to be concentrated in urban centres, with most facilities clustered in major cities. Increased travel time between the treatment facility and the patient's home has been associated with a later stage of diagnosis, a worse prognosis and decreased quality of life.[12,13] A tertiary centre in Nigeria found that breast cancer patients with a travel time >30 minutes had an increased risk of death.[14] A study in SA found

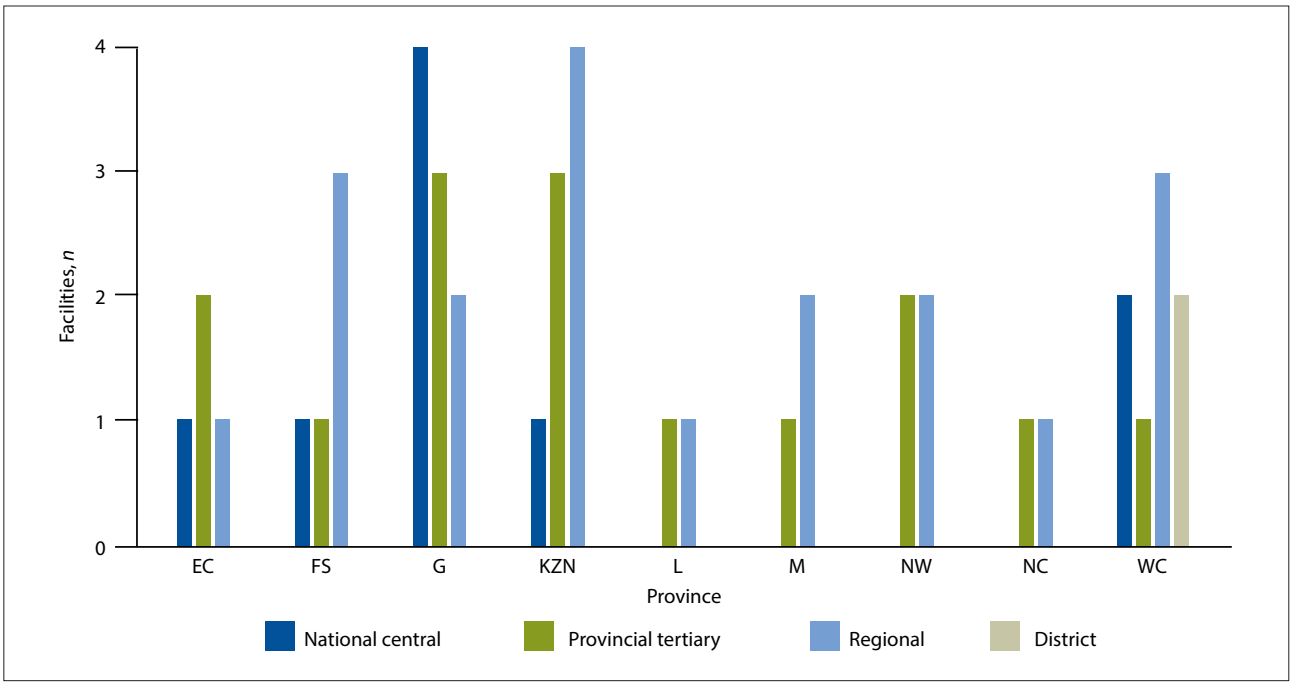

Fig. 1. Facility distribution by province and level of care. (Provinces: EC = Eastern Cape; FS = Free State; G = Gauteng; KZN = KwaZulu-Natal; L = Limpopo; M = Mpumalanga; NW = North West; NC = Northern Cape; WC = Western Cape.)

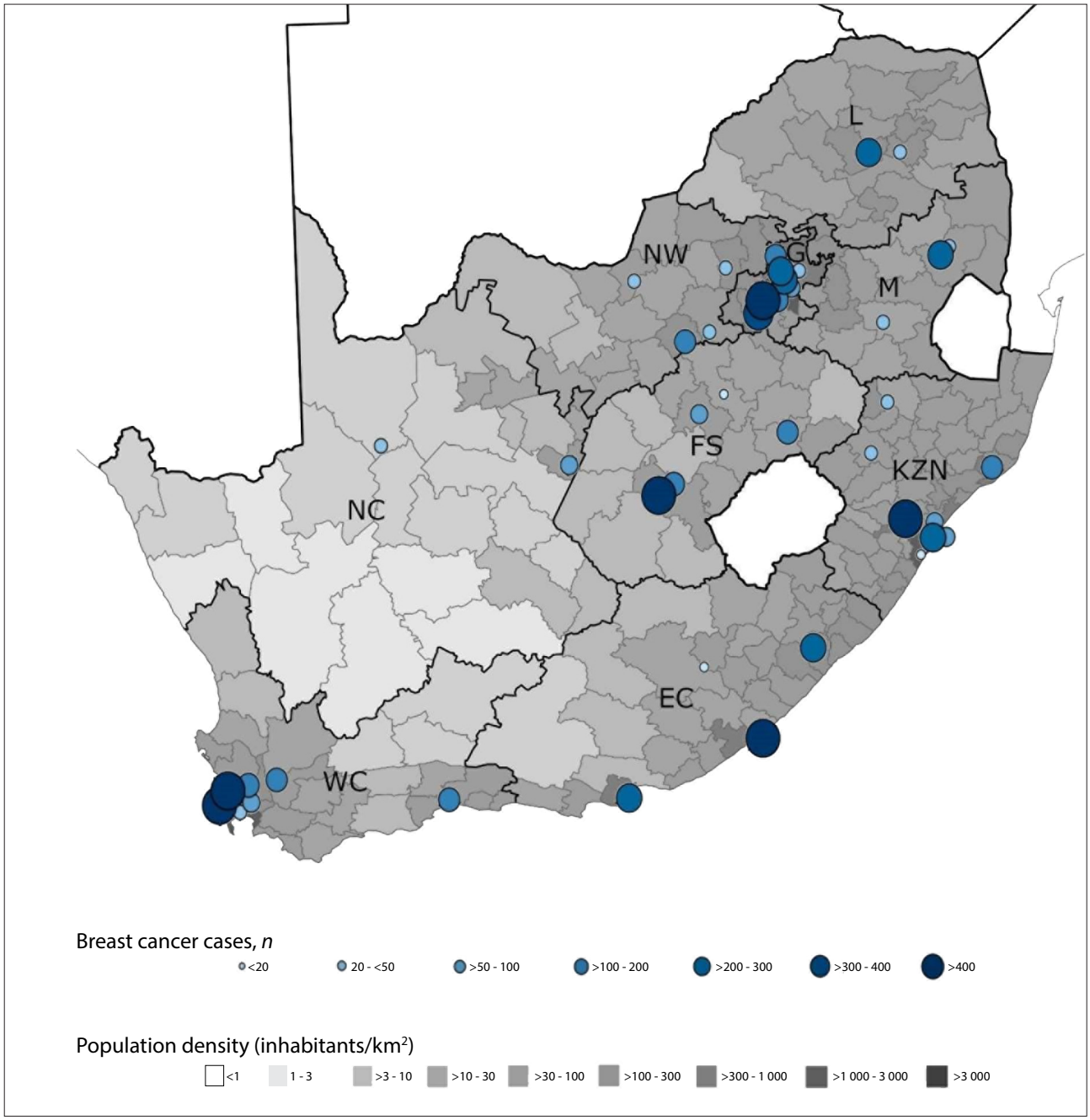

Fig. 2. Clinician-estimated number of annual breast cancer cases seen by facility. Population density data extracted from the 2016 Community Survey.[11] (Provinces: EC = Eastern Cape; FS = Free State; G = Gauteng; KZN = KwaZulu-Natal; L = Limpopo; M = Mpumalanga; NW = North West; NC = Northern Cape; WC = Western Cape.)

that living >20 km from the treatment facility increased the likelihood of a diagnosis of late-stage breast cancer.[15] Owing to the specialised, multimodal nature of breast cancer treatment, it is challenging to decentralise services to rural areas. The proposed national guideline aims instead to clarify referral pathways to minimise travel time, improve access to specialised care and reduce system-related delays to diagnosis, staging and therapy. Priority should be given to developing dedicated patient transport systems that could improve quality of care and treatment adherence.[13,16]

In this study, an estimated two-thirds (66%) of breast cancer patients had late-stage disease at diagnosis. This is consistent with findings from previous studies in the region. A recent study compared the proportion of breast cancer patients presenting with advanced disease in SA (63.3%), Botswana (64.7%) and the USA (13.0%).[17] Advanced disease at diagnosis is associated with worse outcomes, increased cost of therapy[18] and limited treatment options, with many cases of advanced breast cancer not being amenable to surgical intervention. Advanced disease at presentation may provide an explanation for the difference between the facilities' estimated number of annual cases seen and the number of breast cancer surgeries performed.

Staging and diagnostics

Facilities in all provinces reported having access to basic diagnostic modalities (e.g. core biopsy, ultrasound-guided biopsy and mammogram). However, most facilities did not have access to more

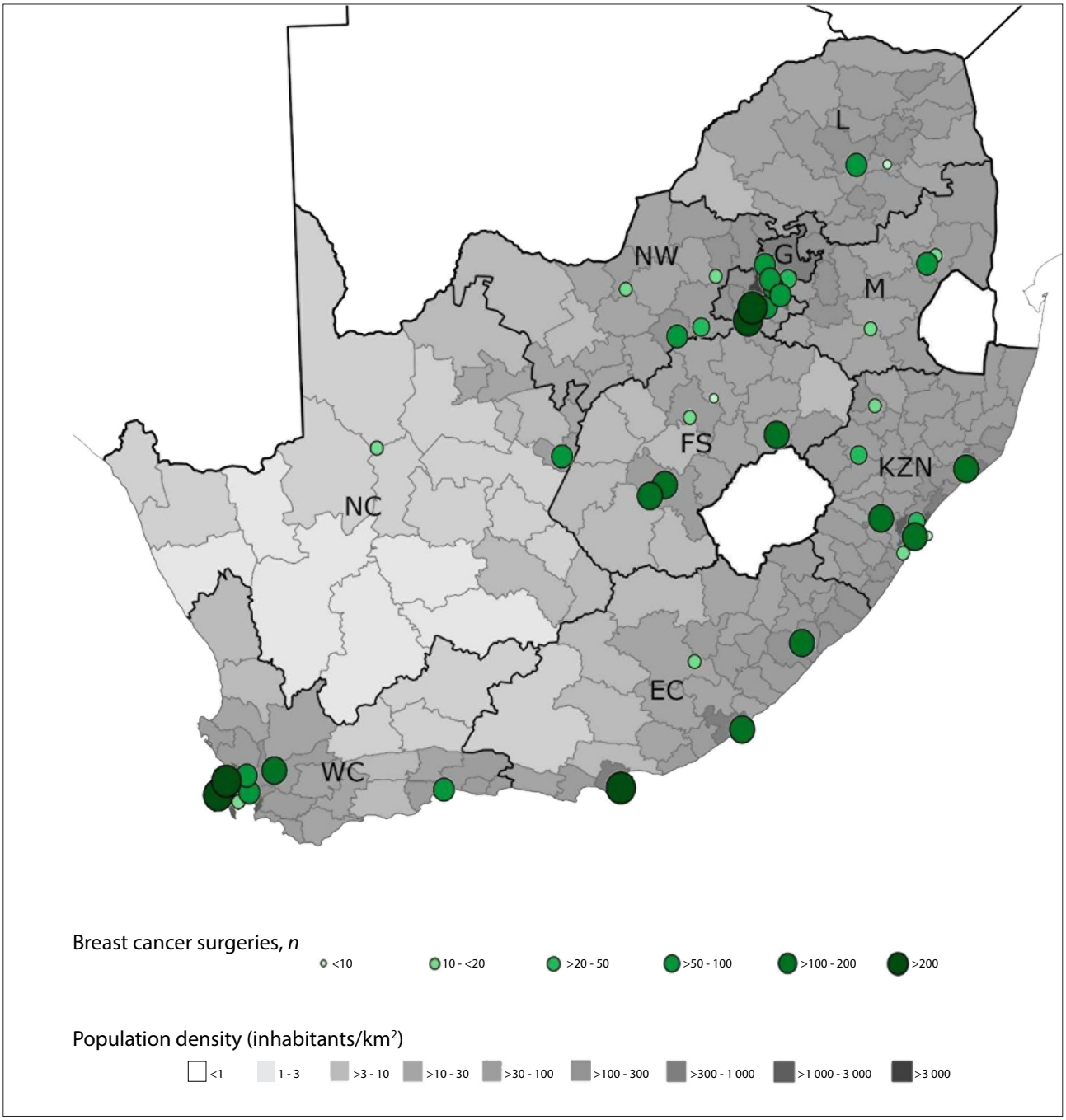

Fig. 3. Clinician-estimated annual number of breast cancer surgeries by facility. Population density data extracted from the 2016 Community Survey.[11] (Provinces: EC = Eastern Cape; FS = Free State; G = Gauteng; KZN = KwaZulu-Natal; L = Limpopo; M = Mpumalanga; NW = North West; NC = Northern Cape; WC = Western Cape.)

advanced modalities (e.g. stereotactic biopsy, Hookwire, Magseed, radio-guided occult lesion localisation) useful in the diagnosis of occult breast lesions, with these modalities being unavailable in three of nine provinces. Most facilities reported access to ultrasound and computed tomography scans; however, magnetic resonance imaging, bone scans and positron emission tomography were unavailable at most centres. A recent SA study in KwaZulu-Natal Province reported waiting time for imaging for breast cancer staging to be the most significant factor in provider-related treatment delays.[19] Lack of access to essential diagnostic and staging modalities contributes to diagnostic and treatment delays, further escalating the costs of therapy and worsening patient outcomes.

Breast cancer management

Surgery plays a central role in the effective management of breast cancer. Surgical interventions may be indicated for definitive treatment, resection of metastases, pain relief, control of oncological emergencies, diagnosis and staging, and even cancer prevention. BCS is regarded as the accepted first-line intervention for early breast cancer, provided that both complete tumour excision and acceptable cosmesis are achievable. Total mastectomy (TM) is indicated where absolute contraindications for BCS exist, including timely access to radiotherapy. In one SA report from Johannesburg, only 20% of eligible patients in a major academic centre received BCS, and patients with stage I disease were more likely to receive TM than

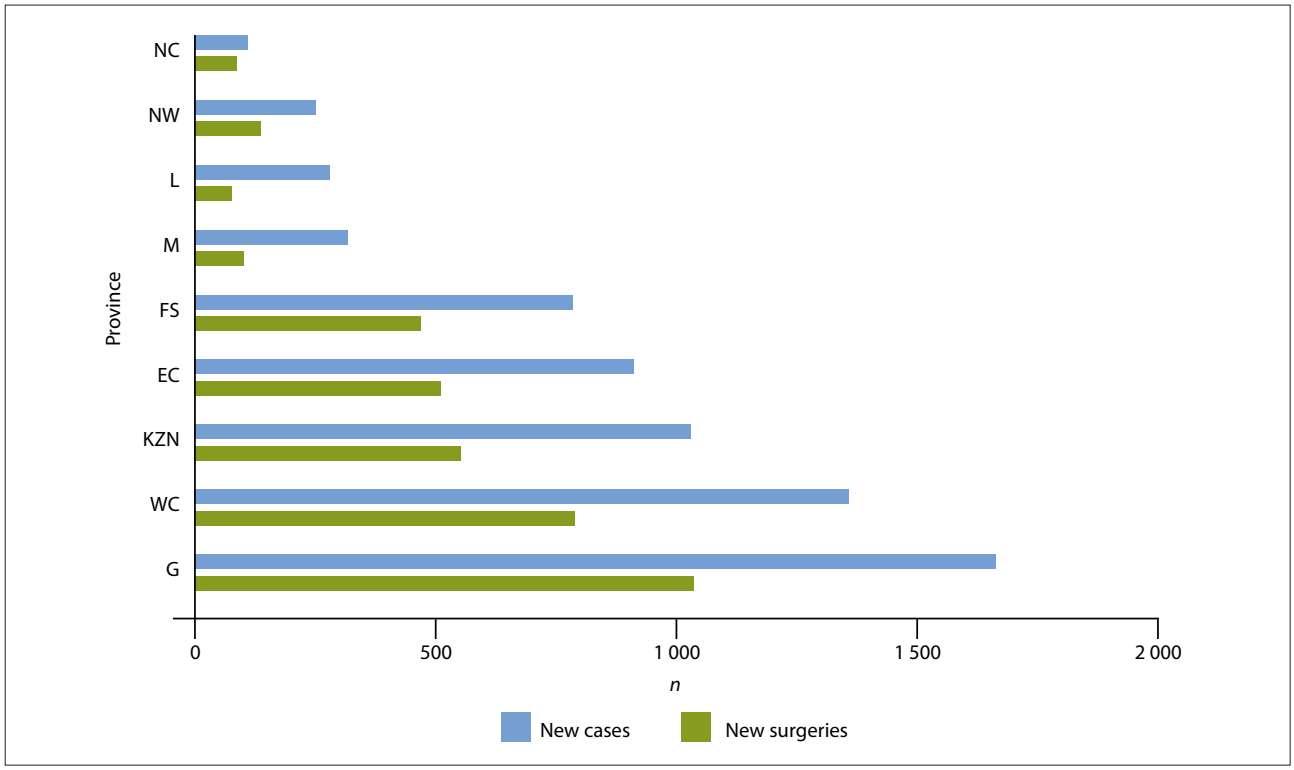

Fig. 4. Clinician-estimated annual number of breast cancer cases and breast cancer surgeries by province. (EC = Eastern Cape; FS = Free State; G = Gauteng; KZN = KwaZulu-Natal; L = Limpopo; M = Mpumalanga; NW = North West; NC = Northern Cape; WC = Western Cape.)

BCS.[20] A systematic review of female breast surgery in sub-Saharan Africa reported a similarly low rate of BCS, with BCS representing only 27% of surgeries for early breast cancer, and >60% of women receiving TM.[21] However, in the present study, most facilities (79%) reported being able to perform BCS. This finding suggests that adequate surgical capacity exists to provide it. In this context, previously reported low rates of BCS may represent a lack of access to radiotherapy, factors related to patient preference and a high proportion of advanced disease at diagnosis. It is worthwhile to note that the reported availability of a service does not mean that the service produces quality outcomes, and while 79% of facilities reported the capacity to perform BCS, only 30% reported access to an oncoplastic breast surgeon. This is an area for further research.

In this study, only one-third of facilities reported the capacity to perform breast reconstruction surgery. A lack of access to implants/equipment, inadequate surgical expertise and insufficient theatre time were reported barriers to the provision of this service. Consequently, most SA breast cancer patients requiring surgery are not offered breast reconstruction. Lack of reconstructive options, in addition to the impact on survivors' quality of life and fear of disfigurement,[21] is a source of patient hesitancy to present with breast symptoms, potentially contributing to late diagnosis and treatment non-adherence. External breast prostheses should be offered as the minimum standard of care where surgical breast reconstruction is not accessible. However, only 2% of facilities reported access to a prosthetist.

Almost half of the facilities (47%) reported not having access to SLNB, citing lack of access to nuclear medicine and non-availability of consumables (e.g. blue dye) as predominant barriers. The implication is that clinically node-negative patients who are seen at facilities without access to SLNB receive axillary lymph node dissection (ALND) for axillary assessment. ALND carries significant upper limb morbidity, with risks such as sensory loss, decreased range of movement and lymphoedema.[22] Groenewald *et al.*[23] evaluated the application of SLNB and ALND in two breast cancer units in Gauteng Province, SA. Of the node-negative patients in their cohort, 73.3% underwent SLNB, suggesting a high rate of SLNB in facilities that can provide it.

Endocrine therapy has been shown to achieve local control and improve survival outcomes for patients with specific breast cancer subtypes.[7] In this study, most facilities reported access to tamoxifen (86%) and anastrozole (67%), with both agents available at facilities within all nine provinces. HER2-positive tumours constitute ~25% of all early breast cancers,[24] and are associated with a high risk of micro-metastatic disease. The current international standard of care is that trastuzumab (Herceptin) should be considered for all patients with HER2-positive tumours. However, the cost of providing this treatment has limited its use.[25] In this study, only 11 facilities (26%) reported access to trastuzumab, and two of the nine provinces had no access to this medicine.

Waiting times

The proposed national breast cancer guideline advocates that patients should receive their first definitive treatment within 31 days of a breast cancer diagnosis. This study reported a mean waiting time for surgery of 28 days nationally. Two provinces were outliers with much longer delays to surgery, namely the Free State (68 days) and the Western Cape (61 days). Treatment delays of >60 days have adversely affected survival outcomes in advanced breast cancer cases.[26] While longer waiting times may indicate a lack of theatre time and other resource shortages, it may also reflect a higher number of patients who present with early breast cancer and are eligible for surgical intervention.

While these results may be encouraging in suggesting that where surgical services are available, patients can receive guideline-concordant care, it may be that the actual delay comes before the decision to treat, during the pre-hospital phase. A Cape Town-

Table 1. Availability of breast cancer services in South African public healthcare sector facilities (*N*=43)

Service	*n/n* (%)	Access per province (*n*=9)
Facility access to diagnostic modalities		
Core biopsy	43/43 (100)	
FNA	37/43 (86)	
Ultrasound-guided biopsy	33/43 (77)	
Mammogram	33/43 (77)	
Hookwire	16/43 (37)	
MRI	15/43 (35)	
Stereotactic biopsy	14/43 (33)	
Facility access to staging modalities		
Ultrasound	37/43 (86)	
CT scan	38/43 (88)	
MRI	15/43 (35)	
Bone scan	15/43 (35)	
PET scan	9/43 (21)	
Facility access to surgical interventions (per facility; *n*=43)		
Breast-conserving surgery	35/43 (81)	9/9
Sentinel lymph node biopsy	23/43 (53)	8/9
Techniques available (*n*=23)		
Blue dye	14/23 (61)	
Radioisotope tracer	10/23 (43)	
Magnetic tracer	7/23 (30)	
Breast reconstruction	15/43 (35)	6/9
Techniques available (*n*=15)		
Autologous reconstruction	14/15 (93)	
Prosthetic reconstruction	8/15 (53)	
Goldilocks mastectomy	2/15 (13)	
Hormonal/biological agents		
Tamoxifen	37/43 (86)	9/9
Anastrozole	29/43 (67)	9/9
Trastuzumab	11/43 (26)	2/9

FNA = fine needle aspirate; MRI = magnetic resonance imaging; CT = computed tomography; PET = positron emission tomography.

Table 2. Barriers to breast cancer surgical services in South African public healthcare facilities (*N*=43)

Service lacking access	*n/n* (%)
Breast-conserving surgery (*n*=9 lacking access)	
Patients not eligible owing to locally advanced disease/late diagnosis	7/9 (78)
Lack of access to radiotherapy	1/9 (11)
Lack of access to necessary surgical expertise	1/9 (11)
Sentinel lymph node biopsy (*n*=20 lacking access)	
Lack of access to nuclear medicine	18/20 (90)
Lack of access to blue dye	15/20 (75)
Late diagnosis	6/20 (30)
Lack of access to surgical expertise	2/20 (10)
Other (cost, Gamma probe)	2/20 (10)
Breast reconstruction (*n*=28 lacking access)	
Lack of access to implants/equipment	22/28 (79)
Lack of access to surgical expertise	22/28 (79)
Lack of access to theatre time	13/28 (46)
Late diagnosis	13/28 (46)

based study of breast cancer patients reported a median time from symptom onset to first treatment of 110 days, with a striking 50% of participants making ≥4 visits to a primary healthcare facility before an appropriate referral to a tertiary one-stop breast clinic.[27] In sub-Saharan Africa, the financial impact of travel and treatment, concerns around stigma, fears of disfigurement and treatment side-effects, and preferential use of traditional medicine have been found to contribute to patient-related delays in seeking care.[28-30]

Multidisciplinary team

In this study, most facilities (79%) reported using recommendations from an MDT in formulating treatment decisions for breast cancer patients. However, the representation of different MDT members varied across facilities, and ultimately failed to meet the recommendations of the proposed national breast cancer guideline.

The guideline's recommended staffing requirements for the most simplified breast unit require the presence of a radiologist, pathologist and mammographer. Only seven of the 43 facilities (16%) reported having all three specialists at their facility. More specialised breast units must have an oncoplastic surgeon, currently only present at the same seven facilities, and a lymphoedema specialist, present at only three facilities (7%). Oncology services were available at 22 facilities (51%). However, only eight facilities (19%) had access to radiation and medical oncology services. Psychology services and social work were similarly poorly represented, present at only 34% and 32% of facilities, respectively. Genetic services (14%) and dedicated palliative care services (16%) were similarly scarce. Breast cancer nurses were reported to be present at 25% of facilities. The extreme under-representation of essential MDT members is indicative of staffing gaps that must be addressed if the implantation of the proposed national policy is to become a reality.

The Breast Cancer Prevention and Control Policy guideline[7] provides a necessary and centralising vision for what the provision of breast cancer services should look like. However, it currently describes a standard of care not realised by most facilities providing breast cancer services. The allocation of resources in the form of staffing, equipment, training and audit will be essential to support the development of these units to meet the described standard of care.

Study limitations

This study relied on estimated data from individual clinicians involved in the provision of breast cancer surgical services within the public healthcare sector, and is vulnerable to reporting bias. The study reported the availability of specific services across different facilities; however, as patient outcome data were not surveyed, limited inferences can be made regarding the quality of care between facilities. This is an area for further research.

The study is limited by the retrospective nature of the data collected and does not include services that may have been developed since 2019.

Conclusion

This study provides the first comprehensive review of breast cancer surgical services in the SA public healthcare sector. Broad disparities exist in access to essential staging and diagnostic modalities between facilities in different provinces. In addition, there is limited capacity to provide key surgical interventions, particularly SLNB and breast reconstruction. These findings suggest that breast cancer care in most settings within the public healthcare sector is not concordant with proposed national guidelines, with the exception of several established breast units in large urban centres. There is an urgent

need to address the deficits in the distribution and capacity of breast cancer surgical services in SA, and to close the gap between policy and implementation. This research should inform the further design and planning of services by relevant stakeholders to improve breast cancer care and outcomes.

Data availability. The data used for this study are available from the corresponding author on request.

Declaration. This study was conducted as part of LM's MSc (Global Surgery) at the University of Cape Town.

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Author contributions. All authors contributed towards study conceptualisation and design. LM performed data collection and analyses, and drafted the manuscript. All authors provided revisions and approved the final manuscript.

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Conflicts of interest. None.

1. Azubuike SO, Muirhead C, Hayes L, McNally R. Rising global burden of breast cancer: The case of sub-Saharan Africa (with emphasis on Nigeria) and implications for regional development: A review. World J Surg Oncol 2018;16(1):63. https://doi.org/10.1186/s12957-018-1345-2
2. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2021;71(3):209-249. https://doi.org/10.3322/caac.21660
3. Allemani C, Matsuda T, Di Carlo V, et al. Global surveillance of trends in cancer survival 2000-14 (CONCORD-3): Analysis of individual records for 37 513 025 patients diagnosed with one of 18 cancers from 322 population-based registries in 71 countries. Lancet 2018;391:1023-1075. https://doi.org/10.1016/S0140-6736(17)33326-3
4. Rayne S, Burger S, van Straten S, Biccard B, Phaahla MJ, Smith M. Setting the research and implementation agenda for equitable access to surgical care in South Africa. BMJ Glob Health 2017;2(2):e000170. https://doi.org/10.1136/bmjgh-2016-000170
5. Bloom DE, Cafiero ET, Jané-Llopis, et al. The global economic burden of noncommunicable diseases. Geneva: World Economic Forum and Harvard School of Public Health, 2011. https://www3.weforum.org/docs/WEF_Harvard_HE_GlobalEconomicBurdenNonCommunicableDiseases_2011.pdf (accessed 27 May 2021).
6. McCormack V, McKenzie F, Foerster M, et al. Breast cancer survival and survival gap apportionment in sub-Saharan Africa (ABC-DO): A prospective cohort study. Lancet Glob Health 2020;8(9):e1203-e1212. https://doi.org/10.1016/S2214-109X(20)30261-8
7. National Department of Health, South Africa. Breast Cancer Prevention and Control Policy. Pretoria: NDoH, 2017. https://extranet.who.int/ncdccs/Data/ZAF_B5_breast cancer policy.pdf (accessed 19 April 2021).
8. Dey P, Bundred N, Gibbs A, et al. Costs and benefits of a one stop clinic compared with a dedicated breast clinic: Randomised controlled trial. BMJ 2002;324(7336):507. https://doi.org/10.1136/bmj.324.7336.507
9. South Africa. National Health Act No. 61 of 2003. Government Gazette no. 35101. https://www.gov.za/sites/default/files/gcis_document/201409/35101rg9701gon185a.pdf (accessed 15 October 2022).
10. Humanitarian Data Exchange. Health facilities in sub-Saharan Africa. Humdata, 2020. https://data.humdata.org/dataset/health-facilities-in-subsaharan-africa (accessed 22 August 2022).
11. Wikimedia Commons. South Africa 2016 population density by municipality. Wikimedia Commons, 2020. https://commons.wikimedia.org/wiki/File:South_Africa_2016_population_density_by_municipality.svg (accessed 24 November 2022).
12. Ambroggi M, Biasini C, Del Giovane C, Fornari F, Cavanna L. Distance as a barrier to cancer diagnosis and treatment: Review of the literature. Oncologist 2015;20(12):1378-1385.
13. O'Neil DS, Chen WC, Ayeni O, et al. Breast cancer care quality in South Africa's public health system: An evaluation using American Society of Clinical Oncology/National Quality Forum measures. J Glob Oncol 2019;5:1-16. https://doi.org/10.1200/JGO.19.00171
14. Knapp GC, Tansley G, Olasehinde O, et al. Geospatial access predicts cancer stage at presentation and outcomes for patients with breast cancer in southwest Nigeria: A population-based study. Cancer 2020;127(9):1432-1438. https://doi.org/10.1002/cncr.33394
15. Dickens C, Joffe M, Jacobson J, et al. Stage at breast cancer diagnosis and distance from diagnostic hospital in a periurban setting: A South African public hospital case series of over 1,000 women. Int J Cancer 2014;135(9):2173-2182. https://doi.org/10.1002/ijc.28861
16. Lince-Deroche N, Rensburg C, Masuku S, Rayne S, Benn C, Holele P. Breast cancer in South Africa: Developing an affordable and achievable plan to improve detection and survival. In: Health Systems Trust. South African Health Review 2017. Durban,: Health Systems Trust, 2017:181-188. https://www.hst.org.za/publications/South%20African%20Health%20Reviews/17_Breast%20cancer%20in%20South%20Africa_developing%20an%20affordable%20and%20achievable%20plan%20to%20improve%20detection%20and%20survival.pdf (accessed 13 March 2026).
17. Sinha S, Bhatia R, Narasimamurthy M, Rayne S, Grover S. Epidemiology of breast cancer presentation in Botswana, South Africa, and the United States. J Surg Res 2022;279:5339. https://doi.org/10.1016/j.jss.2022.04.071
18. Sun L, Legood R, Dos-Santos-Silva I, Mathur Gaiha S, Sadique Z. Global treatment costs of breast cancer by stage: A systematic review. PLoS ONE 2018;13(11):e0207993. https://doi.org/10.1371/journal.pone.0207993
19. Dalwai E, Buccimazza I. System delays in breast cancer. S Afr J Surg 2015;53(2):40-42. https://doi.org/10.7196/SAJSNEW.7741
20. Cubasch H, Joffe M, Ruff P, et al. Breast conservation surgery versus total mastectomy among women with localized breast cancer in Soweto, South Africa. PLoS ONE 2017;12(8):e0182125. https://doi.org/10.1371/journal.pone.0182125
21. Amouzou KS, Ketevi AA, Sambiani DM, Caroli A. Female breast cancer in sub-Saharan Africa: A PRISMA-S-compliant systematic review of surgery. J Surg Oncol 2022;125(3):336-351. https://doi.org/10.1002/jso.26720
22. Gu J, Groot G, Boden C, Busch A, Holtslander L, Lim H. Review of factors influencing women's choice of mastectomy versus breast conserving therapy in early-stage breast cancer: A systematic review. Clin Breast Cancer 2018;18(4):539-554. https://doi.org/10.1016/j.clbc.2017.12.013
23. Groenewald C, Cubasch H, Mannell A, Ayeni O, Nietz S. Axillary lymph node dissection for patients with invasive breast cancer at Charlotte Maxeke and Chris Hani Baragwanath Academic Hospitals. S Afr J Surg 2019;57(4):18-24.
24. Dickens C, Duarte R, Zietsman A, et al. Racial comparison of receptor-defined breast cancer in Southern African women: Subtype prevalence and age-incidence analysis of nationwide cancer registry data. Cancer Epidemiol Biomarkers Prev 2014;23(1):2311-2321. https://doi.org/10.1158/1055-9965.EPI-14-0603
25. Wiseman RJ, Riddin J, Jugathpal J, Parrish AG, Ruff P, Blockman M. Adjuvant trastuzumab in early HER2-positive breast cancer: Journeying towards the optimal duration of therapy in South Africa. S Afr Med J 2020;110(4):271-273. https://doi.org/10.7196/SAMJ.2020.v110i4.14621
26. McLaughlin JM, Anderson RT, Ferketich AK, Seiber EE, Balkrishnan R, Paskett ED. Effect on survival of longer intervals between confirmed diagnosis and treatment initiation among low-income women with breast cancer. J Clin Oncol 2012;30(36):4493-4500. https://doi.org/10.1200/JCO.2012.39.7695
27. Moodley J, Cairncross L, Naiker T, Constant D. From symptom discovery to treatment – women's pathways to breast cancer care: A cross-sectional study. BMC Cancer 2018;18(1):312. https://doi.org/10.1186/s12885-018-4219-7
28. Foerster M, Anderson BO, McKenzie F, et al. Inequities in breast cancer treatment in sub-Saharan Africa: Findings from a prospective multi-country observational study. Breast Cancer Res 2019;21(1):93. https://doi.org/10.1186/s13058-019-1174-4
29. Sutter SA, Slinker A, Balumuka DD, Mitchell KB. Surgical management of breast cancer in Africa: A continent-wide review of intervention practices, barriers to care, and adjuvant therapy. J Glob Oncol 2016;3(2):162-168. https://doi.org/10.1200/JGO.2016.003095
30. Lambert M, Mendenhall E, Kim AW, Cubasch H, Joffe M, Norris SA. Health system experiences of breast cancer survivors in urban South Africa. Women Health 2020;16:1745506520949419. https://doi.org/10.1177/1745506520949419

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