

<https://doi.org/10.46344/JBINO.2025.v14i05.05>

THE ROLE OF PUBLIC HEALTH SURVEILLANCE IN SHAPING BREAST CANCER OUTCOMES

*Emmanuel Ifeanyi Obeagu

Department of Biomedical and Laboratory Science, Africa University, Zimbabwe, E-mail: emmanuelobeagu@yahoo.com, ORCID: 0000-0002-4538-0161

ABSTRACT

Breast cancer remains a leading cause of morbidity and mortality among women globally, with substantial disparities in outcomes between high- and low-resource settings. Public health surveillance—the systematic collection, analysis, and dissemination of health data—provides critical insights into incidence, mortality, risk factors, and screening uptake, enabling evidence-based strategies for prevention, early detection, and treatment. This narrative review examines the role of public health surveillance in shaping breast cancer outcomes, highlighting its contributions to epidemiological understanding, program planning, resource allocation, and policy development. By integrating surveillance data into comprehensive cancer control initiatives, health systems can identify high-risk populations, improve early detection, optimize treatment pathways, and evaluate intervention effectiveness. Strengthening surveillance infrastructure, particularly in low-resource settings, is essential for reducing disparities and enhancing the global impact of breast cancer control efforts.

Keywords: Breast cancer, Public health surveillance, Epidemiology, Early detection, Health policy

Introduction

Breast cancer is the most commonly diagnosed cancer among women worldwide and a leading cause of cancer-related death. In 2020, over 2.3 million new cases were reported globally, resulting in nearly 685,000 deaths. While advances in diagnostics, treatment, and public awareness have improved outcomes in high-resource settings, disparities remain pronounced in low- and middle-income countries (LMICs), where late-stage diagnosis, limited healthcare access, and inadequate health infrastructure contribute to higher mortality [1-2]. Public health surveillance plays a pivotal role in addressing these disparities by systematically collecting, analyzing, and disseminating data on breast cancer incidence, mortality, risk factors, screening participation, and treatment outcomes. These data provide the evidence base for designing and implementing targeted interventions, allocating resources efficiently, and formulating policies that improve early detection and care. Surveillance also enables monitoring of program effectiveness and identification of emerging trends, ensuring that public health strategies remain responsive to changing epidemiological patterns [3-5]. Effective surveillance systems, including population-based cancer registries, hospital reporting networks, and vital statistics, allow health authorities to track disease patterns, evaluate screening and treatment programs, and prioritize high-risk populations. By integrating these data into national and regional cancer control strategies, health systems can optimize

prevention, early detection, and treatment efforts. Moreover, surveillance informs research, supports policy advocacy, and strengthens health system planning, collectively contributing to improved breast cancer outcomes [6-8]. This narrative review explores the role of public health surveillance in shaping breast cancer outcomes, highlighting its contributions to epidemiology, early detection, program evaluation, and policy development. It also discusses challenges in surveillance implementation and opportunities for strengthening data systems to reduce disparities and enhance the effectiveness of breast cancer control worldwide.

Epidemiology of Breast Cancer: Insights from Surveillance

Public health surveillance provides essential insights into the epidemiology of breast cancer, enabling health authorities to understand patterns of incidence, prevalence, and mortality across populations. Population-based cancer registries, hospital reporting systems, and vital statistics form the backbone of surveillance, offering longitudinal data that reveal temporal trends and geographic variations in disease burden [9-10]. Epidemiological data highlight significant disparities in breast cancer outcomes. High-income countries generally report higher incidence rates but lower mortality, reflecting widespread screening, early detection, and access to advanced treatment. Conversely, many low- and middle-income countries (LMICs) exhibit lower reported incidence but higher mortality, often due to late-stage diagnosis, limited diagnostic capacity, and

inadequate access to care. Surveillance data also illuminate differences by age, ethnicity, socioeconomic status, and urban-rural residence, enabling targeted interventions for populations at greatest risk [11-13].

Beyond basic incidence and mortality statistics, surveillance helps identify risk factor patterns within populations. Data on reproductive history, hormonal exposure, obesity, family history, and genetic predisposition provide valuable context for designing prevention strategies. Tracking these factors over time allows public health authorities to anticipate shifts in disease burden and adapt intervention strategies accordingly [14-15]. Moreover, surveillance informs projections for healthcare planning. By analyzing trends in incidence and mortality, health systems can estimate future demand for screening services, diagnostic infrastructure, and treatment facilities. This foresight is crucial for allocating resources efficiently and developing national cancer control programs that are evidence-based and context-specific [15-16].

Surveillance for Early Detection and Screening Programs

Public health surveillance plays a crucial role in guiding early detection and breast cancer screening programs. By systematically tracking population-level data on screening coverage, participation rates, and diagnostic follow-up, surveillance systems provide the evidence needed to design effective, targeted interventions [17]. Data derived from surveillance help identify gaps in screening access and adherence, highlighting populations at higher risk due to

geographic, socioeconomic, or cultural barriers. For example, surveillance may reveal low mammography uptake in rural areas, prompting mobile clinic initiatives or community-based screening programs. Similarly, disparities in age-specific screening participation can inform tailored public health messaging and outreach strategies [18-19].

Surveillance also enables evaluation of screening program effectiveness. By linking screening data to diagnostic outcomes, policymakers and program managers can assess whether screening guidelines—including recommended age ranges and screening intervals—are achieving early detection goals. Continuous monitoring ensures that programs adapt to emerging trends and changing population needs, maximizing the impact of early detection initiatives [20-21]. Moreover, surveillance informs resource allocation and prioritization. Understanding where and among whom breast cancer is most prevalent allows health authorities to focus investments in diagnostic infrastructure, training of healthcare personnel, and community outreach programs. This targeted approach improves efficiency, ensuring that limited resources yield the greatest public health benefit [22-23]. Integrating surveillance with screening programs strengthens continuity of care. Tracking participants from initial screening through diagnosis and treatment follow-up reduces loss to care and enhances overall program outcomes. In low- and middle-income countries, where infrastructure and resources are limited, such integration is critical for translating awareness into actionable health behaviors and

measurable improvements in survival [24-25].

Guiding Health Policy and Resource Allocation

Public health surveillance is essential for informing health policy and guiding the allocation of resources in breast cancer control. Accurate, timely, and population-specific data provide the evidence needed to prioritize interventions, develop national cancer control programs, and ensure equitable access to prevention, diagnosis, and treatment services [26]. Surveillance data enable policymakers to identify high-risk populations and geographic areas with elevated incidence or mortality. This evidence supports targeted interventions, such as intensified screening campaigns, community education programs, and allocation of diagnostic and treatment resources where they are most needed. For example, regions with low screening uptake or high rates of late-stage diagnosis may be prioritized for mobile mammography units, community health worker engagement, or subsidized diagnostic services [27-28].

Moreover, surveillance informs the development of policy frameworks, including guidelines for age-specific screening, treatment protocols, and survivorship care. By monitoring trends in incidence, mortality, and survival, health authorities can evaluate the effectiveness of existing policies and adjust strategies to reflect emerging epidemiological patterns. Surveillance also supports health financing decisions, ensuring that investments in breast cancer control are evidence-driven and maximize population health impact [29]. In addition, integrating surveillance

into policy planning facilitates accountability and continuous program improvement. Metrics derived from surveillance—such as screening coverage, stage at diagnosis, and treatment adherence—allow policymakers to assess progress toward national and international targets, identify gaps, and implement corrective measures [30]. Surveillance data contribute to broader advocacy efforts. Evidence of disparities in outcomes or access can be leveraged to mobilize political will, secure funding, and strengthen multisectoral collaborations aimed at reducing the breast cancer burden.

Monitoring Outcomes and Program Evaluation

Public health surveillance is critical for monitoring breast cancer outcomes and evaluating the effectiveness of interventions across the continuum of care. By systematically tracking data on survival rates, stage at diagnosis, treatment adherence, recurrence, and mortality, surveillance provides the metrics needed to assess program performance and inform continuous improvement [31]. Surveillance facilitates the evaluation of screening programs by linking participation data with diagnostic and treatment outcomes. This integration allows health authorities to determine whether early detection initiatives are achieving intended goals, such as increasing diagnosis at earlier stages and reducing mortality. For example, trends in stage-specific survival rates can highlight the impact of screening efforts and identify areas where improvements in follow-up care or diagnostic access are needed [32].

Moreover, monitoring outcomes supports research and policy development. Longitudinal surveillance data enable the identification of emerging trends, treatment gaps, and population-specific risk factors. These insights inform evidence-based adjustments to public health strategies, resource allocation, and health policy, ensuring that interventions remain responsive to evolving epidemiological patterns [33]. Program evaluation using surveillance data also enhances accountability and transparency. Health systems can measure progress against national cancer control targets, identify disparities in access and outcomes, and implement corrective measures to address inequities. Additionally, by providing robust evidence of program effectiveness, surveillance supports advocacy and funding decisions, reinforcing the sustainability of breast cancer control initiatives [34]. In resource-limited settings, where health system constraints are more pronounced, surveillance-driven monitoring and evaluation are particularly valuable. They ensure that scarce resources are directed toward high-impact interventions, optimize service delivery, and reduce loss to follow-up, thereby improving survival and quality of life for patients [35].

Conclusion

Public health surveillance is a cornerstone of effective breast cancer control, providing the data necessary to guide prevention, early detection, treatment, and policy decisions. By systematically collecting, analyzing, and disseminating information on incidence, mortality, risk factors, screening participation, and treatment outcomes, surveillance enables

evidence-based interventions that improve breast cancer outcomes across diverse populations. Surveillance informs epidemiological understanding, identifies high-risk populations, guides resource allocation, and supports program evaluation, ensuring that interventions are targeted, equitable, and effective. When integrated with screening initiatives, community engagement, and policy frameworks, surveillance transforms knowledge into actionable strategies, enhancing early detection, treatment access, and survivorship.

References

1. Arnold, M., Morgan, E., Rungay, H., Mafra, A., Singh, D., Laversanne, M., Vignat, J., Gralow, J. R., Cardoso, F., Siesling, S., & Soerjomataram, I. (2022). Current and future burden of breast cancer: Global statistics for 2020 and 2040. *Breast (Edinburgh, Scotland)*, 66, 15–23. <https://doi.org/10.1016/j.breast.2022.08.010>
2. Lei, S., Zheng, R., Zhang, S., Wang, S., Chen, R., Sun, K., Zeng, H., Zhou, J., & Wei, W. (2021). Global patterns of breast cancer incidence and mortality: A population-based cancer registry data analysis from 2000 to 2020. *Cancer communications (London, England)*, 41(11), 1183–1194. <https://doi.org/10.1002/cac2.12207>
3. Obeagu E. I. (2025). N2 Neutrophils and Tumor Progression in Breast Cancer: Molecular Pathways and Implications. *Breast cancer (Dove Medical Press)*, 17, 639–651. <https://doi.org/10.2147/BCTT.S542787>
4. Obeagu, E. I., & Obeagu, G. U. (2024). Exploring the profound link: Breastfeeding's impact on alleviating the burden of breast cancer - A review. *Medicine*, 103(15),

- e37695.
<https://doi.org/10.1097/MD.000000000000037695>
5. Wheeler, S. B., Reeder-Hayes, K. E., & Carey, L. A. (2013). Disparities in breast cancer treatment and outcomes: biological, social, and health system determinants and opportunities for research. *The oncologist*, 18(9), 986–993. <https://doi.org/10.1634/theoncologist.2013-0243>
 6. Obeagu, E. I., & Obeagu, G. U. (2024). Lymphocyte infiltration in breast cancer: A promising prognostic indicator. *Medicine*, 103(49), e40845. <https://doi.org/10.1097/MD.000000000000040845>
 7. Obeagu, E. I., & Obeagu, G. U. (2024). Exploring neutrophil functionality in breast cancer progression: A review. *Medicine*, 103(13), e37654. <https://doi.org/10.1097/MD.000000000000037654>
 8. Bradley, C. J., Kitchen, S., Bhatia, S., Bynum, J., Darien, G., Lichtenfeld, J. L., Oyer, R., Shulman, L. N., & Sheldon, L. K. (2022). Policies and Practices to Address Cancer's Long-Term Adverse Consequences. *Journal of the National Cancer Institute*, 114(8), 1065–1071. <https://doi.org/10.1093/jnci/djac086>
 9. Obeagu E. I. (2025). Neutrophil-driven tumor inflammation in breast cancer: Pathways and therapeutic implications: A narrative review. *Medicine*, 104(25), e43024. <https://doi.org/10.1097/MD.000000000000043024>
 10. Gbenonsi, G. Y., Martini, J., & Mahieu, C. (2024). An analytical framework for breast cancer public policies in Sub-Saharan Africa: results from a comprehensive literature review and an adapted policy Delphi. *BMC public health*, 24(1), 1535. <https://doi.org/10.1186/s12889-024-18937-5>
 11. Espina, C., Soerjomataram, I., Forman, D., & Martín-Moreno, J. M. (2018). Cancer prevention policy in the EU: Best practices are now well recognised; no reason for countries to lag behind. *Journal of cancer policy*, 18, 40–51. <https://doi.org/10.1016/j.jcpo.2018.09.001>
 12. Obeagu E. I. (2025). The selenium paradox friend or foe in breast cancer? *Annals of medicine and surgery* (2012), 87(9), 5569–5577. <https://doi.org/10.1097/MS9.00000000000003464>
 13. Obeagu, E. I., & Obeagu, G. U. (2025). Revolutionizing breast cancer monitoring: emerging hematocrit-based metrics - a narrative review. *Annals of medicine and surgery* (2012), 87(6), 3327–3338. <https://doi.org/10.1097/MS9.00000000000003020>
 14. Shetty M. K. (2010). Screening for breast cancer with mammography: current status and an overview. *Indian journal of surgical oncology*, 1(3), 218–223. <https://doi.org/10.1007/s13193-010-0014-x>
 15. Ponce-Chazarri, L., Ponce-Blandón, J. A., Immordino, P., Giordano, A., & Morales, F. (2023). Barriers to Breast Cancer-Screening Adherence in Vulnerable Populations. *Cancers*, 15(3), 604. <https://doi.org/10.3390/cancers15030604>
 16. Obeagu E. I. (2025). The nutritional equation: decoding diet's influence on breast cancer risk and progression - a perspective. *Annals of medicine and surgery* (2012), 87(9), 5528–5534.

- <https://doi.org/10.1097/MS9.00000000000003612>
17. Gbenonsi, G. Y., Martini, J., & Mahieu, C. (2024). An analytical framework for breast cancer public policies in Sub-Saharan Africa: results from a comprehensive literature review and an adapted policy Delphi. *BMC public health*, 24(1), 1535. <https://doi.org/10.1186/s12889-024-18937-5>
 18. Obeagu, E. I., & Maibouge Tanko, M. S. (2025). Iron metabolism in breast cancer: mechanisms and therapeutic implications: a narrative review. *Annals of medicine and surgery* (2012), 87(6), 3403–3409. <https://doi.org/10.1097/MS9.00000000000003173>
 19. Wilkinson, L., & Gathani, T. (2022). Understanding breast cancer as a global health concern. *The British journal of radiology*, 95(1130), 20211033. <https://doi.org/10.1259/bjr.20211033>
 20. Obeagu E. I. (2025). Thromboinflammatory pathways in breast cancer: clinical and molecular insights into venous thromboembolism risk - a narrative review. *Annals of medicine and surgery* (2012), 87(9), 5822–5828. <https://doi.org/10.1097/MS9.00000000000003644>
 21. Kitaw, T. A., Tilahun, B. D., Zemariam, A. B., Getie, A., Bizuayehu, M. A., & Haile, R. N. (2025). The financial toxicity of cancer: unveiling global burden and risk factors - a systematic review and meta-analysis. *BMJ global health*, 10(2), e017133. <https://doi.org/10.1136/bmjgh-2024-017133>
 22. Obeagu, E. I., & Obeagu, G. U. (2024). Predictive models and biomarkers for survival in stage III breast cancer: a review of clinical applications and future directions. *Annals of medicine and surgery* (2012), 86(10), 5980–5987. <https://doi.org/10.1097/MS9.00000000000002517>
 23. Bhatia, S., Landier, W., Paskett, E. D., Peters, K. B., Merrill, J. K., Phillips, J., & Osarogiagbon, R. U. (2022). Rural-Urban Disparities in Cancer Outcomes: Opportunities for Future Research. *Journal of the National Cancer Institute*, 114(7), 940–952. <https://doi.org/10.1093/jnci/djac030>
 24. Malope, S. D., Norris, S. A., & Joffe, M. (2024). Culture, community, and cancer: understandings of breast cancer from a non-lived experience among women living in Soweto. *BMC women's health*, 24(1), 594. <https://doi.org/10.1186/s12905-024-03431-2>
 25. Sítima, G., Galhardo-Branco, C., & Reis-Pina, P. (2024). Equity of access to palliative care: a scoping review. *International journal for equity in health*, 23(1), 248. <https://doi.org/10.1186/s12939-024-02321-1>
 26. Kreuter, M. W., Thompson, T., McQueen, A., & Garg, R. (2021). Addressing Social Needs in Health Care Settings: Evidence, Challenges, and Opportunities for Public Health. *Annual review of public health*, 42, 329–344. <https://doi.org/10.1146/annurev-publhealth-090419-102204>
 27. Aslam, A., Mustafa, A. G., Hussnain, A., Saeed, H., Nazar, F., Amjad, M., Mahmood, A., Afzal, A., Fatima, A., & Alkhalidi, D. K. (2024). Assessing Awareness, Attitude, and Practices of Breast Cancer Screening and Prevention Among General Public and Physicians in Pakistan: A Nation With the Highest Breast Cancer Incidence in Asia. *International journal of breast cancer*, 2024, 2128388. <https://doi.org/10.1155/2024/2128388>

28. Alrosan, A. Z., Alwidyan, T., Heilat, G. B., Rataan, A. O., Madae'en, S., Alrosan, K., Awwad, F. S., & Ali, T. (2025). Knowledge and awareness of breast cancer signs and symptoms among Jordanian women. *Future science OA*, 11(1), 2510871. <https://doi.org/10.1080/20565623.2025.2510871>
29. Turkson-Ocran, R. N., Nkimbeng, M., Erol, D., Hwang, D. A., Aryitey, A. A., & Hughes, V. (2022). Strategies for Providing Culturally Sensitive Care to Diverse Populations. *Journal of Christian nursing : a quarterly publication of Nurses Christian Fellowship*, 39(1), 16–21. <https://doi.org/10.1097/CNJ.0000000000000900>
30. Wakefield, M. A., Loken, B., & Hornik, R. C. (2010). Use of mass media campaigns to change health behaviour. *Lancet (London, England)*, 376(9748), 1261–1271. [https://doi.org/10.1016/S0140-6736\(10\)60809-4](https://doi.org/10.1016/S0140-6736(10)60809-4)
31. AlMutawah, K., Taqi, G., Radhwan, S., AlMutairi, A., AlHussainan, A., Faraj, M., & AlBaloul, A. H. (2025). Knowledge and awareness of breast cancer symptoms, risk factors, and screening barriers among women in Kuwait: a cross-sectional study. *BMC women's health*, 25(1), 448. <https://doi.org/10.1186/s12905-025-03994-8>
32. Gbenonsi, G. Y., Martini, J., & Mahieu, C. (2024). An analytical framework for breast cancer public policies in Sub-Saharan Africa: results from a comprehensive literature review and an adapted policy Delphi. *BMC public health*, 24(1), 1535. <https://doi.org/10.1186/s12889-024-18937-5>
33. Al Hasan, S. M., Bennett, D. L., & Toriola, A. T. (2025). Screening programmes and breast cancer mortality: an observational study of 194 countries. *Bulletin of the World Health Organization*, 103(8), 470–483. <https://doi.org/10.2471/BLT.24.292529>
34. Iqbal J. (2025). Women-Centric Breast Cancer Care in Low- and Middle-Income Countries: Challenges, Solutions, and a Roadmap for Equity. *Cancer control : journal of the Moffitt Cancer Center*, 32, 10732748251378804. <https://doi.org/10.1177/10732748251378804>
35. Caldwell, H. A. T., Yusuf, J., Carrea, C., Conrad, P., Embrett, M., Fierlbeck, K., Hajizadeh, M., Kirk, S. F. L., Rothfus, M., Sampalli, T., Sim, S. M., Tomblin Murphy, G., & Williams, L. (2024). Strategies and indicators to integrate health equity in health service and delivery systems in high-income countries: a scoping review. *JB I evidence synthesis*, 22(6), 949–1070. <https://doi.org/10.11124/JBIES-23-00051>