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Reducing Breast Cancer Disparities with Precision Public Health:

A New Strategy to Improve Prevention and Advance Health Equity in Delaware Hotspots

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Abstract

While Black and White women are diagnosed with breast cancer (BC) at similar rates, Black women die from BC at a 40% higher rate. This disparity is even more pronounced for younger Black women, who die from BC at nearly twice the rate as younger White women. Black-White differences in BC mortality are largely attributable to health care and tumor biology factors. Black women face greater barriers to accessing BC screening and are twice as likely to be diagnosed with the aggressive triple-negative breast cancer (TNBC) subtype. Delaware leads the US for the incidence of late-stage BC diagnosed among younger women and TNBC. This commentary begins with a discussion of precision public health, an emerging framework that builds on and complements recent advances in precision medicine. Next, a new precision public health initiative designed to reduce BC disparities in Delaware by targeting local hotspots with prevention interventions is presented. Finally, next steps are considered for implementation, evaluation, and new research activities.

Introduction: The Emergence of Precision Public Health

Precision medicine is an innovative approach to disease prevention and treatment that personalizes care to individual variability in genetics, environment, and behavior.[1] In this way, precision medicine improves upon "one size fits all" treatments developed for the "average patient." Early advances in precision medicine largely focused on the development of gene-targeted therapies that can more accurately kill cancer cells while sparing healthy cells that are often harmed with more conventional cancer treatments (e.g., chemotherapy).[2] Although it is the case that genetic alterations are at the root of cancer etiology, most of these alterations represent accumulated genomic damage incurred from environmental (e.g., pollution) and behavioral (e.g., smoking) exposures rather than heritable factors.[1] Therefore, advances in precision medicine going forward will increasingly personalize care to the full range of factors that influence health—notably exposures that largely operate outside the clinic walls.

Precision public health represents an emerging approach that both draws on and complements precision medicine.[3] *Whereas precision medicine personalizes care to individual characteristics, precision public health personalizes prevention to the context of disease*. It is well established that carcinogenic and other adverse exposures are more likely to cluster geographically, particularly in areas with larger proportions of low-income and racial/ethnic minority residents.[4] By leveraging big data and new advances in geospatial methods and other analytic approaches, precision public health interventions can be targeted to well-defined geographies (i.e., "neighborhoods") to improve disease prevention for subpopulations with disparate health outcomes. As one illustration of this approach, Lynch and colleagues recently drew on

Pennsylvania Cancer Registry and U.S. Census data to identify neighborhoods with greater risk for liver cancer.[5] Because the leading risk factors for liver cancer are potentially modifiable (i.e., behaviors that increase the transmission of Hepatitis B and C), identifying high-risk neighborhoods can facilitate the optimal allocation of community-based prevention resources (e.g., harm reduction programs).

Replicating a precision public health approach across multiple high-priority neighborhoods can improve population health and advance health equity across larger geographies. With that vision in mind, the objective of this commentary is to describe a precision public health initiative designed to reduce racial disparities in breast cancer (BC) by targeting hotspots here in Delaware. This commentary will briefly review the epidemiological data on BC disparities nationally and locally before describing new activities designed to reverse those trends in the First State.

Breast Cancer Disparities: National and Delaware Trends

Nationwide, Black and White women are diagnosed with BC at similar rates (127.8 vs. 133.7 100,000) but Black women die from BC at a 40% higher rate (27.6. vs. 19.7 per 100,000).[6] This disparity is even more pronounced among younger women: before age 50, Black women die from BC at nearly twice the rate as White women.[6] The Black-White difference in BC mortality among younger women is largely explained by health care and tumor biology factors.[7] Black women face greater barriers to accessing BC screening and are therefore more likely to be diagnosed at an advanced stage.[8,9] In addition, Black women are twice as likely to be diagnosed with triple-negative breast cancer (TNBC), the most aggressive BC subtype that is more likely to present at a younger age and advanced stage.[10] As we have previously reported, residentially segregated neighborhoods have less access to mammography facilities[11] and have greater exposure to the environmental conditions linked to the more aggressive tumor biology observed among younger Black women.[12] This includes living in neighborhoods that are proximal to industrial plants and high-volume roadways, have less healthy food environments and greater densities of liquor stores, and have limited supports for breastfeeding. These environmental conditions lead to greater exposure to pollution, metabolic conditions, and alcohol use, as well as lower rates of breastfeeding, which are all BC risk factors.

Unfortunately, these trends are even more evident here in Delaware. *Our state leads the US in the incidence of late-stage BC among women under age 50*,[13] *the incidence of TNBC overall and among Black women*,[14] *and alcohol-attributable BC*.[15] While quite concerning, there are clear steps we can take to improve primary and secondary prevention, reduce the overall burden of BC, and close racial disparities in BC mortality. Delaware is certainly no stranger to advancing health equity. About a decade ago, stakeholders from multiple sectors worked collectively to eliminate the disparity in colorectal cancer.[16] We are now poised to repeat that success with BC.

A Call to Action: Addressing Breast Cancer Disparities Statewide

Last year, as part of a group of concerned Delaware clinicians, community advocates, and researchers, we issued a call to action directed at reducing racial disparities in breast cancer.[17] Drawing on the lessons learned from the colorectal cancer success, we recommended two evidence-based strategies. First, we called for new policies and processes that would ensure all Delaware women of average risk be advised to initiate BC screening at age 40. When the US Preventive Services Task Force (USPSTF) updated their BC screening guidelines earlier this

year, they joined several other medical organizations in recommending that screening begin at age 40, down from age 50 in their prior recommendation.[18] The USPSTF pointed to an increasing rate of BC among younger women, and the racial disparities among this age group, as justification for updating their recommended age of screening initiation. However, it is not sufficient to simply advise women given the evidence that Black women disproportionately face structural barriers to accessing mammography, resulting in 20% lower odds of completing screening as recommended.[19] Therefore, we called for targeted strategies developed specifically for Black women to ensure equity in BC screening.[17]

Our second recommended strategy was to conduct formal BC risk assessments for women prior to screening age. Whereas the recommendation to initiate BC screening at age 40 applies to women of *average risk*, the American College of Radiology and the Society of Breast Imaging recommend risk assessments before age 30 to identify women at elevated risk for BC.[20] Women at greater risk for BC include those with a 1) known genetic predisposition (e.g., *BRCA1* or *BRCA2*), 2) strong family history even without a known pathogenic genetic variant, 3) prior treatment with chest or mantle radiation, 4) prior history of BC or lobular neoplasia, and 5) dense breasts. In addition to taking a comprehensive family history to determine if a woman should be referred to genetic testing to confirm the presence of a variant, multiple BC risk "calculators" have been validated to aid in conducting a risk assessment.[20] Women identified as being at elevated risk may be recommended to initiate breast screening before age 40, offered supplemental forms of imaging (e.g., ultrasound), and provided prophylactic treatments.[20] In addition, risk assessments can be opportunities to address other potentially modifiable risk factors (e.g., alcohol use).

Operationalizing a Precision Public Health Approach in Delaware

Earlier this year, our group reported on the detection of two hotspots of advanced BC in New Castle County, Delaware.[21] We focused on stage-at-diagnosis because it is an important predictor of BC outcomes including mortality. One hotspot was in the northeast part of Wilmington, approximately corresponding to the Riverside community. In this hotspot, 55% of cases were diagnosed at an advanced stage, compared to 44% for the county. Approximately 96% of the women with BC in this hotspot were Black, higher than the 89% for the general population in this area. This indicates that even in this highly segregated community, Black women were overrepresented among advanced BC cases. The second hotspot approximately corresponded to Middletown, where we observed a greater rate of advanced BC specifically among women under age 50. Black women were again overrepresented in this hotspot, accounting for 44% of the cases compared to 29% of the general population.

We are now conducting follow-up analyses to better understand which factors are driving these hotspots. In general, areas with higher rates of advanced BC may reflect 1) lower rates of screening mammography and/or 2) higher rates of more aggressive disease (e.g., TNBC) secondary to adverse exposures. While work is underway to better understand Middletown, our ongoing analyses of BC patient records from the Wilmington hotspot have produced instructive findings. First, the preliminary results showed that fewer than one-third of the women diagnosed with advanced BC were detected with breast screening compared to 63% of those diagnosed at an earlier stage. Stated differently, more than two-thirds of these women were detected clinically after palpating a mass or experiencing other physical symptoms. Because aggressive BC grows more quickly, it can present in the interval between screenings for women who complete annual

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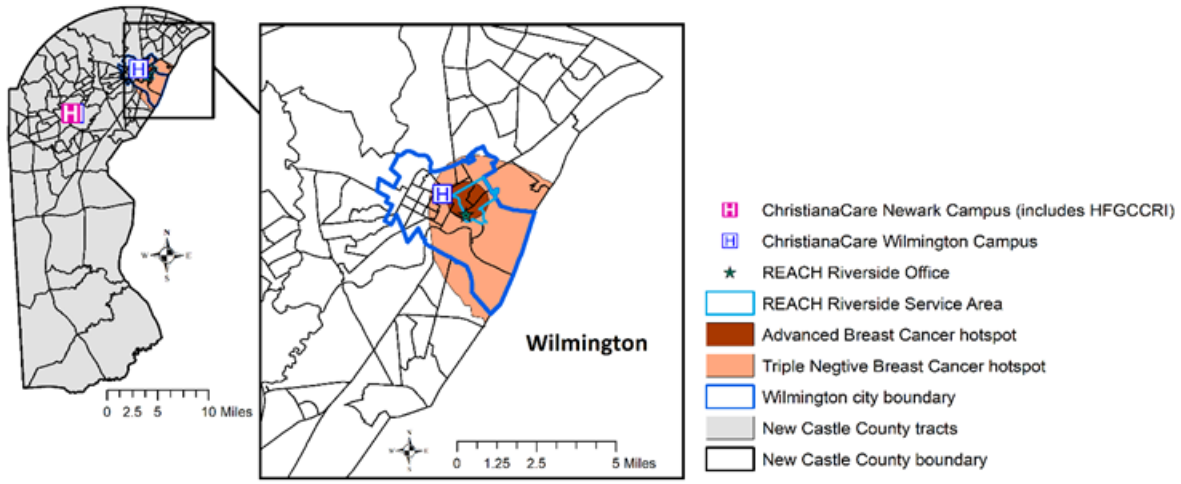
mammograms, leading to a clinical vs. screening method of detection. Indeed, the Wilmington advanced BC hotspot falls within a larger geographic area that we previously identified as a hotspot for TNBC (Figure 1).[22] Therefore, we examined the prior history of screening for BC patients in this hotspot and found that fewer than a half of the advanced BC cases had ever completed a mammogram, compared to 67% of those diagnosed at an earlier stage. Given the high rates of clinical detection paired with low rates of prior mammography for advanced BC patients in this hotspot, there is a clear opportunity to improve screening uptake in this neighborhood. Furthermore, regardless of stage-at-diagnosis, approximately one-third of the BC cases from this hotspot had a first-degree relative with a history of breast or ovarian cancer but were not referred to genetic counseling prior to their diagnosis. The high rates of unaddressed family history paired with an elevated geographic risk of TNBC underscores the importance of taregting formal BC risk assessments to this hotspot.

Figure 1. Map of New Castle County (Wilmington inset) depicting the location of an advanced breast cancer hotspot, embedded within a larger triple negative breast cancer hotspot, that approximately corresponds to the Riverside community.



Now that we have a more precise understanding of the context of elevated rates of advanced BC in the Wilmington hotspot, we have mobilized resources to implement a targeted prevention intervention in this community. We will be drawing on the Achieving Cancer Equity through Identification, Testing, and Screening (ACE-ITS) program developed at the Georgetown Lombardi Comprehensive Cancer Center in Washington, DC, which was designed to serve an urban underresourced population.[23] The ACE-ITS program centers on three interrelated activities. First, women from the target community who are overdue for screening are identified through record reviews and community outreach. Second, all women are offered the opportunity to complete a formal BC risk assessment. Third, women are offered navigation services to help connect them to mammography facilities and any other prevention services that may be indicated based on the risk assessment (e.g., genetic counseling).

To adapt ACE-ITS to the Wilmington hotspot, we will be embedding a community health worker (CHW) within the REACH Riverside organization that serves the Riverside community. CHWs are lay individuals who are trained to help connect members of the community to the health care system.[24] A systematic review of randomized controlled trials found that CHWs can significantly increase BC screening uptake, particularly in urban settings and when the CHW is

racially or ethnically concordant with the patients they were serving.[25] It is for this reason that we aim to recruit a CHW from the Riverside community. REACH Riverside, an acronym for Redevelopment, Education, and Community Health, is one of 27 Purpose Built Communities in the US that work to advance racial equity, economic mobility, and improved health. REACH Riverside directly addresses the upstream social determinants of health by improving access to affordable housing, supporting educational and vocational opportunities across the lifespan, and connecting residents to food and other support programs. While REACH Riverside broadly aims to enhance the health of its community, it did not previously have an explicit focus on improving BC prevention. With support from the Delaware Cancer Consortium, the CHW will complement REACH Riverside's work by identifying and engaging women overdue for screening and other services, connect them with REACH Riverside and other community resources to help overcome structural barriers to screening, and serve as a liaison to screening mammography facilities and other BC prevention services. The long-term objective of this initiative will be to develop competencies, experience, and protocols that can serve to guide the implementation of future precision public health interventions in other Delaware hotspots.

Future Directions

Our next step is to implement this intervention in the Wilmington hotspot and to conduct a formal evaluation. We will assess the impact of the adapted ACE-ITS program on rates of BC screening uptake in Riverside by partnering with the Delaware Health Information Network (DHIN). The DHIN is a health information exchange that manages the largest database of healthcare claims in the state. DHIN data will allow us to estimate the true population rates of BC screening in Riverside relative to comparable control communities, thereby adjusting for any secular trends operating at a more regional level. Over the longer term, we aim to assess rates of advanced BC in Riverside, with the goal of converting Riverside from a hot- to a cold spot.

An additional next step, as referenced above, is to complete analyses to better understand the drivers of the Middletown hotspot. Our preliminary results would suggest that simply increasing BC screening rates may not be sufficient to improve rates of early detection. We have been partnering with community groups to interpret the results, including the Middletown-based Alpha Alpha Tau Omega (AATΩ) Chapter of the Alpha Kappa Alpha Sorority, the oldest Greek-letter organization established by African-American college-educated women. We aim to continue this partnership and co-design a targeted intervention to address the specific factors driving elevated rates of advanced BC among younger women in the Middletown area.

Finally, we aim to extend this precision public health approach to Kent and Sussex Counties. To date, we have limited our hotspot analyses to New Castle County (NCC) based on cancer registry data maintained by the Helen F. Graham Cancer Center & Research Institute (HFGCCRI) at ChristianaCare. Approximately 85% of BC patients who reside in NCC receive their cancer care at the HFGCCRI. This subset of patients are representative of the true population of NCC BC cases in terms of age, race, BC subtype, and stage at diagnosis.[22] Having access to such a large and representative subset of BC patients from NCC has allowed us to accurately estimate hotspots for the full county. However, the HFGCCRI does not provide the same share of care for BC patients in the southern part of the state. To conduct reliable hotspots analyses in Kent and Sussex Counties, we would need access to a more complete statewide data source, which is maintained by the Delaware Cancer Registry. Hotspot analyses require non-deidentified patient data, including residential address, which represent protected health information. Historically, for

privacy protections, this type of data has not been made available in the same ways deidentified data have been. In this era of precision health, where we aim to personalize care to individual and neighborhood characteristics, deidentified data will only take us so far. By working together to develop new approaches to data analysis, we will be able to support initiatives that both protect privacy interests and advance health equity. The wellbeing of our fellow Delawareans, particularly those experiencing disparate health outcomes, depends on it.

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