Germline testing for prostate cancer: current state and opportunities for enhanced access

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Summary

Germline Testing (GT) for prostate cancer (PCA) is now central to PCA care and hereditary cancer assessment, with a rising role in PCA screening approaches. Guidelines have significantly expanded to include testing patients with metastatic PCA, advanced PCA or with high-risk features, and for males with or without PCA with a strong family cancer history to identify hereditary cancer syndromes for patients and their families. However, the expansion of GT has overwhelmed genetic counselling programs, necessitating the development and evaluation of alternate genetic delivery models. Furthermore, disparities in engagement in PCA GT are of major concern for impacting PCA-related and overall cancer-related outcomes for patients and their families. This review focuses on integrating PCA GT guidelines with implementation strategies and addressing PCA GT disparities to help inform current and future strategies to enhance the benefits of GT across populations.

Keywords: Germline testing; Prostate cancer; Genetic counselling; Disparities

Introduction

Prostate cancer (PCA) consistently remains among the highest in both cancer incidence and mortality affecting US males.[1] The treatment of metastatic, castration-resistant PCA (mCRPC) has been revolutionised by precision medicine. Treatment for mCRPC now centres on germline testing (GT) to inform options for PARP inhibitors upfront or upon progression for patients who carry pathogenic/likely pathogenic variants (P/LPVs) in host of genes including *BRCA2, BRCA1, ATM,* DNA mismatch repair genes, *CHEK2,* and *PALB2,* among other genes.[2–7] Furthermore, PCA screening guidelines advocate for starting screening at a younger age (age 40 years) compared to the general population for males who carry P/LPVs in *BRCA2, BRCA1, ATM, CHEK2, PALB2, HOXB13, MLH1, MSH2, MSH6, PMS2, EPCAM,* and *TP53* due to higher risk for PCA and aggressive disease for some of these genes.[8] Multiple genes associated with PCA are linked with hereditary cancer syndromes which predispose to several different types of cancers for individuals and their blood relatives.[9] Therefore, clinical guidelines from multiple professional societies and organisations have expanded criteria for GT for PCA.[2,10,11]

As guidelines for PCA GT have expanded, there is growing need to consider alternate genetics care delivery models.[12–17] Genetic counselling remains a gold standard of genetic evaluation and yet, the volumes of patients in need of GT is outpacing the capacity for genetic counselling.[13] Therefore, strategies to provide access to GT with appropriate pretest informed consent and education have emerged and are increasingly being studied and implemented in clinical practice.

As GT is growing in clinical impact, there is increasing concern about widening of disparities. Black males have 1.4-fold greater PCA incidence and 1.7-fold greater risk of death from PCA than males from any other race.[1] Clinical genetics programs, genetic studies, and precision medicine studies consistently show under-engagement of Black males and males from diverse populations, which may be due to multiple factors including educational, awareness, cultural, and access barriers.[18–22] These issues are critical to address as genetic evaluation strategies are developed to ensure equity in PCA care.

Given the evolving and impactful nature of PCA GT, this review is therefore developed to provide an overview in three main areas: (1) summary of PCA GT guidelines; (2) implementation of GT and improving access with alternate genetics delivery strategies primarily in the US; and (3) addressing disparities for Black males in PCA GT. Our goal is to inform collaboration between clinical, research, and advocacy communities to advance

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Key messages

- National guidelines in the US and internationally endorse germline testing (GT) for PCA for patients with metastatic disease, high-risk disease, or with strong family cancer history to inform PCA treatment, screening, and hereditary cancer assessment.
- The growing volume of patients in need of PCA GT has outpaced the capacity and access to genetic counselling programs, necessitating the creation of adapted models of genetics care delivery that incorporate digital tools for pretest genetic education and telehealth services to provide access to genetic services.
- There is growing concern about disparities with engagement in GT for PCA for Black males and is relevant across diverse racial and ethnic populations, limiting the benefits of GT for PCA and impact on precision medicine, tailored cancer screening, and hereditary implications in families.
- Multidimensional strategies that encompass interpersonal, organisational, community, and policy levels of society are needed to collectively ensure that under-represented males are having increasing awareness and access to PCA GT.

PCA GT and realise the vision of precision medicine across populations.

Search strategy and selection criteria

Overall, the goal of the literature reviews for the key topics covered was to identify impactful publications or original published data and then synthesise for this review. A nonsystematic review was conducted for guidelines regarding PCA GT. The terms "males" or "men" were used for search and may be used interchangeably in this manuscript for consistency with the guidelines or as originally published. Furthermore, the terms "mutations" or "pathogenic variants" may be used interchangeably for consistency with guidelines. Searches were conducted on Medline and PubMed using combinations of key words "prostate cancer," "germline testing," "genetic testing" "guidelines," "professional organisations," and "professional societies." These searches resulted in approximately 16 publications that spanned national or international guidelines, statements or guidelines from professional organisations, and reviews of PCA GT guidelines. While several additional publications resulted from the searches, guidelines chosen included those that were the most recent updates from professional organisations/societies or were published since 2020 to include the most up-to-date information for this review.

Regarding implementation of PCA GT, a literature search was conducted on PubMed using the terms "implementation AND genetic testing AND prostate cancer." This search yielded 55 results which were reviewed to identify original studies and published guidance statements about implementation of GT. Reference lists of these articles were used to identify additional relevant publications.

Regarding the topic of addressing disparities in PCA GT, a literature review was conducted in PubMed using key words and Mesh terms related to "prostate cancer", "genetic testing", and "disparities". All peer-reviewed articles available in English, including reviews, that explicitly discussed elements of disparities (e.g., barriers to care, access, language, cultural considerations, provider knowledge) and included participants in the United States were considered for this literature review. If an individual article was included in a review, it was excluded from separate consideration for this review. Reference lists of these articles were used to identify additional relevant publications. A total of 32 articles were synthesised of which 17 included a patient sample, three included a provider sample, two included diverse stakeholders, and ten articles were reviews. Based on the available articles, the review then focused primarily on studies in Black/African American populations in the US.

Germline testing guidelines

National Comprehensive Cancer Network (NCCN) guidelines have addressed PCA GT in the Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate (Version 3.2025) guideline where current criteria include any male with metastatic PCA or PCA with very-high or high-risk features, which include higher clinical stage, higher Grade Group, or PSA>20 at diagnosis (Table 1).[10] The guidelines further include family history-based criteria that fit hereditary breast and ovarian cancer (HBOC) syndrome (breast, ovarian, pancreatic, high- or very high-risk or metastatic PCA) for patients with a personal history of PCA (Table 1). Furthermore, criteria include testing males with biochemical recurrence meeting specific risk or family history scenarios and consideration of GT for males diagnosed with PCA at age ≤55 years.[10] Additional criteria for PCA GT include Ashkenazi Jewish ancestry for men with PCA or having a family history of cancers associated with HBOC or Lynch syndrome regardless of personal PCA history.[10]

Genes to test are *BRCA1* and *BRCA2, CHEK2, PALB2, ATM, HOXB13, RAD51D,* and *TP53* based on risk associated with PCA and inclusion on multigene testing panels.[9,10] While there is emerging data linking PCA with Lynch syndrome particularly for *MSH2* and *MSH6*,[9,23–25] GT for genes linked with Lynch syndrome (*MLH1, MSH2, MSH6, PMS2, EPCAM*) is captured in the NCCN Lynch Syndrome (Version 2.2024) guideline based upon family history of Lynch syndrome-related cancers.[26] It is important to note the gene-specific variability regarding PCA risk, aggressiveness, associated hereditary cancers, and implications for targeted therapies (Table 2). These risks and estimates evolve over time given new studies in patient and geographic populations.[9]

Additional professional societies and expert panels have provided guidance on PCA GT factoring in expert

Criteria	NCCN BOPP version 3.2025	EAU-EANM-ESTRO-ESUR-ISUP-SIOG 2024	SBOC 2024 Brazilian guidelines	AUA-ASTRO: clinically-localized PCA 2022	AUA-ASTRO advanced PCA guideline 2023
Adverse tumour or PCA characteristics	- Metastatic disease - Very high-risk features (any one of the following): • cT3b–cT4; primary Gleason pattern 5 • >4 cores with Grade Group 4/5 • 2 or more high risk features - High risk features (any one of the following): • cT3a • Grade Group 4 or 5 • PSA >20 ng/mL) - Age dx ≤ 55 (Consider) - Biochemical recurrence	Men with metastatic PCa who are candidates for targeted treatment; • Men with BRCA mutations on somatic testing	Metastatic disease High risk features Intraductal/ductal histology ISUP ≥ 3 (Gleason 4 + 3 or higher)	High-risk disease or intermediate risk disease with intraductal or cribriform histology	Metastatic disease: hormone-sensitive or castration-resistant
Family history: encompasses males with or without a personal history of PCA	Personal history of prostate cancer: ≥1 close blood relative with: - breast cancer at age ≤50 y - at any age: triple-negative breast cancer; male breast cancer; ovarian cancer; pancreatic cancer; metastatic, high-, or very-high-risk prostate cancer ≥3 close blood relatives with PCA (any grade) and/or BCA including pt with PCA - Lynch criteria Unaffected: Having a first-degree relative with any of the criteria above	• Men with multiple family members diagnosed with clinically significant PCa at age <60 years or a family member who died from PCa • Men with a family history of high-risk germline mutations or a family history of multiple cancers on the same side of the family	Suspected hereditary syndrome	Strong family history of PCA: - Ex: first- or second-degree relatives with Grade group 2 or higher PCA, particularly if age<60, metastatic or lethal disease Strong family history of related cancers: breast, colorectal, ovarian, pancreatic, upper tract urothelial Known familial mutation in cancer risk gene	
Ancestry	Personal history of PCA and Ashkenazi Jewish ancestry		Localized PCA and Ashkenazi Jewish ancestry	Ashkenazi Jewish ancestry esp if ≥ GG2	

Table 1: **Selected prostate cancer (PCA) germline testing guidance from professional societies.**

opinion, evidence synthesis, and/or consensus agreement. EAU-EANM-ESTRO-ESUR-ISUP-SIOG Guidelines on Prostate Cancer 2024 address PCA GT.[28] Specific criteria for testing include patients with metastatic PCA who are candidates for targeted treatment and testing those with *BRCA* PVs found on somatic testing.[28] Additional criteria include testing patients with or without a PCA diagnosis based on family history criteria which include having multiple family members diagnosed with clinically significant PCA at age <60 years or a family member who died from PCA or having a family history of high-risk germline P/LPVs or a family history of multiple cancers on the same side of the family.[28] The 2022 AUA/ASTRO Guideline for clinically-localised PCA states clinicians should perform an assessment of patient and tumour risk factors to guide the decision to offer GT and align with NCCN guidelines (Table 1).[10,29] The 2023 Amended AUA/SUO Guideline for advanced PCA states clinicians should offer GT, and consider somatic testing and genetic counselling in patients with metastatic, hormone-sensitive PCA.[30] Furthermore, the guideline states in patients with metastatic, castration-resistant PCA clinicians should offer germline (if not already performed) and somatic GT to identify DNA repair deficiency which may inform prognosis and familial cancer risk, as well as direct potential targeted therapies.[30] Guidance from SBOC in Brazil states to test males with metastatic disease, high risk features, Intraductal/ductal histology, or ISUP ≥3 (Gleason 4 + 3 or higher) (Table 1).[31]

Additional professional organisations address PCA GT either as part of general guidance for cancer-related GT or as part of patient-facing information, such as the American Cancer Society (ACS).[32] ACS provides information to patients that genetic counselling or testing may be recommended for patients with PCA who are of Ashkenazi Jewish ancestry, have advanced or metastatic disease, have high-risk features or intraductal histology, or have somatic testing that reveals a P/LPV in a cancer-risk gene, all in lay language.[32] Furthermore, the ACS describes the importance of family cancer history or having a known P/LPV in the family as reasons to also consider GT.[32] In addition, expert consensus statements have provided key insights informing national and international societies in guideline development.[27,33]

Most guidelines and consensus statements recommend or suggest testing for genes associated with PCA or that may be informative for targeted therapies including *BRCA1, BRCA2, EPCAM, HOXB13, MLH1, MSH2, MSH6, PMS2, ATM, CHEK2,* and *PALB2* which

	Strength of association to prostate cancer susceptibility[a]	Risk for aggressive prostate cancer[b]	Therapeutic implications in mCRPC[c]	Hereditary cancer implications[d]
ATM	++	++	+++	+++
BRCA1	++	+/++	++	+++
BRCA2	+++	+++	+++	+++
CHEK2	+/++	+	++/+++	+++
EPCAM	–	–	–	+++
HOXB13	+++	–	–	+++
PALB2	++	+/++	++/+++	+++
MLH1	–	+	++	+++
MSH6	++	+	++	+++
MSH2	++	+	++	+++
PMS2	–	+	++	+++
TP53	+	++	+	+++

Adapted from Giri et al. Journal of Clinical Oncology 2020 (ref[27]) and incorporate additional references.[2–10] [a]Risks evolve over time as genetic variants are studied, validated, and assessed across populations. [b]Risk for aggressive prostate cancer may also evolve over time with further studies. [c]PARP inhibitors are approved in the metastatic, castration-resistant setting for a spectrum of DNA repair genes depending on the study and specific PARP inhibitor (ref[2]). Clinical outcomes to PARP inhibitors vary by DNA repair gene and as such is reflected in the Table. Immune checkpoint inhibitors are approved for MSI-High or mismatch repair deficient metastatic, castration-resistant prostate cancer; clinical outcomes may vary and as such are reflected in the table. [d]Hereditary cancer implications refer to hereditary risk for prostate cancer and additional cancers based on the gene.

Table 2: **Genes on common prostate cancer germline panels and implications for prostate cancer risk, treatment, and hereditary cancer risk.**

are part of most commercially-available PCA-specific GT panels.[10,27–33] Broader panel testing can also be considered if genes linked with PCA are included. In addition, most guidelines recommend that patients make an informed decision for GT through genetic counselling.[10,27–33] However, given the rise in patient volumes in need of GT, referring all patients to genetic counselling is not sustainable, requiring alternate delivery models of genetics care delivery that enable patients to make an informed decision for GT while providing access to GT.[13]

Implementation of germline testing for prostate cancer

Despite expanded guidelines for PCA GT, many barriers to implementation exist, including scarcity of genetic counsellors relative to the number of patients eligible for testing, inadequate education and awareness among non-genetic clinicians and patients, variable perceptions of guidelines on GT, lack of effective workflows, constraints on time and space in busy clinics, and costs.[34–36] Data from the U.S. and other countries show underutilisation of GT for PCA,[34,37] even among patients with mCRPC for whom results may enable targeted treatment options.[38] Using nationally representative U.S. data from the National Cancer Institute's Health Information National Trends Survey (HINTS), 52.3% of patients with breast/ovarian cancer reported undergoing cancer-specific GT compared to 1.0% with PCA ($p = 0.001$).[37] Utilisation of GT for PCA is lower among urologists compared to medical oncologists,[38] which may be due in part to lack of formal education in genetics resulting in variable knowledge of genes relevant to PCA and differences between somatic vs germline GT.[39] Patient factors such as age, insurance coverage and potential impact for management have also been shown to affect utilisation of GT.[36,38] In the U.S. HINTS data, patients with PCA were less aware of cancer-specific GT compared to patients with breast/ovarian cancer or adults without a cancer history (19.7% vs 64.7% vs 35.8%, respectively; $p = 0.003$).[37] Using data from multiple global social media networks (Twitter/X, Facebook and YouTube), substantially less social media engagement for BRCA and GT in PCA was found compared to breast cancer, highlighting the need to raise public awareness about its importance in PCA.[40]

In the 2019 Philadelphia Consensus Conference, strategies for genetic evaluation were endorsed.[27] These include a traditional model wherein nongenetic providers identify patients, obtain a family history and provide referral to genetic counselling, or a collaborative/point-of-care/hybrid model in which nongenetic providers provide pre-test informed consent and order genetic tests, followed by post-test engagement with the healthcare provider and/or genetic specialist. Videos were recommended to help deliver pretest informed consent, and telehealth/telephone delivery of genetic counselling was recommended as a suitable alternative to in-person genetic counselling.

Several other global societies have issued guidance regarding the implementation of GT. For example, multi-disciplinary panels from Singapore and Canada recommend a "mainstreaming model", in which clinicians who are not genetics professionals are trained to perform pre-test counselling and GT.[34,41] However, other pathways may be used when this is not possible. The Canadian position paper also recommends that centres implement a systematic process to monitor equitable access to genetic assessment.[34]

A position paper from the Italian Scientific Societies further recommended that "adequate training and qualification for multidisciplinary team members are crucial for the success of the patient care path."[42] They describe the importance of engaging all professionals involved in the preventive and therapeutic pathway to implement testing and to incorporate results into clinical decision-making. Overall, these recommendations highlight how implementation challenges are a global issue.

Beginning in 2019, the University of California San Francisco implemented a hybrid model called "Genetic Testing Station (GTS)" to streamline GT for PCA.[43] Oncologists discussed GT and provided an electronic referral, after which an embedded genetic counselling assistant played a video, gathered family history and collected a sample for testing. Results of testing then

were reviewed by genetic counsellors and disclosed via letters or appointments.[43] Among 713 patients referred to the GTS, 83% completed GT. Notably, Black patients had the lowest completion rate among racial subgroups. In addition, Hispanic patients and non-English speaking patients had significantly lower completion. Switching from on-site to telehealth services during the pandemic did not affect completions.[43]

University of Michigan reported on implementation of a program with clinician-led GT for PCA.[44] First, doctors, nurses and physician assistants in the Urologic Oncology and Medical Oncology clinics received a presentation and handouts for training about GT. Subsequently, they enrolled 275 patients in a prospective study of the clinician-led pathway, of whom 98% were satisfied with the counselling they received and 74% elected to undergo GT.[44] Similarly, a multi-center study in Australia examined a mainstreaming model with counselling and testing by oncologists rather than genetics professionals for patients with metastatic PCA.[45] Medical oncologists and fellows received training about germline GT, and patients found to have a PV or VUS through the program were then referred to a genetic counsellor. Overall, 63 (95%) of 66 patients underwent GT; 100% were pleased with GT and to receive results from their oncologist; 98% were pleased to have GT at their usual oncology appointment. Clinicians were also satisfied with mainstreaming, which required 87% fewer genetics consultations compared to a traditional pathway. The main barriers described by clinicians were time during appointments and inadequate knowledge.[45]

A U.S. community urology practice implemented on-site testing and family history collection, with follow-up genetic counselling.[46] This pathway resulted in a statistically significant increase in compliance with GT from 34% to 99%. They recommend on-site GT to increase the number of eligible patients receiving guideline-concordant GT.[46] At University of California Los Angeles, an academic/industry partnership was established with a private genetic counselling service to provide multilingual genetic counselling.[47] The workflow included referral for counselling by a clinician, after which clinic staff arranged for return for an in-person visit including a telemedicine consult. Post-test management was via email with an explanatory video for negative results, and a follow-up video visit at home for patients with PVs or VUS. Counselling was completed by 89% of patients who agreed to participate with 97% testing uptake; satisfaction was also high (27.9/30 on the Genetic Counsellor Satisfaction Scale). Additionally, costs were substantially lower.[47]

Finally, studies have examined the use of technological tools for implementation of PCA GT (Table 3). Evaluation and Management for Prostate Oncology, Wellness, and Risk (EMPOWER) study was a patient-choice study between video-based genetic education (11 min, 19 s video) or genetic counselling for pre-test informed consent.[14] The majority of participants chose video (71%) over genetic counselling (29%) due to convenience, lower time commitment and reduced wait time, and there were no significant differences in decisional conflict, patient satisfaction, or uptake of GT.[14] The ProGen multisite trial randomly assigned 662 patients to video education (8-min video) vs in-person genetic counselling in a 3:1 fashion.[16] There were no significant differences between groups in completion of GT or genetic knowledge, although significantly more in the genetic counselling arm agreed that all of their questions were answered. The Genetic Testing for Men with Metastatic Prostate Cancer (GENTleMEN) research study facilitated informed consent for GT through a patient-driven website with information about benefits and risks, including optional videos.[17] Of 816 eligible males who consented to participate, 68% completed GT.[17] Technology-enhanced AcceleRation of Germline Evaluation for Therapy (TARGET) evaluated a 9-module patient driven webtool to provide pre-test genetic education for individuals with PCA.[15] The randomised trial found that the use of the TARGET webtool was non-inferior to traditional genetic counselling with respect to decisional conflict for GT.[15] To assist clinicians to identify patients who may benefit from PCA genetic evaluation, an online tool called HELIX was found to be useful for targeted family history collection for genetic evaluation in PCA,[48] and virtual genetics boards have been successfully used to educate providers on the complexities of genetic evaluation.[49] Other digital tools such as podcasts and social media may be helpful to provide education and raise awareness about GT for PCA in the general population.[50] Fig. 1 provides a simplified schema of traditional genetic counselling and alternative genetics delivery and where digital tools may be useful.

Taken together, while genetic counselling remains the gold standard for genetic evaluation, the exponential rise in patient volumes in need of GT has led to the need to study alternate genetic education and testing delivery models. However, disparities remain of key concern as seen by under-engagement of diverse racial and ethnic populations.

Public awareness/education	Podcasts Social media
Patient selection and management	Automated tools to identify eligible patients Family history collection tools Decision support tools Virtual genetics boards
Pre-test education	Video-based Web-based Telehealth

Table 3: **Technological options to facilitate uptake of germline genetic evaluation.**

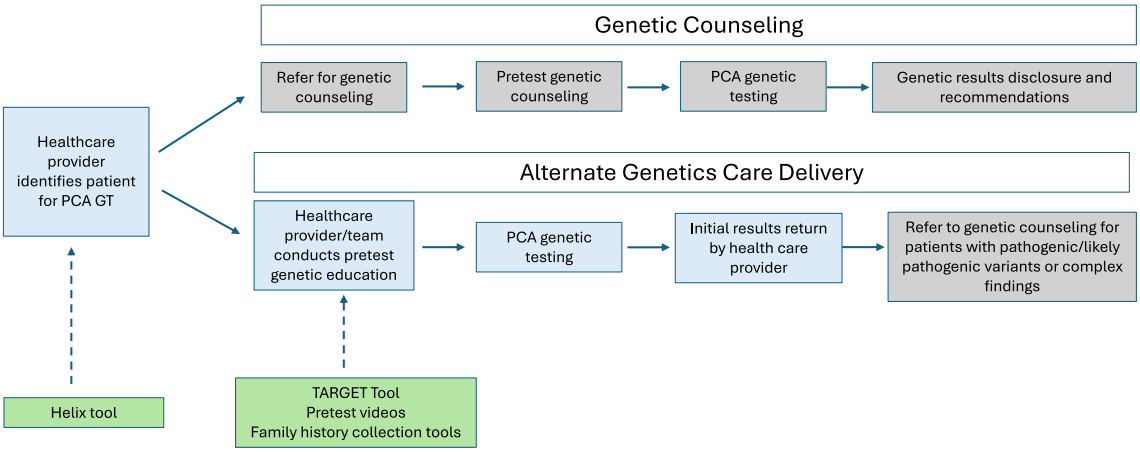

Fig. 1: Schema of genetics care delivery models highlighting use of digital tools in continuum of genetics care.

Addressing disparities in engagement in prostate cancer genetic testing for black males

Despite innovations in GT, significant barriers limit equitable access.[18,19,51–54] For example, Black males are more likely to develop advanced PCA and face higher mortality rates, yet they have historically been underrepresented in genetic research and clinical care.[3–7,9,51–57] These disparities are particularly concerning because genetic evaluation is essential for assessing personal and familial cancer risk, determining eligibility for precision therapies, and facilitating access to clinical trials.[2,8,10] The downstream impact of disparities in GT extends beyond the individual to the society-level, contributing to gaps in risk assessment, unequal access to targeted treatments, and limited representation in research that informs future advancements (Fig. 2).[51] As disparities in GT for PCA are multifaceted and encompass structural and social factors, barriers and implementation strategies can be organised by the Socioecological Model, focussing on the individual, interpersonal, organisational, community, and systemic/policy levels contributing to disparities in PCA GT (Fig. 3).[51]

Strategies to address individual-level challenges

Barriers at the individual level hinder participation in GT across diverse communities.[51] Limited health literacy and confusion surrounding genetic vs genomic testing contribute to misunderstandings about the benefits of testing.[19,51] Black males express privacy concerns and mistrust rooted in historical abuses such as the Tuskegee Syphilis Study further discourages engagement.[18,19,51–54] Cultural beliefs, including reluctance to seek medical help unless symptomatic and the perception that doing so may be viewed as a weakness, also reduce participation.[18,19] Financial barriers, such as lack of health insurance, additionally exacerbate these issues.[51]

Interventions to address individual awareness, knowledge, attitudes and beliefs can be addressed with carefully developed patient or public education tools delivered through various formats and modalities. For example, increasing health literacy through patient-driven educational tools has been shown to reduce decisional conflict and improve access to testing.[15] A review noted several studies in which educational videos disseminated through trusted community spaces, such as barber shops and churches, significantly enhanced cancer knowledge and screening engagement.[53] Efforts to reach a larger segment of the public through public education campaigns emphasising personal and family health history are also crucial.[52] Considering culturally relevant educational materials and multilingual interpreters can enhance communication with non-

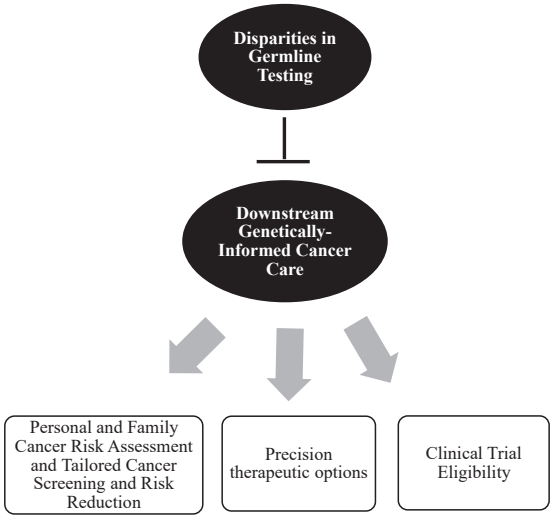

Fig. 2: Impact of disparities in germline testing for downstream clinical outcomes.

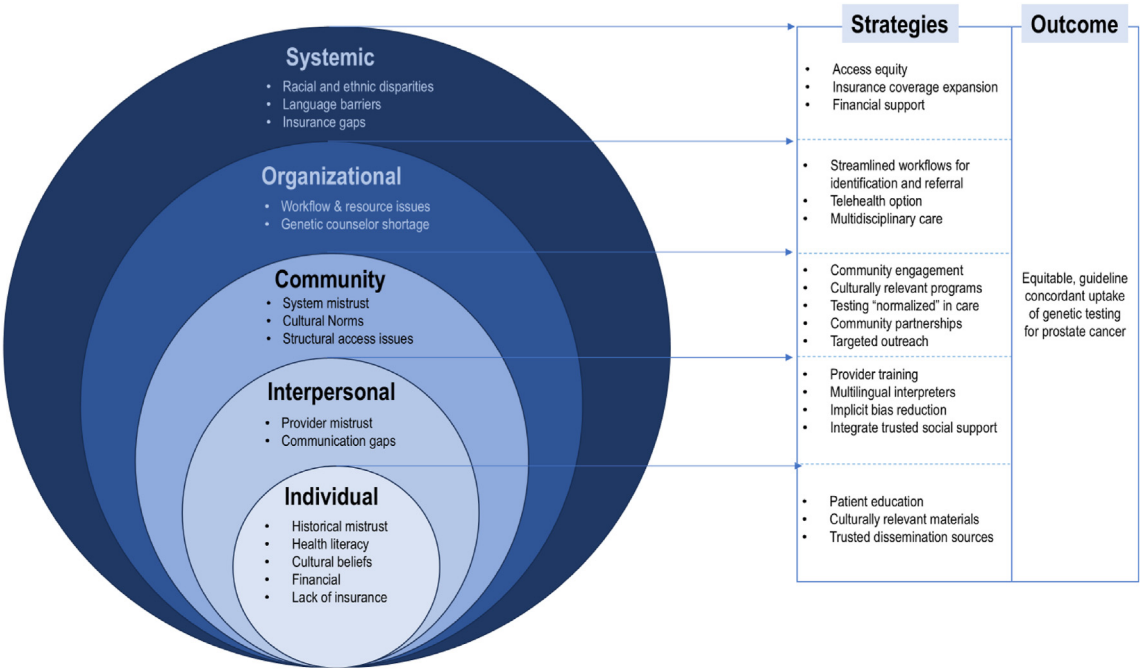

Fig. 3: Strategies for equity in prostate cancer genetic testing grounded in socioecological model. Adapted from Sallis et al. 2008.

English-speaking patients.[52] Social media platforms are increasingly used for broad-based PCA education, offering wider channels to engage individuals.[53] However, careful targeting of these educational resources will likely enhance success to reach the target audience.[51]

Strategies to address interpersonal barriers

At the interpersonal level, mistrust in healthcare providers emerge as a significant barrier to GT among Black males (Fig. 3).[19,51,58] For example, studies show that non-White patients are less likely to trust healthcare providers compared to White patients.[19] Patients often report strained relationships with providers, expressing concerns about hidden agendas or financial motives behind testing recommendations.[19]

Interventions that include training and skills development for healthcare providers to communicate effectively with diverse patient populations can help build trust and reduce decisional conflict regarding testing.[51] Helping providers recognise potential implicit biases can improve care quality for patients from all backgrounds.[51] Some studies found that African American males may suspect hidden agendas or fear that their test results could affect their access to insurance or healthcare.[18,19] To combat these barriers, healthcare providers must adopt proactive referral practices to ensure that all eligible patients are offered GT equitably, regardless of race.[21] The low representation of minority providers may further hinder trust and engagement with GT.[51,55] Only 2% of US urologists[59] and 2% of genetic counsellors in the US identify as Black. Recruiting more healthcare providers from diverse backgrounds and encouraging partnerships between patients and providers of the same ethnic background can enhance communication and improve study participation rates.[51]

Strategies at the organisational level

Clinic workflows and resources significantly impact the integration of GT into oncology practices. However, these efforts are often hindered by time constraints, inadequate space, and staffing shortages.[35] Multidisciplinary approaches that include clear referral pathways and co-located genetic counsellors can improve testing access. According to Gunn et al., structured systems including standardised intake forms and family history tools reduce referral bias.[60] This approach can simultaneously overcome barriers such as inconsistent provider knowledge and awareness of GT guidelines and provider biases leading to the documented differential referral for and access to genetic services.[60,61]

Additional institutional barriers include the shortage of genetic counsellors, especially in rural areas.[13,27] Expanding genetic counselling through telehealth and video sessions can improve access, while fostering trust through multidisciplinary care teams can enhance collaboration and improve patient outcomes.[52,56] Language barriers and lack of insurance further exacerbate these disparities.[61] Strategies to include expanding access to telehealth consultations or medical interpreters

in preferred language or innovative delivery approaches, such as the GT Station, which can increase testing rates despite persistent racial disparities.[43]

Finally, navigators are an important resource deployed by health care organisations that hold promise for addressing PCA and GT disparities. The Prostate REACH study demonstrated that patient navigation services, which assist individuals in navigating insurance and healthcare systems, can improve access and outcomes for underserved populations, with participants in the navigation group showing a 43% increase in completing PCA screenings compared to those without navigation support.[62] This highlights the importance of navigating insurance and healthcare systems to address barriers faced by high-risk individuals.[62] Community-based patient navigation programs have been shown to increase PCA screening rates and reduce missed appointments among Black males.[53]

Strategies and the community level

Historic abuses, such as the Tuskegee Syphilis Study, lends to mistrust about healthcare and GT.[19] This mistrust is compounded by cultural norms that discourage expressing discomfort or seeking preventive care, further limiting participation in GT.[19] A systematic review by Briggs et al. highlighted the success of community-based interventions in improving GT rates by addressing culturally-specific barriers and offering accessible, clear communication about testing benefits to bridge the gap in access to genetic services for underserved populations.[63]

Engaging trusted individuals such as family members, partners, peers, and respected community figures can encourage participation in GT to overcome medical mistrust stemming from past negative experiences with providers.[51,52] For example, a stakeholder conference addressing PCT GT engagement for Black males recommended using culturally tailored communication and peer support. Strong consensus was found for strategies such as training Black role models (mean score 4.81–5.00) and delivering empowering, culturally relevant messages (4.57–5.00) to reduce mistrust and improve engagement.[51] Normalising testing by emphasising its importance for early detection and treatment may encourage participation.[19,58]

Conducting outreach through community institutions, such as churches and barber shops, and engaging spouses and partners can further promote participation in GT and reduce structural barriers such as transportation challenges.[51,53] For example, one study developed and tested a church-based intervention to promote informed decision-making for PCA screening among African American men. Findings showed that delivering the intervention through African American churches increased PCA knowledge ($p < 0.0001$) and self-efficacy ($p = 0.025$), suggesting that faith-based outreach can encourage participation in health interventions.[64] This model can be applied to GT outreach, leveraging community trust and support to improve engagement.[64] Barbershop-based health initiatives have been shown to significantly increase cancer screening participation. One study found that participants who received cancer education through barbershops were more likely to engage in screenings compared to those without such exposure.[65] This approach is likely effective because barbershops provide a trusted, familiar environment for health discussions.[65,66] These community-led interactions and events can facilitate participation by healthcare providers and health care organisations to enhance outreach efforts, for example, by embedding risk assessment or other health services into local events.[51]

Strategies at the system level

Systemic barriers to GT and healthcare services contribute to significant racial disparities, for example, affecting Black patients, who are less likely than their White counterparts to complete germline GT.[57,61] A systematic review by Briggs et al. found significant racial/ethnic disparities among patients recruited for PCA GT; White males comprised 85.8% of the total population followed by 12.7% Black, 0.5% Hispanic/Latino, and Asian, Native Hawaiian/Pacific Islander were virtually unrepresented.[63] Ensuring equal access to care and incorporating insurance coverage and financial support can address socioeconomic barriers.[57] For example, supporting broader efforts increases access to GT such as the bipartisan Reducing Hereditary Cancer Act (H.R.1526) to provide Medicare coverage of GT for individuals with a personal or family history of P/LPV in a hereditary cancer gene or suspected history of hereditary cancer, and associated coverage of risk-reducing surgeries and screenings.[67]

This section of the review has focused on opportunities and challenges to access to PCA GT among males in the US, and most of these studies focused on disparities in Black men. This reflects the large disparities in PCA incidence, stage of diagnosis, and mortality of Black men compared to other groups.[1] However, it is acknowledged that there is global interest in this topic to improve knowledge about germline alterations across diverse racial and ethnic populations and to address access based on geographic areas that may have under-testing or over-testing.[68] Individuals of Asian ancestry have also been significantly underrepresented in genetic studies.[68] Since rates of P/LPVs in cancer genes can vary substantially across racial/ethnic populations,[9,69–71] it is important to study diverse populations to inform GT for individuals who may benefit the most while limiting over-testing. Proponents of universal testing highlight the limitation of current guidelines for identifying patients who may have P/LPVs in cancer genes[72]; however these studies primarily included White participants. It is important to gain greater understanding of carrier rates across

populations while addressing persistent underutilisation of testing for those at highest risk, ensuring equitable resource allocation given insufficient genetics professionals, and mitigating the downstream consequences of testing for an expanded pool of patients.[73] The recent ASCO guideline regarding GT for metastatic PCA emphasised the need for broader engagement of individuals of diverse backgrounds across the US and globally to promote health equity.[74]

Conclusions

In summary, GT for PCA is now central to PCA care and hereditary cancer assessment, with a rising role in PCA screening approaches. Therefore, addressing implementation challenges and disparities in PCA GT are critical to ensure widespread personalised access to the benefits of precision medicine.

Outstanding questions

Key opportunities include characterisation of PCA genetic risk variants across racial/ethnic populations globally, studying real-world application of implementation strategies for greater access to GT, evaluating awareness campaigns in Spanish and multiple languages, studying the use of social media in Spanish and cross-culturally to assess knowledge and engagement in PCA GT, and studying the deployment of genetic services by engagement with primary care collaborators. Many additional avenues will enhance access to PCA GT while assessing implementation and patient-reported outcomes to ensure equitable access to PCA GT in the precision medicine era.

Contributors

All authors (SL, STV, and VNG) were responsible for all aspects of this review including conceptualisation, methodology, supervision, writing or the original and revised draft, review, and all editing.

Declaration of interests

SL reports consulting with Astellas, Savor Healthand Doceree, unrelated to the current manuscript. VNG has stock ownership in Novopyxis, unrelated to the current manuscript.

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