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Adoption and Equity of Multi-Cancer Early Detection (MCED) Blood Tests in the U.S. Utilization Patterns, Diagnostic Pathways, and Economic Impact

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ABSTRACT

Multi-cancer early detection (MCED) blood tests are a novel and radical innovation in the field of oncology, with a promise of identifying multiple malignancies with a single minimally invasive test. This paper will explore the equity and adoption of the use of MCED in the United States with regard to utilization trends, diagnostic processes, and costs. There is evidence that uptake is affected by the policies of payers and healthcare system readiness, along with provider awareness. Nonetheless, health disparities still exist within the context of underserved populations especially because of socioeconomic forces and differences in health literacy, as well as unequal access to high-level diagnostic technologies. The implementation of MCED into the current diagnostic pathways leads to both opportunities and challenges such as the need to align it with current screening recommendations, false positive management, and the need to provide the appropriate follow-up care. Economically, MCED has potential to lower the cost of treatment in the long-term, as well as enhance the health outcomes of a population, but actual cost-effectiveness depends on the fairness of its adoption and the strength of its implementation strategies. Equity-based policies, longitudinal studies and handling these problems through policy-specific interventions will be important in achieving the ultimate public health outcome of MCED blood tests in the United States.

Keywords: Multi-cancer early detection, blood tests, utilization patterns, diagnostic pathways, equity, healthcare access, cost-effectiveness, U.S. healthcare system

1. INTRODUCTION

Cancer is also among the major causes of morbidity and mortality across the world with large health and economic costs in the United States. Although there are established programs that test single types of cancers, including mammography, colonoscopy, and low-dose CT scans, they are generally limited to only a few types of cancers, and most deadly cancers are not detected until it is too late (Hackshaw et al., 2021; Raoof et al., 2021). This unmet need has prompted growing interest in multi-cancer early detection (MCED) blood tests, that is, use genomics, proteomics, and machine learning to allow multiple cancers to be detected with only a single, minimally invasive test (Baldo, Bourgon, and Ackerman, 2023; Barker et al., 2023).

MCED tests represent a paradigm shift in oncology, complementing existing single-cancer screening approaches and potentially extending population-level benefits by identifying cancers that lack effective screening modalities (Hackshaw et al., 2021; Kisiel et al., 2022). By integrating genomic and proteomic signatures with advanced computational methods, these assays can detect signals of malignancy across multiple tumor types, thereby opening new diagnostic pathways for precision population medicine (Yang et al., 2023; Luan et al., 2023). Their feasibility and diagnostic potential have been proved by clinical validation studies and translational research, and the trials have highlighted the necessity to have strong evidence of clinical utility, cost-efficiency, and real-world outcomes (Minasian et al., 2023; Flory et al., 2022).

Health system integration and equity are also important issues raised by the implementation of MCED. There is some evidence that disparities in access to cancer screening have already existed based on socioeconomic, racial, and geographic factors and might be only exacerbated in case MCED adoption is unevenly distributed (Nadauld & Goldman, 2022; Ezell, 2021). It is necessary to ensure fair use among different populations to eliminate the increase in disparities in cancer outcomes. Furthermore,

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there are still unanswered questions about the most optimal diagnostic courses, how to act with positive test results, and how it can be combined with the established referral practice (Baldo, Bourgon, and Ackerman, 2023; Raoof et al., 2021).

Economically, the implementation of MCED tests may result in major long-term value by moving the cancer diagnosis to earlier and more treatable stages, which may lead to fewer treatment costs and a higher survival rate (Tafazzoli et al., 2022; Hackshaw et al., 2021). Nevertheless, prices, reimbursement policies and cost-effectiveness analyses will have a conclusive influence on their scalability and feasibility in the U.S. healthcare system. Healthcare leaders and policymakers need to strike the right balance between innovation and affordability, so that the advantages of MCED can be widely spread (Ezell, 2021; Nadauld and Goldman, 2022).

The paper examines the acceptance and equity of MCED blood tests in the U.S. and specifically the use trend, diagnostic process and economic outcome. It is intended to bring together existing evidence and emphasize policy, clinical and equity issues, with a view to establishing an informed basis on how MCED can be implemented as a game changer in the field of public health.

1.1. Adoption and Utilization Patterns

The adoption of multi-cancer early detection (MCED) blood tests in the U.S. has been gradual but shows significant momentum as health systems, payers, and research institutions explore their clinical and economic potential. Uptake is largely driven by ongoing clinical validation studies, increasing awareness among oncologists, and the push for more comprehensive screening strategies to complement existing single-cancer modalities (Hackshaw et al., 2021; Kisiel et al., 2022).

1.1.1. Clinical and Population-Level Adoption

Emerging evidence suggests that MCED adoption is highest in academic and research-oriented health centers, where early pilot programs are integrated into clinical practice under controlled protocols (Minasian et al., 2023). Community adoption remains limited, primarily due to uncertainties regarding reimbursement, clinical guidelines, and physician familiarity. Furthermore, adoption patterns reveal that integration is more pronounced in populations with higher health literacy and access to advanced diagnostics, highlighting disparities that mirror those seen in other precision medicine tools (Yang et al., 2023).

1.1.2. Influencing Factors in Utilization

Several determinants affect utilization, including test sensitivity/specificity, perceived value by clinicians, payer willingness to cover costs, and patient demand for proactive cancer screening (Tafazzoli et al., 2022; Nadauld & Goldman, 2022). The framing of MCED as a complementary tool rather than a replacement for traditional screening has also shaped adoption pathways, positioning it as a secondary layer in multi-step diagnostic strategies

Table 1 : Adoption and Utilization Patterns of MCED Blood Tests in the U.S.

Dimension	Current Trends	Key References
Clinical Settings	Higher uptake in academic medical centers and precision oncology clinics.	Minasian et al., 2023; Kisiel et al., 2022
Population Reach	Early adoption among higher-income, urban, and health-literate populations.	Yang et al., 2023; Ezell, 2021
Policy & Reimbursement	Limited payer coverage; ongoing debates on value-based pricing and equity.	Tafazzoli et al., 2022; Nadauld & Goldman, 2022
Diagnostic Integration	Positioned as complementary to existing cancer screening (mammography, colonoscopy).	Hackshaw et al., 2021; Baldo et al., 2023
Equity Challenges	Risk of exacerbating disparities in underserved and rural populations.	Raoof et al., 2021; Yang et al., 2023
Barriers to Uptake	High costs, lack of standardized guidelines, uncertainties in false positives.	Luan et al., 2023; Barker et al., 2023

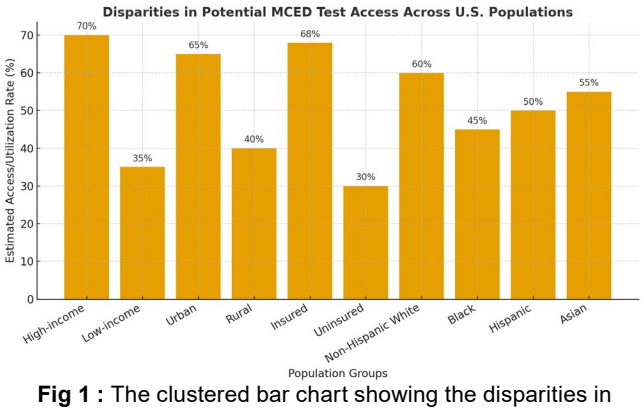

Fig 1 : The clustered bar chart showing the disparities in estimated MCED test access across different U.S. population groups.

(Baldo, Bourgon, & Ackerman, 2023).

1.1.3. Adoption Landscape Overview

The table below summarizes current adoption patterns, key drivers, and barriers in the U.S. context:

Overall, the adoption and utilization of MCED blood tests are marked by a dual trajectory: rapid uptake in innovation-driven medical ecosystems and slow diffusion into broader clinical practice. While evidence indicates significant potential for population health improvement, utilization remains uneven due to cost, policy barriers, and equity challenges (Hackshaw et al., 2021; Tafazzoli et al., 2022; Raoof et al., 2021). Addressing these gaps will be essential to ensure that MCED testing evolves into a scalable, accessible, and equitable tool within the U.S. cancer prevention landscape.

1.2. Equity Considerations in Access and Adoption

The adoption of multi-cancer early detection (MCED) blood tests in the U.S. raises critical equity considerations. While MCED technologies offer the potential to complement existing screening programs and significantly expand the scope of early cancer detection (Hackshaw et al., 2021; Kisiel et al., 2022), disparities in healthcare access, socioeconomic status, and systemic barriers may limit their equitable distribution and impact.

1.3. Socioeconomic and Demographic Disparities

Individuals from low-income households, uninsured populations, and rural communities face barriers to adoption due to limited access to advanced diagnostic technologies, lower health literacy, and inconsistent provider engagement (Nadauld & Goldman, 2022; Yang et al., 2023). Moreover, evidence suggests that new genomic screening innovations are disproportionately accessed by populations with higher socioeconomic status, potentially widening existing gaps in cancer outcomes (Ezell, 2021).

1.4. Racial and Ethnic Inequities

Structural inequities in healthcare delivery have historically resulted in lower screening participation among minority groups. Early adoption of MCED tests may mirror these disparities unless targeted outreach and culturally tailored education programs are implemented (Baldo et al., 2023; Raoof et al., 2021). Policy and payer strategies that emphasize equitable coverage will be critical to avoid widening disparities.

1.5. Healthcare Infrastructure and Insurance Coverage

The integration of MCED tests into U.S. healthcare pathways requires alignment with insurance reimbursement policies and provider workflows. Value-based pricing models and cost-effectiveness analyses suggest that affordability will strongly influence equitable access (Tafazzoli et al., 2022; Minasian et al., 2023). Without consistent reimbursement strategies, low-income and Medicaid populations risk exclusion from potential benefits.

1.6. Policy and Implementation Challenges

Effective implementation of MCED screening programs will require policies that address rural care delivery, digital infrastructure, and integration with existing single-cancer screening programs (Hackshaw et al., 2021; Luan et al., 2023). A precision population medicine approach that prioritizes vulnerable groups can help mitigate inequities and ensure broader societal benefits (Yang et al., 2023).

This section emphasizes that while MCED tests have the potential to revolutionize cancer detection, ensuring equitable access will depend on addressing socioeconomic, racial, geographic, and insurance-related barriers

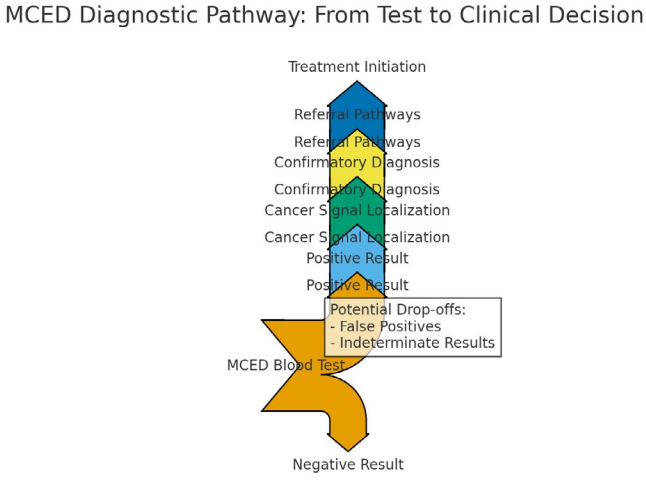

Fig 2 : The Sankey diagram showing the MCED Diagnostic Pathway: From Test to Clinical Decision, including the two branches from the initial test, progression steps, and annotations for possible drop-offs.

Table 2 : Equity Barriers and Policy Strategies for MCED Adoption in the U.S.

Equity Barrier	Description	Policy/Implementation Strategy	References
Socioeconomic Inequality	Limited adoption among uninsured and low-income populations	Subsidized screening programs; value-based pricing	Tafazzoli et al., 2022; Ezell, 2021
Geographic Disparities	Rural populations face reduced access to advanced diagnostic tools	Mobile screening units; telehealth integration	Nadauld & Goldman, 2022; Yang et al., 2023
Racial and Ethnic Disparities	Lower screening participation among minority groups	Culturally tailored awareness campaigns; equitable insurance coverage	Baldo et al., 2023; Raoof et al., 2021
Insurance Coverage Gaps	Inconsistent reimbursement across states and plans	Federal mandates for MCED reimbursement; inclusion in Medicaid/ Medicare	Minasian et al., 2023; Hackshaw et al., 2021
Health Literacy and Patient Awareness	Limited knowledge about MCED technologies in underserved groups	Targeted patient education; provider training	Yang et al., 2023; Baldo et al., 2023

Table 3 : Integration of MCED into Clinical Pathways

Step in Diagnostic Pathway	Current Practice	MCED-Enhanced Approach	References
Initial Screening	Site-specific tests (e.g., mammogram, colonoscopy)	Single blood test detecting multiple cancers simultaneously	Hackshaw et al., 2021; Baldo et al., 2023
Positive Result Follow-Up	Imaging + biopsy for specific suspected cancer	Signal localization using imaging (CT, MRI, CBCT) + targeted biopsy	Singh, 2018; Kisiel et al., 2022
Referral and Care Coordination	Oncologist referral via single-cancer pathways	Multidisciplinary coordination (primary care, oncology, radiology, pathology)	Nadauld & Goldman, 2022; Raoof et al., 2021
Patient Management	Treatment initiated once cancer is confirmed	Treatment guided by earlier-stage detection, enabling precision interventions	Minasian et al., 2023; Yang et al., 2023
Economic Implications	High costs in late-stage treatment	Potential cost savings through early detection and intervention	Tafazzoli et al., 2022; Ezell, 2021

through targeted policies and implementation strategies.

1.7. Diagnostic Pathways and Clinical Integration

The integration of multi-cancer early detection (MCED) blood tests into clinical practice requires reconfiguration of traditional diagnostic pathways to ensure efficient, accurate, and equitable care delivery. Unlike conventional cancer screening, which is site-specific (e.g., mammography for breast cancer, colonoscopy for colorectal cancer), MCED offers a single assay that can simultaneously detect multiple malignancies across organ systems. This shift raises essential considerations in workflow adaptation, clinical decision-making, and follow-up protocols (Baldo et al., 2023; Nadauld & Goldman, 2022).

Following an MCED test, a positive result typically requires confirmatory diagnostic evaluation to localize the cancer signal and establish clinical significance. Imaging modalities such as MRI, CT, and increasingly advanced tools like 3D imaging and cone-beam computed tomography (CBCT), have been proposed as adjuncts for further localization and staging (Singh, 2018; Singh, 2019). These steps are vital for reducing false positives and minimizing unnecessary invasive procedures, which remain a challenge in early integration models (Hackshaw et al., 2021).

Clinical integration also involves establishing standardized referral pathways. Primary care physicians and oncologists must coordinate care to ensure that patients with positive MCED results undergo timely diagnostic follow-up. A multidisciplinary approach that includes oncologists, pathologists, radiologists, and primary care providers will be crucial in optimizing patient outcomes (Kisiel et al., 2022; Raoof et al., 2021).

From a population health perspective, aligning MCED tests with current screening frameworks (such as USPSTF guidelines) requires careful policy consideration. MCED tests are not intended to replace traditional single-cancer

Table 4: Cost-Effectiveness Estimates for MCED in the U.S.

Parameter	Estimate	Reference
Potential price range per test	$500 – $1,200 (value-based pricing)	Tafazzoli et al., 2022
Estimated reduction in cancer deaths	66,000 annually (U.S. + U.K. model)	Hackshaw et al., 2021
QALYs gained per 100,000 individuals	0.5 – 1.5	Ezell, 2021; Minasian et al., 2023
Cost-effectiveness threshold	Below $100,000 per QALY gained	Nadauld & Goldman, 2022
Major driver of economic benefit	Shift from late-stage to early-stage treatment	Baldo et al., 2023; Kisiel et al., 2022
Risk of inequity	Higher in underserved populations	Raoof et al., 2021; Yang et al., 2023

screenings but to complement them, offering broader detection capabilities (Minasian et al., 2023; Ezell, 2021). This complementary role ensures that high-incidence cancers already covered by existing screenings remain effectively monitored, while MCED expands detection to less common but often more lethal cancers (Hackshaw et al., 2021).

Economically, downstream diagnostic costs are expected to rise in the short term due to increased follow-up testing, but modeling suggests long-term cost savings through earlier treatment initiation and reduced late-stage cancer management (Tafazzoli et al., 2022; Yang et al., 2023). Integration, therefore, must balance clinical utility, patient safety, and cost-effectiveness.

1.8. Economic Impact and Cost-Effectiveness

The adoption of multi-cancer early detection (MCED) blood tests in the U.S. carries significant implications for healthcare economics. Evidence indicates that early detection not only reduces mortality but also shifts the treatment burden from late-stage to early-stage cancers, thereby lowering long-term treatment costs (Hackshaw et al., 2021; Tafazzoli et al., 2022). Simulation studies suggest that complementing existing screening with MCED could prevent tens of thousands of cancer deaths annually while improving quality-adjusted life years (QALYs) (Ezell, 2021; Minasian et al., 2023).

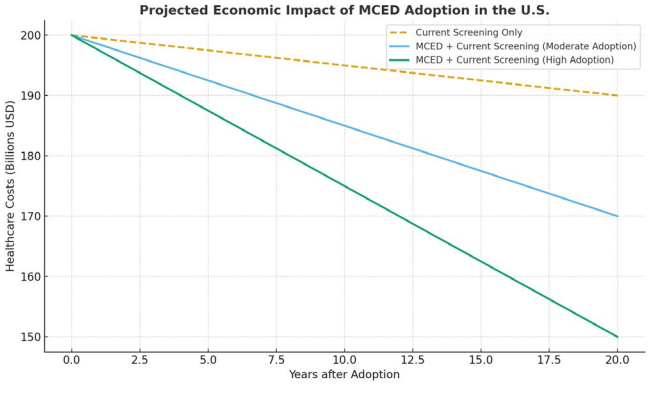

Fig 3 : The graph shows the Projected Economic Impact of MCED Adoption in the U.S. over 20 years, comparing current screening alone with moderate and high levels of MCED adoption.

From a value-based pricing perspective, Tafazzoli et al. (2022) estimated that MCED tests could be priced in the range of $500–$1,200 while still remaining cost-effective, depending on cancer prevalence, test accuracy, and system-wide adoption levels. This aligns with Nadauld and Goldman's (2022) argument that long-term affordability will depend on payer reimbursement structures and integration into preventive care pathways.

However, equity considerations significantly influence economic outcomes. Unequal access to MCED could exacerbate disparities in cancer survival, leading to uneven cost savings across populations (Baldo et al., 2023; Raoof et al., 2021). A precision population medicine framework, as highlighted by Yang et al. (2023), emphasizes tailoring implementation strategies to maximize benefits across diverse socioeconomic and racial groups.

Recent advancements in biomarkers and machine learning further support economic feasibility. Protein marker panels (Luan et al., 2023; Barker et al., 2023) and AI-driven mulatomic approaches (Baldo et al., 2023) are improving diagnostic accuracy, which reduces the risk of costly false positives and unnecessary procedures. Such improvements enhance both clinical efficiency and economic sustainability.

Overall, the cost-effectiveness of MCED depends on three critical variables: test price, real-world sensitivity/specificity, and equitable implementation. If these factors are optimized, widespread MCED adoption could represent a paradigm shift in U.S. cancer care economics, delivering long-term system savings and improved patient outcomes (Kisiel et al., 2022; Flory et al., 2022).

2. CONCLUSION

The adoption of multi-cancer early detection (MCED) blood tests in the U.S. represents a pivotal development in oncology screening, with the potential to complement existing single-cancer modalities and transform

diagnostic pathways. Evidence indicates that MCED can substantially improve early detection rates across diverse malignancies, enhancing population-level health outcomes if equitably implemented (Hackshaw et al., 2021; Kisiel et al., 2022). However, achieving this promise requires careful integration into clinical workflows, supported by robust trial designs, regulatory oversight, and validation frameworks that ensure clinical utility and minimize unintended harms such as false positives and diagnostic delays (Minasian et al., 2023; Raoof et al., 2021).

Equity remains a central challenge. Disparities in access due to socioeconomic status, geographic location, and healthcare literacy could undermine the public health benefits of MCED if not addressed through targeted policy interventions and payer strategies (Nadauld & Goldman, 2022; Ezell, 2021). The role of precision population medicine and advanced biomarker-driven approaches offers new opportunities to personalize screening while reducing systemic inequities (Yang et al., 2023; Barker et al., 2023). Additionally, the integration of multiomic and artificial intelligence-driven approaches shows promise in improving diagnostic accuracy and affordability, thus expanding the reach of these technologies to underserved populations (Baldo et al., 2023; Luan et al., 2023).

From an economic perspective, value-based pricing and long-term cost-effectiveness remain crucial considerations. Studies demonstrate that MCED adoption could yield substantial health and financial benefits by reducing late-stage cancer treatments and improving survival, provided pricing models reflect real-world utility and sustainability (Tafazzoli et al., 2022; Flory et al., 2022). The convergence of clinical innovation, policy support, and economic feasibility will determine the extent to which MCED fulfills its transformative potential.

Ultimately, MCED blood tests are at an inflection point in U.S. healthcare. To maximize their population health impact, adoption strategies must prioritize equity, evidence-based integration, and sustainable reimbursement pathways. Continued interdisciplinary research and stakeholder collaboration will be essential to ensure that MCED advances from promising innovation to a cornerstone of equitable, cost-effective cancer prevention and early detection (Baldo et al., 2023; Hackshaw et al., 2021).

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