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Biotechnology, Primary Healthcare Access Equity and Gender Equity: The Role of Women in Biotech for Global Health Security

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ABSTRACT

Biotechnology is emerging as a strategic driver of health innovation and economic growth in the UAE, MENA, and Africa. Yet, equitable primary healthcare (PHC) remains foundational to achieving universal health goals. This paper examines how biotechnology development, PHC equity, gender inclusion and intergenerational intersect to advance global health security. A narrative literature review was conducted using peer-reviewed sources, policy briefs, and expert commentary, including Dr. Allama Elmehdi's publications, to synthesize trends and insights from 2018–2025. Biotechnology promises transformative solutions, but faces barriers including talent shortages, infrastructure gaps, and regulatory hurdles. PHC provides an essential delivery foundation, while gender equity is vital to strengthening leadership and innovation impact. Policy coherence aligning biotech, PHC, and gender equity accelerates sustainable health outcomes. Inclusive leadership, especially empowering women, ensures innovations reach all communities equitably. Integrated strategies combining biotech investment, PHC strengthening, and gender-inclusive leadership are critical to resilient, equitable, and effective global health systems.

Keywords: Biotechnology, Primary health care (PHC), Health equity, Gender equity, Women in biotechnology, Global health security, Health innovation, United Arab Emirates (UAE), Middle East and North Africa (MENA), Africa health security

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INTRODUCTION

Biotechnology, the fusion of biology with technology, is increasingly seen as a key driver of innovation in healthcare, agriculture and environmental health. In regions like the UAE, Middle East and Africa, governments are prioritizing biotech as a strategic sector for economic diversification and improved health outcomes^{1, 2}. At the same time, global health experts emphasize that equitable primary health care (PHC) is foundational for achieving universal health and security³. Importantly, gender equity underpins both of these goals: women comprise roughly 67–70% of the health workforce globally yet hold a small minority of leadership roles^{3, 4, 5}. Empowering women in biotech and health leadership is not only a matter of fairness but a vital strategy for building resilient, inclusive health systems^{5, 6}. This review, authored by Dr. Allama Elmehdi (a health economist and biotech leader), synthesizes recent literature (2018–2025) and expert commentary – including Dr. Elmehdi’s own LinkedIn publications – to examine how biotechnology development, primary care access, and gender inclusion intersect to advance global health security⁷.

MATERIALS AND METHOD

We conducted a narrative literature review of peer-reviewed articles, policy reports, industry analyses, and relevant online content published in the last five years. Key sources included World Health Organization (WHO) fact sheets and policy briefs, regional health and innovation reports, and specialist media on health innovation. We also incorporated insights from Dr. Allama Elmehdi’s public statements and LinkedIn posts, which frequently address biotech innovation, health financing, and gender equity. Search terms spanned “biotechnology”, “primary health care”, “health equity”, “women in biotech”, and regional keywords (e.g. “UAE”, “Africa”, “MENA”). By triangulating data from these diverse sources, we identified trends, gaps and lessons related to biotechnology ecosystems, PHC access equity, and the role of women in health innovation.

RESULTS AND DISCUSSION

Biotechnology’s Growth and Promise:

Globally, the biotechnology industry is expanding across health, agriculture, energy and beyond⁸. A recent PwC/Strategy& analysis notes that biotechnology “harnesses cellular and biological processes” to create products with wide applicability, and that countries with strong talent, resources and infrastructure are poised to reap large economic rewards from biotech⁸. In the Middle East, strategic initiatives reflect this potential. In January 2024, Saudi Arabia launched a National Biotechnology Strategy aiming to make the country a biotech leader in MENA by 2030 and an international hub by 2040². Similarly, Abu Dhabi’s Vision 2030 explicitly identifies biotechnology as a key sub-sector for development². Analysts

observe that the UAE in particular is “on the verge of a healthcare revolution” if the environment for biotech innovation is fostered¹. The Abu Dhabi Health Week conference (2024) highlighted such momentum: Abu Dhabi’s new HELM (Healthcare, Life Sciences & MedTech) cluster is projected to contribute over AED94 billion to GDP and attract AED42 billion in investment, creating roughly 30,000 jobs by 2045¹. In short, recent initiatives and investments demonstrate clear commitment in the Gulf region to advancing biotechnology as an engine of health innovation and economic growth¹.

Ecosystem Challenges and Enablers:

Despite this optimism, experts warn of substantial challenges in building a vibrant biotech sector. By nature, biotech R&D is expensive, long-term and risky. The UAE sector remains “relatively underdeveloped” compared to global hubs, not for lack of resources, but due to the inherent complexity and capital intensity of biotechnology¹. Talent shortages and infrastructure gaps also pose obstacles. Economist Impact reports from Abu Dhabi note that attracting and retaining skilled researchers – through education reform and talent programs – is foundational. For example, Abu Dhabi’s Tawteen initiative sets quotas for Emirati participation in healthcare and has spurred partnerships between local companies and global academic institutions⁹. Industry analyses likewise call for targeted “enablers”: increased public and private funding for commercialization, expansion of skilled human capital, development of state-of-the-art facilities, and clear regulatory frameworks⁸. The Riyadh- and Abu Dhabi-driven strategies reflect this: they emphasize intellectual property protections, incubation programs, and investment incentives to overcome the “valley of death” between lab discoveries and market products⁹. In summary, building a biotech ecosystem in the UAE, Saudi Arabia and other emerging regions will require sustained government commitment on par with educational and infrastructure reform^{1,9}.

Primary Healthcare as Foundation:

Paralleling biotech ambitions, global health authorities reaffirm that primary healthcare (PHC) is essential for equitable health coverage and security. WHO notes that PHC is the most inclusive, equitable and cost-effective approach to achieving universal health coverage³. Estimates suggest that scaling PHC services in low- and middle-income countries could save millions of lives and markedly increase life expectancy by 2030³. Critically, PHC also provides the “front door” to health systems, enabling early detection of outbreaks and management of chronic conditions^{3,9}. In practical terms, this means robust PHC networks and health information systems are needed alongside high-tech innovations. Economist Impact emphasizes that a strong local healthcare system – with good data and functioning primary care – is key to testing and deploying biotech breakthroughs effectively⁹. Without

equitable PHC, high-tech solutions may not reach rural or vulnerable communities, undermining health security. Thus the literature consistently links PHC investment to improved equity and resilience: “investments in PHC improve equity and access, healthcare performance, accountability and health outcomes” globally³.

Equity and Gender Dynamics:

Underlying both biotech and PHC efforts is the question of who has access and who leads. Gender equity emerges as a critical concern. Notably, women constitute roughly 67–70% of the global health and social care workforce^{4, 5}. They serve on the front lines as nurses, midwives, community health workers, and increasingly as researchers and entrepreneurs. Yet women remain underrepresented in decision-making and leadership: WHO reports that although women form the large majority of health workers, they occupy only about 25% of senior roles⁴. This “leadership gap” has practical consequences. Analyses show that programs are more effective and equitable when women are empowered in decision roles. For example, women-led initiatives have been pivotal in mobilizing vaccine campaigns, increasing community engagement, and expanding service reach in low-resource areas⁵. Dr. Allama Elmechdi echoes this perspective from his forum contributions: “empowering women in biotech is not only a matter of equity, it’s essential for resilient, inclusive, and forward-looking health systems”⁶. In biotech specifically, women’s participation helps ensure innovations address diverse needs. An Alliance for Science report documents many African women scientists leading agricultural biotech projects to improve nutrition and fight hunger, and argues that women must be involved for the sector to advance¹⁰.

In sum, both empirical studies and expert opinion stress that gender inclusion enhances innovation and access: closing gaps for women in health roles accelerates progress toward universal health goals.

DISCUSSION

The findings illustrate a tight interplay:

Biotechnology and primary healthcare are mutually reinforcing pillars of global health security, and gender equity amplifies their impact. Investments in biotech can generate new vaccines, diagnostics and therapies – but those innovations must be delivered through strong PHC systems to be effective. WHO and analysts alike argue that without robust PHC, health systems lack the capacity to use cutting-edge tools efficiently^{3,9}. For example, a novel treatment developed in a lab is only as impactful as the distribution channels and clinics that provide it; thus, countries like the UAE and Saudi Arabia are wise to pursue both technology hubs and primary care renewal in parallel (e.g. UAE’s Health Data Law and genomic projects alongside biotech clusters^{1,3}).

Policy coherence is needed:

Governments should align biotechnology strategies with universal health coverage mandates and equity targets. Economist Impact's Abu Dhabi reflections and the PwC analysis both emphasize that long-term government commitment across talent, infrastructure and regulatory policy is key to a thriving biotech ecosystem^{8,9}. Similarly, WHO calls for whole-of-government approaches to PHC, embedding equity and community engagement in all health policies³. In this review, we see that where governments prioritize these factors — as in the UAE's integrated healthcare initiatives and Saudi Arabia's new biotech regulation — progress is most likely. However, challenges persist: Dr. Elmehdi's posts (and allied commentary) note that even in wealthy nations, the tech and finance sectors must be educated about biotech's unique risks and timelines⁸. This suggests a broader role for health economics: designing financing models that acknowledge biotech's longer development cycles, and ensuring that cost burdens don't skew innovations away from public health goals. Gender equity emerges as both a cross-cutting issue and a discrete lever. The evidence and expert statements (WHO, GLIDE, Alliance for Science, Dr. Elmehdi) all underline that empowering women – in the lab, on policy boards, and in community programs – drives better health outcomes. For example, when women co-design health interventions, uptake improves among girls and mothers, and services become more culturally responsive^{5,6}. In biotechnology R&D, having women leaders can influence research agendas (e.g. more focus on maternal health, vaccines, nutrition). Therefore, initiatives to train and fund women scientists, as well as to dismantle workplace barriers (as WHO advocates⁴, are integral to the broader strategy of biotech-enabled health security. Dr. Elmehdi's experience in global forums aligns with this: he highlights sessions that bring together visionary biotech leaders – noting that “fostering innovation and supporting diverse leadership” yields solutions that are “accessible and sustainable, especially for under-resourced regions”⁶. In practice, this means embedding gender analysis and leadership quotas in health and innovation programs.

Dr. Allama ELMEHDI highlights that global challenges are becoming increasingly substantial and complex. She argues that, in terms of workforce capacity, the male working-age population alone cannot effectively achieve development objectives across all sectors within a short timeframe. Consequently, the involvement of women and youth is essential, not only due to demographic considerations but also because the magnitude of these challenges precludes excluding such a significant share of the active population. Dr. ELMEHDI stresses that gender and intergenerational equity must be implemented in an explicit, systematic, and rational manner to cultivate a genuine spirit of collaboration among all stakeholders. The goal is to engage these partners synergistically and cooperatively to

strengthen health systems while reducing the risk of anti-competitive practices and unfair competition that could compromise intervention quality and the achievement of the Sustainable Development Goals (SDGs). She emphasizes that this approach must consider the specific contextual realities of each gender and generation, and be guided by a balanced framework of mutual respect and recognition among all parties.

According to Dr. Allama ELMEHDI, it is necessary to make initiatives aimed at promoting women's participation more inclusive and less discriminatory by reframing them under alternative terminology. For example, replacing the term *UAE Women in Biotech* with *UAE Biotech Gender Equity* or *Gender Equity for UAE Biotech* would shift the focus from "Women" to "Gender Equity," thereby encouraging men to feel more concerned and engaged in collaboratively supporting women's inclusion. In the same vein, she recommends rebranding youth-focused activities as *intergenerational initiatives* rather than *youth initiatives*, in order to strengthen mentorship and intergenerational collaboration, ultimately reducing the transition and succession gap between generations.

Finally, the context of global health security (pandemics, climate shocks, etc.) frames all these points. COVID-19 taught that countries with resilient PHC could better trace and contain outbreaks, and that biotech (e.g. rapid mRNA vaccine development) was crucial to ending the crisis. Looking forward, the intersection of biotech and equity will shape responses to new threats. For instance, genomic surveillance (a biotech tool) requires ethical governance and equitable access to data ¹; vaccine development should incorporate varied populations and be distributed fairly via PHC networks. Both industry and public health voices warn that neglecting equity – be it gender or socioeconomic – can undermine pandemic control and recovery. The connected sources consistently argue that building "resilient, inclusive, and forward-looking health systems" depends on bridging divides in technology adoption and leadership ^{5,6}.

CONCLUSION

The literature and practitioner insights reviewed here paint a clear picture: biotechnology holds transformative promise for health and economic development in the UAE, Middle East, Africa and beyond, but its full potential will only be realized through equitable systems and inclusive leadership. Recent initiatives in the Gulf underscore a strategic push toward biotech innovation, yet analyses also caution that sustained investment, supportive regulation and talent development are needed to overcome the sector's intrinsic challenges. At the same time, global health authorities stress that strong primary health care must underpin this innovation, as PHC is the most equitable, cost-effective path to universal health security. Critically, gender equity emerges not as a side issue but as a multiplier: empowering women

in biotech research, health workforce leadership and community outreach leads to more effective, sustainable solutions. Dr. Elmehdi's own commentary resonates with these themes, noting that "empowering women in biotech is not only a matter of equity, it's essential for resilient, inclusive" health systems.

Dr. Allama ELMEHDI's analysis underscores the pressing need for more inclusive and collaborative approaches to addressing global challenges. As development goals grow in complexity and urgency, mobilizing the entire active population, including women and youth, is essential to ensuring resilient, effective, and equitable systems, particularly in health. Traditional approaches that separate or narrowly target women or youth may unintentionally reinforce divisions and limit collective impact. Promoting gender and intergenerational equity through explicitly inclusive and cooperative frameworks provides a pathway toward more sustainable solutions, enhanced mentorship, and fairer opportunities across generations.

Policy Implications: For policymakers and investors, this review highlights several priorities.

A **Align biotech and PHC strategies:** Investments in research, infrastructure and venture capital for biotech should go hand-in-hand with strengthening primary care networks and data systems, ensuring innovations reach all segments of the population.

B **Commit long-term support:** Biotech ecosystems require multi-year public-private partnerships, education pipelines, and regulatory frameworks. Governments should emulate models like Abu Dhabi's talent programs or Singapore's biotech incubators, sustaining them beyond political cycles.

C **Advance gender equity:** Health ministries, academia and industry must proactively promote women's participation through scholarships, mentorship and leadership targets. As evidence shows, engaging women at every level accelerates progress toward health goals.

The UAE, Saudi Arabia, and MENA countries are investing in biotech to meet health and economic goals, but success depends on talent, R&D funding, and supportive policies. Strong primary health care systems ensure equitable access and resilience, enabling innovation to reach all. Gender equity is critical, empowering women to lead in biotech and healthcare delivery for better outcomes. Policymakers must align biotech strategies with universal health and gender goals. Long-term commitment and cross-sector collaboration, as shown in Abu Dhabi and Singapore, can build robust biotech ecosystems while advancing health equity for all.

Global health security in the coming decade will depend on an integrated approach: cutting-edge biotech innovation plus universal, equitable primary care plus inclusive leadership. By following this multidimensional strategy, the global community can better prepare for future health threats while improving day-to-day care for all.

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