Perspectives | Volume 1, Article 2, 23 Apr 2025 | 10.11604/PHCP.2025.1.2.46265

Harnessing precision population health tools to advance primary health care

Ndirangu Wanjuki

Corresponding author: Ndirangu Wanjuki, Amref Health Africa, Nairobi, Kenya

Received: *20 Dec 2024* - ***Accepted:*** *27 Mar 2025* - ***Published:*** *23 Apr 2025*

Domain: Public health

Keywords: Precision population health, universal health coverage, health equity, data science, health system efficiency

Cite this article: *Ndirangu Wanjuki et al. Harnessing precision population health tools to advance primary health care. Primary Health Care Practice Journal. 2025;1:2. [**doi**: 10.11604/PHCP.2025.1.2.46265]*

Available online at: https://www.phcp-journal.org//content/article/1/2/full

tools to advance primary health care

Harnessing precision population health tools to advance primary health care

Ndirangu Wanjuki[1,&]

[1]Amref Health Africa, Nairobi, Kenya

[&]Corresponding author
Ndirangu Wanjuki, Amref Health Africa, Nairobi, Kenya

Abstract

The 2023 Universal Health Coverage (UHC) Global Monitoring Report emphasizes the urgent need to reorient health systems toward a primary health care (PHC) approach to help accelerate progress toward the 2030 UHC targets. This article outlines precision population health as a strategic pathway for this shift. It defines the concept, examines its potential to address systemic inefficiencies, and presents actionable tools for implementation. The article classifies precision population health tools into six core domains: data analytics and science, ecosystem engagement, lean models, strategic purchasing, public health security, and soft skills. Concentrating on the first three categories, the article describes examples of tools to improve health system efficiency, especially in resource-constrained settings. For example, data science tools such as proximate analytics and predictive modelling optimize

like ecosystem-wide diagnosis and coaching foster collaborative problem-solving. Lean models, including last-mile services, self-care, and virtual learning, enhance access to health services and efficiency. A subsequent publication will examine the remaining three domains. Development agencies and philanthropic organisations are urged to prioritise technical assistance that emphasises skills development and fosters South-South learning and collaboration to support government-led scaling of precision population health tools towards UHC and system resilience.

Perspective

When I first came across the 2023 Universal Health Coverage (UHC) Report, I was struck by its stark message: 4.5 billion people still don´t have access to essential health services, and over a billion face financial ruin when they seek care [1]. As someone engaged in health systems, I believe there´s no better way to tackle this crisis than by focusing on primary health care (PHC), as the World Health Organization recommends. But the game-changer here is something I have defined as precision population health. Despite well-intentioned ongoing efforts, PHC frameworks often remain inefficient, frequently failing to optimize resources, leverage real-time impact data, or adapt to unique population needs. Without effectively responding to available impact data, interventions lack precision, leaving vulnerable groups underserved. Precision population health offers a meaningful shift, harnessing insights from impact data, ecosystem collaboration, lean models, strategic purchasing, public health security, and soft skills to deliver targeted, high-impact interventions that prioritize those most in need.

intervention or set of interventions) to ensure the perfect fit, with the suit's wearer being a demographic group such as women of reproductive age.

By definition, precision population health uses routine impact data to inform the design and deployment of resource-efficient strategies that equitably and sustainably improve health outcomes for at-risk demographic groups.

It is built on five principles: identifying at-risk demographic groups, using routine proximate impact data such as facility deaths or complications, ensuring actionable insights are strategically accessible through user-friendly platforms, driving lean ecosystem improvements, and promoting health equity by considering social factors such as gender, age, and economic status.

While precision medicine focuses on individual treatment (like using genetics to fight cancer), precision public health works to broadly protect populations based on disease risks among sub-groups [2,3]. Precision population health finds the sweet spot: it digs deep into specific demographics and puts people at the center, to target their unique challenges for the greatest possible equitable impact through resource-efficient system improvements. Precision population health originated from early population genomics work and now integrates social, behavioral, and environmental factors.

Precision population health builds on the WHO´s six building blocks as a complementary approach to health system optimisation. It employs targeted, data-driven interventions for at-risk populations to supplement, rather than replace, existing strategies. It enhances current systems to promote equity and improve outcomes. For example, how can health systems better deploy existing human resources to reach

service delivery and impact?

Tools for precision population health

I propose six categories of precision population health tools: data science, ecosystem engagement, lean models, strategic purchasing, public health security, and soft skills and mindset. Technology plays a potentially transformative role as an enabler across all these categories. This article focuses on the first three. The tools highlighted in this article serve as a starter pack, encouraging practitioners to explore new tools, experiment with them, and share their insights.

1. Data analytics and data science - turning information to impact: this foundational category includes proximate impact analytics, predictive modelling, data visibility, information system interoperability, and data governance, as examples of data innovation tools.

Proximate analytics enables the use of routine health data to fine-tune health system strategies, even in resource-constrained settings. However, this potential is often hindered by challenges such as low reporting rates, incomplete data, and an over-reliance on input- and output-focused service statistics. Strengthening data completeness and quality, particularly for impact data such as maternal death reviews, is essential for generating meaningful insights that optimise impact pathways [4]. Predictive modelling, such as Kenya´s Antimicro.ai for antimicrobial resistance [5] and artificial intelligence (AI) solutions to combat malnutrition [6], leverages AI to improve health outcomes. Precision population health observatories can provide context-specific insights to enhance programs and achieve gains, such as those experienced in HIV programs [7]. System interoperability connects data across systems to reveal

2. Ecosystem engagement - health is everyone´s responsibility: this category includes ecosystem-wide diagnosis, coaching and mentoring, socio-ecological determinants, and co-creation with communities as examples made possible through the practice of adaptive leadership.

Adaptive leadership is key in countries facing tough health challenges, such as fiscal constraints amidst development financing landscape shifts, climate change impacts, and epidemiologic shifts. It drives ecosystem-wide learning by coaching people to build new skills and tackle complex problems through rigorous prioritization and action [10]. Tackling social and ecological determinants, such as ensuring high levels of girls' education in regions significantly affected by gender inequalities, requires cross-sector collaboration and integrated data. Notably, working directly with communities to design interventions improves equity and responsiveness.

3. Lean models - doing more with less: in health systems, efficiency isn´t just about cutting costs-it´s about eliminating waste and reaching the most underserved populations. Lean models do exactly this. Examples include tackling inequalities, eradicating poverty, delivering last-mile services, self-care, medicine access initiatives, virtual learning, primary care autonomy, genomic sequencing, disease elimination, water access, and addressing micronutrient deficiencies.

Addressing health inequalities means focusing on underserved populations informed by impact data, as seen in specific HIV program models [11]. It also requires fair resource distribution, local manufacturing, including micro-manufacturing [12], and poverty reduction efforts like Bangladesh Rehabilitation Assistance Committee (BRAC´s)

Reaching remote or hard-to-access areas relies on last-mile services, such as community case management [14,15], one-health mobile clinics [16], cost-effective movable clinics [17], intra-hospital oxygen systems [12], and digital health tools [18,19]. Self-care allows individuals to take charge of their health [20], while public-private partnerships enhance access to essential medicines like heat-stable carbetocin [21]. Virtual learning helps train health workers efficiently [22], and decentralizing decision-making improves the quality of primary healthcare [23,24]. Genomic sequencing enables precise diagnosis and treatment [25]. As with smallpox eradication, eliminating diseases depends on global collaboration and consistent funding [26,27]. In 2020, more than two billion people lacked safe water, highlighting the need for urgent investments [28]. Tackling micronutrient deficiencies like anaemia requires scalable solutions such as biofortified foods and multiple micronutrient powders [29].

Despite the promise of precision population health tools, implementation and scale-up remain hindered by inadequate South-to-South learning, which often fails to empower professionals in resource-limited settings on how to drive change. Strengthening knowledge exchange and equipping health workers with adaptive leadership skills are critical for effectively scaling and replicating these tools.

Concluding reflections

Precision population health reorients health systems on PHC principles, improving efficiency and driving progress toward UHC. To succeed, it is essential to use proven tools to decisively target vulnerable demographic groups with high-impact interventions while evading pitfalls like ethical data risks, leadership gaps, equity blindness, evidence-to-policy

Practitioners and development agencies need to back government-led efforts to expand the application of precision population health tools, including by strengthening South-to-South learning. This is key to rethinking health systems as modern frameworks designed to tackle the uncertain and complex challenges of today and the future [30].

Future research on precision population health should focus on integrating artificial intelligence and machine learning for predictive modelling, expanding the application of genomic sequencing applications in resource-limited settings, developing precision population health observatories, strengthening multisectoral partnerships to address social determinants of health, and enhancing workforce capacity in adaptive leadership to scale the effective deployment of primary health care using precision population health tools.

Competing interests

The authors declare no competing interests.

Authors' contributions

All the authors read and approved the final version of this manuscript.

References

1. World Health Organization. Tracking Universal Health Coverage: 2023 Global monitoring report. 2023. Google

2. Centers for Disease Control and Prevention (CDC). **From Precision Medicine to Precision Public Health: The Dialogue Continues**. 2022. Accessed 8th December, 2024.

3. Ndirangu M. **Precision public health best path to a healthier future for Africa**. 2024. Accessed 17th September, 2024.

4. Wanjuki N. **Eight Practices for Health Systems 2.0 Practitioners**. 2024. Accessed 8th December, 2024.

5. The Global Alliance for Vaccines and Immunization (Gavi). **How AI is transforming health care in Kenya amid rapid innovation**. 2024. Accessed 5th November, 2024.

6. Gitahi G. **Curbing malnutrition with AI**. Microsoft. Accessed 8th December, 2024.

7. Joint United Nations Programme on HIV/AIDS (UNAIDS). The path that ends AIDS: UNAIDS Global AIDS Update 2023. Geneva: UNAIDS. 2023.

8. **KEMSA's Reverse Logistics Transform Malaria Net Distribution Across Kenya**. Capital FM. 2024. Accessed 8th December, 2024.

9. International Organization for Standardization. ISO 27799:2016 Health informatics - Information security management in health using ISO/IEC 27002. 2016.

Business Review Press. 2009. **Google Scholar**

11. Subedar H, Barnett S, Chaka T, Dladla S, Hagerman E, Jenkins S *et al*. Tackling HIV by empowering adolescent girls and young women: a multisectoral, government led campaign in South Africa. BMJ. 2018 Dec 7;363:k4585. Accessed 9th December, 2024. **PubMed** | **Google Scholar**

12. The Global Fund. **News Releases: Global Fund Investment in Medical Oxygen Infrastructure Launches in Kenya**. 2023. Accessed 6th December, 2024.

13. Bangladesh Rehabilitation Assistance Committee (BRAC). Impact and Reach of BRAC´s Graduation Approach. 2019. Accessed 5th December, 2024.

14. Marita E, Langat B, Kinyari T, Igunza P, Apat D, Kimori J *et al*. Implementation of community case management of malaria in malaria endemic counties of western Kenya: are community health volunteers up to the task in diagnosing malaria? Malar J. 2022 Mar 5;21(1):73. Accessed 5th December, 2024. **PubMed** | **Google Scholar**

15. Amref Health Africa. **Why African nations should invest in community health**. 2024. Accessed 7th December, 2024.

16. Amref Health Africa. **One Health Approach Strengthens Human and Animal Health in Turkana, Kenya**. 2024. Accessed 17th August, 2024.

Astrazeneca Deploy COVID-19 Mobile Clinics In Kenya. 2024. Accessed 9th December, 2024.

18. Amref Health Africa. **Sh154m AI programme promises to cure TB screening headache**. 2024. Accessed 8th December, 2024.

19. Wotton L, Wu A, Wu I. **Jacaranda Health advances maternal and infant health across Kenya and beyond with AWS**. 2024. Accessed 7th December 2024.

20. Amref Health Africa. **The Transformative Potential of Self-Care for Health in Africa**. 2024. Accessed 14th November, 2024.

21. Widmer M, Piaggio G, Nguyen TMH, Osoti A, Owa OO, Misra S *et al*. Heat-Stable Carbetocin versus Oxytocin to Prevent Hemorrhage after Vaginal Birth. N Engl J Med. 2018 Aug 23;379(8):743-752. Accessed 24th December, 2024. **PubMed** | **Google Scholar**

22. **COVID-19: Amref Health Africa´s response so far**. The Voice. 2020. Accessed 17th November, 2024.

23. Council of Governors. **Fourth Edition of The Compendium of County Innovations and Best Practices**. 2023. Accessed 29th November, 2024.

24. Wekesa N. **Strengthening Health Outcomes through Facility Improvement Funds (FIF) – A Case Study of Makueni County**. Amref Health Africa. 2022. Accessed 29th November, 2024.

improve risk prediction. Nat Genet. 2024 May;56(5):819-826. Accessed 29th November, 2024. **PubMed** | **Google Scholar**

26. Yang F. **Smallpox, Big Achievement: Lessons from Disease Eradication**. 2022. Accessed 19th November, 2024.

27. World Health Organization. World Malaria Report 2023. 2023. Accessed 20th November, 2024. **Google Scholar**

28. UNICEF. **Universal Access to Water, Sanitation and Hygiene: An investment opportunity for the private and public sectors**. 2021. Accessed 5th December, 2024.

29. Suchdev PS, Jefferds MED, Ota E, da Silva Lopes K, De-Regil LM. Home fortification of foods with multiple micronutrient powders for health and nutrition in children under two years of age. Cochrane Database Syst Rev. 2020 Feb 28;2(2):CD008959. Accessed 5th December, 2024. **PubMed** | **Google Scholar**

30. Wanjuki N. **Re-imagining Health Systems: Introducing Health Systems 2.0**. 2024. Accessed 14th December, 2024.