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Integrating biomarkers, diagnostic innovation, and behavioral determinants into healthcare management systems

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Editorial

The evolution of healthcare management in the 21st century is increasingly driven by the need to integrate clinical insights with system-level strategies. Amid growing pressures from both communicable and non-communicable disease burdens, healthcare systems must adopt evidence-based approaches that not only treat illness but also anticipate, monitor, and prevent it.[1] This editorial highlights a collection of research that illustrates how biomarkers, diagnostic innovations, and behavioral determinants can be systematically integrated into healthcare management practices to optimize patient outcomes and resource allocation particularly in developing healthcare systems like Indonesia's.

The use of biomarkers such as leptin and neutrophil-to-lymphocyte ratio (NLR) offers powerful tools for health service stratification.[2] For example, a randomized controlled trial investigating moderate-intensity continuous training (MICT) with vitamin D supplementation in obese patients revealed improvements in both leptin levels and anthropometric outcomes.[3] These findings support the development of preventive health programs that incorporate lifestyle-based interventions with measurable biomarker endpoints, enabling more targeted and cost-effective management of chronic conditions such as obesity. Integrating biomarkers like leptin and NLR into routine clinical assessments could enhance early detection of metabolic dysfunction, improve patient risk profiling, and inform personalized therapeutic strategies.[2] As biomarkers reflect underlying inflammatory and metabolic states, they offer insights beyond traditional clinical measures, thus facilitating earlier intervention and potentially reducing long-term healthcare costs and disease burden. Future research should explore the combined use of multiple biomarkers in diverse populations to validate their predictive utility, refine stratification models, and optimize individual treatment plans within preventive and chronic disease management frameworks.

Likewise, the association between NLR and suicidal ideation among patients with affective disorders opens a pathway for mental health services to adopt predictive risk models within hospital and community-based mental health management.[4,5] Suicide represents a significant global public health issue, resulting in over 700,000 fatalities annually.[6] Approximately 50% of individuals who succumb to suicide have experienced at least one clinically diagnosed mental health disorder within the year preceding their death.[7] By integrating simple, low-cost hematological assessments into routine care protocols, managers can strengthen early warning systems and intervention strategies for psychiatric patients.[5,8]

Moreover, utilizing biomarkers such as NLR in routine psychiatric evaluation could bridge gaps in existing risk-assessment methodologies, providing objective and quantifiable data to complement traditional psychological screening tools.[5] By implementing such biomarker-driven assessments in clinical practice, healthcare providers can more accurately identify individuals at

elevated risk, tailor interventions to individual biological profiles, and potentially improve patient adherence and outcomes.[6] Additionally, the introduction of biomarker-based predictive models within mental health frameworks could facilitate resource allocation, enabling services to proactively prioritize high-risk individuals for intensive care, counselling, or targeted pharmacological interventions, ultimately contributing to a reduction in suicide rates and improvement in overall mental health care effectiveness.[8]

On the diagnostic front, the implementation of Multiplex PCR–Universal Lateral Flow Assay (MPCR-ULFA) for suspected tuberculosis cases demonstrates how point-of-care diagnostics can reduce delays in treatment initiation and curb disease transmission.[9] From a systems perspective, such tools improve diagnostic throughput, reduce dependency on centralized labs, and support decentralized healthcare delivery models, aligning with goals of universal health coverage (UHC).

Behavioral determinants also hold critical value in shaping service delivery. Insights from the Indonesian Demographic and Health Survey on the early sexual debut among adolescents call for intersectoral coordination between healthcare providers, education systems, and community stakeholders to deliver integrated reproductive health education and services.[10] Healthcare managers must utilize such data to design community-responsive programs that align with the social realities of their target populations.

The study on toxicity of Centella asiatica extract using zebrafish embryos, while biological in nature, reinforces the importance of pharmacovigilance and evidence-based regulation in managing traditional medicine use an area often overlooked in healthcare policy and supply chain management.[11]

The survival analysis of stage III breast cancer patients offers valuable insights for oncology service planning, particularly for designing long-term monitoring systems, palliative care integration, and investment in early detection infrastructure. These data inform resource planning, including the need for oncology specialists, chemotherapy access, and patient support services.

Together, these studies affirm that the future of healthcare management must be data driven, multidisciplinary, and patient-centered. By leveraging biological markers, advanced diagnostics, and behavioral data, healthcare administrators and policymakers can design systems that are not only reactive to disease, but also predictive, preventive, and responsive to community needs. This issue invites healthcare leaders, practitioners, and scholars to reimagine the architecture of healthcare systems where clinical evidence meets management strategy in order to deliver better health outcomes, more efficient care, and stronger population health across diverse settings.

Health practitioners play a pivotal role in translating data-driven innovations into effective clinical practice.[12] By continuously updating their knowledge and competencies in biomarker interpretation, digital health technologies, and predictive analytics, practitioners can effectively harness emerging diagnostic tools to guide clinical decisions.[12] Additionally, practitioners serve as vital connectors between technology and patient care, facilitating patient education and ensuring individuals understand the implications of biomarker-driven assessments for their health management. Through proactive engagement, practitioners can motivate patients toward adherence to preventive strategies, lifestyle modifications, and personalized treatment plans. Ultimately, the successful adoption of data-driven healthcare frameworks depends on health practitioners' willingness to embrace innovation, adapt clinical workflows accordingly, and actively participate in multidisciplinary teams committed to optimizing patient outcomes and advancing population health.

Moreover, health practitioners are essential advocates and champions of evidence-based policy implementation at the frontline of patient care.[13] They can provide critical insights to administrators and policymakers, identifying practical barriers and opportunities to enhance the integration of predictive analytics and biomarker assessments into routine clinical workflows.[13] By actively contributing to quality improvement initiatives, practitioners help ensure that new technologies and approaches align with patient safety, ethical standards, and clinical effectiveness. Additionally, practitioners' direct engagement with diverse patient populations

uniquely positions them to recognize and address disparities in access and utilization of data-driven health interventions, thereby promoting equity in healthcare delivery. Their sustained involvement in continuous professional development, interdisciplinary research, and collaboration with healthcare administrators ensures a dynamic, adaptive healthcare ecosystem that remains responsive to evolving community health needs.

Furthermore, the integration of data-driven healthcare approaches necessitates robust collaboration across clinical disciplines, technology experts, and health policy stakeholders.[12] Building comprehensive healthcare ecosystems that incorporate real-time data analytics, artificial intelligence, and personalized patient monitoring can empower healthcare providers to make informed, timely decisions. Such ecosystems can also foster patient engagement and self-management by providing individuals with actionable health insights, promoting healthier lifestyle choices, and enabling proactive health interventions. As healthcare continues to evolve toward precision and preventive models, interdisciplinary cooperation, continuous education of healthcare professionals, and strategic investment in health information systems will be critical for achieving sustainable, equitable, and high-quality healthcare delivery.

REFERENCES

1. Jackson-Morris A, Masyuko S, Morrell L, Kataria I, Kocher EL, Nugent R. Tackling syndemics by integrating infectious and noncommunicable diseases in health systems of low-and middle-income countries: A narrative systematic review. PLOS Global Public Health.2024;4(5):e0003114. DOI: 10.1371/journal.pgph.0003114
2. Zahorec R. Neutrophil-to-lymphocyte ratio, past, present and future perspectives. Bratisl Lek Listy. 2021;122(7):474-88. DOI: 10.4149/BLL_2021_078
3. Sheikholeslami-Vatani D, Rostamzadeh N. Changes in appetite-dependent hormones and body composition after 8 weeks of high-intensity interval training and vitamin D supplementation in sedentary overweight men. Frontiers in Nutrition. 2022;9:827630. DOI: 10.3389/fnut.2022.827630
4. Wulan NMCR, Wiradana W. Peripheral inflammatory markers and suicidal behavior in depressive and anxiety disorders: A systematic review and meta-analysis of neutrophil-to-lymphocyte, platelet-to-lymphocyte, and monocyte-to-lymphocyte ratios. Scientia Psychiatrica. 2025;6(2):766-82. DOI: 10.37275/scipsy.v6i2.192
5. Velasco A, Lengvenyte A, Rodriguez-Revuelta J, Jimenez-Treviño L, Courtet P, Garcia-Portilla MP, et al. Neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, and monocyte-to-lymphocyte ratio in depressed patients with suicidal behavior: A systematic review. European Psychiatry. 2024;67(1):e76. DOI: 10.1016/j.ajem.2020.11.058
6. World Health Organization. Preventing suicide: A resource for media professionals, 2023 update: World Health Organization; 2023.
7. Carpenter BD, Gatz M, Smyer MA. Mental health and aging in the 2020s. Am Psychol. 2022;77(4):538-50. DOI: 10.1037/amp0000873
8. Bodaghi A, Fattahi N, Ramazani A. Biomarkers: Promising and valuable tools towards diagnosis, prognosis and treatment of Covid-19 and other diseases. Heliyon. 2023;9(2). DOI: 10.1016/j.heliyon.2023.e13323
9. Wang X, Wang G, Wang Y, Quan S, Qi H, Sun L, et al. Development and preliminary application of multiplex loop-mediated isothermal amplification coupled with lateral flow biosensor for detection of mycobacterium tuberculosis complex. Frontiers in cellular and infection microbiology. 2021;11:666492. DOI: 10.1016/j.heliyon.2023.e13323
10. Cini KI, Wulan NR, Dumuid D, Triputri AN, Abbsar I, Li L, et al. Towards responsive policy and actions to address non-communicable disease risks amongst adolescents in Indonesia: insights from key stakeholders. The Lancet Regional Health-Southeast Asia. 2023;18. DOI: 10.1016/j.lansea.2023.100260
11. Ekor M. The growing use of herbal medicines: Issues relating to adverse reactions and challenges in monitoring safety. Frontiers in pharmacology. 2014;4:177. DOI: 10.3389/fphar.2013.00177

12. Pietronudo MC, Zhou F, Caporuscio A, La Ragione G, Risitano M. New emerging capabilities for managing data-driven innovation in healthcare: The role of digital platforms. European Journal of Innovation Management. 2022 Dec 19;25(6):867-91. DOI: 10.1108/EJIM-07-2021-0327
13. Li YH, Li YL, Wei MY, Li GY. Innovation and challenges of artificial intelligence technology in personalized healthcare. Scientific reports. 2024 Aug 16;14(1):18994. DOI: 10.1038/s41598-024-70073-7