

Tools for Maternal, Newborn, and Women's Health Screening, Triage, and Outbreak Detection

High-burden maternal, newborn, and women's health conditions remain substantially under-detected in many low- and middle-income countries (LMICs) because diagnostic pathways often depend on centralized laboratories, imaging expertise, repeat visits, or protocols that are difficult to operationalize at primary care level. These gaps are especially consequential for hypertensive disorders of pregnancy (including preeclampsia), gestational hyperglycemia, and serious neonatal infections. For these conditions, delayed recognition rapidly increases the risk of maternal and neonatal morbidity and mortality. The World Health Organization (WHO) emphasizes that high-quality antenatal care and timely recognition and management of pregnancy complications are core strategies to reduce preventable deaths and improve outcomes.¹⁻³

Preeclampsia illustrates the limitations of laboratory-dependent or referral-reliant pathways. WHO stresses the need for early detection, appropriate prevention for high-risk women (e.g., low-dose aspirin; calcium supplementation in low-intake settings), and prompt treatment, including magnesium sulfate for seizure prevention. However, risk stratification and escalation decisions often occur without timely access to confirmatory testing. Blood pressure (BP) measurement, which is a cornerstone of detection, often remains intermittent and clinic-dependent.³⁻⁴

Self-monitoring approaches can complement facility-based antenatal care (ANC), and WHO has recently supported implementation of self-monitoring BP during pregnancy through digital adaptation guidance.⁵ Evidence from large randomized trials of BP self-monitoring with telemonitoring in pregnant individuals with chronic or gestational hypertension suggests safety and feasibility, while also underscoring that effectiveness depends on how home measurements are integrated into care pathways and treatment decisions.⁶ These realities motivate innovation toward cuffless or low-burden BP measurement/monitoring approaches that reduce reliance on traditional cuffs and consumables while maintaining clinical usefulness, potentially enabling more frequent measurement and earlier identification of deteriorating trajectories in decentralized or community-linked ANC settings.⁶⁻⁸

In parallel, biomarker-based approaches for preeclampsia triage have matured substantially. Quantitative angiogenic markers such as placental growth factor (PlGF) and the sFlt-1/PlGF ratio can improve triage among women with suspected preeclampsia, helping distinguish those at high near-term risk from those who can be safely managed with outpatient follow-up.⁹⁻¹¹ Pragmatic trial evidence (e.g., PlGF testing embedded in clinical pathways) suggests meaningful reductions in adverse outcomes and faster recognition, supporting the case for simplified, deployable biomarker triage as an adjunct to clinical assessment where it can change decisions.¹⁰ In addition, noninvasive signals may be complementary: deep-learning analysis of retinal fundus images has demonstrated promising predictive performance for preeclampsia in prospective cohort data, creating a pathway toward non-invasive screening or risk stratification if validated across diverse populations and care settings.¹²

Gestational hyperglycemia detection and monitoring face an equally limiting set of constraints. WHO diagnostic criteria for hyperglycemia first detected in pregnancy are grounded in glucose testing (including OGTT-based thresholds), but fasting requirements, laboratory access, and the burden of repeat visits reduce coverage and equity.¹³ Recent global reviews highlight rising prevalence, wide practice variation, and the need for context-appropriate screening and monitoring pathways that can be implemented reliably in routine ANC, particularly in high-volume LMIC clinics.¹⁴ Innovation opportunities include simplified, minimally invasive or non-fasting approaches (paired with clear referral/management algorithms), as well as practical monitoring strategies that reduce dependence on laboratory infrastructure while still enabling clinically meaningful action.

Minimally invasive continuous glucose monitoring (CGM) in pregnancy is increasingly studied for its ability to characterize glycemic patterns beyond episodic testing and inform management decisions. Reviews and commentaries highlight emerging clinical insights and remaining evidence gaps, including the need to define optimal targets and pathways for use in gestational diabetes.¹⁵⁻¹⁶ Building on this trajectory, non-invasive, device-based gestational glucose monitoring, including optical, electromagnetic, and other cross-sector sensing modalities, represents a high-risk, high-reward opportunity if performance, calibration stability, and real-world robustness can be achieved with near-zero consumable cost suitable for routine ANC workflows.¹⁷⁻¹⁸ However, regulatory history underscores the importance of rigorous validation. The U.S. FDA has explicitly warned against smartwatches or rings that claim to measure glucose non-invasively without authorization, noting potential harm from inaccurate readings.¹⁹ This combination of clinical need, workflow constraints, and validation requires durable, low-cost sensing platforms that can enable scalable repeat or longitudinal monitoring while meeting real-world standards for safety, accuracy, and deployability.¹⁵⁻¹⁹

For newborns, neonatal sepsis remains a time-critical diagnostic and health system challenge. The BARNARDS study estimates that sepsis contributes to approximately 2.5 million neonatal deaths globally each year, primarily within the first month of life.²⁰ Because clinical deterioration can occur within hours, timely initiation of intravenous fluids and antibiotic therapy is essential. Delays in initiating effective antimicrobial therapy are strongly associated with increased mortality in sepsis, underscoring the urgency of rapid recognition and treatment initiation.²¹⁻²² In 2024, WHO released updated recommendations that explicitly include diagnostic considerations alongside empiric antibiotic regimens for infants aged 0–59 days, reflecting the persistent gap between symptom-based recognition and the need for rapid treatment escalation decisions.²³⁻²⁴ In many frontline settings, the goal is not a perfect etiologic diagnosis but rapid, high-sensitivity decision support such as immediate referral, initiation/continuation of antibiotics, or safe de-escalation/step-down from intensive care. Emerging approaches that combine continuous physiologic monitoring, host-response biomarkers, and minimally invasive sensing offer the potential to detect deterioration earlier than episodic testing and support antimicrobial stewardship in neonatal care.²⁵⁻³¹

A complementary neonatal priority is earlier identification of infectious disease outbreak clusters in neonatal intensive care units (NICUs). Neonatal units are uniquely vulnerable to rapid transmission and severe outcomes, and outbreak response depends on both infection prevention and control (IPC) fundamentals and timely detection that triggers investigation and containment. WHO has recently published practical facility-level outbreak preparedness, readiness, and response resources for IPC, which provide a policy anchor for strengthening early warning systems and rapid response capability including automated signal detection from routinely collected clinical or microbiology data.³²

Across use cases, technologies that deliver actionable results in a single encounter; minimize sample processing and training requirements; consider infrastructure constraints; and map clearly to escalation, referral, or treatment protocols can be transformative. Programmatic impact will depend on operational fit and affordability at scale, especially where screening is applied to large populations or where NICU early-warning systems must function continuously with minimal incremental burden.

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