

## RESEARCH LETTER

# Can artificial intelligence-augmented fetal monitoring prevent intrapartum stillbirth and neonatal death in a low-income setting: An observational study?

Chikondi Chiweza<sup>1</sup> | Ibe Iwuh<sup>2</sup> | Abida Hasan<sup>2</sup> | Address Malata<sup>3</sup> | Michael Belfort<sup>2</sup> | Jeffrey Wilkinson<sup>2</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, Baylor College of Medicine Children's Foundation Malawi, Lilongwe, Malawi

<sup>2</sup>Department of Obstetrics and Gynecology, Baylor College of Medicine, Houston, Texas, USA

<sup>3</sup>Malawi University of Science and Technology, Mikolongwe, Malawi

## Correspondence

Jeffrey Wilkinson, Department of Obstetrics and Gynecology, Global Women's Health, Baylor College of Medicine, Houston, TX, USA.

Email: [jeffreypwilkinson@gmail.com](mailto:jeffreypwilkinson@gmail.com) and [jeffrey.wilkinson@bcm.edu](mailto:jeffrey.wilkinson@bcm.edu)

## Funding information

Perigen Inc, Grant/Award Number: In Kind Support; United Nations Population Fund

The United Nations reported 1.9 million stillbirths globally in 2019 with 820 000 in sub-Saharan Africa. Over 40% of stillbirths occur during labour and are preventable with high-quality antenatal care and intrapartum monitoring.<sup>1</sup> Neonatal mortality also remains high in low-income settings with a major contributor being birth asphyxia.<sup>2</sup> Intrapartum stillbirths and birth-asphyxia-related neonatal deaths can be prevented with adequate intrapartum fetal monitoring and safe, expedited operative delivery when indicated.

Continuous electronic fetal monitoring (CEFM) and intermittent auscultation (IA) can both predict fetal well-being.<sup>3</sup> In many high-income settings, CEFM has replaced IA, but IA is proposed as a safe alternative to CEFM in low-risk patients with a lower rate of caesarean delivery compared with CEFM.<sup>4</sup> Identification of low-risk patients is difficult in low-income countries because of sub-optimal antenatal care, staffing and other resource constraints. Proper IA requires a high midwife-to-patient ratio during active labour and one-on-one care during the second stage, which is also largely not achievable in low-income settings. CEFM requires equipment, knowledge and skills that are similarly not widely accessible. Artificial-intelligence-augmented CEFM (AI-CEFM) identifies fetal heart rate abnormalities, provides a provisional interpretation and alerts obstetric providers. AI-CEFM has potential advantages over IA and standard CEFM in settings with limited staff, lack of experience in CEFM interpretation and a large percentage of high-risk patients.

In an established public-private partnership with, and with the permission of, the Malawi Ministry of Health, we instituted PeriWatch Vigilance™ AI-CEFM at a hospital in Malawi with over 7000 deliveries in 2021 during the height of the COVID-19 pandemic. Perigen Inc., the AI-CEFM software manufacturer, contributed technical support and use of the software remotely. Staff were trained in the use of the monitors and software, and in the identification of fetal heart rate abnormalities. AI-CEFM was employed using a risk stratification algorithm (Figure 1) designed for staff to escalate AI-CEFM alerts to consultant-level physicians.

AI-CEFM was available in four of nine labour rooms and two antenatal rooms; 24-hour obstetrician services were available for interpretation of the findings. The hospital has a 95% decision-to-delivery interval of 30 minutes or less for caesarean deliveries with a surgical site infection rate less than 5% and no direct-cause maternal deaths in 2021.

Stillbirths, early neonatal deaths and caesarean delivery rates for 6 months before and 6 months after implementation of AI-CEFM were examined. There was a marked reduction in intrapartum stillbirths and early neonatal deaths with a small but statistically significant increase in the caesarean delivery rate, as shown in Table 1.

This represents compelling preliminary data on the use of AI-CEFM in low-income settings to reduce intrapartum stillbirths and early neonatal deaths. There are limitations in interpreting or generalizing these findings. Selection and expectancy bias are potential confounders in the results. Also, 24-hour obstetrician coverage is not common in this setting. However, we were able to demonstrate remote interpretation

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Chikondi Chiweza and Ibe Iwuh are co-first authors.

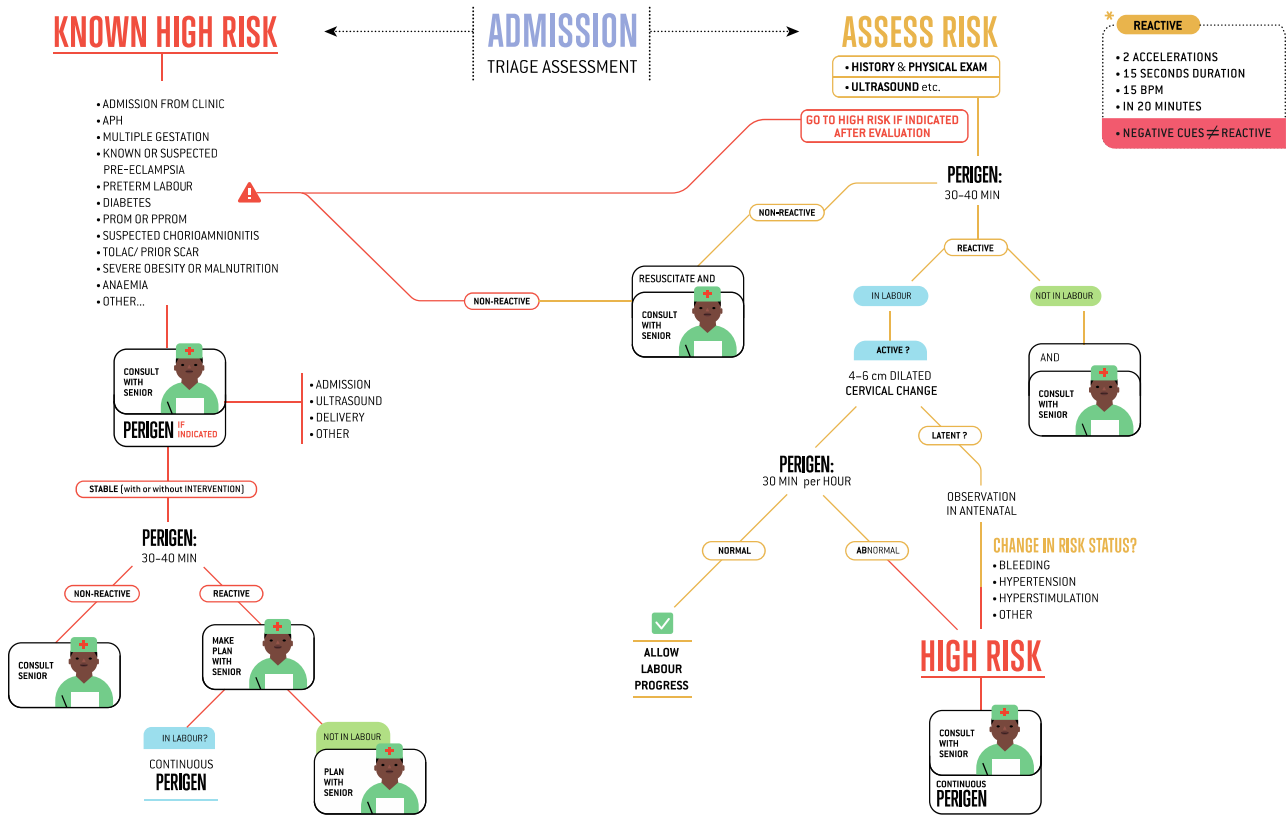


FIGURE 1 AI-CEFM algorithm

TABLE 1 Peripartum outcomes before and after implementation of AI-CEFM in a maternity hospital in Malawi

	Before			After			p value
	N	%	1 in X births	N	%	1 in X births	
Deliveries	3843			4083			
Intrapartum stillbirths (SB)	15	0.39%	256	1	0.02%	4083	0.0007
Early neonatal deaths (ENND)	29	0.75%	133	7	0.17%	583	0.0002
Intrapartum SB and ENND	44	1.14%	87	8	0.20%	510	<0.0001
Caesarean delivery	403	10.49%		514	12.59%		0.0039

of the AI-CEFM findings, emphasizing the potential for telemedicine use with remote obstetric supervision in other sites. These early data suggest the need for a prospective trial comparing AI-CEFM with standard CEFM and/or IA. Any such trial should only be performed in a hospital where adequate surgical safety has been established. Increased rates of caesarean delivery remain a likely effect of this technology so this risk must be carefully and prospectively analysed. Artificial intelligence technology is being used in low-income settings for many applications. Saving babies' lives should not be an exception.

**ACKNOWLEDGEMENTS**

On behalf of the AI-CEFM in Low-Income Settings Working Group, we are grateful to: Malawi Ministry of Health, Dr Charles Mwansambo, Area 25 Ministry of Health Leadership;

Baylor College of Medicine Children's Foundation Malawi, Phoebe Nyasulu, CEO Alfred Mwenitete, Information Technologies; Malawi University Of Science and Technology; Perigen, Inc. Matthew Sappern, CEO; UNFPA, Masaki Watabe, Juliana Lunguzi; Baylor College of Medicine; Texas Children's Hospital.

**FUNDING INFORMATION**

Funding for this study was provided by the Texas Children's Hospital and the United Nations Population Fund Malawi. Perigen Inc. provided software and technical support but no direct funding.

**CONFLICT OF INTERESTS**

None declared. Completed disclosure of interests form available to view online as supporting information.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Chiweza C, Iwuh I, Hasan A, Malata A, Belfort M, Wilkinson J. Can artificial intelligence-augmented fetal monitoring prevent intrapartum stillbirth and neonatal death in a low-income setting: An observational study? *BJOG*. 2022;00:1–3. <https://doi.org/10.1111/1471-0528.17321>