Quantitative Fetal Haemoglobin Measurement: Gazelle™ Point-of-Care Electrophoresis versus Standard HPLC Methodology

ASCAT 2026
7-10 October 2026 | London, UK
Central Hall Westminster

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INTRODUCTION

Fetal haemoglobin (HbF) is an important modifier of sickle cell anaemia and an important marker for monitoring response and adherence to hydroxyurea therapy.

Standard HPLC-based HbF measurement is useful but expensive, centralized, and can be difficult to interpret in samples with elevated HbF.

Gazelle™ is a portable electrophoresis platform that offers lower-cost HbF quantitation suitable for low-resource settings.

OBJECTIVES

Study context
H-PRIME (Hydroxyurea–Pragmatic Reduction In Mortality and Economic burden) is a large randomized clinical trial evaluating practical hydroxyurea treatment and other strategies in children with sickle cell anaemia at four sites in Eastern Uganda.

This analysis aimed to:
- Compare Gazelle HbF quantitation with Bio-Rad D-10 HPLC using paired H-PRIME samples.
- Assess agreement across sites and timepoints before and during hydroxyurea treatment.
- Evaluate Gazelle as a practical alternative for decentralized HbF monitoring in Africa.

METHODS AND MATERIALS

- Samples were obtained within the H-PRIME clinical trial in 1,785 children with sickle cell anaemia aged 1–10 years at four sites in Eastern Uganda.
- A total of 3,069 paired venous blood samples were analyzed before and during hydroxyurea treatment.
- HbF was measured on the same EDTA sample using Gazelle™ and Bio-Rad D-10 HPLC.
- For HPLC, traces were re-interpreted to capture the full HbF signal at elevated values.
- Agreement was assessed using Lin's concordance, reduced major axis regression, and Bland-Altman analysis

RESULTS

Overall agreement was good: Lin's concordance 0.76 (95% CI 0.75–0.77).

Gazelle values were modestly higher than HPLC: mean difference +5.3%, with 95% limits of agreement -3.0% to 13.6%.

RMA regression: intercept +1.8%; slope +1.3, with the difference increasing at higher HbF values.

Agreement remained similar across sites: Lin's concordance 0.72–0.80.

Before hydroxyurea, mean HbF was 11.4% by HPLC vs. 16.2% by Gazelle; on treatment, 18.9% vs. 25.3%, respectively.

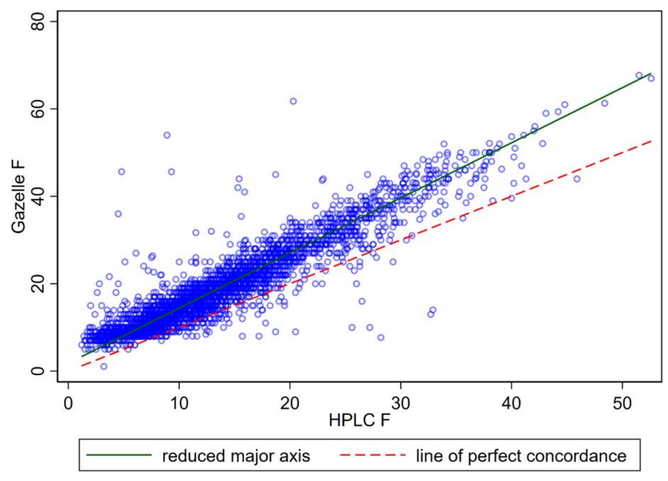


Figure 1. Scatter plot of Gazelle™ HbF versus HPLC HbF values. The red line shows concordance, if there were perfect agreement between the two methods. The green line is the line of best fit to the observed data.

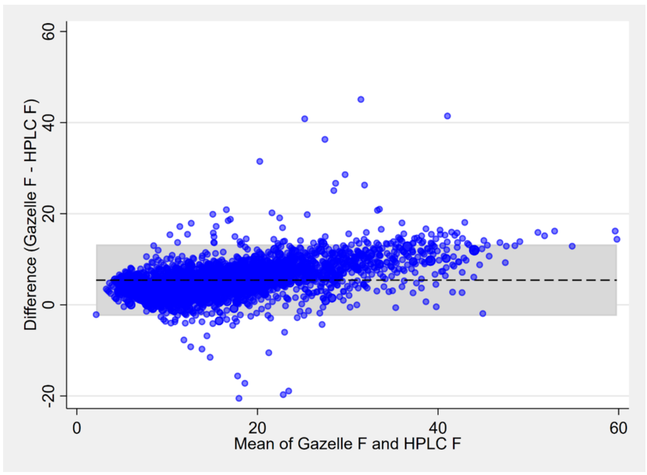


Figure 2. Bland-Altman plot showing the difference between the Gazelle-HPLC methods versus the average of the two methods. The dashed line is the mean difference between the measures, and the shaded area is the range containing 95% of the differences.

Site	Mean difference (Gazelle-HPLC) (%)	95% limits of agreement (%)	Lin's concordance (95% CI)
Overall	**5.4**	**-2.4 to 13.2**	**0.76 (0.75–0.78)**
Mbale	5.5	-1.9 to 12.9	0.75 (0.73–0.77)
Soroti	5.8	-1.3 to 12.9	0.78 (0.76–0.80)
Atutur	6.5	-1.7 to 14.7	0.72 (0.70–0.75)
Ngora	3.7	-4.2 to 11.6	0.81 (0.79–0.83)

Table 1. Agreement summary by site



Figure 3. Gazelle Hb Variant, which reports HbA, HbS, HbC, HbF and HbA2 as relative percentages.

CONCLUSIONS

- Gazelle showed good concordance with standard HPLC for quantitative HbF measurement.
- Gazelle values tended to be slightly higher, particularly at higher HbF concentrations.
- Unlike the D-10 output, Gazelle results were easier to interpret and did not require recalculation.
- Although analysis times are similar for both methods, the portable Gazelle allows for bed-side results in <8min.

Given its portability, rapid turnaround, and lower cost, Gazelle is a promising tool for HbF monitoring in sickle cell care in low-income settings.

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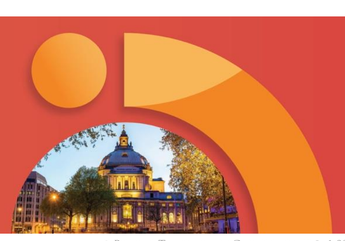
Acknowledgements: We thank Hemex Health for providing the Gazelle™ instruments and cartridges used in this study.

References:

1. **Olupot-Olupot P, Amorut D, Ongodia P, et al.** Hydroxyurea–Pragmatic Reduction In Mortality and Economic burden (H-PRIME): a 2×2×2 factorial randomized open-label trial investigating practical approaches to treatment of sickle cell disease at four sites in Eastern Uganda. *Wellcome Open Research*. 2025.
2. **Quinn CT, Kincaid A, McElhinney K, Korpik J, Ware RE, Kalfa TA.** Feasibility and accuracy of point-of-care measurements of fetal hemoglobin. *Blood Global Hematology*. In press.
3. **Quinn CT, Ware RE.** The modern use of hydroxyurea for children with sickle cell anemia. *Haematologica*. 2025;110(5):1061–1073.
4. **Aygun B, Lane A, Smart LR, et al.** Hydroxyurea dose optimisation for children with sickle cell anaemia in sub-Saharan Africa (REACH): extended follow-up of a multicentre, open-label, phase 1/2 trial. *Lancet Haematology*. 2024;11(6):e425–e435.
5. **Akinsheye I, Alsultan A, Solovieff N, et al.** Fetal hemoglobin in sickle cell anemia. *Blood*. 2011;118(1):19–27.
6. **Laksap S, Suanboon S, Punyamung M, Ruengdit C, Pornprasert S.** Comparative evaluation of high-performance liquid chromatography and capillary zone electrophoresis for detection of hemoglobin variants and quantitation of HbA0, HbA2, HbE, and HbF. *Clinical Chemistry and Laboratory Medicine*. 2024;62(7):1383–1392.
7. **Bio-Rad Laboratories.** D-10 Hemoglobin Testing System documentation / β-thalassemia Short Program information. Bio-Rad Laboratories. *This is the one supporting the discussion of interpretation limitations at elevated HbF.*



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