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CLINICAL RESEARCH

Outcomes, challenges and prospects of emicizumab prophylaxis in Sub-Saharan Africa – Insights from the Tanzanian experience

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Background: Prophylaxis is the global standard of care for haemophilia A (HA), and its adoption has been accelerated by wide use of emicizumab prophylaxis globally. Reports on the prophylaxis in people with haemophilia living in Africa are limited. **Objectives:** We evaluated adherence trends, bleeding outcomes and safety profile of emicizumab prophylaxis in haemophilia A patients managed at the Muhimbili National Hospital (MNH), Tanzania. **Methodology:** This was a cross-sectional analysis which included HA patients of all ages on emicizumab prophylaxis. After obtaining informed and institutional approvals, we collected data on adherence patterns, self-reported adverse events and bleeding outcomes. We assessed factors associated

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with breakthrough bleeding using a robust Poisson method. **Results:** From January to March 2024, 55 people with HA (PwHA) were included in the study. The median age (IQR) was 8 (4,14) years with the majority having severe haemophilia. The median (IQR) ABR for spontaneous bleeds was 8 (5,16), which became zero following a year of emicizumab prophylaxis. Most participants (78%) were adherent. Bleeding occurred in 63.6% of the participants, the majority being traumatic (62.9%). Spontaneous bleeding occurred in 17%, while 20% experienced both spontaneous and traumatic bleeds. In the 19 participants with target joints, the target joint resolution was 79% (15/19). Age was the sole predictor of breakthrough bleeding, which occurred predominantly in those over 18 years of age. The adverse event rate was low (9.1%), with injection site reactions being the most frequent. **Conclusions:** In this real-world experience with emicizumab prophylaxis from Africa, the majority of the patients' adherence was good and emicizumab prophylaxis was effective in preventing spontaneous bleeding. The safety profile of emicizumab was acceptable and consistent with other global real-world experiences.

Keywords: *Emicizumab, Haemophilia A, Bleeding, Adherence, Prophylaxis; Africa, Real-world experience*

Coordinated efforts by various stakeholders have led to the improvement of outcomes for people with haemophilia (PWH) in Africa [1,2]. Despite this, 90 % of all undiagnosed haemophilia cases worldwide are in Africa [3], with only 2% of those diagnosed accessing clotting factor concentrates (CFCs) [3]. With a broad population exceeding 60 million, anecdotal data reports that Tanzania has only 400 confirmed cases of haemophilia, with most being haemophilia A (HA). Currently, all CFCs accessible in Tanzania are offered via an initiative by the World Federation Humanitarian Aid Program (WFHHAP). Although prophylaxis is the global standard of care for individuals with Haemophilia, until recently, factor on-demand was the sole method of therapy available. The introduction of emicizumab in April 2021 therefore marked the beginning of prophylaxis therapy for PWH in Tanzania.

Emicizumab is a genetically engineered bi-specific monoclonal antibody that links activated FIX and FX, thereby re-establishing coagulation [4,5]. It has been proven effective and safe in both clinical research and practical studies [6-10]. Advantages of emicizumab include, among others, a decrease in bleeding events, improvement of joint health and enhancement in the overall quality of life [11]. Although approximately 29 African countries now have access to emicizumab with the assistance of WFHHAP [11], few have published their data. Despite its availability in Tanzania for the last 3 years, no studies have yet evaluated adherence, bleeding outcomes and the safety profile of emicizumab prophylaxis among people with HA (PWHA) in the country.

MATERIALS AND METHODS

Enrolment and data collection

This cross-sectional study enrolled patients with haemophilia on emicizumab prophylaxis in Tanzania who were undergoing follow-up at Muhimbili National Hospital (MNH). MNH is home to Tanzania's largest haemophilia treatment centre (HTC), catering to both children and adults with haemophilia and other genetic bleeding disorders. Currently, only a limited number of vials are supplied annually, and therefore, emicizumab prophylaxis is strictly initiated at MNH for HA patients with inhibitors, severe disease, poor venous access and patients with history of major bleeding. On request by the HTC in Dar es Salaam, being under five years of age was also considered a standalone criterion in order to prevent early onset joint arthropathy and future disability as seen in the other patients not on prophylaxis. Maintenance doses can, nonetheless, be delivered at regional HTCs or alternative peripheral facilities equipped to provide subcutaneous injections. Patients who are willing and who exhibit proficiency during their follow-up clinics at MNH are encouraged to self-administer at home.

Recruitment of study participants was conducted daily at the HTC. The diagnosis was first verified through the hospital's electronic records platform (JEEVA) before recruitment. Although the country had an overall count of 65 patients receiving emicizumab during the period of the study, only those who consented to participate and had completed their loading dose in the study period (January to March 2024) were enrolled. In addition, invitation to participate in the study was made through phone calls and telephone interviews conducted for individuals who qualified but who did not show up at the clinic. A structured questionnaire administered by the investigators was used to gather both sociodemographic and clinical information. Details regarding clinical characteristics and laboratory investigations pertinent to the study were collected from patients records and JEEVA.

Assessment of adherence

Adherence to emicizumab prophylaxis was evaluated by gathering patient-reported information regarding the vials of emicizumab prescribed and used in the past three months leading up to the interview. This was validated by reviewing the emicizumab dispensing ledger at the clinic alongside pharmacy records. As emicizumab is provided on donation, every vial is tracked by the clinic through the retention of stickers from the vials that include the barcode, which are subsequently affixed to patients' records in the register for each clinic visit where emicizumab was dispensed and administered. As the donation comprises only the 30mg vial, a formula was applied to determine adherence. This was done by dividing the actual number of vials utilised by the vials dispensed from the MNH pharmacy and thereafter converting it into a percentage. This was performed for each individual month and cumulatively over the three-month period. Patients were subsequently categorized as adherent, sub-optimal, or non-adherent depending on whether they had missed less than 15%, 15-25%, or more than 25% of the recommended dosage, respectively [12]. For completion, reasons for skipped doses during these three months were also collected.

Assessment of bleeding outcomes

In this study, bleeding was characterised as visible bleeding from mucocutaneous areas, bleeding validated by imaging reports for individuals with CNS bleeding and as pain or swelling managed with CFCs or supportive methods (Protection, Rest, Ice, Compression & Elevation) for patients with musculoskeletal bleeds. Collected bleeding variables included the frequency of bleeding episodes, the nature of the bleed (spontaneous versus traumatic), the location of the bleed, and whether there was a resolution of target joints after emicizumab for patients with a noted history of a target joint before prophylaxis. Calculations for an annual bleeding rate (ABR) was done to objectively measure and standardise bleeding rates among patients, regardless of the duration of prophylaxis [7]. This was determined for every patient by dividing the total number of bleeding events by number of months on prophylaxis and there-after multiplying by twelve months. An overall ARB was calculated to involve both traumatic and spontaneous and then separately for each.

Assessment of adverse events

An adverse effect was defined as any negative or unintended sign or symptom that arose or intensified from baseline following the commencement of emicizumab prophylaxis. A list of common adverse events was presented to the patient based on reports from HAVEN studies and other real-world reviews, including thrombotic incidents, headaches, diarrhea, reactions at the injection site (such as bruising, discomfort, induration, pain, pruritus, rash, site reactions, swelling, or urticarial formations), arthralgia, myalgia, and fever [6-8,11-13]. Participants were permitted to report any additional new symptoms outside those listed that they would associate with the use of emicizumab. The appearance of any of these symptoms at least once after the start of emicizumab was recorded as an adverse event.

Statistical analysis

Data gathered from the questionnaire was entered into the Open Data Kit (ODK) database and subsequently migrated into a Microsoft Excel sheet, where it was cleaned and analysed utilising Stata version 17. Descriptive statistics were applied for the evaluation of both sociodemographic and clinical information. The Chi-square or Fisher's exact test, as applicable, were employed to evaluate the associations among age, disease severity, adherence patterns, mode of payment, residence, and spontaneous bleeding. A robust Poisson regression model was utilised to assess the predictors of spontaneous bleeding. The Mann Whitney U test was carried out to compare the median occurrences of ABR for spontaneous bleeding before and after emicizumab prophylaxis. A p-value of less than 0.05 was regarded as statistically significant.

Ethical considerations

Ethical clearance to undertake this study was granted by the Muhimbili University of Health and Allied Sciences (MUHAS) Institutional Review Board (IRB) (Ref No. DA.282/298/01.C/2006) and from the Muhimbili National Hospital Directorate of research and publications (MNH/CRTCU/Perm/2024/080). A letter of permission from MNH was then presented to the head of the MNH HTC. Written consent was obtained from participants who physically attended the clinic while verbal consent was obtained from those who participated via telephone interview.

RESULTS

Sociodemographic and clinical traits before emicizumab prophylaxis

Our study enrolled a total of 55 child and adult participants with a median age (IQR) of 8 years (4, 14). Although the main HTC providing care is based

Table 1. Sociodemographic and clinical characteristics of study participants

VARIABLE	FREQUENCY(N=55)	PERCENTAGE(%)
Age group		
Below 5 years	14	25.5%
5-18 years	34	61.8%
Above 18 years	7	12.7%
Median age (IQR)	8 (4,14)	
Area of residence		
Dar es Salaam	28	50.9%
Outside Dar es Salaam	27	49.1%
Haemophilia severity		
Severe (<1%)	28	50.9%
Moderate (1-5%)	22	40.0%
Mild (6-40%)	4	7.3%
Unknown	1	1.8%
History of inhibitors post CFC exposure		
Present	19	34.6%
Absent	36	65.4%
Pre-emicizumab prophylaxis ABR (median and IQR)	8(5,16)	
Target joint prior to prophylaxis		
Present	19	34.6%
Absent	36	65.4%

IQR: Interquartile range ABR: Annualised bleeding rate CFC: Clotting factor concentrate

in Dar es Salaam, nearly half of the participants resided in regions outside the area (49.1%). Most of the participants had severe HA (50.9%), with 40.0% and 7.3% having moderate and mild HA, respectively. Although none of them had quantification of active inhibitors at the point of diagnosis, 23.0% exhibited an inhibitor on mixing study following a record of CFC exposure. Whilst none of the participants had been on a prophylaxis programme previously, the majority had been exposed to CFCs (83.6%) and fresh frozen plasma (72.7%) on demand. Prior to emicizumab prophylaxis, the median ABR (IQR) for spontaneous bleeds was 8 (5,16). For joint health, 34.6% reported the existence of a target joint and 11% had permanent joint destruction in at least one joint causing disability prior to prophylaxis. Table 1 summarises the sociodemographic and clinical characteristics of the study population.

Initiation of emicizumab, maintenance and adherence

Initiation of emicizumab was founded on a criterion developed by the WFH in partnership with the HTC. Being under five was the most prevalent reason for starting prophylaxis in about 32.7% of participants. History of inhibitors (23.6%), severe disease (20.0%), moderate disease with a background of major bleeding (12.7%) and poor venous access (5.5%), represented additional reasons for initiation. The median length (IQR) of emicizumab prophylaxis in the study group was 12 months (7,32), with the maximum duration recorded at 32 months. For maintenance dosing, the majority of the patients preferred monthly administration at 6mg/kg (67.3%) while the remainder chose bi-monthly (32.7%) at 3mg/kg . Despite being a subcutaneous injection that may be delivered by the patient or a caregiver, only 30.0% of the patients were self-injecting at home. Although around half (49.1%) admitted to having skipped at least one dose of emicizumab within the past three months, the vast majority of study participants were adherent to prophylaxis (78.2%). Based on the monthly adherence pattern, a downward shift in adherence was observed in the last month, where only 56.4% were found to be adherent in contrast to 72.7% during the first month (Figure 1). Among the explanations provided for missed doses, long proximity to the HTC (44.4%), lack of money to pay for consultation (33.3%) and shift to CFC because of scarcity of emicizumab (25.9%) were noted. Other reasons reported included absence of fare funds (11.1%), perceived wellness due to lack of bleeding events (7.4%), and one adult participant felt overwhelmed by the numerous injections, given that only the 30mg vial is available.

Figure 1. Adherence patterns of study participant on emicizumab prophylaxis

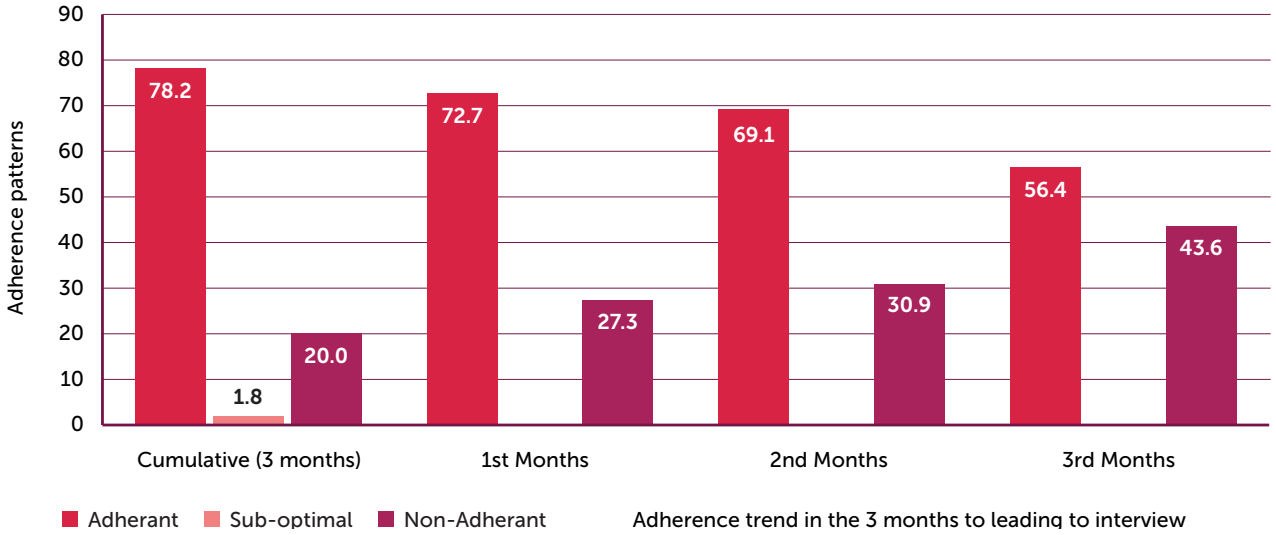
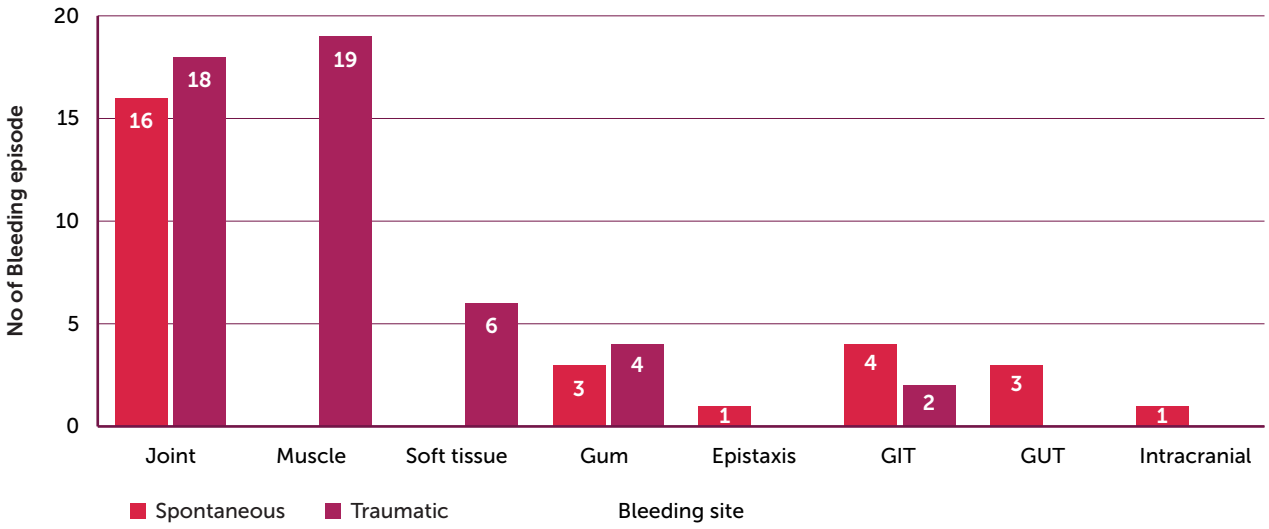


Figure 2: Site and location of bleeds in Haemophilia A patients on emicizumab prophylaxis



Bleeding outcomes

A total of 35 (63.6%) participants experienced at least one bleeding incident throughout the duration of prophylaxis. Among these, 62.9% encountered traumatic bleeding, 17.1% spontaneous bleeding, and 20.0% had both. A total of 77 bleeding events were reported, with most being due to trauma (61%, 41/77) (Figure 2). The overall median annual bleeding rate (ABR)(IQR) for both spontaneous and traumatic bleeds was 0.75 (0,1.7). The ABR (IQR) for spontaneous bleeding by itself significantly decreased to 0 (0,0) for 8 patients before prophylaxis which was statistically significant ($p < 0.001$). Of the 19 individuals who indicated the existence of a target joint prior prophylaxis, 79.0% indicated resolution of the target joint while on emicizumab. Age was the only factor significantly associated with spontaneous bleeding, where individuals over 18 years old exhibited the highest rate of spontaneous bleeding compared to other age categories ($p < 0.001$). The association between sociodemographic and clinical characteritics and spontaneous bleeding is shown in Table 2.

Adverse events

Only 5 participants (9.1%) indicated experiencing one or more adverse events during emicizumab prophylaxis. The most frequently reported adverse events were injection site reactions (5.5%) and headaches (3.6%). No thrombotic events were reported. All adverse events were mild and transient.

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Table 2. Association between sociodemographic and clinical characteristics and spontaneous bleeding

	SPONTANEOUS BLEEDING			UNIVARIABLE ANALYSIS		
VARIABLE	YES (%)	NO (%)	P VALUE	APR	95%CI	P VALUE
Age group (years)						
< 5	1 (7.1%)	13 (92.9%)	< 0.0001	Ref		
5-18	5 (15.2%)	28 (84.8%)		2.12	0.27-16.54	0.473
>18	5 (83.3%)	1 (16.7%)		11.67	1.71-79.76	0.012
Severity of haemophilia						
Mild	1 (25.0%)	3 (75.0%)	0.885	Ref		
Moderate	4 (18.2%)	18 (81.8%)		0.73	0.11-4.94	0.744
Severe	6 (23.1%)	20 (76.9%)		0.92	0.15-5.79	0.932
Cumulative adherence						
Adherence	6 (14.6%)	35 (85.4%)	0.098	0.35	0.13-0.95	0.040
Non-adherence	5 (41.7%)	7 (58.3%)		Ref		
Residence						
Dar-es-Salaam	5 (19.2%)	21 (80.8%)	1.000	Ref		
Outside Dar-es-Salaam	6 (22.2%)	21 (77.8%)		1.16	0.40-3.33	0.789
Mode of payment						
Exemption	0 (0.0%)	1 (100.0%)	1.000	0.80	0.68-0.95	0.010
Insured	7 (23.3%)	23 (76.7%)		0.99	0.80-1.22	0.900
Private	2 (25.0%)	6 (75.0%)		1.00	0.75-1.34	1.000
Public (cost sharing)	4 (25.0%)	12 (75.0%)		Ref		

aPR: Adjusted prevalence ratio
Ref: Reference category

DISCUSSION

This is the first study in Tanzania to report on the adherence and clinical outcomes of emicizumab prophylaxis. The present study found that more than three quarters of participants were adherent to their treatment regimen. A significantly higher adherence rate was reported in a study carried out by Li et al. (2019), who examined patterns and predictors of adherence to emicizumab [14]. In their research, individuals who transitioned from on-demand treatment to prophylaxis with emicizumab, as seen in our case, had an adherence rate of 89%, while those moving from standard prophylaxis using CFCs or bypassing agents (BA) had an even higher adherence rate at 98% [14]. Although a similar study in West Africa reported an adherence rate of 100% [12], it should be noted that their study encompassed solely individuals who had prior compliance with factor prophylaxis. This selection bias may explain the observed difference in our adherence rates. Unlike numerous empirical studies, our study cohort had not previously encountered prophylactic treatment, and this lack of previous exposure might therefore have affected their adherence patterns. Elements that might have enhanced adherence in our study may involve the availability of a caregiver, as most of our patients were young individuals. Disease severity and a past occurrence of major bleeds might also have influenced their commitment to prophylaxis.

The decreasing pattern in adherence observed from the initial to the final months can be accounted for by the short-term unavailability of emicizumab in the HTC, since they had not yet received their WFHHAP donation. This resulted in the transition of certain patients to prophylaxis with CFCs, while keeping emicizumab solely for those with severe disease, inhibitors and inadequate venous access. The transition to prophylaxis with CFCs, however, should be viewed as an opportunity for initiation of a prophylactic programme using CFCs. This would then reserve emicizumab, which is more costly and dependent on donations, for the group of patients with no alternative treatment available. It should be noted that including children under five as a sole criterion for eligibility at the beginning of the programme was an ambitious target and may have contributed to the early out-of-stock. At global level, children below five years are included only if there are additional factors to consider (e.g. presence of an inhibitor).

With only a limited number of participants self-administering emicizumab, we recommend educating

patients and caregivers, thereby empowering them to achieve greater independence and self-efficacy. The strategy of educating of patients and caregivers has been demonstrated to be efficient in other studies as, by enhancing patients' independence in self-administration, it enables home prophylaxis [15]

Despite over half of the participants experiencing bleeds during prophylaxis with emicizumab, the majority of bleeding had a trauma etiology. This finding aligned with a report from a study conducted in Colorado, where 63.2% of participants experienced bleeding during prophylactic treatment, with 70% of the overall incidents being due to trauma [7]. Significantly, the ABR for spontaneous bleeding decreased to zero for the majority of our patients, supporting the hypothesis that, while the risk of bleeding during emicizumab prophylaxis is not entirely eliminated, patients are converted to milder phenotypes, bleeding mainly as a result of trauma. This was likewise reported in Ivory Coast, where an ABR of zero for spontaneous bleeding during a span of 12 months of prophylaxis was reported [12].

Although no testing for the existence of antibodies to emicizumab was undertaken during the study, none of our participants experienced repeated unresponsive bleeding during prophylaxis, with the exception of one individual who had two instances of gastrointestinal bleeding despite being adherent. Both incidents required hospitalisation and the administration of CFCs. Further evaluation revealed a positive H. pylori test with an esophagogastroduodenoscopy, confirming active bleeding gastric ulcers. The study also observed one case of intracranial bleeding. On data analysis, this was found to be non-adherent to prophylaxis and had also suffered gum, joint and genitourinary bleeding. The resolution of target joints was similar to a study in Taiwan that found persistence of target joints in only 17.9% of those with prior history following prophylaxis [13]. Older age (> 18 years) was the only significant predictor of spontaneous bleeding while on prophylaxis. A study by Mendelovich et al. from the Israeli National Hemophilia Center found that an association exists between age and the likelihood of bleeding, with individuals older than 18 years being significantly affected [9]. Although an association between age and adherence was not found in our study, we recognise that our sample size was probably not large enough to have provided this association.

Emicizumab prophylaxis was found to be safe, with fewer than 10% of the patients experiencing reporting adverse event(s). Injection site reactions were the most frequent unfavorable occurrence in this study, similar to what was reported in the HAVEN studies and other real-world reviews [6-8]. As in other reports [11-13], our study indicated that these events were minor and transient, with no the patients ceasing treatment due to unbearable symptoms. None of our participants experienced thrombotic incidents. This might be linked to the minimal exposure of activated prothrombin complex concentrates (aPCC) among study participants. Those with previous exposure stated to have utilised it for fewer than three days during circumcision procedures, with no instance exceeding 100IU/kg daily.

This study had some limitations. Although we recognise that newer methods for evaluating treatment adherence in patients receiving emicizumab prophylaxis are available, such as the VERITAS-NexGen [16] (which encompasses elements of planning, administration, timing, dosing, and patient independence in handling bleeds during prophylaxis), this option was not implemented since only 30.0% of our subjects were self-administering. The study also did not collect the actual doses received by the patients during the loading and maintenance doses, which may have been helpful for putting the bleeding outcomes into context. However, it should be noted that 3 mg/kg/week x 4 weeks was given for as loading and 1.5 mg/kg/week, 3mg/kg /bi monthly or 6 mg/kg/ monthly, as per the WFH regulations and manufacturer recommendations. As we conducted a cross-sectional study examining patients' characteristics before receiving treatment, we may have encountered a degree of recall bias from the participants.

CONCLUSION

To the best of our knowledge, this study stands as one of the few studies conducted in the Sub-Saharan population to thoroughly evaluate adherence, treatment outcomes and the safety profile of emicizumab prophylaxis. These distinctive results are critical in highlighting the disparities between patients from low and middle-income countries and those from developed settings, a consideration that should come to bear when designing humanitarian programmes for these regions. The study encompassed approximately 80% of all patients with HA in Tanzania on prophylaxis, providing valuable insights into the actual circumstances surrounding patients receiving emicizumab prophylaxis in the country.

Among this cohort of PwHA, adherence to emicizumab prophylaxis was high. Despite being a subcutaneous injection that could allow home prophylaxis, the majority continue to receive prophylaxis from health care facilities. Emicizumab prophylaxis is efficacious in preventing spontaneous

bleeding and has an acceptable safety profile. Older age was significantly associated with spontaneous bleeding while on prophylaxis. Continued monitoring and pharmacovigilance with larger cohorts are essential to assess long term outcomes and optimise patient management strategies.

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Conflict of interest

RM has received an unrestricted research grant from the Novo Nordisk Haemophilia Foundation.

JM has received research grants/research support from Biomarin, CSL, Novo Nordisk, Pfizer, Roche, Sanofi, Spark and Vega; has been a consultant/scientific board for Biomarin, CSL Behring, Novo Nordisk, Roche, Takeda, Sanofi, Spa and Vegar; and has received speaker bureau from Novo Nordisk, Pfizer, Roche, Sanofi and Takeda.

The other authors have advised no interests that might be perceived as posing a conflict or bias.

Consent

Informed consent has been obtained from the participants in the study reported in this paper.

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REFERENCES

1. Diop S, Haffar A, Mahlangu J, et al. Improving access to hemophilia care in sub-Saharan Africa by capacity building. *Blood Adv* 2019; 3(Suppl 1): 1-4. doi: 10.1182/bloodadvances.2019GS121537.
2. Ndoumba-Mintya A, Diallo YL, Tayou TC, Mbanya DN. Optimizing haemophilia care in resource-limited countries: current challenges and future prospects. *J Blood Med* 2023; 14: 141-6. doi: 10.2147/JBM.S291536.
3. Pierce GF, Adediran M, Diop S, Dunn AL, El Ekiaby M, et al. Achieving access to haemophilia care in low-income and lower-middle-income countries: expanded Humanitarian Aid Program of the World Federation of Hemophilia after 5 years. *Lancet Haematol* 2022; 9(9): e689-e97. doi: 10.1016/S2352-3026(22)00209-5.
4. Blair HA. Emicizumab: A review in haemophilia A. Drugs 2019; 79(15): 1697-707. doi: 10.1007/s40265-019-01200-2.
5. Oldenburg J, Mahlangu JN, Kim B, et al. Emicizumab prophylaxis in hemophilia A with inhibitors. *N Engl J Med* 2017; 377(9): 809-18. doi: 10.1056/NEJMoa1703068.
6. Callaghan MU, Negrier C, Paz-Priel I, Chang T, et al. Long-term outcomes with emicizumab prophylaxis for hemophilia A with or without FVIII inhibitors from the HAVEN 1-4 studies. *Blood* 2021; 137(16): 2231-42. doi: 10.1182/blood.2020009217.
7. Warren BB, Chan A, Manco-Johnson M, et al. Emicizumab initiation and bleeding outcomes in people with hemophilia A with and without inhibitors: A single-center report. *Res Pract Thromb Haemost* 2021; 5(5): e12571. doi: 10.1002/rth2.12571.
8. Arcudi S, Gualtierotti R, Marino S, et al. Real-world data on emicizumab prophylaxis in the Milan cohort. *Haemophilia* 2022; 28(5): e141-e144. doi: 10.1111/hae.14630.
9. Levy-Mendelovich S, Brutman-Barazani T, Budnik I, et al. Real-world data on bleeding patterns of hemophilia A patients treated with emicizumab. *J Clin Med* 2021; 10(19): 4303. doi: 10.3390/jcm10194303.
10. Liu G, Huang K, Li G, et al. Real-world experience of emicizumab prophylaxis in young children with hemophilia A: retrospective data from China. *Front Pediatr* 2022; 10: 992267. doi: 10.3389/fped.2022.992267.
11. Mahlangu J, Iorio A, Kenet G. Emicizumab state-of-the-art update. *Haemophilia* 2022; 28 Suppl 4(Suppl 4): 103-10. doi: 10.1111/hae.14524.
12. Lambert C, Meité N'D, Kouassi GK, et al. Nonreplacement therapy for hemophilia in low-income countries: experience from a prospective study in Ivory Coast. *Res Pract Thromb Haemost* 2022; 7(1): 100033. doi: 10.1016/j.rpth.2022.100033.
13. Barg AA, Livnat T, Budnik I, et al. Emicizumab treatment and monitoring in a paediatric cohort: real-world data. *Br J Haematol* 2020; 19(2): 282-90. doi: 10.1111/bjh.16964.
14. Li A, Goodfriend C, Sokol J, Kruse-Jarres R. Patterns and predictors of emicizumab adherence in people with hemophilia. *Blood* 2019; 134(Supplement 1): 128083. doi: 10.1182/blood-2019-128083.
15. Schrijvers LH, Beijlevelt-van der Zande M, Peters M, Lock J, et al. Adherence to prophylaxis and bleeding outcome in haemophilia: a multicentre study. *Br J Haematol* 2016; 174(3): 454-60. doi: 10.1111/bjh.14072.
16. Okolo A, Shapiro A, Janson I, et al. Psychometrics and applications of a novel self-report measure of emicizumab adherence: VERITASNexGen. *Haemophilia* 2023; 29(5): 1299-1305. doi: 10.1111/hae.14851.

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