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*Corresponding author

*Dr. Liane Nkengurutse. Centre des Opérations d'Urgence de Santé Publique (COUSP/PHEOC Burundi), Bujumbura, Burundi.

*Dr. John Otshudiema. African Region Mpox Response, World Health Organization – WHO African Regional Office, OMS, Cité du Djoué, BP 06, Brazzaville, Republic of Congo.

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Case Study

Clinical Predictors and Determinants of Mpox Complications in Hospitalized Patients: A Prospective Cohort Study from Burundi

Liane Nkengurutse[1,*]; John Otshudiema[2,3,*]; Godefroid Kamwenubusa[1,*]; Issa Diallo[2]; Odette Nsavyimana[4]; Jean Claude Mbonicura[4]; Jean Claude Nkurunziza[4]; Fidèle Cishahayo[5]; Dieudonné Niyongere[5]; Bonite Havyarimana[5]; Déo Simbarariye[6]; Marc Nimburanira[6]; Bosco Ntiranyibagira[6]; Senya Diane Nzeyimana[2]; Brigitte Ndelema[2]; Denise Nkezimana[2]; Parfait Shingiro[1]; Aimable Sibomana[1]; Stany Nduwimana[2]; Freddy Nyabenda[1]; Alexis Niyomwungere[2]; Mamadou Zongo[1,2]; Abdoulaye Bousso[1,2]; Samuel Boland[2]; Jeanine Ndayisenga[7]; Dionis Nizigiyimana[7]; Joseph Nyandwi[7,**]; Alimuddin Zumla[8,**]; Rosamund Lewis[9,**]; Stanislas Harakandi[4**]

**** First Authors ** Senior Authors***

[1]Centre des Opérations d'Urgence de Santé Publique (COUSP/PHEOC Burundi), Bujumbura, Burundi.

[2]World Health Organization, WHO Burundi, Bujumbura, Burundi.

[3]African Region Mpox Response, World Health Organization, WHO African Regional Office, Brazzaville, Congo.

[4]Mpox Treatment Center, Centre Hospitalo-Universitaire de Kamenge (CHUK), Bujumbura, Burundi.

[5]Mpox Treatment Center, Clinique Prince Louis Rwagasore (CPLR), Bujumbura, Burundi.

[6]Mpox Treatment Center, Hôpital Militaire de Kamenge (HMK), Bujumbura, Burundi.

[7]Institut National de Santé Publique (INSP), Bujumbura, Burundi.

[8]Global Mpox Response, WHO Health Emergencies Programme, World Health Organization, WHO Headquarters, Geneva, Switzerland.

[9]Division of Infection and Immunity, Centre for Clinical Microbiology, University College London, London, and UK National Institutes of Healthcare Research (NIHR), Biomedical Research Centre, UCL Hospitals NHS Foundation Trust, London, United Kingdom.

Abstract

Objectives: To identify predictors and determinants of mpox complications among hospitalized patients in Bujumbura, Burundi, amidst the ongoing mpox outbreak.

Methods: This prospective cohort study analyzed 850 laboratory-confirmed cases of mpox from three treatment centers between July and October 2024. We assessed clinical characteristics and outcomes using data from medical and laboratory records, along with structured interviews with health professionals. We estimated risk factors for complications using multivariate Firth penalized logistic regression stratified by age and HIV status.

Results: Among the 850 participants, 54.4% were male, and the median age was 20.3 years. Complications developed in 3.1% of cases, with conjunctivitis (OR 27.30, 95% CI: 7.67–122.23) and sore throat (OR 12.63, 95% CI: 5.78–30.21) as significant predictors of severe disease. In contrast, generalized rash (OR

0.10, 95% CI: 0.04–0.24) and lymphadenopathy (OR 0.24, 95% CI: 0.08–0.62) were associated with lower severity. Sexual contacts were the predominant route of infection.

Conclusions: Our findings identified key predictors of mpox complications with non-cutaneous symptoms like conjunctivitis and sore throat indicating severity. These insights support targeted interventions in resource-limited settings, although further research on underlying immunological mechanisms is required.

Research in Context

Background of the Evidence

A comprehensive analysis of the World Health Organization (WHO), PubMed, and Scopus databases from 2018 to 2024 was conducted to identify knowledge gaps concerning mpox severity predictors. The search terms used included “risk factors”, “disease severity”, “mpox”, and “monkeypox”. Studies published in English and French were considered. As of 2023, known clinical and demographic predictors included age, sex, and HIV status, as reported by Charniga et al. (2023) and Ogoina et al. (2023). However, these results were weakened by small sample sizes and a lack of statistical power, particularly in sub-Saharan Africa.

Table 1: *Summary of occupation data.*

Occupation	Count (*N* = 465)	Percent (%)
Primary and Secondary Students	162	34.8
Merchants and Sellers	65	14.0
Casual Sex Partners	22	4.7
Drivers	19	4.1
Military and Police	16	3.4
Healthcare Professionals	4	0.9
University Students	13	2.8
Mechanics	11	2.4
Other	153	32.9

Table 2: *Distribution of complications.*

Primary Complicatrion	Count	Percentage (%)
No Complications	820	96.5
Any Complication	26	3.1
Vaginitis	9	1.1
Ulceration in the Genital Area	4	0.5
Conjunctivitis	2	0.2
Necrotic Lesions in the Scrotum/Penis	2	0.2
Other Specific Complications (e.g., cellulitis, HIV-related ocular lesions, genital eruption, complicated pyelonephritis with vaginitis, Fournier’s gangrene)	≤1 each	<0.2 each
Secondary Complication		
No Secondary Complications	807	94.9
Any Secondary Complication	43	5.1
Specific Cases (e.g., complicated pyelonephritis, Fournier’s gangrene)	≤1 each	<0.2 each

Table 3: *Demographic, clinical characteristics and comorbidities of study participants.*

Category	Subcategory	Count	Percent (%)
Comorbidity	STI History (No)	710	58.1
	STI History (Yes)	67	5.49
	Hypertension (No)	871	68.6
	Hypertension (Yes)	1	0.08
	Diabetes (No)	814	66.7
	Diabetes (Yes)	3	0.25
	Cancer (No)	844	69.1
	Cancer (Yes)	1	0.08
	Kidney Failure (No)	843	69
	Kidney Failure (Yes)	2	0.16
	Others (No)	204	16.67
	Others (Yes)	2	0.16
	Erythematous-Squamous Dermatosis	1	0.08
	Pyelonephritis Complicated by Vaginitis	1	0.08
Lesions	Anorectal	181	14.8
	Penile	306	36
	Vaginal	200	23.5
	Oral	250	29.4
	Generalized Rash	717	84.4
HIV Status	Negative	785	92.4
	Unknown	33	3.9
	Positive	28	3.3
Age (Positive Cases)	16-19 years	4	
	20-29 years	9	
	30-39 years	9	
	40-49 years	5	
	50+ years	1	

Stratified analyses across age and HIV status, with interaction testing, confirmed consistent associations despite varying effect magnitudes in key subgroups.

Moreover, few studies have been conducted on countries with sustained transmission such as Burundi. Additionally, non-cutaneous symptoms such as conjunctivitis and sore throat, which may indicate severity, often go unnoticed in literature favoring cutaneous manifestations. Addressing these gaps in research and knowledge could facilitate the development of risk-stratification tools suited to the context of an outbreak and improving patient care in resource-limited settings.

Added Value of This Study

This is the most extensive cohort analysis of laboratory-confirmed mpox cases in Burundi to date (N = 850),

Table 4: *Firth penalized multivariate logistic regression analysis of disease risk factors*

Variables	Balanced Dataset		Unbalanced Dataset	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Sore throat	12.63 (5.78-30.21)	<0.001*	4.32 (1.15-19.61)	0.030
Conjunctivitis	27.30 (7.67-122.23)	<0.001*	45.44 (5.98-464.05)	<0.001*
Asthenia/Fatigue	0.33 (0.10-0.93)	0.036	1.81 (0.35-9.58)	0.477
Muscle pain	2.86 (1.07-8.00)	0.037	1.06 (0.23-4.73)	0.940
Back pain	0.05 (0.01-0.43)	0.006*	0.21 (0.01-2.01)	0.185
Chills/sweats	0.03 (0.00-0.30)	<0.001*	0.27 (0.00-3.23)	0.344
Local lymphadenopathy	0.24 (0.08-0.62)	0.003*	0.13 (0.01-1.06)	0.058
Genital edema	5.66 (1.55-23.28)	0.008*	3.67 (0.58-22.69)	0.162
Generalized lesions	0.10 (0.04-0.24)	<0.001*	0.36 (0.05-1.69)	0.203
Oral lesions	0.20 (0.07-0.55)	0.001*	0.44 (0.07-2.01)	0.304
Vaginal lesions	3.44 (1.68-7.14)	<0.001*	8.88 (2.45-39.30)	<0.001*
OR: Odds Ratio; CI: Confidence Interval				

**Statistically significant after Benjamini-Hochberg correction (FDR = 0.05)*

Only variables with significant associations in at least one dataset are shown Model fit: Hosmer-Lemeshow test p = 0.82; AUC = 0.83

Table 5: *Analysis of factors associated with mpox severity score, Chi-squared , and Fisher's exact tests for association test between the clinical outcomes.*

Clinical Features	Chi-squared (χ^2)	Fisher Test (aOR)	HIV-stratified χ^2
Demographic and Clinical Factors			
Prolonged Hospitalization	27.75*	0.51*	2.42
HIV Status	15.93*	-	-
STI	35.07*	0.12*	171.91
Lesion Patterns			
Penis Lesions	105.71*	0.21*	0.16
Vaginal Lesions	69.47*	0.22*	35.21*
Oral Lesions	3.83	1.34	6.89*
Constitutional Symptoms			
Fever >38.5°C	11.96*	1.54*	3.56
Asthenia/Fatigue	1.08	1.16	32.89*
Muscle Pain	1.43*	0.81*	8.25*
Genital Edema	48.30*	0.23*	31.10*
Sore Throat	0.57	0.89	41.64*
Conjunctivitis	26.86*	6.85*	3.82
Headaches	10.40*	0.63*	28.62*
Cough/Respiratory	22.37*	3.69*	3.85

**p < 0.05; -, not applicable*

Abbreviations: aOR, adjusted odds ratio; STI, sexually transmitted infection; HIV, human 241 immunodeficiency virus.

providing robust proof through Firth penalized regression analysis. This study identifies non-cutaneous symptoms, especially conjunctivitis (OR 27.30) and sore throat (OR 12.63), as significant predictors of complications, and challenges the conventional focus on cutaneous symptoms. The research also uncovers protective associations of local lymphadenopathy and some types of lesions, potentially reflecting effective immune responses. The innovative application of age-stratified analyses, coupled with the inclusion of data on HIV status, offers entirely new insights into the demographic and clinical risk factors in African populations. These findings could directly influence clinical risk stratification and resource allocation strategies, particularly in low-resource settings. The present study addresses important knowledge gaps by using contemporary statistical modeling, which could contribute significantly to recommendations on best practices to mitigate adverse outcomes and thus inform public health interventions.

Implications for available evidence

Contrary to previous studies concentrating on cutaneous manifestations, our results underscore the prognostic significance of non-cutaneous symptoms in the early detection of severe cases, including conjunctivitis

and sore throat. The findings also emphasize the need for enhanced surveillance among older adults and HIV-positive patients, who are at a higher risk of severe disease. Practical applications include incorporating non-cutaneous manifestations into clinical scoring systems for improved early triaging and monitoring. Policy recommendations focus on age-based risk stratification with custom interventions for at-risk groups. Future studies should aim at validating these predictors across major geographic regions and figuring out the immunologic basis for protective factors such as local lymphadenopathy. Streamlined and simplified evidence-based tools are crucial for better global mpox management in resourcelimited settings.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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