Case Report: Mpox related mortality in a 7-month-old infant in Zambia

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Abstract

Mpox is a zoonotic disease caused by the orthopoxvirus genus, with increasing incidence among children in low- and middle-income countries. It is transmitted via human-to-human, animal-to-human, and vertical transmission pathways and is characterized by systemic symptoms and a distinctive rash. In March 2025, Zambia recorded its first Mpox-related mortality in a 7-month-old premature infant, prompting an investigation into contributing factors. A descriptive case study was conducted at Chipata First-Level Hospital in Lusaka Province to examine the diagnosis, treatment, and facility preparedness in managing this case.

The infant presented with respiratory distress and skin lesions two weeks after symptom onset. Initially misdiagnosed as chickenpox, she was later treated for pneumonia with suspected Mpox. Her condition worsened despite administration of antibiotics, oxygen therapy, and wound care. She was moved to an understaffed isolation ward, and no laboratory or radiological investigations were performed due to resource constraints. HIV status was assumed negative based on maternal history. The child deteriorated and died on the third day of admission.

This case highlights several healthcare system gaps in Mpox case management in Zambia. These include delayed health-seeking behavior, limited diagnostic capacity, staffing shortages, and weak surveillance and response systems. Risk factors such as prematurity and inadequate clinical suspicion may have further contributed to the fatal outcome. The findings underscore the urgent need for improved clinical awareness of Mpox, community engagement to encourage early care-seeking, enhanced diagnostic capacity, and better facility preparedness to manage future Mpox cases effectively and reduce mortality.

Key words: Mpox, Prematurity, Infant, Mortality

Introduction

Mpox (formerly known as Monkeypox) is a zoonotic disease that has been known to affect humans since the 1970s and has been observed to affect more children and adolescents in low and middle-income countries (1,2). It has a similar clinical presentation to smallpox, though Mpox presents with less severe disease. Clinical symptoms include; itchy and painful firm or rubbery lesions that are well circumscribed, and umbilicated in later stages usually affecting palms of hands and soles of feet but may affect various body parts at different times. Other features include fever, myalgia, chills and lymphadenopathy (3–5). The severity and the clinical features may vary depending on how the infection was acquired (3,4). Severity is also dependent on other factors. For example, very young age, poor nutrition status and being immunocompromised such as in HIV patients with high viral load and low CD4 count lead to severe disease outcomes (6–9). Incidence is higher in children and estimated to be as high as 18.1 / 100 000 among 5 - 9 year old (1,3,5). It affects more

males than females (1,2). A mortality rate of about 11% in unvaccinated individuals has been reported previously (2,8,10,11).

Mpox belongs to the family poxviridae and the genus orthopoxvirus, the same genus for smallpox. It is classified into 2 clades which are geographically structured. Clade I (formerly known as the Congo Basin or Central African clade) includes two subclades: Clade Ia and Clade Ib. Clade II (formerly known as the West African clade) includes two subclades: Clade IIa and Clade IIb. Clade I is associated with higher virulence and higher mortality compared to clade II (3,9,11–13).

The cases reported in Zambia so far are clade 1b (14). In the Central African Republic and the Democratic Republic of the Congo, clade I Mpox Virus (MPXV) has been reported. Similarly, Sudan has also recorded outbreaks linked primarily to clade I MPXV (15–17). Nigeria, however, has recorded an increase in cases of clade IIb (18). Aside from central African region, other regions including: North African region, European region, Region of the Americas, South-East Asia region, and Western Pacific region all show higher prevalence of clade II than clade I (16).

In terms of the transmission pathway, Mpox is "human-human and animal-human." The virus can initially infect humans through animal bites and scratches. Stool and flies have also been found to be possible vectors of transmission(19). Human to human transmission occurs through contact with bodily fluids, respiratory droplets or contact with exudates from the lesions or with contaminated surfaces (3,9,12,13). Mpox is also transmitted vertically from mother to unborn child and may also be transmitted through breastfeeding (5,20–23). When vertically transmitted from mother to unborn child, Mpox can lead to still births and miscarriages (20,24,25).

As of 31 March 2025, Zambia had recorded 36 confirmed cases of Mpox across 4 provinces (Central, Copperbelt, Lusaka and Western). Of these, there was an equal sex distribution and more than half (55%) were children. The country unfortunately recorded its first Mpox related mortality in a 7-month-old infant on the 13th March 2025 (14). Therefore, we investigated to understand the what may have contributed to the mortality. We looked at any delay in health seeking, diagnosis and management of the patient, patient follow ups and any risk factors that the patient had that may have contributed to the outcome.

Methods

Study design, setting and data collection

This was a descriptive study of a 7-month-old infant that was recorded as the first Mpox related death in Zambia. The investigation took place at Chipata First-Level Hospital, Mandevu constituency in Lusaka Province, Zambia. Data was gathered through in-person interviews with medical professionals involved in the management and treatment of the Mpox case, as well as a review of the deceased infant's medical records. In addition, an evaluation of the preparedness of healthcare facility to detect, manage and respond to Mpox cases was conducted.

Data Analysis

A detailed descriptive epidemiology of the case was conducted. The patients' demographics details, clinical features, treatment, and disease progression was analyzed and documented, including all relevant laboratory findings and assessment of the diagnosis timeline. To assess risk factors for Mpox mortality, we looked for any delays in seeking healthcare services and comorbid conditions. We assessed how patient was managed throughout the entire hospital stay and any gaps in healthcare delivery noted.

Ethical Considerations

Permission was sought from the Lusaka provincial health office and the senior medical superintendent for Chipata first-level hospital before beginning to look through the patient's medical records. To ensure privacy of the patient, the identities were not recorded. Permission was also sought to publish the information in a peer-reviewed journal.

Case Presentation

History

A 7-month-old female infant, born preterm at an unknown gestational age with a birth weight of 1.8 kg, presented at Chipata First-Level Hospital on March 13, 2025, with complaints of cough and respiratory difficulties for three days, skin lesions for seven days, a history of diarrhea before admission which had resolved and poor appetite but no vomiting or fever.
Prior to hospital admission, she had been seen at a local clinic for similar symptoms and received unknown medication, but her condition did not improve. She was still breastfeeding and had received all age-appropriate immunizations. Her HIV status was unknown, with reliance on maternal antenatal HIV results. She had no history of travel out of Lusaka and no known contact with an Mpox case. The mother was a housewife while the father was a businessman man who

sometimes traveled out of town.

Examination Findings

Upon initial examination at Chipata First-Level Hospital, the infant was in respiratory distress with a respiratory rate of 60 bpm, nasal flaring, and accessory muscle use, afebrile (36.3°C), with no pallor, jaundice, or cyanosis. Chest auscultation revealed bilateral basal fine crepitations. The skin had red fluid-filled lesions, some open with crusting around them. Cardiovascular examination showed normal heartrate with normal heart sounds. Examination of other systems was normal.

Initial diagnosis was dermatitis, later revised to bronchiolitis to rule out pneumonia with suspected chickenpox on same day. She was admitted for oxygen therapy, Amoxicillin and Paracetamol syrup.

Clinical Progression

Day 1: The child was admitted in a general pediatric ward for bronchiolitis to rule out pneumonia with chickenpox and given oxygen therapy, Amoxicillin and Paracetamol syrup. Investigations such as full blood count and chest x-ray were also ordered. Further nursing care included keeping the child warm and nasal suctioning as per required need.

Day 2: She became irritable and developed bleeding skin lesions. A diagnosis of pneumonia with suspected Mpox was made, prompting transfer to the isolation ward despite the ward having inadequate staffing. Treatment included Cefotaxime, calamine lotion, wound care, and continuation of oxygen therapy. Blood samples and swabs from the lesions were then collected and sent to the Zambia National Public Health Reference Laboratory (ZNPHRL) for Mpox polymerase chain reaction (PCR) testing and Next Generation sequencing (NGS).

Day 3: The patient remained in isolation, but at midnight, her mother noticed a change in her breathing. With no staff allocated to the isolation ward at that time, when the healthcare workers arrived, despite adequate resuscitation, the infant was unresponsive with dilated pupils and no cardiopulmonary activity. She was pronounced dead at 00:40 hours on March 15, 2025. Cause of death at that time was severe pneumonia in suspected Mpox patient.

Figure 2: Some fluid filled lesions around the neck with some crusted

Figure 1: Bleeding skin lesion around the neck

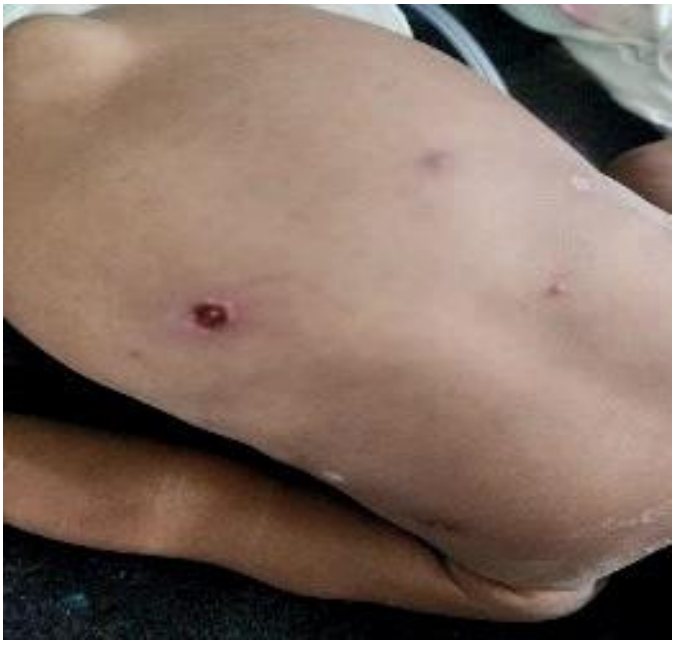

Figure 3: Crusted skin lesion on the abdomen

On the 17th of March, 2025 (2 days after patient's death), Chipata First-Level Hospital received the notification of a confirmed Mpox case result from ZNPHRL. The type of Mpox isolated was clade 1b. As a response to this notification, the next day, the sub-district rapid response team mobilized and visited the deceased's home for the purpose of notifying them on the results including contact tracing of close contacts. Health care workers that were in contact with the case were listed as contacts. A total of 7 contacts were enlisted, and followed up for a period of 21 days, and all contacts remained asymptomatic.

Discussion

This case report gives a detailed account of the first Mpox mortality recorded in Zambia involving a 7-month-old infant. It highlights the importance of seeking healthcare services early, critical need for increased community awareness, strengthened surveillance, increased index of mpox suspicion, early detection, and improved staffing of healthcare facilities in Zambia.

In agreement with our findings, previous studies have shown that children are at high risk for severe Mpox infection (3,16,26,27). The one-week delay in seeking medical attention may have contributed to the worsening of illness. Studies have shown that seeking early medical attention usually leads to better outcome in patients with Mpox (28,29). Therefore, risk communication and community sensitization needs to be intensified on early seeking of medical care to improve outcomes (30,31).

In terms of symptoms and diagnosis, the child presented with rash typical of Mpox. However, studies have shown that the lesions of chicken pox may be similar to those of Mpox (32,33). Therefore, there is need for high index of suspicion in any child that presents with chicken pox. The initial misdiagnosis of dermatitis at the referral hospital also suggests limitations in clinical awareness and low index of Mpox suspicion among some health care workers. High index of suspicion and proper management reduces Mpox mortality (9,28). More continuous medical education on Mpox symptoms, diagnosis and management especially in pediatric cases where presentation may be atypical needs to be conducted among health care workers (3,34,35).

There were inadequate investigations done on the child presumably due to limited resources. Full blood count was ordered but not done due to lack of reagents. Another gap was lack of HIV testing and relying on maternal diagnosis.

Studies have shown that patients with HIV and Mpox usually present with more severe symptoms and more complications (36–38). It therefore would have been necessary to know whether this child had HIV coinfection which may have contributed to poor prognosis. Emphasis should, therefore, be made to all health care workers to adhere to standard guidelines on Prevention of mother to child transmission (PMTCT) for three monthly HIV testing on breastfeeding mothers and their infants so as to reduce on mother to child HIV transmission (39).

The treatment of Mpox is supportive focusing on skin care and analgesia for pain relief (1,3,40). In some countries, Tecovirimat an antiviral is licensed for use in severe mpox cases in children, adolescents and adults (3,40). This patient presented with severe pneumonia and Mpox. Though rare, some studies have shown that in immune compromised, Mpox can present with complications including superimposed bacterial infection and pneumonia (28,40). Therefore, the treatment with the antibiotic may have been warranted.

Of significance is that the patient was born prematurely with a birth weight of 1.8kg. Premature infants have increased susceptibility to childhood infection due to inadequate immunity (41–43). A recent metanalyses from Congo DRC showed that weak immune system increased the risks of mortality from mpox (27). Prematurity in this child could have led to an increased susceptibility to severe Mpox infection and mortality despite having an adequate nutritional status (3).

Even though Chipata First Level Hospital had an isolation ward, it lacked enough staffing. Inadequate staff were allocated for the isolation ward, hence the ward lacked staffing during the night shift. Despite only having one patient, a well-staffed ward leads to proper patient care and reduces on mortality of patients as observed in other studies (44–46). Gaps in facility surveillance included; inadequate contact tracing and lack of detailed verbal autopsy, resulting in the failure to fully identify the source of the infection. The unwillingness from the child's family and the inadequate history given by the few family members who were interviewed may have contributed to the inadequate surveillance response activities. Contact tracing in Mpox is vital to prevent further disease spread (47,48).

Mpox infection in a 7-month-old with no history of travel or known contact with an Mpox case shows that there is ongoing transmission within the household or community (1,3). More community education on

Mpox needs to be done. Opportunities of community education include; child health clinics, radio programs, school assemblies, education in market places and media (27,30,31). Communities should be reassured on the lack of stigma as many of them may fail to seek healthcare in fear of being stigmatized (31,49).

While this case provides critical insights, the investigation faced limitations. A detailed verbal autopsy could not be conducted due to the family's mobility between residences, which also hindered effective contact tracing and family counselling.

Conclusion

This case report has highlighted some factors that may have contributed to Zambia's first Mpox-related death. Delays in seeking health care services and prematurity could have been the major contributing factors to the disease progression and eventual mortality. Educating communities about Mpox symptoms and preventive measures can reduce transmission risks. Strengthening Mpox surveillance and ensuring healthcare workers are equipped with better diagnostic guidelines will also improve early detection. Investing in training programs and ensuring sufficient medical supplies such as reagents for basic tests (e.g. full blood count), improving oxygen supplies in all health care facilities, and provision of adequate staff can enhance Mpox case management.

References

1. Sanchez Clemente N, Coles C, Paixao ES,Brickley EB, Whittaker E, Alfven T, et al. Paediatric, maternal, and congenital mpox: a systematic review and meta-analysis. Lancet Glob Heal [Internet]. 2024;12(4):e572–88. Available from: http://dx.doi. org/10.1016/S2214-109X(23)00607-1

2. Whitehouse ER, Bonwitt J, Hughes CM, Lushima RS, Likafi T, Nguete B, et al. Clinical and Epidemiological Findings from Enhanced Monkeypox Surveillance in Tshuapa Province, Dem- ocratic Republic of the Congo during 2011-2015. J Infect Dis. 2021;223(11):1870-8.

3. Beeson AM, Haston J, McCormick DW, Reynolds M, Chatham-Stephens K, McCollum AM, et al. Mpox in Children and Adolescents: Epidemiology, Clinical Features, Diagnosis, and Management. Pediatrics. 2023;151(2).

4. Reynolds MG, Yorita KL, Kuehnert MJ, Davidson WB, Huhn GD, Holman RC, et al. Clinical manifestations of human monkeypox influenced by route of infection. J Infect Dis. 2006;194(6):773–80.

5. Jezek Z, Gromyko AI, Szczeniowski M V. Human monkeypox. J Hyg Epidemiol Microbiol Immunol [Internet]. 1983;27(1):13-28. Available from: http://europepmc.org/abstract/MED/6304185

6. Sklenovská N, Van Ranst M. Emergence of Monkeypox as the Most Important Orthopoxvirus Infection in Humans. Front Public Heal. 2018;6(September):1–12.

7. Reynolds MG, McCollum AM, Nguete B, Lushima RS, Petersen BW. Improving the care and treatment of monkeypox patients in low-resource settings: Applying evidence from con- temporary biomedical and smallpox biodefense research. Viruses. 2017;9(12).

8. Ježek Z, Szczeniowski M, Paluku KM, Mutombo M. Human Monkeypox: Clinical Features of 282 Patients. J Infect Dis. 1987;156(2):293–8.

9. World Health Organisation.v Strategic Framework_for_Enhancing_Prevention and control of mpox 2024 2027. 2024.

10. Wilson ME, Hughes JM, McCollum AM,Damon IK. Human monkeypox. Clin Infect Dis. 2014;58(2):260–7.

11. Meo MO, Meo MZ, Khan IM, Butt MA,Usmani AM, Meo SA. Rising epidemiological trends in prevalence and mortality of mpox: Global insights and analysis. Saudi Med J. 2024;45(12):1334–9.

12. Vakaniaki EH, Kacita C, Kinganda-Lusamaki E, O'Toole Á, Wawina-Bokalanga T, Mukadi-Bamuleka D, et al. Sustained human outbreak of a new MPXV clade I lineage in eastern Dem- ocratic Republic of the Congo. Nat Med. 2024;30(October).

13. Akingbola A, Adegbesan CA, Adewole O, Idahor C, Odukoya T, Nwaeze E, et al. Understanding the resurgence of mpox : key drivers and lessons from recent outbreaks in Africa. Trop Med Health [Internet]. 2025;1:1-12. Available from: https://doi. org/10.1186/s41182-024-00678-1

14. ZNPHI/MOH/WHO. ZAMBIA MPOX SITUATION REPORT 14. ZNPHI Sitrep week 14. 2025;(March):1–10

15. Rimoin AW, Mulembakani PM, Johnston SC, Lloyd Smith JO, Kisalu NK, Kinkela TL, et al. Major increase in human monkeypox incidence 30 years after smallpox vaccination campaigns cease in the Democratic Republic of Congo. Proc Natl Acad Sci U S A. 2010;107(37):16262–7.

16. Laurenson-Schafer H, Sklenovská N, Hoxha A,Kerr SM, Ndumbi P, Fitzner J, et al. Description of the first global out- break of mpox: an analysis of global surveillance data.Lancet Glob Heal. 2023;11(7):e1012–23.

17. Kalthan E, Tenguere J, Ndjapou SG, Koyazengbe TA, Mbomba J, Marada RM, et al. Investigation of an outbreak of monkeypox in an area occupied by armed groups, CentralAfrican Republic. Med Mal Infect [Internet]. 018;48(4):263–8. Available from:https://doi.org/10.1016/j.med mal.2018.02.010

18. Awoyomi OJ, Njoga EO, Jaja IF, Oyeleye FA, Awoyomi PO, Ibrahim MA, et al. Mpox in Nigeria: Perceptions and knowledge of the disease among critical stakeholders-Global public health consequences. PLoS One [Internet]. 2023;18(3 March):1–22. Available from: http://dx.doi.org/10.1371/journal.pone.0283571

19. Patrono L V, Pléh K, Samuni L, Ulrich M, Röthemeier C, Sachse A, et al. Monkeypox virus emergence in wild chimpanzees reveals distinct clinical outcomes and viral diversity. Nat Micro- biol [Internet]. 2020;5(7):955–65. Available from: https://doi. org/10.1038/s41564-020-0706-0

20. Mbala PK, Huggins JW, Riu-Rovira T, Ahuka SM, Mulembakani P, Rimoin AW, et al. Maternal and Fetal Outcomes among Pregnant Women with Human Monkeypox Infection in the Democratic Republic of Congo. J Infect Dis. 2017;216(7):824–8.

21. Schwartz DA, Ha S, Dashraath P, Baud D,Pittman PR, Wal- dorf KA. Mpox Virus in Pregnancy, the Placenta, and Newborn: An Emerging Poxvirus With Similarities to Smallpox and Other Orthopoxvirus Agents Causing Maternal and Fetal Disease. Arch Pathol Lab Med. 2023;147(7):746–57.

22. Oakley LP, Hufstetler K, O'Shea J, Sharpe JD, McArdle C, Neelam V, et al. Mpox Cases Among Cisgender Women and Pregnant Persons -United States, May 11–November 7, 2022. MMWR Morb Mortal Wkly Rep. 2023;72(1):9–14.

23. Nakoune E, Lampaert E, Ndjapou SG, Janssens C, Zuniga I, Van Herp M, et al. A Nosocomial Outbreak of Human Monkey- pox in the Central African Republic. Open Forum Infect Dis. 2017;4(4):1–4.

24. Gostin LO, Jha AK, Finch A. The Mpox Global Health Emergency - A Time for Solidarity and Equity. N Engl J Med. 2024;1267–70.

25. Velázquez-Cervantes MA, Ulloa-Aguilar JM, León-Juárez M. Mpox and pregnancy: A neglected disease and its impact on perinatal health. Rev Clínica Española (English Ed. 2023;223(1):32–9.

26. Zimmermann P, Curtis N. Monkeypox-What Pediatricians Need to Know. Pediatr Infect Dis J [Internet]. 2022;41(12). Available from:https://journals.lww.com/pidj/fulltext/2022/12000/monkeypox_what_pediatricians_need_to_ know.23.aspx

27. Zobel F, Cheuyem L, Zemsi A, Ndungo JH, Achangwa C, Takpando-le-grand DR, et al. Mpox severity and mortality in the most endemic focus in africa : a systematic review and meta-anal- ysis (1970-2024). 2025;1–31.

28. Ugwu CLJ, Bragazzi NL, Wu J, Kong JD, Asgary A, Orbinski J, et al. Risk factors associated with human Mpox infection: A systematic review and meta-Analysis. BMJ Glob Heal. 2025;10(2):1–14.

29. Weissman JS, Stern R, Fielding SL, Epstein AM. Delayed Access to Health Care: Risk Factors, Reasons, and Consequences. Ann Intern Med [Internet]. 1991 Feb 15;114(4):325–31. Availa- ble from: https://doi.org/10.7326/0003-4819-114-4-325

30. Elechi KW, Soyemi T, Anuoluwa O, Clinton O, Adaobi OM, Godfrey OC, et al. Building Bridges : The Role of Effective Community Engagement Strategies for Mpox Prevention and Response. 2025;15(September).

31. Afzal M, Sah AK. Effectiveness of Public Health Campaigns on Mpox Awareness and Prevention in Rural India: A Narrative Review. Infect Dis Clin Pract [Internet]. 2025;33(3). Available from: https://journals.lww.com/infectdis/fulltext/2025/05000/effectiveness_of_public_health_campaigns_on_mpox.6.aspx

32. Rasizadeh R, Ali S, Parisa SA, and Bannazadeh Baghi H. Comparison of human monkeypox, chickenpox and smallpox: a comprehensive review of pathology and dermatological manifestations. Curr Med Res Opin [Internet]. 2023 May 4;39(5):751–60. Available from: https://doi.org/10.1080/03007995.2023.2200122

33. Goupeyou-youmsi J, Ajong BN, Minkandi CA, Adama M. Mpox clinical features and varicella-zoster virus coinfection in the Democratic Republic of Congo : a systematicreview and meta-analysis (1970 – 2024). 2025;0–3.

34. Sokunbi AE, Adeyemi O. Exploring atypical manifestations of Mpox: Anarrative review. Res J Heal Sci. 2024;12(1):71–81.

35. Sanchez Clemente N, Le Doare K, Mupere E, Nachega JB, Rulisa S, Titanji B. Hidden in plain sight: the threat of mpox to children and adolescents. Lancet Child Adolesc Heal [Inter- net]. 2024 Dec 1;8(12):849–51. Available from: https://doi.org/10.1016/S2352-4642(24)00298-0

36. Pesonel E, Laouénan C, Guiraud L, Bourner J, Hoffmann I, Molino D, et al. Clinical Characterization and Outcomes of Human Clade IIb Mpox Virus Disease : A European Multicenter Mpox Observational Cohort Study (MOSAIC). Clin Infect Dis [Internet]. 2025;1–14. Available from: https://doi.org/10.1093/cid/ciae657

37. Saldana CS, Kelley CF, Aldred BM, Cantos VD. Mpox and HIV: a Narrative Review. Curr HIV/AIDS Rep [Internet]. 2023;20(4):261–9. Available from: https://doi.org/10.1007/s11904-023-00661-1

38. Mitjà O, Alemany A, Marks M, Lezama MoraJI, Rodríguez-Aldama JC, Torres Silva MS, et al. Mpox in people with advanced HIV infection: a global case series. Lancet. 2023;401(10380):939–49.

39. Zambian Ministry of Health. for Treatment and Prevention of HIV Infection. 2022;(May).Available from: https://www.differenti atedservicedelivery.org/wp-content/uploads/August-2022-Zambia-Consolidated-Guide lines.pdf

40. Titanji BK, Hazra A, Zucker J. Mpox Clinical Presentation, Diagnostic Approaches, and Treatment Strategies: A Review. JAMA [Internet]. 2024 Nov 19;332(19):1652–62. Available from: https://doi.org/10.1001/jama.2024.21091

41. Strunk T, Andrew C, Peter R, Karen S, and Burgner D. Innate immunity in human newborn infants: prematurity means more thanimmaturity. J Matern Neonatal Med [Internet]. 2011 Jan 1;24(1):25–31. Available from: https://doi.org/10.3109/147 67058.2010.482605

42. Idzikowski E, Connors TJ. Impact and Clinical Implications of Prematurity on Adaptive Immune Development. Curr Pediatr Rep [Internet]. 2020;8(4):194–201. Availablefrom: https://doi. org/10.1007/s40124-020-00234-5

43. Helmo FR, Eduardo Arthur Rodovalho A, Renata Alves de Andrade M, Viviane Oliveira S, Laura Penna R, Maria Luíza Gonçalves dosReis M, et al. Intrauterine infection, immune system and premature birth. J Matern Neonatal Med [Internet]. 2018 May 3;31(9):1227–33. Available from: https://doi.org/10. 1080/14767058.2017.1311318

44. Needleman J, Shekelle PG. More ward nursing staff improves inpatient outcomes, but how much is enough? BMJ Qual Saf. 2019;28(8):603–5.

45. Whitman GR, Kim Y, Davidson LJ, Wolf GA,Wang SL. The Impact of Staffing on Patient Outcomes Across Specialty Units. JONA J Nurs Adm [Internet]. 2002;32(12). Available from: https://journals.lww.com/jonajournal/fulltext/2002/12000/the_impact_of_staffing_on_patient_outcomes_across.8.aspx

46. Griffiths P, Saville C, Ball JE, Chable R, Dimech A, Jones J, et al. The Safer Nursing Care Tool as a guide to nurse staffing requirements on hospital wards: observational and modelling study. Heal Serv Deliv Res. 2020;8(16):1–162.

47. Prins H, Coyer L, De Angelis S, Bluemel B, Cauchi D, Baka A. Evaluation of mpox contact tracing activities and data collection in EU/EEA countries during the 2022 multicountry outbreak in nonendemic countries. J Med Virol. 2024;96(1):1–9.

48. Chitwood MH, Kwon J, Savinkina A, Walker J, Bilinski A, Gonsalves G. Estimated Testing, Tracing, and Vaccination Targets for Containment of the US Mpox Outbreak. JAMA Netw Open. 2023;6(1):E2250984.

49. Derksen L, Muula A. Love in the Time of HIV : Theory and Evidence on Social Stigma and Health Seeking Behavior. 2014;