National Women & Infants Health Programme

HSE Public Health: National Health Protection Office
FSS Sláinte Poiblí: An Oifig Náisiúnta um Chosaint Sláinte

Clinical Update

Monkeypox virus or Mpox (MPXV) in Pregnancy – Guidance for Maternity Services

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Background – MPXV

Monkeypox is a viral zoonotic disease reported in the Central African Republic and in Western Africa. It is caused by monkeypox virus, a member of the Orthopox virus genus, closely related to smallpox. The clinical presentation of monkeypox resembles that of smallpox; however, Monkeypox is less contagious than smallpox and causes less severe illness. Human monkeypox was first identified in humans in 1970 in the Democratic Republic of the Congo (DRC).(1) In November 2022, WHO recommended using the name mpox as a new name for monkeypox.(2)

There are two known clades (strains) of MPXV: clade I, previously called the Congo Basin or Central African clade, which includes subclades Ia and the recently identified Ib; and clade II, previously called the West African clade, which includes subclades IIa and IIb.(1,3) The two major clades of MPXV have been recognised as circulating endemically in Africa, with differing transmissibility, pathogenicity and case fatality rates.(4,5)

Due to its viral phylogenetic properties and epidemiological evidence of increased human-to-human transmission outside of endemic geographic locations, MPXV causing the 2022 outbreak was classified within a distinct subclade, termed IIb.(6) A new variant of clade I MPXV was described in South Kivu, DRC in 2023. It carries predominantly APOBEC3-type mutations, indicating adaptation of the virus due to circulation among humans. It was estimated to have emerged around mid-September 2023, and its human-to-human transmission has been ongoing since then.(7,8)

In July 2022, the multi-country outbreak of mpox (clade IIb) was declared a public health emergency of international concern (PHEIC) as it spread rapidly via sexual contact across a range of countries where the virus had not been seen before. The 2022–2023 MPXV outbreak was found to result from an offshoot of the clade II strain that possessed novel mutations and was classified as a new strain, clade IIb.(5,9) That PHEIC was declared over in May 2023 after there had been a sustained decline in global cases.(1,10)

In August 2024, the World Health Organization (WHO) again declared a public health emergency of international concern (PHEIC) for mpox. This followed the growing spread of the mpox clade I strain in non-endemic African countries. (11) The spread of cases in the DRC is attributed to two distinct outbreaks - spread of MPXV clade Ia in Equateur and endemic regions of the country, and the emergence of the new MPXV clade (clade Ib) in the South and North Kivu provinces.(11,12)

Monkeypox is transmitted to humans through close contact with an infected person or animal, or with material contaminated with the virus.(1,3,13,14) Animal hosts include a range of rodents and non-human primates. Transmission can occur through contact with the virus from an animal or other source e.g. preparation or ingestion of bushmeat or contact with bedding contaminated with the virus, or via inoculation by an infected animal bite. Human-to-human transmission occurs by direct contact with lesion exudate, crust material, lesion scabs, body fluids or contaminated materials such as bedding and clothing, and hand touch surfaces. The virus usually enters the body through broken skin respiratory tract or mucous membranes (eyes, nose, mouth). Person to person transmission may also occur through large respiratory droplets that generally cannot travel more than one or two metres, and this usually requires prolonged face-to-face contact. Close household or sexual contact poses the greatest risk person–to person spread, particularly after direct contact with lesions. Faecal viral shedding may represent another mode of transmission. Transmission can also occur from mother to fetus, which can lead to congenital monkeypox, and newborn infection by close contact is also possible.(15)

The overall case fatality rate (CFR) of mpox has been previously estimated at 8.7%, though differences have been observed between clades, estimated as 8-15% for Clade I and 1–6% for Clade IIa.(5,13,16) The mortality rate was ranged from 0.01 to 1.81% for the Clade IIb MPXV associated with the 2022–23 outbreak. (13,17–20)

2022 outbreak

In May 2022, mpox was reported as an emerging global outbreak; this was characterised as part of the clade II MPXV (IIb).(6) In July 2022, the WHO declared the global mpox clade IIb outbreak a public health emergency of international concern, with (then) more than 16,000 reported cases from 75 countries and territories, and five deaths. The 10 most affected countries globally at that stage were: the US, Spain, Germany, the UK, France, Brazil, Canada, Netherlands, Columbia and Peru; these countries accounted for 88% of the cases reported globally.(1,10) By September 7th 2022, a total of 54,709 laboratory confirmed cases and 397 probable cases, including 18 deaths, had been reported to the WHO. (21)

In the 2022 clade II outbreak, the risk of mpox infection following sexual exposure was found to be high.(13,22) A UK study found that 53% of transmission occurred during the pre-symptomatic period.(17) Asymptomatic mpox infections were reported as well; studies found that between 1.3% and 6.5% of infected people never experienced symptoms.(23)

The epidemiological picture through 2022 and 2023 in Ireland was reported to be similar to that seen in other countries.(24) There were 13 cases of mpox (clade IIb) confirmed in Ireland in 2023 and 227 cases in 2022, with 99% detected in males and 48% cases associated with recent international travel.(18,25) The first detection of MPXV in Ireland was notified to the public health authorities on 31 May 2022, with the peak of the outbreak observed nationally in August 2022 and, while mpox cases declined since this time, sporadic detections persisted in 2023.(18)

2024 outbreak (ongoing)

The DRC is the most affected country by MPXV in the world, having reported cases of mpox continuously for the past 50 years. The mpox virus (MPXV) clade I epidemic that has affected the DRC since November 2023 has spread to several other African countries including Burundi, Rwanda, Uganda and Kenya.(7) (12) Evidence is still emerging regarding transmission routes and transmission dynamics in the clade I outbreak in DRC and other African countries, but multiple modes are being reported, including sexual and household transmission.(3,12,16) About 52% of people with confirmed mpox in the DRC's South Kivu in late 2023 and early 2024 were women, nearly a third of whom were sex workers.(26)

In 2024, as of 26 May, a total of 7,851 mpox cases were reported in the DRC, including 384 deaths (with a CFR of 4.9%). These cases were reported in 177 of the 519 (34%) health zones across 22 out of the 26 provinces (85%).(8) The size of these outbreaks could be larger than reported due to under-ascertainment and under-reporting.(16) On 15 August 2024, the first case of MPXV clade Ib was reported in the EU/EEA and the ECDC reported then that more imported MPXV clade I cases would likely occur.(27)

Since its first detection in September 2023, clade Ib MPXV has been detected in 30 countries. Eighteen of these countries have only ever reported travel-related cases and 12 countries have ever reported community transmission of this clade, 10 countries of which are still experiencing community transmission through May 2025. Genomic sequencing data suggest that all cases detected to date are genomically linked to the strain detected for the first time in 2023 in South Kivu, DRC. The WHO report that available evidence therefore suggests exclusive human-to-human contact transmission for this virus sub-clade (Ib).(28)

In the past twelve months, as of June 2025, 26 countries have reported 37 656 confirmed mpox cases, including 131 deaths. The three countries with the majority of the cases in the last 12 months are DRC, (n = 20 826), Uganda, (n = 6988), and Sierra Leone, (n = 4294). In these countries the case fatality ratio (CFR) has ranged from 0.2 -1% over the last year.(28)

The median age of affected persons in the current outbreak is 21 years, with most (59%) between 15 and 29 years of age and greater than 50% of cases occurring in women.(29)

Cases of clade IIb mpox in Ireland remain low with 22 cases reported to date in 2025. There were 25 cases of mpox confirmed in Ireland in 2024, 13 cases in 2023 and 227 cases in 2022. In February 2025, the HSE detected one imported case of clade I mpox; the Irish resident had recently returned to Ireland following travel to the DRC.(30)

As of June 2025, the WHO continues to regard mpox as a public health emergency of international concern (PHEIC). (31)

An overview of the global situation, regularly updated can be found here:-
https://worldhealthorg.shinyapps.io/mpx_global/

Clinical Features

The incubation period of mpox is usually from 6 to 13 days but can range from 5 to 21 days. Mpox is usually a self-limited disease with the symptoms lasting from 2 to 4 weeks. Severe cases appear to be more common in children and are related to the extent of virus exposure, patient health status, underlying immune deficiencies and nature of any complications. Severe disease includes haemorrhagic disease, sepsis, encephalitis, or other conditions requiring hospitalisation.(13,14,20,32)

Symptoms include fever, which may be absent in mild cases, headache, myalgia, back pain and exhaustion. The rash appears 1-3 days after the fever starts, this is generally seen on face (95% of cases) and extremities (palms and soles; 75%), and spreads to other parts of the body. Also affected are oral mucous membranes (in 70% of cases), genitalia (30%), and conjunctivae (20%), as well as the cornea. It is a maculo-papular rash that evolves into vesicles and pustules, which crust, dry up and fall off. The number of lesions varies from a few to several thousand. A person with mpox infection is considered contagious from initial viral prodrome and development of rash until the lesions have fully healed and new skin has formed over the scabs.

The cases of mpox described in the 2022 outbreak were reported to have some atypical features. The rash was more likely to start in the genital and perianal areas, not always disseminate to other parts of the body and typical prodromal symptoms were sometimes mild or absent. Studies on the multi-country mpox outbreak which started in May 2022 showed an incubation period of 7–8 days. Shorter incubation periods of 2–4 days were also observed, possibly due to direct viral inoculation via sexual transmission.(13,20) Data from a contact tracing study in the UK showed that 95% of people with potential infection would manifest symptoms within 16–23 days.(33) A

minority of cases (1–13%) were hospitalised for isolation, pain management, or for complications such as secondary skin infections, abscesses, and difficulty in swallowing. Serious complications were rare and included epiglottitis, myocarditis, and encephalitis.(17,19) Sporadic fatal cases were reported, often in immunocompromised people, and the overall CFR in the 2022 outbreak was reported in larger series at less than 0.1%.(13)

The mpox cases described in the 2024 outbreak showed distinct clinical patterns compared with clade Ia outbreaks elsewhere in the country (DRC) and the global clade IIb outbreak. In adults, the disease primarily affected the genito-urinary system, compatible with sexual transmission, whereas children mostly manifested extragenital lesions.(34) Overall, clade Ib infections in adults appear to be somewhat more severe, with higher total lesion counts and seemingly more frequent secondary bacterial infection, and urogenital and systemic complications.(34)

MPXV in Pregnancy

It is unknown if pregnant women are more susceptible to being infected with mpox virus or if the disease is more severe during pregnancy. However, an increased risk of maternal mortality and morbidity has been documented with other poxvirus infections.(35,36) Fetal loss following vertical transmission has been reported with smallpox and with other orthopox viruses.(37,38)

The effects of Mpox on pregnancy and the pregnant woman are not well documented, but there are reports of high fetal loss rates in affected individuals.(15) Preterm delivery and neonatal mpox infection have also been reported.(15,39) Summarising current reports of paediatric maternal and congenital mpox suggests a 50% fetal/perinatal morality rate and a case fatality rate of 11% in children.(15)

The frequency and risk factors for severity and adverse pregnancy outcomes are not known. It is unknown when or how often vertical transmission occurs during pregnancy, nor how infection during pregnancy contributes to stillbirth risk.(38) However, several routes have been proposed by which MPXV can cause intrauterine infection.(40)

In 1988 Jezek and Fenner described a probable case of perinatal MPV infection that had occurred in Zaire (this case is often misreported as occurring in DRC). The pregnant woman developed clinical evidence of mpox at approximately 24 weeks' gestation and 6 weeks later delivered a premature infant with a generalized skin rash suggestive of mpox disease. The infant died from malnutrition 6 weeks after birth. No pathology studies were performed, and this case was not confirmed by laboratory identification of the virus.(41)

The most data available on clade I mpox in pregnancy come from a paper that reported four pregnant women treated in the DRC, from 2007 to July 2011.(42) One was infected at six weeks (miscarriage at 9 weeks), one at 6-7 weeks (miscarriage at 8-9 weeks), one at 14 weeks (livebirth at term), and one at 18 weeks (fetal death at 21 weeks). Mpox virus DNA was found in the placenta, umbilical cord, and fetal tissue of the stillborn fetus, demonstrating vertical transmission of MPXV.(38,42) A follow up series added mention of a 5th case where a late fetal death also occurred. (43) Although the numbers were small, these cases suggested that there was at least a 75% fetal mortality rate for clade I MPXV infections in pregnant women, adding mpox to the list of TORCH infections that produce congenital disease.(5,38,44)

No infected pregnant women were reported in any of the CDC reports of the 2003 US outbreak of mpox.(45) The clinical characteristics of the 2017–18 Nigerian mpox outbreak were largely similar to those of previous outbreaks in the US and DRC. However, unlike the clade II outbreak in the US in 2003 in which no deaths were reported, the 2017–18 Nigerian clade II (IIa) outbreak was associated with a case fatality rate of 6%, and four of the seven patients who died had concomitant HIV/AIDS.(5,46) There are two reports of mpox occurring during pregnancy in the 2017–2018 mpox outbreak in Nigeria, and both led to fetal death (16 weeks and 26 weeks).(46,47)

2022-2023 outbreak

Women infected with MPXV during the 2022 outbreak represent a very small part of the overall infected population.(13,48–50) One report found that 61% of 74 cis women and non-binary individuals with mpox and 89% of 62 trans women with mpox acquired it through sexual contact.(19,50) According to the WHO data related to the 2022–2023 mpox multi-country outbreak, 3141 out of the 87,036 confirmed Mpox cases (3.6%) involved women, mostly from the WHO Region of the Americas (74%) and who were exposed to the virus via sexual encounters (51% of cases for which the transmission route was documented).(48)

The WHO identified 58 female cases with mpox infection who were either pregnant or recently pregnant as of 13 June 2023; thirteen women were known to be hospitalised, but none were identified that required intensive care, and there were no known maternal deaths.(10,21) Mpox virus infections in cisgender women during May 11–November 7 constituted <3% of total U.S. cases. Twenty-three mpox cases were reported by the CDC in persons who were pregnant or recently pregnant (these cases also presumably feature in the WHO reports); four required hospitalisation for mpox and 11 received tecovirimat with no adverse reactions were reported.(51,52) These cases were evenly distributed across all trimesters of the pregnancy. A rash was a universal symptom, and genital lesions were reported in some cases.(51) There are additional isolated case reports of mpox infection in pregnant women from the 2022 outbreak, with no complications or adverse pregnancy outcomes reported.(48,53,54)

An authoritative review reports that during the 2022–2023 mpox outbreak, there have been no reports of intrauterine or placental infection or intrauterine transmission of the virus from Europe, Brazil, the US, or elsewhere; and no maternal deaths from mpox have been identified.(5) The absence of perinatal morbidity and mortality from Clade IIb corresponds to the overall CFR in this outbreak among non-pregnant women of <0.1%, and as this clade has been demonstrated to produce less severe disease than mpox Clade I or IIa variants.(5,44)

2024 outbreak (ongoing)

Available data on the current outbreak of clade Ib MPZX mostly comes from the DRC. One paper has mapped the cases in South Kivu DRC from September 2023 to April 2024 and reported outcomes of 371 mpox cases. There were eight pregnant women admitted to hospital, of whom four had fetal losses—a fetal mortality rate of 50% - with no postmortem or placental examination. Three women who had spontaneous pregnancy loss developed clinically severe mpox symptoms during the first 10 weeks of pregnancy with confirmed MPXV infection and were negative for

HIV.(44,55) The primary paper here also reports a maternal death with mpox infection 2 weeks after caesarean birth.(55) The cases may overlap, but another published case series from the same DRC region reports that four (67%) of the six pregnant women with a recorded outcome had adverse pregnancy outcomes (there were 21 pregnant women in the cohort of 510 mpox cases).(34) The updated final publication from Masirika et al in the South Kivu outbreak reports that 14 pregnant women were admitted with mpox infection and 8 had a fetal loss. (56)
Another recent publication from the DRC reports 10 pregnant women among 353 hospitalised with mpox infection, but no specific pregnancy outcomes; this cohort includes two infant deaths.(57)

Clinical Guidance

This clinical guidance is based on the literature review on mpox infection and current guidance (which is still being updated for the 2024-5, ongoing, outbreak) from various bodies and professional organisations including the HPSC (Ireland)(58)(59), SMFM (US)(35), the RCOG (UK)(60), the ECDC(3), the WHO(1) and the CDC(61,62).

Updates from the HPSC are available at: https://www.hpsc.ie/a-z/zoonotic/monkeypox/

Mpox should be considered as a diagnosis if there is / has been:

- Travel to an affected country where mpox is endemic, in the previous 21 days.
- Close contact with a person with confirmed or probable mpox infection (co-habiting, sexual contact, contact with bodily fluids or infected bedding)
- Close or intimate in-person contact with individuals in a social network experiencing mpox activity
- Contact with a dead or live wild animal or exotic pet that is an African endemic species or used products derived from such animals (e.g., game meat, creams, lotions, powders, etc.)

The HPSC assessment and testing pathways are available and should be followed:-
https://www.hpsc.ie/a-z/zoonotic/monkeypox/guidance/Interim%20MPXVCI&II%20acute%20settings%20and%20HIVSTIID%20pathway.pdf

The signs and symptoms of mpox infection in people who are pregnant appear similar to those in non-pregnant people with mpox virus infection, including prodromal symptoms and rash.

Rash in a pregnant woman, who has risk factors for mpox infection needs to be differentiated from dermatoses of pregnancy, including polymorphic eruption of pregnancy. Those with rashes initially considered characteristic of more common infections (e.g., varicella zoster or sexually transmitted infections (STIs) like herpes or secondary syphilis) should be carefully evaluated for a characteristic mpox rash, and diagnostic testing should be considered, especially if the person has epidemiologic risk factors for mpox infection. Co-infections with mpox virus and STIs have been reported and the presence of an STI does not rule out mpox, so a broad approach to testing is encouraged.

Mpox infection can have considerable risks to the fetus, so testing asymptomatic pregnant women with significant MPXV exposure is suggested, to identify those who will require monitoring and ongoing fetal surveillance. It is worth noting that the majority of the cases reported to date with clade I mpox infection in pregnancy have been associated with infection and associated adverse outcomes in the first and early second trimesters of pregnancy.(15,44)

Care of the pregnant woman

As per the HPSC guidance if there is a suspicion of mpox infection:(58)

- All recommended infection protection control (IPC) precautions should be implemented
- All healthcare staff/visitors/ patients who have contact with the woman should be documented

- Referral to Public Health should made – this is a notifiable disease
- All testing should follow the process outlined in the HPSC guidance
- Cases should, following an individual health risk assessment for severity and risk factors, be clinically categorised as either requiring inpatient care, or being fit for home isolation.

Testing for Mpox:
- Testing procedures should follow the HPSC guidance
- One standard viral swab in viral transport medium.
- Swab taken from a cutaneous lesion either ulcer or vesicular fluid if present.
- The sample will be tested for MPX DNA at the NVRL with the aim to test concurrently for VZV DNA and HSV 1 and 2 DNA.
- If there are concerns that patient is presenting during the prodromal stage and there are no cutaneous lesions, a throat swab may be taken instead.
- A negative result for the throat swab does not rule out infection and clinical correlation is advised, with a follow up swab sample is required if lesions develop

For Asymptomatic exposure:
- Test for mpox infection
- Isolate at home while waiting for test result
- If negative test – stop monitoring and consider post-exposure vaccination. This advice may vary depending on the level / significance of exposure
- If positive test – isolation at home for 21 days, with clinical self-monitoring (temperature and rash)

For Symptomatic cases:
- Test for mpox infection
- Isolate while waiting for test result
- If negative test – isolation at home for 21 days, with clinical self-monitoring, and retest if symptoms persist
- If positive test – hospitalise in a tertiary hospital or designated centre (e.g. Mater/ CUMH)

Due to low anticipated numbers and severity of the current MPXV clade I outbreak, it is important that women are cared for in a unit with:
- Infectious disease expertise available
- Maternal fetal medicine expertise on site

Pregnant women with severe mpox infection (and, given expected severity, this includes suspected Clade I cases) or complex obstetric conditions should be admitted to hospital.

At present, there is no conclusion regarding the value of amniocentesis in pregnancy where there is confirmed maternal mpox infection because of limited evidence on the risk of and mechanisms of vertical transmission. This should be made clear when offering amniocentesis to pregnant women to test the fetus, including discussion explaining the risks and benefits and highlighting the limited evidence.(60)

Pregnant women should be prioritised for medical treatment. This is because of the probable increased risk of severe disease during pregnancy, risk of transmission to the fetus during pregnancy or to the newborn by close contact during and after birth, risk of pregnancy loss and risk of severe infection in newborns. Treatment for mpox virus should therefore be offered to pregnant women, and the risks and benefits of treatment should be discussed. Close monitoring for severe disease and pregnancy complications is important.

The HPSC's MPOX Clinical Management of Cases (Therapeutic Options) document includes detail on treatment of pregnant women and newborns.(59)
https://www.hpsc.ie/a-z/zoonotic/monkeypox/guidance/Tecovirimat%20Guidance%20Document%2015.08.22%20V1.0.pdf

Treatment – pregnant women

There is no specific treatment for mpox infection, nor is there a specific vaccine that is fully protective against mpox virus infection. Antiviral therapy may be considered in unwell pregnant women and should be initiated in consultation with an infectious diseases physician and in a tertiary centre.

Tecovirimat should be considered the first-line antiviral for pregnant or post-partum women. Tecovirimat (also known as TPOXX or ST-246) is an antiviral medication approved for the treatment of smallpox in adults and children, and it is expected to have antiviral activity against mpox virus.(63) The usual course is 14 days.

In the 2022-3 outbreak, among 549 patients with mpox virus infection treated with tecovirimat under an Expanded Access Investigational New Drug protocol, 99.8% received it orally as an outpatient. Among 369 patients, few adverse events were reported. The median interval was three days from initiation of tecovirimat to subjective improvement, with no difference by HIV infection status. In 3.5% of patients adverse events were reported, one of which was nonserious. The CDC conclude that tecovirimat is generally well tolerated, and that these data support continued access to treatment with tecovirimat during the current mpox outbreak.(64) Eleven pregnant women received tecovirimat (administered during all trimesters of pregnancy) and no medication-related adverse events were reported.(51) Tecovirimat is also authorised for the treatment of paediatric MPXV, including in neonates.(39)

Breastfeeding should be discontinued with tecovirimat use, given evidence of excretion in breast milk in animal studies.

Although cidofovir and brincidofovir have been considered as alternative antiviral therapies to treat mpox infection, animal studies showed evidence of teratogenicity. As such, these medications should not be used to treat mpox infection in those who are in the first trimester of pregnancy or breastfeeding. Brincidofovir has been authorised for the treatment of paediatric MPXV, including in neonates.(39) Neither are available for use in Ireland.(59)

Animal reproduction studies have not been conducted with vaccinia immune globulin (VIGIV); therefore, it is not known whether it can cause fetal harm when administered during pregnancy

or whether it can affect future fertility. However, immune globulins have been widely used during pregnancy for many years without any apparent negative reproductive effects. The risks and benefits of VIGIV administration should be assessed for each individual patient. If tecovirimat is unavailable, VIG is the next preferred option, and in pregnant women, VIGIV may be preferred over tecovirimat (presuming VIG is available). VIGIV is not routinely stocked and accessible in Ireland, so this would need to be coordinated through national public health authorities, in collaboration with international partners such as the CDC or WHO.(59)

Secondary bacterial skin infection is common in mpox infection and requires early intervention; antibiotics may be required.

Fetal monitoring and indications for delivery

As data on mpox in pregnancy are limited, the risk to the fetus is uncertain, however, vertical transmission and fetal demise are possible and have been reported. Therefore, a cautious approach is advised.

This includes regulator fetal monitoring by cardiotocography, if the gestational age is ≥ 26 weeks and/or if the mother is unwell. Ultrasound scans should be offered as clinically indicated; however, if the pregnant woman has mild disease, it may be appropriate to defer ultrasound until they are no longer infectious. Once acute infection has resolved, 4-weekly ultrasound scan checking fetal growth and anatomy, amniotic fluid measurement and Doppler should be performed.

Antenatal corticosteroids, according to national guidance(65), should be administered for fetal lung maturation depending on gestation and on the maternal condition, and if delivery is imminent. This should be in discussion with all relevant specialist involved, and take into account the woman's wellbeing, recognising that steroids may cause deterioration in the maternal condition because of their immunosuppressive mechanism of action.

There is no evidence around the optimal mode of birth in a pregnant woman with active mpox infection. The relationship between the timing of infection, risk for congenital infection, and transplacental or intrapartum transmission is unknown.

In clade II mpox cases, maternal infection *per se* is not an indication to expedite delivery, as most cases are not serious and are self-limiting. Deferring delivery might also permit the transplacental transfer of maternal IgG antibodies against mpox. However, both perinatal and maternal mortality reports with clade I MPXV are much more concerning, with deaths occurring in the first 1-2 weeks after clinical presentations with mpox infection, so this guidance is likely to change.(15,44)

If at any stage there is evidence of fetal compromise, or if the life of the mother is at risk, consideration should be given to delivering the baby, taking into account the gestational age, estimated fetal weight, condition of the fetus, and whether the mother is likely to benefit from, or be further compromised by, the birth.

It is likely that vertical transmission occurs, even if the routes remain speculative (40), in which case Caesarean section may be of no benefit. As the virus can be transmitted via contact with open mpox lesions, it is likely, labour and/or vaginal birth in a woman with genital lesions may

lead to neonatal infection. However there has been no clear evidence of transmission through vaginal fluids. Caesarean section can be considered if there are genital or perineal viral lesions to reduce the risk of neonatal contact during delivery, and to prevent neonatal infection.

Infection prevention and control (IPC) measures should be followed for the disposal of placenta and pregnancy related fluids or tissues according to individual hospital protocols for potentially infectious material.(59)

Care of the newborn

The mother should be counselled about the risk of transmission and the potential for severe disease in newborns. Infants born to a mother with confirmed mpox infection should be isolated separately from the mother to reduce the risk of transmission. If a baby subsequently tests positive for mpox infection, they can be reunited with the mother. Full PPE should be worn by the maternity and neonatal staff caring for the mother and baby.

The baby should be carefully monitored for signs of compromise or mpox infection. Apart from macroscopic examination of lesions the baby should undergo viral PCR testing either by throat swab or any lesions that are present. Due to the increased risks in this age group, there is a low threshold for antiviral treatment if the baby contracts mpox. Consideration should be given to post exposure vaccination if viral testing is negative. The baby will require 3 weeks of isolation as a close contact if tests are negative and they remain asymptomatic. All cases of mpox-exposed infants should be discussed with the Paediatric Infectious Disease Consultant on call at Children's Health Ireland.(59)

Breastfeeding

Breast milk is the best source of nutrition for most newborns, and it provides protection against many illnesses. It is unknown if MPXV is present in breast milk. However, given that MPXV is spread by close contact and neonatal mpox infection may be severe, the proposed strategy for neonatal care would preclude women with active mpox infection from breastfeeding or expressing milk for their newborn. Consideration may be given to using the vaccine (Imvanex®; see below) for those at increased risk who are breastfeeding following individual benefit risk assessment, although the vaccine has not been evaluated for safety and efficacy in breastfeeding.(66)

Vaccination in pregnancy

This guidance on vaccination is based on the current guidance from various bodies including the HPSC Ireland(67), SMFM(68), the EMA, the WHO(66) and the CDC(69).

The National Immunisation Advisory Committee, Ireland (NIAC) published and updated recommendations on vaccination against MPXV from 2022 onwards. Vaccination is currently recommended on a case-by-case basis and current vaccination approaches follow an 'at risk' principle:

- Primary preventative (pre-exposure) vaccination (PPV)
- Post-exposure preventative vaccination
- Vaccination to certain individuals at high risk.

https://www.hiqa.ie/reports-and-publications/niac-immunisation-guideline/chapter-13a-mpox
https://www.rcpi.ie/healthcare-leadership/niac/immunisation-guidelines-for-ireland
https://www.hse.ie/eng/health/immunisation/hcpinfo/mpox/

Smallpox (vaccinia) vaccination is effective against MPXV. Previous smallpox vaccines have been shown to be 85% effective in preventing mpox in close contacts.

Imvanex® (Imvamune® or MVA-BN) is the only smallpox vaccine authorised by the EMA for active immunisation against smallpox in adults (2013). This vaccine was authorised by the EU for protection against mpox in adults in 2022.(70) It is authorised in the US (as JYNNEOS) and in Canada (as Imvamune®) for the prevention of smallpox and mpox disease in adults aged >18 years.(66) The vaccine contains a live non-replicating form of vaccinia. Two doses are administered 28 days apart for maximum effectiveness.

At the time of EMA authorisation, data from human and animal studies suggested that a single dose of MVA-BN may offer fast protection against mpox, and that the second dose mainly serves to extend the durability of protection.(70) During outbreaks, MVA-BN has been reported to lower the chance of mpox disease by 62% to 85%. In people already exposed to mpox, MVA-BN reduced disease risk by 20%.(71) Effectiveness of MVA-BN as primary preventive vaccination (PPV) in humans against clade IIb mpox is reported as 'clear from real-world studies' and effectiveness against more-lethal clade I is 'likely', based on animal-challenge studies with multiple orthopoxvirus species.(71)

When vaccination is indicated for a person who is pregnant, breastfeeding, or trying to become pregnant, Imvanex® is the vaccine of choice because it is non-replication competent. Other replication-incompetent vaccines are widely used and, indeed, explicitly encouraged during pregnancy (e.g., influenza, COVID-19, respiratory syncytial virus, pertussis) where the corresponding viruses pose substantial health risks to the mother, to the newborn, or both. Available human data on this Imvanex® administered to pregnant women are still reported as insufficient to determine if there are any vaccine-associated risks in pregnancy.(66) Studies of the vaccine in animals have shown no evidence of harm to a developing fetus.
There is no theoretical reason for concerns in pregnancy and the adverse events profile is expected to be similar to that in non-pregnant vaccinees. NIAC concluded that while currently available mpox vaccines are not licensed in pregnant women, they may be considered as pre or post exposure prophylaxis following an individual benefit risk assessment.

Therefore, consideration may be given to using the vaccine in pregnancy for those at increased risk following individual assessment. Vaccine recipients should be given comprehensive information about the mpox, the risks of contracting it, and the benefits and risks of the vaccine. They should be informed that they may develop adverse reactions similar to the prodromal symptoms of mpox infection during the first 48 hours after vaccination. During the 2022-2023 MPXV clade IIb outbreaks, several countries explicitly recommended MVA-BN during pregnancy or lactation.(71)

ACAM2000 is a live replicating vaccine licensed for prevention of smallpox.(66) This vaccine has no regulatory approval for mpox.(71) Vaccination with ACAM2000 is contraindicated in those who

are pregnant or breastfeeding, due to the risk of pregnancy or fetal loss, congenital defects, and vaccinia virus infection in fetuses and newborns, as well as the availability of the non-replicating viral vaccine (Imvanex®). Vaccinia virus infection following vaccination with replication-competent smallpox vaccines have been reported in fetuses and newborns.(66) It is not known whether vaccinia virus or antibodies are secreted in breast milk. If an individual is vaccinated with ACAM2000, they should be counselled to avoid becoming pregnant (or getting their partner pregnant) for 4 weeks after vaccination, and until the vaccination site has healed, the scabs have fallen off, and a fresh layer of intact skin has formed.

Healthcare workers and pre-exposure prophylaxis

All healthcare workers should follow recommended infection prevention and control (IPC) measures.(58)
PPE should be worn for any in-person care of a pregnant woman with mpox.

Where possible, healthcare workers who are immunocompromised or pregnant should not directly care for suspected or confirmed mpox cases. Pregnant staff members should not care for women with suspected or confirmed mpox.

Consideration may be given to vaccination, for those at increased risk following an individual benefit-risk assessment. Imvanex® has been used in Europe for pre and post exposure prophylaxis against mpox. The vaccine can prevent the onset of symptoms if given within four days of exposure. If given between 5-14 days after the date of exposure, it may reduce the symptoms but may not prevent the disease.

While the priority is to ensure appropriate IPC measures are followed, vaccination may provide additional protection depending on the nature and timing of exposure risk. Designated healthcare and laboratory staff (including domestic staff etc.) who will be involved in the management of mpox cases, or their samples, should be offered two doses of the vaccine, 28 days apart.(67)

Post exposure prophylaxis for contacts

High and intermediate risk contacts within four days of last exposure to a laboratory confirmed case should be offered one 0.5 ml dose of the vaccine (Imvanex®). This may include healthcare workers (including domestic staff, etc.) caring for the case, and other contacts who have not previously been vaccinated. If there is a likelihood of ongoing exposure, a second dose should be given at least 28 days after the first. The vaccine can prevent the onset of symptoms if given within 4 days of known exposure. If given within five to 14 days after the date of last exposure, it may reduce the symptoms but not prevent the disease.(67)

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