Understanding sexual transmission dynamics and transmission contexts of monkeypox virus: a mixed-methods study of the early outbreak in Belgium (May–June 2022)

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► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/sextrans-2022-055601).

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Received 11 August 2022
Accepted 31 October 2022

To cite: Vanhamel J, Laisnez V, Liesenborghs L, *et al*. *Sex Transm Infect* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/sextrans-2022-055601

ABSTRACT

Objective The available epidemiological and clinical evidence from the currently ongoing monkeypox (MPX) outbreak in non-endemic areas suggests an important factor of sexual transmission. However, limited information on the behaviour and experiences of individuals with an MPX infection has to date been provided. We aimed to describe the initial phase of the MPX outbreak in Belgium, and to provide a more in-depth description of sexual behaviour and transmission contexts.

Methods We used routine national surveillance data of 139 confirmed MPX cases with date of symptom onset until 19 June 2022, complemented with 12 semistructured interviews conducted with a subsample of these cases.

Results Sexualised environments, including large festivals and cruising venues for gay men, were the suspected exposure setting for the majority of the cases in the early outbreak phase. In-depth narratives of sexual behaviour support the hypothesis of MPX transmission through close physical contact during sex. Despite awareness of the ongoing MPX outbreak, low self-perceived risk of MPX acquisition and confusing initial signs and symptoms for other STIs or skin conditions delayed early detection of an MPX infection. In addition, we describe relevant contextual factors beyond individual behaviour, related to sexual networks, interpersonal interactions and health systems. Some of these factors may complicate early MPX detection and control efforts.

Conclusion Our results highlight the role of sexual contact and networks in the transmission of MPX during the early phase of the outbreak in Belgium. Risk communication messages should consistently and transparently state the predominant sexual transmission potential of MPX virus, and prevention and control measures must be adapted to reflect multilevel factors contributing to MPX transmission risk.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Monkeypox virus is known to spread among humans mainly through close physical contact. Clinical and epidemiological information from the ongoing global outbreak suggests that sexual contact might be a particularly efficient form of monkeypox transmission, yet we lack a contextualised understanding of transmission dynamics.

WHAT THIS STUDY ADDS

⇒ Combining routine Belgian surveillance data with a unique insight into the narratives of people who acquired monkeypox, our study confirms the high sexual transmission potential of monkeypox virus and reveals important interpersonal, network-level and health system factors contributing to efficient transmission contexts for monkeypox.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our study demonstrates the importance of risk communication and outbreak control measures that address the multilevel factors associated with monkeypox transmission.

BACKGROUND

In the first half of May 2022, the UK reported several cases of laboratory-confirmed monkeypox (MPX) virus infection.[1] Soon after, other countries in Europe, including Portugal, Italy and Belgium, reported similar cases, raising the alarm for potential widespread transmission of MPX.[2–4]

Not only the scale of this current outbreak is unprecedented, but also the geographical spread and the transmission mode. Historically, only few cases have occurred outside Central and Western Africa, mostly import related through infected animals or travellers and with limited secondary attack rates.[5–12] However, as of 20 October 2022, 75 345 confirmed cases of MPX have been reported from 109 countries globally.[13] People identifying as gay and bisexual men having sex with men (gbMSM) have been disproportionately affected.[14 15] This raises questions about the role of sexual behaviour in the transmission of MPX. Apart from zoonotic transmission, human-to-human transmission in endemic countries is thought to occur through

direct or indirect contact with skin lesions or bodily fluids, or via respiratory droplets during prolonged face-to-face contact.[16 17] Although transmission during sexual contact has been speculated, it was never confirmed in these settings.[18] In the current outbreak, however, patients predominantly presented with localised anogenital or oral lesions, suggesting transmission through local inoculation via close physical contact during sex.[15 19 20] There is a need to unravel sexual behaviour histories and relevant contextual factors contributing to transmission risks, to better understand MPX transmission dynamics.

The first MPX case in Belgium was notified on 19 May 2022. On 21 October 2022, Belgium had become one of the most affected countries globally, reporting 67.61 cases per 1 million inhabitants.[21] Cases clustered mainly in urban areas, especially in and around the city of Antwerp, with many initial cases reporting an epidemiological link to an international gay-oriented fetish festival that took place from 5 to 8 May 2022.[22] In Belgium, all suspected MPX cases are referred to designated facilities for clinical assessment and laboratory confirmation within specialised infectious disease units.

The objective of this study was to describe the initial phase of the outbreak in Belgium and to provide a more in-depth description of sexual behaviour and transmission contexts.

METHODS

Study design

We conducted a rapid cross-sectional, observational, mixed-methods study of laboratory-confirmed MPX cases with onset of symptoms between 10 May and 19 June 2022 in Belgium.

Data collection and analysis

This study was based on two distinct, yet inter-related, data sources: national routine surveillance data of confirmed MPX cases, and narrative data from semistructured interviews conducted with a subsample of these cases.

National routine surveillance

Probable and confirmed cases of MPX are mandatory notifiable to the three regional health authorities in Belgium. A confirmed case was defined as a person with an MPX virus-specific PCR assay positive result or an orthopoxvirus-specific PCR assay positive result, and symptom onset since 1 March 2022, as defined by the European Centre for Disease Prevention and Control.[6] All cases are interviewed by the regional public health authorities to collect information on the most probable source of infection and to initiate contact tracing. The Belgian Institute for Public Health (Sciensano) is responsible for epidemiological follow-up, risk assessment and development of guidelines for healthcare workers. As part of the outbreak management procedures, a linelist is constructed with the information collected by the regional health authorities on demographic characteristics, diagnosis, clinical symptoms and possible exposure settings and transmission routes during the 21 days before symptom onset (presumed incubation period). We extracted MPX cases with date of symptom onset until 19 June (N=139) from this linelist to use as a basis for the epidemiological description of the initial weeks of the outbreak. Statistical analyses were performed with R (V.4.0.5).

Semistructured interviews with MPX-confirmed cases

To gain a contextualised understanding of the perspective and behaviour of those affected, we additionally conducted semi-structured interviews with a subsample of the initial cases. Participants were all recruited between 24 May and 30 June 2022 at a large STI clinic in Antwerp, which reported the majority of cases. The attending physician asked patients' informed consent to be contacted by a researcher for an interview at the time of clinical MPX diagnosis. Out of 62 patients, 47 provided consent to be contacted. Of these, a sample of 19 were contacted by the first author (JV) with the invitation to participate. Of these, 12 agreed to participate in this study. Initially, we conducted interviews with all consenting individuals who were available for an interview (ie, convenience sampling). In a later stage, participants were more purposely selected, guided by emergent findings after preliminary analysis of the first interview data and as per the iterative nature of qualitative research. Notably, people with atypical clinical manifestations or symptoms (eg, skin lesions outside the anogenital area, a single isolated skin lesion with or without general symptoms) or particularly information-rich cases based on clinical judgement of the attending physician (eg, a clear epidemiological link, no self-reported history of sexual contact) were intentionally recruited to allow for maximum variation.

Interviews were held via telephone or online, using Zoom, and lasted between 30 and 60 min. All interviews were conducted by a social science researcher with a medical background and trained in qualitative research, guided by a questionnaire containing both open-ended and closed-ended questions (see online supplemental material 1). Questions related to sociodemographic background, social and sexual behaviour during the 3 weeks before symptom onset, epidemiological linkages related to MPX (eg, contact with known MPX cases), and health-seeking behaviour and risk perception related to MPX. Interviews were not recorded to foster a feeling of trust, yet answers were documented in the questionnaire and detailed notes were taken instead.

The first author (JV) analysed the interview data by creating a data matrix of questionnaire responses using a spreadsheet manager (MS Excel V.2108), supplemented with thematic coding of the researcher's notes and free-text data using the Framework Method.[23]

RESULTS

General description of the initial outbreak

The first case of confirmed MPX in Belgium developed symptoms on 10 May. Afterwards, numbers steadily increased, from 3 cases during the first week to 58 cases during the sixth week of the epidemic, as shown in the epidemic curve (see figure 1). This epidemic curve also shows the probable exposure settings. While 31 (61%) cases indicated a gay-oriented festival as being the probable source of infection in the first 4 weeks, this decreased and was only reported by 10 (11%) cases in weeks 5 and 6.

All cases (N=139) were men, with a median age of 38 years (youngest 20, oldest 62 years old). The majority self-identified as gay or bisexual men (95%) (see table 1).

Almost all cases reported skin lesions, the majority of which had anogenital lesions (78%). Eight cases (6%) were hospitalised: six to control pain, one because home isolation was not possible and one for unknown reasons.

Eight cases (aged between 29 and 62 years old) self-reported a history of smallpox vaccination. The HIV status was known for 124 patients, among whom 40 were HIV positive.

Travel history was available for 131 cases, 52 (40%) of whom reported travelling outside Belgium during the presumed incubation period, which was set at 21 days prior to symptom onset. Of all notified cases, 28 (20%) reported contact with a confirmed MPX case during the presumed incubation period.

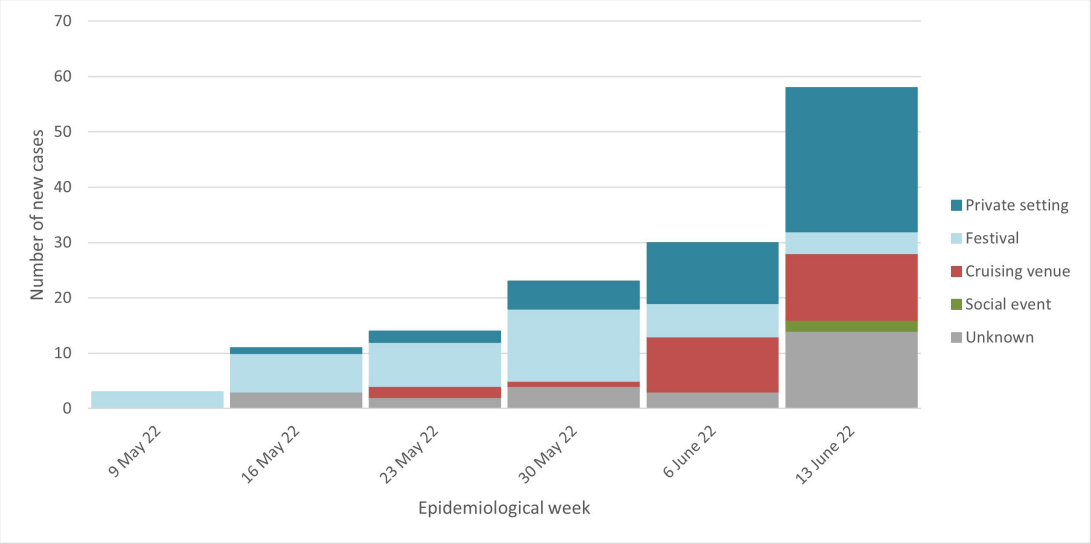

Figure 1 Epidemic curve monkeypox cases per week in Belgium, by date of symptom onset and by most probable exposure setting.

Exposure settings, interactions and conducive contexts for MPX transmission

Among the notified cases, 39 (28%) mentioned participation in a gay-oriented festival where they had sexual contact, and 2 persons (1%) reported participation in a gay-oriented festival without having had sexual contact on-site during the presumed incubation period. Mainly four different festivals were reported: a fetish festival for gbMSM in Belgium (attended by 18 cases), two Pride festivals in Spain (attended, respectively, by 12 and 4 cases) and one Pride festival in Belgium (attended by 11 cases). In addition to the routine surveillance data, we conducted semi-structured interviews with a subsample of 12 MPX cases (see table 2). The narratives of these interviews (summarised through quotation excerpts in table 3) supported the potential role of gay-oriented festivals in MPX transmission, with four participants having attended at least one of these events with anonymous sexual contacts on-site (see online supplemental material 2). In addition, four other interviewees demonstrated an indirect link to these events, through sexual contact with one or more partners who recently attended these events.

Other cruising venues for gbMSM (eg, saunas, gay bars) were reported as the most probable exposure setting by 25 (18%) notified cases. Qualitative data revealed how the anonymous nature of sexual contacts in these venues often complicated backward and forward contact tracing efforts.

Suspected modes of transmission

Sexual contact was self-reported as the most probable mode of transmission, among 83% of the notified cases (table 1). No distinction between different types of sexual contact could be made, as such more granular data were not collected through routine surveillance. Also, all but one interviewee self-perceived having acquired the infection from a sexual partner. However, only two interviewees were able to label a specific sexual encounter as the likely source of MPX acquisition. Both cases had observed a perianal pustular rash on the buttocks of a particular sex partner during penetrative anal sex. Partner notification was not possible for either as the partners were anonymous contacts. When inquiring about noticeable signs and symptoms of possible MPX infection among their sex partners, the other interviewees highlighted a number of impediments to the acquisition of this information, such as darkrooms and the cruising nature of sexual contacts (see table 3).

When comparing a more detailed history of behaviour of interviewees during the presumed incubation period with the manifestation of skin lesions, we generally observed a compatibility between reported sexual behaviour and possible inoculation sites (see online supplemental material 2). Often, multiple sex acts could be documented during the same encounter, combining penetrative oral and anal sex, interspersed with kissing contacts. In such cases, most participants reported anogenital lesions, often combined with skin lesions on other body parts where close physical contact occurred. In three cases, no anogenital lesions could be detected despite reportedly engaging in condomless anal and/or oral penetrative sex.

Four cases from the routine surveillance reported close physical contact other than during sex as the most likely transmission mode. We interviewed one of these cases, which revealed non-sexual transmission via close physical contact or fomites as a possible transmission route. This person did not report any history of sexual contact during the past few months. Yet, he reportedly hugged and kissed, and later shared bathing towels, with contacts identifying as gbMSM attending several cruising venues during a short stay at his place. One of these contacts later reported testing positive for MPX.

Health-seeking behaviour and risk perception

Routine surveillance data show a time interval between symptom onset and clinical diagnosis of up to 21 days (median of 6 days). Analysis of qualitative data provided additional insights into the reasons for diagnostic delay.

Many participants reported not recognising signs and symptoms as suspect of MPX when they first emerged, despite reportedly having heard of MPX circulating in gbMSM communities in Belgium and Europe through several media reports. Inadequate representation of the diversity of the extent and nature of skin lesions through media reports was mentioned as a reason. Skin lesions in the anogenital area were frequently linked to a possible STI, for which care was sought in primary care or specialist sexual health services. In two cases, treatment was first initiated for a presumed STI, such as a herpes simplex or secondary

Table 1 Sociodemographic, clinical and epidemiological characteristics of the initial 139 confirmed cases in the Belgian MPX outbreak based on routine surveillance data

Patient characteristics (N=139)		
Age (years)		
Median (IQR, range)	38 (32–43; 20–62)	
Time between symptom onset and clinical diagnosis (days)		
Median (IQR, range)	6 (4–8; 0–21)	
	n	**%**
Gender		
Male	139	100
Sexual identity		
Gay/bisexual	132	95
Heterosexual	4	3
Unknown	3	2
Reported symptoms*		
General symptoms (fever, general malaise, fatigue, headache, myalgia)	97	70
Skin lesions in anogenital area and other body parts	76	55
Skin lesions only outside the anogenital area	29	21
Skin lesions only in the anogenital area	26	19
Localised lymphadenopathy	40	29
Generalised lymphadenopathy	14	10
Respiratory symptoms (cough, sore throat)	3	2
Unknown	5	4
Hospitalisation due to MPX		
No	131	94
Yes	8	6
HIV status and PrEP use		
HIV negative and on PrEP	52	37
HIV positive	40	29
HIV negative and not on PrEP/PrEP status unknown	32	23
Unknown HIV status	15	11
Suspected setting of exposure†‡		
Private setting	45	32
Festival	41	30
Cruising venue	25	18
Social event	2	1
Unknown	26	19
Suspected route of transmission		
Sexual contact	115	83
Other person-to-person transmission	4	3
Unknown	20	14
Travel outside Belgium in the 21 days prior to symptom onset		
No	79	57
Yes	52	37
Unknown	8	6
Contact of other confirmed MPX case		
No	66	48
Yes	28	20
Unknown	45	32

*Several symptoms could be reported by each case.
†Several suspected settings of exposure could be reported by each case.
‡The categories we used for exposure setting are based on the categories used for reporting to ECDC. The category 'festival' includes large events that were attended by cases where they did or did not have sexual contacts. The category 'cruising venues' includes visits at nightclubs, party, sauna or similar settings with having sexual contacts. The category 'social event' includes visits at bar, restaurant or other small events where there was no sexual contact reported. Other exposure settings reported by the cases in our study fit under the category 'private setting'.
ECDC, European Centre for Disease Prevention and Control; MPX, monkeypox; PrEP, pre-exposure prophylaxis.

Table 2 Sociodemographic, clinical and behavioural characteristics of interview participants

Characteristic	N=12
Age group	
30–40	6
41–50	4
51–60	2
Clinical manifestation of skin lesions	
Anogenital and other body parts	8
Only in anogenital area	2
Only outside anogenital area	2
Type of recent* sexual exposures relevant to MPX transmission†	
Contact with a known confirmed MPX case	3
Sexual contact with a person suspect of MPX‡	2
Sexual contact at a festival publicly associated with MPX	4
Sexual contact with person who attended a festival publicly associated with MPX	4
Sexual contact at cruising venue (sauna, club or bar)	6
Sexual contact via dating apps	5
Other casual sexual contacts at persons' home	3
Suspected mode of transmission	
Close physical contact during sex	11
Close physical contact other than during sex	1

*Recent refers to the 21-day period before symptom onset.
†Multiple responses possible.
‡Refers to contacts being suspect of MPX based on either self-reported (ie, by sex partner) or observed (eg, by the index case) signs or symptoms associated with an MPX infection.
MPX, monkeypox.

syphilis infection, before either patient or provider considered a possible MPX infection.

A low self-perceived MPX risk was linked to notions of MPX being a rare disease in the general population, a low number of sexual partners and consistent condom use, which constituted a perception of safe sex in relation to MPX (see table 3). In three cases, the presence of atypical symptoms (eg, a single lesion or very discrete skin lesions) caused participants to confuse lesions for other possible skin conditions, such as insect bites or eczema. The gradual appearance of additional skin lesions, or the pattern of skin lesions with general symptoms after having had sexual contact with men, ultimately urged participants to seek care that led to a clinical MPX diagnosis.

DISCUSSION

Our findings support the role of sexual contact in the early spread of MPX during the current outbreak in Belgium. Yet, as suggested in previous reports, our surveillance data show a shift in the probable source of infection from (international) festivals and gatherings to smaller, yet also sexualised, events and cruising venues.[24]

This description of the initial cases in Belgium confirms other reports from European countries, indicating that MPX is predominantly spreading in sexual networks of gbMSM. Although our observations do not provide any conclusive evidence in terms of established sexual transmission routes, they support earlier raised hypotheses of MPX transmission through sexual contact. A more detailed inquiry into sexual activities through 12 semi-structured interviews revealed frequent and multiple skin-to-skin and skin-to-mucosa exposures over the 3 weeks before symptom onset. These exposures present different opportunities for MPX transmission, depending on the presence of active virus in skin lesions and bodily fluids of an MPX-infected sexual partner. Recent studies have detected high viral loads in samples from skin lesions, anal swabs, saliva or oropharyngeal swabs of infected patients, and MPX DNA as well as replication-competent virus has also been detected in semen[3 25–27] (own observations). Virus that is shed from these sites can be readily transmitted when it

Table 3 Overview of the main themes and subthemes identified in the narratives of semistructured interviews, supported by illustrative quotes

Theme	Subtheme	Quote
Self-perceived exposure settings and contexts	Gay-oriented festival	"For me, these events [referring to two gay festivals] are all about socialising. And yes, also having sex is part of that for me." (Participant #1)
	Cruising venue	"I travelled to Budapest and, you know, I am a single man… I've been visiting quite some different bars and [gay] saunas(…)I think [the infection] must have happened there." (Participant #11)
	Home	"I usually meet casual hook-ups from Grindr at my place, or his place, it depends." (Participant #9)
	Unknown (sexual)	"I don't know [where infection was acquired], but it must have been from a sexual contact. I have been preoccupied with work, and apart from sexual contacts I haven't been meeting people lately." (Participant #5)
	Unknown (non-sexual)	"I have been puzzled as to where I caught it [monkeypox]. I haven't had any sexual contact in months!" (Participant #12)
Sexual interactions	Anonymous encounters	"I don't spend a lot of time with them [sex partners], it's really just about casual hook-ups(…)When you've had some drinks and the lights are dimmed [in the dark room], you don't really notice much [physical symptoms]." (Participant #8)
	MPX-suspected symptoms among sex partners	"I noticed a rash on his buttocks, but I didn't really think much of it. I thought it must have been some pustules or acne or something." (Participant #4)
	Sexual networks of gbMSM	"Me and my partner met a man via Grindr for a sex date at our place. He told us he was from the U.S.A., visiting Belgium to attend (name of gay fetish festival in Antwerp, Belgium)." (Participant #2)
Health-seeking behaviour and risk perception related to MPX	Confusing MPX symptoms for other STIs	"It started with a pustule on my penis. Then I went to my GP because I recognised it as herpes, from previous times." (Participant #5)
	Confusing MPX symptoms for other skin conditions	"They [the media] always talked about 'pox', in plural, but I only had one lesion that looked like a mosquito bite. How the hell was I supposed to know that was going to be monkeypox?!" (Participant #3)
	Risk perception	"I did not think it [MPX] was something I would get … I have always been careful, using condoms, and I am not that adventurous when I go out." (Participant #5)
		"I had heard of it [monkeypox], but never thought I would really catch it.(…)I always thought of it as something not affecting me. They [media] call it a rare disease." (Participant #3)
	Provider-related diagnostic delay	"He [the GP] thought about Syphilis and did a blood test, but it came back negative. He wanted to test for Syphilis again… I had the feeling he was not really digging deep enough, so I went to an STI clinic instead." (Participant #10)

gbMSM, gay and bisexual men having sex with men; GP, general practitioner; MPX, monkeypox.

comes into contact with mucosal membranes, as during sexual contact. Previous outbreaks in Central and West Africa predominantly occurred after zoonotic spillover from the animal reservoir. Subsequent human-to-human transmission is known to occur through direct skin-to-skin contact or via the respiratory route, but transmission rates were generally found to be low with limited secondary spread.[7] Sexual contact, on the other hand, might be more efficient in transmitting MPX due to the intense contact with mucosal membranes. This enhanced mode of transmission in combination with spread through dense sexual networks, therefore, may allow for sustained transmission within the population.

Although our research strongly focuses on individual behaviour, its role in MPX transmission should be understood within facilitating contexts comprised of multilevel factors. In the context of the current outbreak, our interview data provide more insight into interpersonal and community-level factors. A first finding is the interconnectedness of sexual networks among gbMSM, with linkages to a specific event (ie, international gay-oriented fetish festival) that took place in Belgium early in the epidemic.[28] We described both direct (ie, sexual contact at the event) and indirect (ie, sexual contact with partners who attended the event) connections to this event. Dense sexual networks—across international boundaries—imply that the chance to encounter an MPX-infected sexual partner is higher in communities of gbMSM compared with the general population.[29] Communicating this message is relevant, as we found evidence of low self-perceived MPX risk being linked to notions of low prevalence of MPX in the general population, or a low number of sexual partners, masking the elevation in risk caused by network-level factors. These processes of sensemaking were shown to impact health-seeking behaviour and prevented early diagnosis of an MPX infection in some cases. In addition, we also described factors related to the settings and interactions among gbMSM. The cruising nature of exposure settings, for instance, may facilitate anonymous interaction, with a frequent absence of contact information for contact tracing and partner notification. Lastly, interactions with the health system also emerged from our qualitative data, with primary care providers confusing MPX symptoms for other STIs. Healthcare providers—especially those attending to gbMSM—should maintain a high index of suspicion for MPX, especially among male clients presenting with anogenital skin lesions with or without general symptoms.

Our findings have several implications for effective outbreak control. First, a transparent and consistent communication on the sexual transmission of MPX is warranted, as risk communication is key to enable affected communities to take informed decisions to protect their health.[30] Even though human-to-human MPX transmission could theoretically occur through any close physical contact, all epidemiological, clinical and behavioural reports indicate that non-sexual MPX transmission in the current outbreak is rare. Information campaigns should be broad, yet primarily appeal to communities of gbMSM, as they currently remain most affected by the MPX virus. The risk of stigmatisation should be carefully considered and messages should be prepared in collaboration with affected communities and all relevant stakeholders, including venue managers of locations with cruising opportunities.[31] Moreover, the narratives of interviewees stress the importance of media reports, which should be inclusive towards the broad range in representations of a possible MPX infection to allow early recognition of (atypical) MPX-associated symptoms. Lastly, our data highlight the challenges of contact tracing for anonymous encounters. Therefore, there is a need for a rapid expansion of pre-exposure vaccine accessibility globally and innovative approaches for anonymous partner notification, for instance, through functional additions to the messaging systems of online dating apps, which many users would be in favour of.[32]

There are several limitations to our study. Sensitive information on sexual behaviour might not always be reliably disclosed to public health agencies. We have countered this effect to some extent through conducting interviews with a subsample, by an experienced qualitative researcher skilled in creating a safe and non-judgemental environment. However, social desirability bias cannot be fully excluded. Second, four persons reported only heterosexual contact during the 21-day period before symptom onset, yet no further information could be obtained from these persons to reliably assess the most probable mode of transmission. Lastly, hypotheses inspired by these qualitative data need confirmation through larger quantitative follow-up studies.

CONCLUSION

In-depth behavioural data from this study highlight the role of sexual contact and sexual networks in the transmission of MPX during the early phase of the outbreak in Belgium. Risk communication should consistently and transparently state the predominant sexual transmission potential of MPX. Prevention and control measures must be adapted to reflect the multilevel factors impacting on MPX transmission, including supporting anonymous partner notification and attention for atypical clinical presentations.

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Acknowledgements We would like to thank all interviewed participants for their time, cooperation and efforts. IB and LL are members of the Institute of Tropical Medicine's Outbreak Research Team, which is financially supported by the Department of Economy, Science, and Innovation of the Flemish government. VL is a fellow of the European Centre for Disease Prevention and Control (ECDC) Fellowship Programme, supported financially by the ECDC.

Contributors JV, VL, LL, IB, KV, AL, WVB and BV contributed to the conceptualisation of the study. LL, IB, NB-R, TV, CK and KV were involved in clinical management of the cases. JV, ML and BV designed the interview questionnaire. JV conducted the 12 interviews. NH, OL and RM interviewed cases as part of regional public health authorities. VL, AL and WVB analysed the routine surveillance data. JV and VL prepared the first draft of the manuscript. All authors were involved in the interpretation of the data and in writing and reviewing the final version of the manuscript. All authors approved of the final version. BV is the guarantor for this manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval The planning, conduct and reporting of this study were in line with the Declaration of Helsinki, as revised in 2013. Monkeypox is a notifiable disease in Belgium. The Belgian Institute for Health (Sciensano), in cooperation with the Belgian regional health authorities, has legal permission to process patient information for both routine and outbreak surveillance without patients' explicit consent. The conduct of semistructured interviews was done as part of the routine outbreak investigation activities of the Institute of Tropical Medicine (ITM) in Antwerp, Belgium, and approved by the Institutional Review Board of the ITM (ref. 1596/22). All interview participants provided verbal informed consent.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All relevant data supporting our findings are included in this published article. The complete dataset of conducted interviews is not made publicly available because they might contain information that could identify other persons, yet additional anonymised data are available from the corresponding author on reasonable request.

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Supplementary material 1. Questionnaire used for in-depth interviews with confirmed MPX cases.

MONKEYPOX EPIDEMIOLOGICAL QUESTIONNAIRE

Interview conducted by _____on ___ / ___ / _____

A. DEMOGRAPHIC DATA *(See clinical CRF, only link with unique ID number)*

Unique ID number _____

Hello, my name is _____. I am a researcher at the Institute of Tropical Medicine. I received your information through Dr. XXX, where you are being treated, and I would like to talk to you about a recent infection with the monkey pox virus that you were diagnosed with. First of all, how are you doing now? [supportive listening of the investigator].
As you probably know, much is still unknown about how the monkeypox virus is transmitted, who can transmit it and when you are contagious. Therefore, we would like to understand this better by surveying patients with confirmed infections. You have already indicated your willingness to participate in this, for which we thank you. Are you currently available for an interview that will last about 60 minutes, or would you like me to call you at a later time that is more convenient for you?

Does not wish to reply Y/N

You may have already read about the monkey pox epidemic in Europe. This infection is caused by a virus, which is most likely transmitted between people through close and prolonged physical contact, such as skin-to-skin contact, but also the sharing of contaminated material, such as bed linen. In the current outbreak of the virus, most infections have been among men, many of whom self-identify as gay or bisexual, suggesting possible transmission of the virus during or through sexual contact. However, this form of transmission has not been described before. Through this questionnaire, we try to get a better idea of possible behavioural factors that may play a role in the transmission of the virus. These questions are mainly aimed at mapping the nature and circumstances of your social contact during the period of the estimated time of infection. Some of these questions also focus on more intimate contacts and sexual practices, which we suspect may play a relevant role in this epidemic. These questions can sometimes feel uncomfortable, but they are important in determining which practices increase the risk of infection. These insights will also help to formulate advice that protects public health and is based on science. I would like to inform you that at any time you may indicate that you do not wish to answer a particular question, or that you wish to discontinue the conversation. I also remind you that this questionnaire is completely confidential.

B. GENERAL INFO AND RELEVANT HISTORY

Question	Response options
May I first ask what you do for a living? Do you have any regular hobbies or activities?	
I would like to start by confirming the date when you first experienced HUIDSYMPTOMS (rash, papules, blisters). - *If available from clinical data:* is it true that this was on __/__/_____? - *If not available from clinical data*, can you remember the date when you first became aware of these symptoms?	_____/____/_____ *(if exact date known)* *1 day ago* *2-3 days ago* *4-5 days ago* *6-7 days ago* *More than 1 week ago* *More than 1.5 weeks ago* *2 weeks or more ago*
How did the symptoms progress for you (*timeline with overview of symptoms and injuries per day*)? How do you feel now?	

When did you first hear about the monkey pox virus? - *Was this before or after you became aware of complaints?* - *Which way (e.g. news, social media, others?) did you hear about monkey pox for the first time?* - *Have you been contacted by someone who was diagnosed with the infection and with whom you had contact? If yes, please give further details on the context of the contact.*	
Did you have a suspicion when you noticed the symptoms that it could be a monkey pox virus infection? - *If yes, why?* - *Do you have any idea where you might have caught the infection?*	

C. HIGH-RISK AND HOUSEHOLD CONTACTS

I would like to start by asking you some questions about your social contacts with the persons who may have been infected with the monkeypox virus and persons who belong to your household, i.e. persons with whom you live under the same roof. Is that OK with you [wait for permission].

Question	**Response options**
In the **three weeks** before your symptoms (past two weeks if no symptoms), have you been in close contact with a person who had a possible monkey pox infection, or had signs that might indicate monkey pox, such as skin lesions or flu-like syndrome?	*No* *Yes, with a confirmed monkeypox case* *Yes, with a suspected monkeypox case* *Yes, with a person with skin lesions and/or flu-like syndrome*
If so, when?	_____/_____/_____
What was the link with this contact?	*Permanent partner* *Family member (or relatives living under the same roof)* *Roommate (not a family member)* *Occasional (non-stable) sexual contact* *Patient (and interviewee is a healthcare professional)* *Other, please specify*
If "patient" or "other Specify type of contact (multiple options possible)	*Kiss on greeting or farewell* *Handshake* *Touch rash* *Been within <1.5m for less than five minutes (cumulative)* *Been within <1.5m for more than five minutes (cumulative)*
If "patient" or "other Specify duration spent in the same room (several options possible)	*Not been in the same room* *Remained in the same room for <5 minutes* *Remained in the same room for 5 to 15 minutes*

	Remained in the same room for >15 minutes
Specify use of mouth mask during contact with	*High-risk contact and you wore surgical mask* *High-risk contact wore surgical or FFP2 mask and you FFP2 mask* *High-risk contact wore mask but you did not* *High-risk contact did not wear a mouth mask but you did* *Neither wore a mouth mask*
In the three weeks before your symptoms (past two weeks if no symptoms), have you been in a hospital, clinic or to a general practitioner or other health care provider?	*Yes, general practitioner or other health care provider's practice* *Yes, STI clinic* *Yes, hospital* *Yes, other. Specifieer*_____ *No*
If yes, specify possible risk exposure	
With which persons do you live under the same roof? - *What is your relationship with these people? (go through each contact)*	*Family* *Roommate (not a family member)* *Partner* *Other*
During the **three weeks before the onset of symptoms** (cf. reference date), how would you describe the physical contact you had with these persons ? (*go through each contact, see below)*	*No physical contact* *Occasional physical contact (e.g. fleeting touch, embrace, kiss as greeting)* *Regular physical contact (e.g. daily kissing, daily touching and hugging - **not sexual**)*
Contact 1: ***Contact 2:*** ***Contact 3:*** ***Contact 4:*** ***Contact 5:*** ***Contact 6:***	
If regular physical contact with household members: How would you describe this contact? (nature, frequency, duration) (*for sexual contact, see next section)*	

Have you had contact (touch, dung, faeces or urine removed) with an animal in the **three weeks before the onset of symptoms**? If yes, please specify the type of animal and whether it was dead or alive.	*No* *Yes*
In the three weeks before the onset of symptoms (cf. reference date), have there been any social activities (non-sexual) during which there was intense (physical) contact between persons (e.g. parties, celebrations, activities with close physical proximity)? If so, could you describe this further? (*place, date, indoors or outdoors, duration, number of people present, physical contact)*	

D. SEXUAL CONTACTS WITH STABLE PARTNER

Given the presumed importance of close physical contact for the transmission of this virus, I would like to ask some more intimate questions that relate to any sexual relationships and practices during the two weeks before the onset of symptoms. Are you comfortable with these questions? [Waiting for permission] You can always indicate if you want to skip certain questions.

Question	**Response options**
Did you have any form of sexual contact (including vaginal, anal insertive/receptive, oral and use of sex toys) during the **three weeks before the onset of symptoms** (cf. reference date)?	Yes No (*go to F)*

The following questions relate to contact with any regular sex partners, i.e. a husband or wife or a boyfriend with whom you have a serious relationship.

Question	**Response options**
Do you have one or more steady sexual partners? (i.e. *a husband or wife or a stable friend with whom you have a serious relationship)*	No (*go to E)* Yes, one permanent partner Yes, several permanent partners, namely _____ (number)
Does it concern a permanent sexual relationship with (one or more) men, women, trans men, trans women, non-binary persons or other?	Man: _____ Woman: _____ Transman: _____ Transvrouw: _____ Non-binary person: _____ Other: _____
Did you have sexual contact with one or more of these regular partners during the **three weeks before the onset of symptoms** (cf. reference date)?	Yes No (*go to E)*
How often did you have sexual contact with one or more of these regular partners during the **three weeks before the onset of symptoms** (cf. reference date)?	Daily Almost daily Weekly Only a few times
How did you have sexual contact with this/these steady sex partner(s) in the **three weeks before the onset of the symptoms** (cf. reference date)? (*go*	Anal and I was the active partner ("top")

through each contact, see below)	Anal and I was the passive partner ("bottom") Anal both as active and passive partner ("versa") Giving oral sex ("blowjobs") Getting oral sex ("getting a blowjob") Oral after anal sex Kissing (*+ specify on which parts of the body*) Tongue kissing "Deep kissing" Fisting Rimming ("baffen", anilingus) Vaginal sex (if applicable) Pee sex ("golden shower") Poop sex ("scat", "kaviar spiele", "copra") Other: _____
Contact 1: ***Contact 2:*** ***Contact 3:*** ***Contact 4:*** ***Contact 5:***	
On average, how long were each of these sexual contacts? (*go over for each sexual act)*	Volatile (less than 1 minute) Short duration (1 to 5 minutes) Medium duration (5 to 10 minutes) Prolonged (longer than 10 minutes)
Contact 1: ***Contact 2:*** ***Contact 3*** ***Contact 4:*** ***Contact 5:***	
Were *lubricants* (lubes) used in these sexual contacts?	No Yes, saliva Yes, bodily fluids other than saliva: _____ Yes, commercial means: _____ Other: _____
In how many of these sexual contacts with permanent partner(s) during the **three weeks prior to the onset of symptoms** (cf. reference date) was a condom used?	Once in a while In less than half of the contacts In about half of the contacts In more than half of the contacts Almost always Always

Did you ever use drugs during these sexual contacts with regular partner(s) during the **three weeks before the onset of symptoms** (cf. reference date)?	Yes No
If yes on drug use: What drugs were used in these sexual contacts?	Ecstasy (E, XTC, MDMA) Amphetamine/ speed Crystal meth (methamphetamine, tina, pervitin, glass, ice) Heroin (or related) Mefedron (3/4-MMC, meow, methylon, bubbles) Synthetic (MXE) GHB/GBL (liquid ecstasy) Ketamine (K, Special K, Vitamin K) LSD (acid, lumps) Cocaine Crack Cannabis (Marijuana) Poppers I have taken drugs but did not know what it was
If yes on drug use: How frequently were drugs used in these sexual contacts?	Once in a while In less than half of the contacts In about half of the contacts In more than half of the contacts Almost always Always
Additional comments on drug use	
Did you ever use sex toys during these sexual contacts with regular partner(s) in the **three weeks before the onset of symptoms** (cf. reference date)?	Yes No
If yes on use of sex toys: Can you describe which sex toys were used, and in what way? *Attention to: nature of toy, oral/canal insertion, use of saliva or other bodily fluids, duration of use, sharing with other partners.*	
Comments use sex toys*/*	
Has your regular partner had sex with someone other than you in the past three weeks?	Yes No
If yes, how many sexual partners has your partner had?	

E. OCCASIONAL (non-STABLE) AND ANONYMOUS SEXUAL CONTACTS AND EVENTS

The following questions concern contact with possible loose/occasional and anonymous sex partners. By loose/occasional sex partners we mean one or more people with whom you have sex on a regular basis but who are not in a permanent relationship, but who are also not anonymous (e.g. fuck buddies, friends with benefits, sex buddies). An anonymous sex partner is a person you don't know or don't know well, or who you just got to know, e.g. someone in a "dark room" or someone you meet for sex for the first time (e.g. in a sauna or after online contact on Grindr). Are you comfortable with these questions? [Waiting for permission] You can always indicate if you want to skip certain questions.

Question	**Response options**
Did you have sexual contact with one or more single or anonymous sex partners during the **three weeks before the onset of the symptoms** (cf. reference date)?	No (*go to F)* Yes, one single/anonymous partner Yes, multiple single partners, approximately_____ (estimated number: 5-10-20- >20)
Does it concern sexual contact with (one or more) men, women, trans men, trans women, non-binary persons or other?	Man: _____ Woman: _____ Transman: _____ Transvrouw: _____ Non-binary person: _____ Other: _____
How often did you have sexual contact with one or more single/anonymous partners during the **three weeks before the onset of symptoms** (cf. reference date)?	Daily Almost daily Weekly Only a few times One time only
How did you meet these loose/anonymous partners? (several answers possible)	Via dating apps In bar/cafe In dance club In sex club or swinger club In darkroom/"backroom" In sauna Private (at person's home or party where sex took place) At a public event/festival Other: _____
Comments encounters per contact	
In the **three weeks before the start of the symptoms** (cf. reference date), did you visit one or more places where several people had sexual contact with each other?	Yes No

If yes to the previous question: Can you further describe the context (place, date, circumstances and target audience) of this place/event?	
Have you participated in group sex (*i.e. sex with more than 1 person at the same time, including threesomes*) in the **three weeks before the onset of symptoms** (cf. reference date)?	Yes No
How did you have sexual contact with this/these loose/anonymous sex partner(s) during the **three weeks before the onset of symptoms** (cf. reference date) ?	Anal and I was the active partner ("top") Anal and I was the passive partner ("bottom") Anal both as active and passive partner ("versa") Giving oral sex ("blowjobs") Getting oral sex ("getting a blowjob") Oral after anal sex Kissing (*+ specify on which parts of the body*) Tongue kissing "Deep kissing" Fisting Rimming ("baffen", anilingus) Vaginal sex (if applicable) Pee sex ("golden shower") Poop sex ("scat", "kaviar spiele", "copra") Other: _____
Contact 1: ***Contact 2:*** ***Contact 3:*** ***Contact 4:*** ***Contact 5:*** ***Contact 6:*** ***Contact 7:***	
On average, how long were each of these sexual contacts? (*go over for each sexual contact remembered)*	Volatile (less than 1 minute) Short duration (1 to 5 minutes) Medium duration (5 to 10 minutes) Prolonged (longer than 10 minutes)
Contact 1:	

Contact 2:	
Contact 3:	
Contact 4:	
Contact 5:	
Contact 6:	
Contact 7:	
Were *lubricants* (lubes) used in these sexual contacts?	No Yes, saliva Yes, bodily fluids other than saliva: _____ Yes, commercial means: _____ Other: _____
In how many of these sexual contacts with single/anonymous partner(s) during the **three weeks before the onset of symptoms** (cf. reference date) was a condom used?	Once in a while In less than half of the contacts In about half of the contacts In more than half of the contacts Almost always Always
During these sexual contacts with single/anonymous partner(s), did you ever use drugs during the **three weeks prior to the onset of symptoms** (cf. reference date)?	Yes No
If yes on drug use: What drugs were used in these sexual contacts?	Ecstasy (E, XTC, MDMA) Amphetamine/ speed Crystal meth (methamphetamine, tina, pervitin, glass, ice) Heroin (or related) Mefedron (3/4-MMC, meow, methylon, bubbles) Synthetic (MXE) GHB/GBL (liquid ecstasy) Ketamine (K, Special K, Vitamin K) LSD (acid, lumps) Cocaine Crack Cannabis (Marijuana) Poppers I have taken drugs but did not know what it was
If yes on drug use:	Once in a while

How frequently were drugs used in these sexual contacts?	In less than half of the contacts In about half of the contacts In more than half of the contacts Almost always Always
Additional comments on drug use:	
Did you ever use sex toys during these sexual contacts with single/anonymous partner(s) in the **three weeks before the onset of symptoms** (cf. reference date)?	Yes No
If yes on use of sex toys: Can you describe which sex toys were used, and in what way? *Attention to: nature of toy, oral/canal insertion, use of saliva or other bodily fluids, duration of use, sharing with other partners.*	
If yes on use of sex toys: Were these sex toys sometimes shared with other sexual partners?	Yes (frequency and number of partners) _____ No

F. OTHER SOCIAL CONTACTS AND EVENTS

Question	Response options
During the **three weeks before the onset of symptoms** (cf. reference date), did you attend any major social events (e.g. festivals, music concerts, etc.) where many people gathered in close proximity?	Yes (describe further) No
Description:	
Do you have certain personal items (e.g. clothing, accessories, hygiene material, bedding, etc.) that you share with other people?	Yes No

If yes, description:	
If no sexual contact reported in the 3 weeks before the onset of symptoms: Did your regular partner have sex with someone other than you three weeks before the onset of symptoms?	Yes (how many sex partners outside the steady relationship?) No I do not know I do not wish to answer

G. CONTACT INVESTIGATION

Question	Response options
Since the beginning of the symptoms, have you had any physical contact with the people with whom you live under the same roof?	Yes (describe and list contact if known) No
Contact 1: ***Contact 2:*** ***Contact 3:*** ***Contact 4:*** ***Contact 5:***	
Have you had any sexual contact with your regular partner(s) since the onset of symptoms?	Yes (describe and list contact if known) No
Contact 1: ***Contact 2:*** ***Contact 3:*** ***Contact 4:*** ***Contact 5:***	
Since the onset of symptoms, have you had any sexual contact with casual/occasional and anonymous partners?	Yes (describe and list contact if known)

	No
Contact 1: ***Contact 2:*** ***Contact 3:*** ***Contact 4:*** ***Contact 5:***	
Since the onset of symptoms, have you had close physical (skin-to-skin) contact with other social contacts who are not part of your household?	Yes (describe and list contact if known) No
Contact 1: ***Contact 2:*** ***Contact 3:*** ***Contact 4:*** ***Contact 5:***	

H. OTHER

Question	**Response options**
Finally, having gone through all these things, is there anything else that comes to mind that might be relevant to the possible cause or spread of the virus?	

Thank you for your participation, which will enable us to better understand the current outbreak of monkeypox. If you have any questions, I can answer

them now or later via (email) or (tel).

Supplementary material 2. A more detailed overview of clinical, behavioural and epidemiological information of interview participants.

#	Time between symptom onset and clinical diagnosis	Clinical manifestation	Epidemiological link (direct/indirect) *	Close physical contact (incl. household; no sex) -21 days before symptom onset	Sexual contact -21 days before symptom onset						Relevant contact since date of symptom onset	
						Type of partner**	Setting	Type of sex	Exposure site	MPX suspect ***	Type of contact	MPX suspect ***
1	8 days	Two days of fever, followed by peri-anal lesions without other symptoms.	No known contact with a confirmed positive case. Attended Darklands festival in Antwerp (Belgium)	Regular contact with stable partner as part of the same household.	1	Stable (n=1)	Private sphere (Belgium)	1) Anal ("bottom and top") 2) Oro-penile (active and passive) 3) Kissing	Penis, ano-rectum,, oropharynx and lips.	No	Regular close physical contact with stable partner (no sex).	Stable partner developed symptoms of MPX 8 days after symptoms onset of index case and later tested positive for MPX.
					2	Anonymous (n=10)	Gay sauna with dark room in Lisbon (Portugal)	1) Anal ("bottom and top") 2) Oro-penile (active and passive) 3) Kissing	Penis, ano-rectum, oropharynx and lips.	No		
					3	Anonymous (n=10)	Darklands Festival in Antwerp (Belgium)	1) Anal ("bottom and top") 2) Oro-penile (active and passive) 3) Kissing	Penis, anorectum, oropharynx and lips.	No		
2	15 days	General symptoms of fever and malaise, followed by skin lesions on	No known contact with a confirmed positive case.	Regular contact with stable partner as part of the same household.	1	Stable (n=1)	Private sphere (Belgium)	1) Anal ("bottom") 2) Oro-penile (active and passive) 3) Kissing	Penis, ano-rectum, oropharynx, lips.	No	Regular physical contact with stable partner (no sex)	No

#	Time between symptom onset and clinical diagnosis	Clinical manifestation	Epidemiological link (direct/indirect) *	Close physical contact (incl. household; no sex) -21 days before symptom onset	Sexual contact -21 days before symptom onset						Relevant contact since date of symptom onset	
						Type of partner**	Setting	Type of sex	Exposure site	MPX suspect ***	Type of contact	MPX suspect ***
		cheek, arm and little finger. No ano-genital lesions.	Sexual contact with a man that attended Darklands festival in Antwerp (indirect)		2	Anonymous (n=1)	Private sphere (Grindr date) (Belgium)	1) Anal ("bottom and top") 2) Oro-penile (active and passive) 3) Kissing	Penis, ano-rectum, oropharynx, lips, cheek, neck and torso.	Yes		
					3	Anonymous (n=10)	Gay sauna with dark room (Belgium)	1) Anal ("bottom and top") 2) Oro-penile (active and passive) 3) Kissing	Penis, ano-rectum, oropharynx, lips, cheek, neck and torso.	No		
3	4 days	Papule on leg, followed by general symptoms of fever and headache, and anal pain.	No known contact with a confirmed positive case. One-week trip to Gran Canaria, Spain, with visits to several (sex) clubs (indirect)	None.	1	Occasional (n=3)	Private sphere (Belgium)	1) Anal ("bottom") 2) Oro-penile (active and passive)	Penis, ano-rectum, oropharynx, lips.	No	One occasional sex contact in private sphere on first night of onset of general symptoms.	No
					2	Anonymous (n=2)	Dancing club with dark room (Spain)	1) Anal ("bottom") 2) Oro-penile (active and passive) 3) Kissing	Penis, ano-rectum, oropharynx, lips.	No		
4	5 days	General symptoms and swollen cervical	No contact with a confirmed positive case.	None.	1	Anonymous (n=1)	Private sphere (Grindr date) (Belgium)	1) Anal with condom ("top") 2) Oro-anal ("rimming")	Penis (where not covered by condom),	Yes	None.	/

#	Time between symptom onset and clinical diagnosis	Clinical manifestation	Epidemiological link (direct/indirect) *	Close physical contact (incl. household; no sex) -21 days before symptom onset	Sexual contact -21 days before symptom onset						Relevant contact since date of symptom onset	
						Type of partner**	Setting	Type of sex	Exposure site	MPX suspect ***	Type of contact	MPX suspect ***
		lymph nodes followed by ulcers on penis and itchy vesicle on lip.	Sexual contact with a man that attended Darklands festival and noticed a rash on his buttocks.						oropharynx and lips.			
5	14 days	General symptoms of fever and appetite loss followed by lymphadeno-pathy and skin lesion on forehead, back, legs and penis.	No known contact with a confirmed positive case. Attended Darklands festival in Antwerp (Belgium)	None.	1	Anonymous (n=1)	Darklands Antwerp (Belgium)	1) Anal with condom (“top”) 2) Oro-penile (active and passive) 3) Kissing	Penis, oropharynx, lips, cheeks, neck, torso.	No	None.	/
					2	Anonymous (n=1)	Cruising club Antwerp (Belgium)	1) Anal with condom (“top”) 2) Oro-penile (active and passive) 3) Kissing	Penis, oropharynx, lips, cheeks, neck, torso.	No		
6	15 days	General symptoms followed by skin lesions on abdomen, arm, neck and peri-anal area and proctitis (concurrent Neissia	No known contact with a confirmed positive case. Sexual contact attended Darklands festival.	None.	1	Occasional (n=1)	Private sphere (Belgium)	1) Anal with condom (“top”) 2) Oro-penile (passive) 3) Kissing	Penis, oropharynx, lips.	No	Slept in mother’s bed without changing sheets.	No
					2	Occasional (n=1)	Private sphere (Belgium)	1) Anal (“bottom and top”)	Penis, ano-rectum, oropharynx, lips, cheeks,	No		

#	Time between symptom onset and clinical diagnosis	Clinical manifestation	Epidemiological link (direct/indirect) *	Close physical contact (incl. household; no sex) -21 days before symptom onset	Sexual contact -21 days before symptom onset						Relevant contact since date of symptom onset	
						Type of partner**	Setting	Type of sex	Exposure site	MPX suspect ***	Type of contact	MPX suspect ***
		Gonorrheae infeciton).						2) Oro-penile (active and passive) 3) Kissing	neck and torso.			
7	6 days	Skin lesions on lower arm and lip, and general symptoms (fever, dry cough).	No known contact with a confirmed positive case. Attended Darklands festival in Antwerp (Belgium).	None.	1	Stable (n=1)	Private sphere (Belgium)	1) Oro-penile (active and passive) 2) Kissing	Penis, oropharynx, lips.	No	None.	/
					2	Anonymous (n=6)	Darklands Antwerp (Belgium)	1) Anal ("bottom and top") 2) Oro-penile (active and passive) 3) Kissing	Penis, ano-rectum, oropharynx, lips, cheeks, neck and torso.	No		
					3	Anonymous (n=1)	Private sphere (Grindr date) in Paris (France)	1) Oro-penile (active and passive) 2) Kissing	Penis, oropharynx, lips.	No		
8	4 days	General symptoms followed by ulcerations on cheek, hands, finger, leg, and trunk. No ano-genital lesions. Bacterial	No known contact with a confirmed positive case.	None.	1	Stable (n=1)	Private sphere (Belgium)	1) Anal ("top") 2) Kissing	Penis, lips.	No	Penetrative anal sex ("top") with stable partner.	No
					2	Anonymous (n=2)	Cruising club (Belgium)	1) Anal with condom ("top") 2) Oro-penile (passive) 3) Kissing	Penis, lips.			
					3	Anonymous (n=1)	Cruising club (Belgium)	1) Anal ("top") 2) Oro-penile (passive)	Penis, lips.	No		

#	Time between symptom onset and clinical diagnosis	Clinical manifestation	Epidemiological link (direct/indirect) *	Close physical contact (incl. household; no sex) -21 days before symptom onset	Sexual contact -21 days before symptom onset						Relevant contact since date of symptom onset	
						Type of partner**	Setting	Type of sex	Exposure site	MPX suspect ***	Type of contact	MPX suspect ***
		superinfection of face ulcus.						3) Kissing				
9	6 days	General symptoms and skin lesions on penis and torso.	Roommate (see #10) tested MPX positive. Had sexual contact with a man that attended Darklands festival and noticed a rash on his buttocks.	Frequent and long lasting skin-to-skin contact with roommate (sitting next to each other on couch); no sexual contact.	1	Anonymous (n=1)	Private sphere (Grindr date) (Belgium)	1) Anal ("top") 2) Oro-penile (passive) 3) Kissing	Penis, lips.	No	Close physical contact with roommate (no sex).	Room-mate developed symptoms of MPX 9 days after symptom onset of index case and later tested positive for MPX (see #10)
					2	Anonymous (n=1)	Private sphere (Grindr date) (Belgium)	1) Anal ("top")	Penis.	Yes		
10	5 days	General symptoms and skin lesion on penis and pubis.	Roommate (see #9) tested MPX positive	See #9	1	Anonymous (n=3)	Cruising club (Belgium)	1) Anal with condom ("bottom and top") 2) Oro-penile (active and passive) 3) Kissing	Penis, oropharynx, ano-rectum (where no condom), lips, cheeks, neck, torso.	No	Close physical contact with roommate (no sex).	Room-mate developed symptoms of MPX earlier and recently tested positive for MPX (see #10)
					2	Anonymous (n=7)	Cruising clubs in Budapest (Hungary)	1) Anal with condom ("bottom and top")	Penis, oropharynx, ano-rectum (where no condom), lips,	No		

#	Time between symptom onset and clinical diagnosis	Clinical manifestation	Epidemiological link (direct/indirect) *	Close physical contact (incl. household; no sex) -21 days before symptom onset	Sexual contact -21 days before symptom onset						Relevant contact since date of symptom onset	
						Type of partner**	Setting	Type of sex	Exposure site	MPX suspect ***	Type of contact	MPX suspect ***
								2) Oro-penile (active and passive) 3) Kissing	cheeks, neck, torso.			
11	10 days	General symptoms, adenopathies and skin lesion on scrotum and lesion in the mouth.	None.	Regular contact with stable partner as part of the same household.	1	Stable (n=1)	Private sphere (Belgium)	1) Anal ("top") 2) Oro-penile (active and passive) 3) Kissing	Penis, oropharynx, lips.	No	Sex date with stable partner and two occasional sex partners; sharing of "cock ring" with one of the men during sex.	One occasional partner developed symptoms of MPX 17 days after symptom onset of index case and later tested positive for MPX.
					2	Anonymous (n=3)	Private sphere (Grindr date) (Belgium)	1) Anal ("top") 2) Oro-penile (active and passive) 3) Kissing	Penis, oropharynx, lips, cheeks, neck, torso.	No		
12	16 days	Typical lesions on forehead, scalp, torso, pubic area, neck and eyebrows. No rash, no general symptoms.	None.	Sharing of bath towels with friends staying over and attending several cruising (sex) clubs).	/	/	/	/	/	/	2-weekly visits at hairdresser and multiple (hasty) physical contacts as part of a social setting (e.g. hugging and kissing when greeting friends)	One contact with whom bath towels were shared tested positive for MPX

#	Time between symptom onset and clinical diagnosis	Clinical manifestation	Epidemiological link (direct/indirect) *	Close physical contact (incl. household; no sex) -21 days before symptom onset	Sexual contact -21 days before symptom onset					Relevant contact since date of symptom onset	
						Type of partner**	Setting	Type of sex	Exposure site	MPX suspect ***	Type of contact	MPX suspect ***
												(date of diagnosis unknown)

*A direct link refers to contact with a known confirmed MPX case; an indirect link refers to attendance of events publicly associated with the current MPX outbreak, or contact with sexual partners who disclosed having attended these events.

** A distinction is made between self-reported "stable" (i.e. a spouse or fixed partner within a steady relationship), "occasional" (i.e. a casual partner without steady relationship but who is not unknown to the index case) and "anonymous" partners (i.e. person unknown to the index).

***Refers to contacts being suspect of MPX based on either self-reported (i.e. through self-monitoring by the contact) or observed (e.g. by the index case) symptoms associated with an MPX infection.

Dutch translation of abstract.

Doelstelling:

De beschikbare epidemiologische en klinische gegevens van de huidige uitbraak van het Apenpokkenvirus in niet-endemische gebieden wijzen op een belangrijke factor van seksuele overdracht. Tot op heden is er echter weinig informatie beschikbaar over het gedrag en de ervaringen van personen die een Apenpokkenvirus-infectie doormaakten. We wilden de eerste fase van de uitbraak van Apenpokken in België beschrijven, inclusief een meer diepgaande beschrijving van seksueel gedrag en transmissiecontext.

Methoden:

We gebruikten routinematig verkregen nationale surveillance gegevens van 139 bevestigde gevallen van het Apenpokkenvirus met datum van aanvang van symptomen tot 19 juni 2022, aangevuld met 12 semi-gestructureerde interviews met een steekproef van deze gevallen.

Resultaten:

Geseksualiseerde omgevingen, waaronder grote festivals en “cruising”-locaties voor homoseksuele mannen, waren de vermoedelijke setting van blootstelling voor de meerderheid van de gevallen in de vroege uitbraakfase. Diepgaande interviews over seksueel gedrag ondersteunen de hypothese van Apenpokkenvirus overdracht door nauw lichamelijk contact tijdens seks. Ondanks het feit dat deelnemers op de hoogte waren van de huidige uitbraak van Apenpokken, werd een vroege diagnose van een Apenpokkenvirus-infectie vertraagd door een laag vermeend risico op verwerving van een Apenpokken infectie en het verwarren van de eerste tekenen en symptomen met andere seksueel overdraagbare infecties of huidaandoeningen. Bovendien beschrijven we relevante contextuele factoren buiten het individuele gedrag, die verband houden met seksuele netwerken, interpersoonlijke interacties en gezondheidssystemen. Sommige van deze factoren kunnen de vroege opsporing en bestrijding van Apenpokken bemoeilijken.

Conclusie:

Onze resultaten benadrukken de rol van seksueel contact en seksuele netwerken in de overdracht van het Apenpokkenvirus tijdens de vroege fase van de uitbraak in België. Risicocommunicatie moet consequent en transparant het dominante seksuele transmissiekarakter van het Apenpokkenvirus vermelden, en preventie- en controlemaatregelen moeten worden bijgestuurd om rekening te houden met factoren op verschillende niveaus, die bijdragen tot het risico op overdracht van het Apenpokkenvirus.