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## The 2022 monkeypox outbreak: A UK military perspective

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### ABSTRACT

With the emergence of SARS-CoV-2 and now monkeypox, the UK Defence Medical Services have been required to provide rapid advice in the management of patients with airborne high consequence infectious diseases (A-HCID). The Defence Public Health Network (DPHN) cadre, consisting of closely aligned uniformed and civilian public health specialists have worked at pace to provide evidence-based recommendations on the clinical management, public health response and policy for monkeypox, with military medicine and pathology clinicians (primarily infectious disease physicians and medical microbiologists). Military environments can be complicated and nuanced requiring specialist input and advice to non-specialists as well as unit commanders both in the UK and overseas. DPHN and military infection clinicians have close links with the UK National Health Service (NHS) and the UK Health Security Agency (UKHSA), allowing for a dynamic two-way relationship that encompasses patient management, public health response, research and development of both UK military and national guidelines. This is further demonstrated with the Royal Air Force (RAF) Air Transport Isolator (ATI) capability, provided by Defence to support the UK Government and UKHSA. Military infectious disease clinicians are also embedded within NHS A-HCID units. In this manuscript we provide examples of the close interdisciplinary working of the DPHN and Defence clinicians in managing military monkeypox patients, co-ordinating the public health response, advising the Command and developing monkeypox policy for Defence through cross-government partnership. We also highlight the co-operation between civilian and military medical authorities in managing the current outbreak.

### 1. Introduction

Monkeypox is an orthopoxvirus DNA virus endemic in West and Central Africa and occurs in two distinct genetic clades, West African and Congo-basin [1–4]. The Congo-basin clade is found in the Central

African Republic, the Democratic Republic of Congo and Cameroon, while the West African clade was reported in Sierra Leone, Nigeria, Liberia and Cote d'Ivoire [1]. With the eradication of smallpox in 1980 and cessation of vaccination, monkeypox has emerged as the dominant orthopoxvirus [2]. The first imported cases of monkeypox in the UK

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were reported in 2018 from Nigeria [5]. One of the cases was a naval officer who was managed jointly between the Defence Medical Services (DMS), the Royal Free Hospital and Public Health England (PHE), with a co-ordinated public health (PH) response via DMS clinical and PH clinicians and PHE public health consultants [5].

The current West African clade monkeypox outbreak started in May 2022, with an increase in infection identified in individuals with no travel history. The current outbreak has mostly been limited to gay, bisexual and other men who have sex with men (GBMSM), with 3017 confirmed UK cases as of the 8 August 2022 [6] and little to suggest sustained transmission beyond this group. As of 26 August 2022, there have been 47,652 cases globally in 99 countries, of which 92 have not reported previous cases [7]. The World Health Organisation declared the current monkeypox outbreak a public health emergency of international concern on the 23 July 2022 [8].

The UK Airborne High Consequence Infectious Diseases (A-HCID) network, involving five centres (the Royal Free Hospital (London), Guy's and St Thomas' Hospital (London), Royal Liverpool Hospital (Liverpool), The Royal Victoria Infirmary (Newcastle) and the Royal Hallamshire Hospital (Sheffield)) provides a hub for specialist advice and management in England. It coordinates between Public Health bodies of Scotland, Wales, Northern Ireland, Crown Dependencies and DMS; and supports a spoke model of clinical management advice to Specialist Regional Infectious Disease Centres [9]. The A-HCID centres manage a range of serious airborne infections including Middle East respiratory syndrome (MERS), pandemic influenza and monkeypox [9]. The Royal Free Hospital and Royal Victoria Infirmary are also the designated Contact-HCID (C-HCID) centres managing viral haemorrhagic fevers (VHF) such as Ebola, Lassa and Crimean-Congo haemorrhagic fever (CCHF) [9]. Within the UK, acute infectious diseases, which typically have high case-fatality rates, do not have an effective treatment or prophylaxis and easily spread in the community or healthcare settings are managed as a HCID [9]. Monkeypox West African clade I1b was declassified as a A-HCID in July 2022 by the UK Advisory Committee on Dangerous Pathogens (ACDP) [9], due to an available vaccine and a limited number of severe cases [10]. Furthermore, to the declassification, non A-HCID ID units across the UK, especially in London, have managed cases of monkeypox. Clades I and I1a of monkeypox confirmed by whole genome sequencing are not currently within the outbreak clade and are usually travel associated to West or Central Africa. These clades are managed as a HCID currently, requiring these patients to be admitted to a HCID centre and managed jointly with the UK Health Security Agency (UKHSA, previously Public Health England (PHE)), health protection teams (HPTs) and the Rare and Imported Pathogen Laboratory (RIPL). Close contacts of clades I and I1a are contact traced by the health protection teams, requiring either passive surveillance or isolation [11].

This paper describes the unique role of the Military Infection and Defence PH cadres in providing multidisciplinary support to the UK Defence response to the current monkeypox outbreak. It also demonstrates the significant co-operation between the military and their

civilian medical authorities. Table 1 summarises the key messages.

## 2. UK military infection services

The UK DMS Infection service is divided into clinical advice (Infection Diseases (ID) and Microbiology), diagnostics, and sexual health. The clinical ID service has regular and reserve Officers providing reach-back support to the UK firm base and deployed personnel, who are embedded within UK National Health Service (NHS) Trusts. Since 2017, there has been an on-call ID/tropical medicine reach-back service providing access to an on-call consultant 24 h a day contactable via phone, with an advice/referral email managed daily by an infection specialty trainee. The on-call microbiology reach-back service provides a 24/7/365 consultant-delivered advice service for infection testing, antimicrobial, and infection prevention and control (IPC) issues in the deployed setting.

## 3. The Defence Public Health Network

The Defence Public Health Network (DPHN) delivers global 24/7/365 occupationally and operationally focused PH support across UK Defence, through a small network of uniformed and civilian PH consultants and supporting specialists. The DPHN acts as the global single point of contact (SPOC) for all notifiable diseases and incidents involving Defence personnel and collates information from surveillance systems and infectious disease notifications to coordinate an appropriate PH response. DPHN specialists manage communicable diseases and chemical/environmental incidents in the UK and overseas and work closely with UKHSA regionally based civilian Health Protection Teams (HPT) who have legal primacy for health protection incidents in the UK.

## 4. Epidemiology of monkeypox cases in UK armed forces personnel

To date there have been five confirmed monkeypox cases [12] associated with the current outbreak among Service Personnel (SP) and no epidemiological link or evidence of ongoing transmission between these cases. There have been significantly more suspected cases which have required clinical and PH reach-back support, presenting additional challenges in the deployed setting. Only some of these cases met the UKHSA case definition, which would prompt follow up testing and further PH actions. Common differentials include varicella zoster virus (VZV), herpes simplex virus (HSV) and syphilis. Here we describe the first monkeypox case associated with UK Defence as an example of our recent experience.

## 5. Clinical case

During this current outbreak one of the military infection consultants was alerted to a laboratory confirmed case of monkeypox in a SP through the National Infection Service on-call system, by the base military medical practitioner. The nearby hospital did not have on-site ID clinicians, the SP was managed as a category C patient in accordance with current UKHSA guidance [13], requiring isolation in en-suite accommodation. The alert prompted onward notification via Defence PH SPOC and the duty on call PH consultant. Military ID and PH reach-back support was immediately made available to the base primary care medical team, with input from Defence Primary Health Care (DPHC), to support IPC and clinical management. A PH-led military multi-disciplinary incident meeting was convened to discuss immediate actions by Defence, and this was followed by an incident management team (IMT) meeting involving DPHN, DPHC clinicians, the Defence Consultant Advisor in Medicine, military infection consultants, corporate communications teams and external stakeholders including the UKHSA regional HPT. The purpose of the IMT was to review the epidemiological and microbiological evidence and to undertake a risk

**Table 1**

Key messages for the DMS response to the UK monkeypox outbreak.

Key messages
Close collaborative multidisciplinary working between Defence Public Health, military infection specialists and Defence Primary Care enabled Defence Medical Services (DMS) to coordinate a flexible and coherent response to an emergent health threat.
A high level of co-operation between military and civilian healthcare and health protection organisations is essential to control outbreaks in the military environment.
Effective and timely communication between the DMS and the non-medical military chain of command is required to share situational awareness and to support promulgation of public health messages.
In reach and liaison with the LGBTQ+ military communities were essential for the monkeypox outbreak via LGBTQ+ forums and social media.

assessment which would inform the need for further control measures, contact tracing activity and internal and external communications.

## 6. Military ID clinical support

Uniquely, the DMS has ID Consultants and trainees based in the Royal Free Hospital and the Royal Liverpool Hospital, providing regular clinical input to A-HCID cases. DMS ID Consultants have experience in the management of previous monkeypox cases and SARS-CoV-2 (when first managed by the A-HCID network) [4,5,14]. Furthermore, DMS ID Consultants provide input to national (National Institute of Clinical Excellence [NICE]) and international (World Health Organisation [WHO]) guidelines. These individuals, with their specialist knowledge, across all three domains of the military (land, sea, and air), are available at short notice to provide subject matter expertise to medical and non-medical commanders on the direct and indirect threats posed by these infections. Additionally, they have also established military-specific guidelines in the management of individual patients as well as the PH advice, in conjunction with DPHN colleagues.

Therefore, military infection Consultants can provide swift and pragmatic clinical advice to clinicians based in the UK and overseas. As the outbreak has continued to grow, it has been important to advise military primary and secondary care clinicians of important differential diagnoses, the monkeypox clinical syndrome including the prodromal phase and access to appropriate testing when required. Military infection Consultants have also acted as a conduit between military primary care, DPHN and secondary care including admission to HCID units.

## 7. Interdisciplinary case management

Risk assessment of close contacts was undertaken by DPHN Consultants in conjunction with UKHSA, following extant national guidance [11] and included decisions on classification of contacts in office and healthcare settings which determined whether post exposure vaccination should be recommended along with passive health monitoring. Defence PH worked closely with the primary care clinicians and the base commander to provide advice and reassurance around risk while maintaining patient confidentiality. This collaborative approach served to address concerns raised by base personnel and ensured that a proportionate response was taken which allowed the base to continue to operate with minimal impact on outputs. It was important to acknowledge the concerns of non-medical commanders, whose responsibility is the safety of their personnel and operational output of the unit, but also to explain the risk and to reassure that management actions were in place to mitigate disease spread. Due to the potentially sensitive and stigmatising nature of monkeypox it was important to convey to commanders that they could not have access to patient sensitive information. General information on the disease, associated IPC measures, contact tracing and the management of contacts was provided to commanders via unit medical centres. Reactive lines were developed in case of media interest to promote consistent messaging and the senior medical leadership were briefed. This close collaborative interaction between DPHN, military infection and DPHC clinicians has served as a template for managing all subsequent monkeypox cases. It also reflects the approach of the DMS in multidisciplinary working in response to a wide range of ID notifications, whether in the UK Firm Base or overseas. The interoperability of these close-knit specialty teams is routine practice and permits rapid sharing of information using a range of appropriate communication media, timely assessment of risk and speedy joint decision making to support the incident management response, both in terms of clinical care and PH incident management. Engagement with external partners such as UKHSA can also be facilitated at speed through local networks established before COVID-19 but honed during and since. Military patients have full access to local sexual health services, however data from these services is not often communicated to DMS clinicians, which is important with this current outbreak for both clinical and

public health management. Communication between these services is an area for improvement.

## 8. Development of guidance for military clinicians

The respiratory-driven COVID-19 pandemic saw a novel coronavirus virus spread at pace among an immune-naive global population. It impacted on all aspects of daily life, including military operational outputs. This unprecedented situation, especially during the early stages of the pandemic, necessitated the rapid development of military specific PH and clinical guidance to protect SP and operational delivery as distinct from other occupational settings. Over time, military policy has largely aligned with developing national guidance. In contrast, the epidemiology of the monkeypox outbreak has been characterised by a smaller and more narrowly defined at risk group, a different mechanism and slower rate of transmission requiring direct contact and with effective vaccines and existing treatments made available. Defence PH has shared rapidly developed national guidance with the chain of command with reassurance that the risk posed to SP from monkeypox remains low. Effective links into UK national PH leads have also enabled Defence to adjust guidance in line with expert consensus opinion where necessary.

The outbreak did however generate significant clinical interest in DMS primary care teams who received enquiries from concerned SP presenting with a variety of skin rashes, some with a recent travel history. This had led to inconsistency in how clinicians were responding to possible cases and uncertainty around how to report and where to seek support. In response, a DMS clinical lead for monkeypox was appointed and worked closely with DPHN and infection colleagues to adapt existing national guidance [13] to the military context, with guidance, that contains current case definitions and signposts clinicians to military PH and ID reach-back support. This ensured a suspected case was referred into appropriate services and the correct military and statutory notification process was followed.

To support general awareness throughout Defence, a monkeypox intranet page was established, which offers access to a range of guidance and linked resources including the latest PH messages, vaccination information and guidance on points of contact for further advice or in the event of a SP developing symptoms. A targeted approach to communications has included Twitter and named points of contact to direct messages to Defence's LGBTQ + groups.

Equality and diversity are integral to the UK military, with further work planned. There are several support groups across Defence and the single services to increase awareness and provide support to LGBTQ + communities. Engagement with these groups has been pertinent to the current monkeypox outbreak and provides an example of how the DMS can reach out to under-represented groups within Defence.

Increasingly there has been interest around availability of vaccines. NHS England are responsible for the UK supply of modified vaccinia Ankara (MVA) vaccines (Imvanex) supplied to individuals who are most at risk from monkeypox and the UK military follows extant national policy and priority, aligned with the NHS, which was essential as the vaccine was in short supply and needed targeted allocation. At risk SP can access vaccination for free via NHS vaccine hubs and sexual health clinics and some sexual health services are contacting those individuals likely to be at highest risk to offer vaccination. The expectation is that any high-risk healthcare workers will be offered the vaccine through their employer.

## 9. Managing suspected cases in deployed settings

There are a number of challenges faced by the DMS when managing infectious diseases in deployed SP, including: the need to consider possible aetiologies related to the specifics of the deployment, limited access to, and platforms for, diagnostic testing, availability of local secondary healthcare services, ability to effectively isolate SP and

contact trace in remote locations or field conditions and a mechanism for safely recovering SP without generating additional risk for personnel and platforms. There may also be considerations relevant to engagement with host nation PH services, where these exist, as well as implications for moving patients across international borders. A particular challenge exists in the maritime environment where experiences managing COVID-19 outbreaks on board Royal Navy (RN) ships led to understandable concern around how a suspected monkeypox case would be managed at sea. This is another example where, in the absence of national guidance, military PH and medical specialists can provide the chain of command with reassurance around risks and support in developing outbreak plans based on first principles of outbreak management adapted to RN platforms. Furthermore, the IMT can interpret national contact-tracing guidance as it applies to distinctive operational contexts, for example a RN warship, with its confined living conditions and close crew interactions can make it more akin to a single household.

## 10. Interface between Defence Medical Services and UKHSA

Much work had been done before and during the COVID-19 pandemic to establish links between the DPHN and Regional HPTs in PHE. During the pandemic these links were strengthened at the national level through attendance at IMTs and expert advisory groups and relationships have endured since the establishment of UKHSA in October 2021 [15]. This has allowed the DMS to access timely access to information on the monkeypox outbreak as well as national subject matter expert advice to risk assess the need for vaccinating DMS personnel involved in Air Transporter Isolator moves of monkey pox cases.

### 10.1. Air transportable isolator

The Air Transportable Isolator (ATI) is operated by the Deployed Aeromedical Isolation Team (DAIT) from the Royal Air Force (RAF) Tactical Medical Wing (TMW) and is funded jointly between the Department of Health and Social Care and the Ministry of Defence [16]. The DAIT (consisting of an RAF consultant physician, a civilian HCID expert, RAF aeromedical and infection prevention control nurses) is activated primarily by the UKHSA and NHS England Emergency Preparedness, Resilience and Response (EPRR) network [16]. The ATI is a stretcher-based, wheeled unit which uses a suspended flexible polyvinyl chloride (PVC) envelope and high-efficiency particulate air (HEPA) filtered air flow system to provide isolation for HCID patients [16]. After the loading of the patient into the ATI, the clinical team are able to operate in a light PPE dress state to provide care to patients through half-suits integrated into the PVC envelope [16]. It has been used to undertake aeromedical evacuation (AE) for individuals infected with VHF, including CCHF and Ebola Virus Disease [16] and provides an integrated approach of patient care and delivery to an appropriate HCID unit.

The three key principles of the ATI are to protect the patient, protect the staff and protect the airframe. The ATI can provide uniformity of approach in PPE to HCID patients therefore minimising retraining needs, allowing staff to work in minimal PPE over long hours, whilst the patient can sit up and move/toilet etc in moderate comfort within the envelope. Lastly, many recognised viricidal agents are inherently corrosive to the materials involved in aircraft construction and therefore pose an aviation safety risk, therefore a preventative decontamination strategy is preferred.

## 11. Discussion

Military outbreaks can occur in highly specialised environments, often compounded with operational pressures. The current monkeypox outbreak has further demonstrated the unique roles the DMS Infection and PH cadres have in managing HCID patients among SP within the UK and overseas. Previous VHF outbreaks, the SARS-CoV-2 pandemic and

the current monkeypox outbreak have brought both specialities closer together in providing individual patient management and a co-ordinated tailored occupational and operationally focussed PH response. Another key role is the generation of specific policy advice for commanders, with the current outbreak further galvanising the interdisciplinary approach between both specialities in producing current and evidence-based policy, which is distinctive to the DMS. This optimises the management of the patient and the unit with advice available to both medical and non-medical commanders.

DMS ID clinicians are embedded within the NHS including at a number within both A-HCID and C-HCID units. This relationship allows for continued training and experiential learning, provides experienced clinicians to the NHS, and acts as a conduit for military clinicians to access specialist infection/PH advice and services. The emergence of these infectious diseases has also further developed the relationship between the DPHN and UKHSA at both regional and national levels. The DMS medical, infection and PH interdisciplinary working to the current monkeypox outbreak, has built upon the experiences learnt during the Ebola epidemic in 2014–2016 and SARS-CoV-2 pandemic, demonstrating resilience and adaptability in addressing novel threats of emerging infectious diseases, as exhibited by the proportionate and swift joint response to the current monkeypox outbreak. The DMS, working in tandem with UK HSA and NHS England remain vigilant for the next threat, and will continue to partner to protect UK defence and civilian patients.

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## Declaration of competing interest

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