Best Practices of highly infectious decedent management: Consensus recommendations from an international expert workshop Supplemental File

APPENDICES

Appendix A. Mortuary Workshop and Objectives Outline

Wednesday, January 8, 2020

8:00 – 8:30 **Welcome, Introductions, Overview**

Objectives:

- Introduce everyone in the room and establish the different areas and levels of expertise present.
- Discuss the purpose of the meeting.
- Outline major goals to be accomplished by the end of the day's meeting.

8:30 – 10:00 **Pre-Work Materials and Existing Mortuary Affairs Guidance**

Objectives:

- Recap the pre-work materials and readings.
- Discuss the current state of existing mortuary affairs guidance in regard to highly infectious decedents.
    - Federal laws, regulations, and guidelines specific to handling highly infectious human remains.
    - Federal laws, regulations, and guidelines specific to transporting highly infectious human remains.
        - Pre-, during-, and post-transport considerations.
    - The role of the NDMS and the DMORT team.

10:15 – 12:00 **Logistics Associated with Highly Infectious Decedent Handling & Movement**

Objectives:

- Determine the minimum education and training on highly infectious disease transmission principles necessary to perform tasks, and frequency of retraining.
- Discuss situational determinants (i.e., cause of fatality or mass fatalities).
- Discuss personal protective equipment considerations.
- Discuss decontamination and waste management procedures.

13:15 – 14:45 **Determining Best Practices and Gathering Consensus**

Objectives:

- Discuss best practices on the following topics:
    - Documentation, environmental engineering, information management.
    - Equipment and supplies needed for highly infectious decedent identification, packaging, and transport.
    - Factors determining cremation vs. burial.
    - Psychological and ergonomic principles considerations.

- Actions following exposure, evaluation, and follow-up post-events.

14:45 – 15:30 **Identifying Gaps (small group activity)**

*Objectives***:**

- Outline guidance areas/topics in highly infectious remains handling that have significant coverage in small groups.
- Outline guidance areas/topics in highly infectious remains handling that have significant gaps and are lacking or need to be supplemented in small groups.
- Report back to the larger group.

15:45 – 16:45 **Outlining A Standardized Training and Education**

Objectives:

- Introduce draft training outline for NDMS larger group training
- Refine outline, edit, and refine based on subject matter expert feedback.

16:45 – 17:00 **Wrap-Up, Concluding Thoughts, Action Plan**

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Appendix B. Select Country-Specific HIDM Overview from Workshop Attendees

United States

In the U.S., HIDM can be complex and challenging to navigate given differing guidance among the states and territories. Furthermore, the U.S. has strict guidelines for the importation of human remains into the U.S. for those who have died of a quarantinable communicable disease (e.g., viral hemorrhagic fevers, SARS variants, infectious tuberculosis). When the decedent was a U.S. citizen or lawful permanent resident who died outside of the country, the decedent's next of kin or legal representative(s) needs to notify U.S. consular officials at the Department of State to obtain proper export clearance, import documentation, leak-proof packaging or containers (e.g., urn, casket, body transfer case), and determine logistics for transportation (CDC, 2020c). The CDC's Public Health Emergency Preparedness (PHEP) cooperative agreements Preparedness Capabilities, updated in 2018, include a fatality management component in Capability 5 that can provide assistance to STLT authorities to receive funding, training, and resources for all things related to handling human remains, including HIDM (CDC 2021c).

The first U.S. EVD cluster in 2014 in Dallas, Texas, prompted national conversations around the need for protocols on HIDM (Chevalier et al. 2014). For this incident, the CDC published guidance for handling human remains, highlighting that postmortem transmission of EVD was possible through unsafe remains handling. Only persons trained in HIDM and wearing the recommended PPE should handle the remains and should refrain from washing and cleaning the body, embalming, autopsy, and removing medical devices. Triple bagging of the remains is recommended, and cremation is the preferred method for ultimate disposal (CDC 2015). Transportation of the highly infectious remains should be coordinated with local transport for mortuary care with relevant STLT authorities; transport of noncremated remains via aircraft should be avoided. Decontamination of facilities should follow CDC guidance and use the Environmental Protection Agency's (EPA) recommended disinfectants (CDC 2015; CDC 2020a; EPA n.d.). In 2015, during the 2014-2016 West Africa EVD outbreak, healthcare providers caring for a Lassa fever patient admitted to a New Jersey hospital used the CDC's aforementioned guidance for HIDM (Firger 2015). Early in the COVID-19 pandemic, the CDC's guidance for Ebola handling of human remains was utilized before more information was known about the modes of transmission and virulence of COVID-19 in decedents.

After the West Africa EVD outbreak, the U.S.'s national capacity for HIDM management was built up with guidance, standards, and funding but much of that funding and infrastructure to continue building that capacity was not sustained (Gibbs et al. 2018; Herstein et al. 2020). Now, the global COVID-19 pandemic underscores the importance of this preparedness even further. We need to continue bolstering preparedness efforts in HIDM and build upon tools and best practices we developed during the 2014-2016 West Africa Ebola outbreak to provide a stronger, more capable national response to HIDM as we continue to accelerate our global interactions. Funding ebbs and flows yet the fact this critical gap remains is an important one that is not impacted by the surge of COVID funding that will ultimately recede in the future.

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United Kingdom

With respect to national guidance on HIDM, the UK Health & Safety Executive and the Department of Health has issued guidance pertaining to the *management of Hazard Group 4 viral hemorrhagic fevers and similar human infectious diseases of high consequence* (HSE 2015). Post-mortem examination of a person known to have died of a viral hemorrhagic fever or comparable disease should not be performed; those performing diagnostic tests on suspected cases to make the diagnosis must wear appropriate PPE. For ultimate disposal of the decedent, the body should be properly sealed, labeled, and disinfected; an infection control notification sheet should be completed for the funeral directors, and once sealed the bag or coffin should not be reopened. Embalming should not be conducted but cremation is recommended, and ashes may be safely transported. The family of the decedent should be consulted, and their wishes respected, taking into consideration necessary infection control; personal effects and valuables deemed safe to return to next of kin after decontamination is permitted (HSE 2015). In 2018, the Health and Safety Executive published further guidance on *Managing infection risks when handling the deceased* to provide further insight into mortuary, post-mortem room, funeral premises, and exhumation guidance (HSE 2018).

Germany

Considering that Germany is a republic of 16 federal states, 16 state legislations apply to HIDM. The respective state legislations closely follow recommendations of the Robert Koch Institute—the German equivalent of the CDC—which are based on a framework of recommendations that were updated in 2019 in light of the West Africa EVD outbreak. Outlined in these recommendations for HIDM are the prohibition of embalming procedures and recommendation against routine autopsies (Robert Koch Institut 2019). Furthermore, the body must be covered with a disinfectant mineral binder and consecutively wrapped in at least two bed linens soaked with a 10% formaldehyde solution. Afterward, double-bagging in two liquid-proof, tear-resistant body bags with liquid-proof sealing of the zippers and decontamination of the outside surfaces of the bag—following specifications of the Robert Koch Institute concerning agent-specific disinfectants is recommended (Robert Koch Institut 2017). Marking the coffin with biohazard signs is mandatory, although cremation is strongly recommended; this ensures the handling of the coffin is safe without the use of specific PPE by funeral home employees. Coffin transportation to the crematory should be coordinate by the state public health office and is further security with police accompaniment is recommended (Robert Koch Institut, 2017, 2019).

The bioterrorism exercise MEBBI-1/Magic Tree 2017 was the first time the necessity of an autopsy under biocontainment conditions was exercised to make possible the prosecution and consecutive court proceedings in a potential case of a bioterrorism act. After completion of the exercise, the following shortcomings/problem areas pertaining to HIDM were identified: 1) one of the 16 state forensic pathology offices were equipped or trained to do autopsies under biocontainment conditions; 2) using the facilities and PPE of 7 existing biocontainment units in Germany in principle is feasible. At this time, only one of the states (Berlin) has practical experience and is doing specific training and willing to conduct HIDM autopsies. In Berlin, this is possible due to resources of the biocontainment unit and staff of the Department of Infectious Diseases, Pulmonary and Critical Care of the Charité University Medical Center, staff of the Department of Forensic Pathology of the Charité University Medical Center, staff and equipment of the crime scene investigation unit of the Berlin state police, staff and equipment of the crime

scene investigation unit of the federal police, and federal BSL4-laboratory and staff of the Robert Koch Institute; 3) the capacity to story highly infectious diseases in the case of a multi-causality event varies from state to state so contingency plans usually call for the use of cooling trucks to extend storage capacity; 4) the federal BSL4-laboratory of the Robert Koch Institute in the state of Berlin is the only laboratory equipped and trained to work on evidence from a bioterrorism scene under chain-of-custody provisions. Even in the case of a bioterrorism event with just one casualty this means that the highly infectious decedent, as well as potentially contaminated evidence, would have to be transported across state borders to the federal state of Berlin.

Norway

In an outbreak of a high-consequence infectious disease, the municipal council may adopt measures related to funerals, including deciding that decedents must be cremated, or it may implement other special measures related to funerals as outlined by the Norwegian Infection Control and Prevent Act, §4-6. According to Regulations on transportation, management and embalming of decedents and funerals §2-2, the Norwegian Directorate of Health can order funeral homes to have preparedness plans for transportation and management of a large number of decedents in epidemics and large accidents causing many fatalities. Correspondingly, the responsible for storage rooms for decedents can be ordered to have a preparedness plan for safe storage of large numbers or decedents.

In the case of EVD, the Norwegian Institute of Public Health specifically recommends that handling of the decedent be performed by health care personnel, including placement in a double leak-proof body bag that is sealed and put into a coffin (Norwegian Institute of Public Health, 2014). The coffin must be sealed, and later opening is not allowed. This must be performed by personnel with knowledge and experience in the correct use of personal protective equipment. Later handling of the coffin, cremation or burial must be done in consultation with infection control personnel at the concerned hospital.

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Appendix C. Category A Pathogens example list considered highly infectious in remains (not exhaustive) (UN, 2019)

Bacillus anthracis[1,3]
Clostridium botulinum[2]
Crimean-Congo hemorrhagic fever virus[4]
Ebola virus[4]
Flexal virus[3]
Guanarito virus[4]
Hantaviruses causing hemorrhagic fever with renal syndrome[3]
Hendra virus[4]
Junin virus[4]
Kyasanur Forest disease virus[4]
Lassa virus[4]
Machupo virus[4]
Marburg virus[4]
Monkeypox virus[3]
Nipah virus[4]
Omsk hemorrhagic fever virus[4]
Sabia virus[4]
Variola virus[4]

[1]Low risk of transmission unless the remains are contaminated by spores.
[2]Low risk of transmission unless the remains are contaminated by spores or toxin.
[3] Classified under Risk Group 3
[4] Classified under Risk Group 4