

EBOLA, EMBALMING, AND THE DEAD: CONTROLLING THE SPREAD OF INFECTIOUS DISEASES

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Ebola has been raging through West Africa since March 2014,¹ but the death of Thomas Eric Duncan, the first person to be diagnosed with Ebola in the United States, has raised concerns about possibilities of an outbreak here.²

Two nurses who treated Mr. Duncan in a Dallas hospital tested positive for Ebola, but have been treated and released.³ The fear of Ebola is strong, and many policies have been examined regarding the treatment of people with a high risk of developing Ebola⁴ or objects that have been handled by those with Ebola.⁵ Perhaps because Mr. Duncan is the only fatality in the United States from Ebola, little attention has been paid to the treatment of the remains of those who

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1. *Ebola Virus Disease in Guinea*, WHO (Mar. 23, 2014), http://www.who.int/csr/don/2014_03_23_ebola/en/.

2. Manny Fernandez & Dave Philipps, *Ebola Patient Dies in Dallas*, N.Y. TIMES, Oct. 9, 2014, at A1.

3. Nina Pham was diagnosed with Ebola shortly after Mr. Duncan's death and was released from the hospital on October 24, 2014. Michael Paulson, *Nina Pham, Free of Ebola, Makes White House Detour on Way Home*, N.Y. TIMES, Oct. 25, 2014, at A18. Amber Joy Vinson was released from Emory University's Hospital on October 28, 2014. Greg Botelho et al., *Nurse's Discharge Leaves One Ebola Case in U.S., Though Larger Battle Continues*, CNN (Oct. 28, 2014, 8:49 PM), <http://www.cnn.com/2014/10/28/health/us-ebola/>.

4. The governors of New York and New Jersey announced that medical workers who had contact with Ebola patients in West Africa would be placed in a mandatory twenty-one-day quarantine upon their return to the United States. That policy was immediately criticized and is still evolving. Matt Flegenheimer et al., *Under Pressure, Cuomo Says Ebola Quarantines Can Be Spent at Home*, N.Y. TIMES, Oct. 26, 2014, at A1.

5. The Louisiana Attorney General sought and received a temporary restraining order on October 13, 2014, to prevent the "transport of the incinerator ash from the treated Ebola contaminated waste in Texas to the State of Louisiana." Cole Avery, *Buddy Caldwell Gets Temporary Restraining Order to Keep Ebola Waste Ashes from Louisiana*, TIMES-PICAYUNE (Oct. 13, 2014, 8:51 PM), http://www.nola.com/politics/index.ssf/2014/10/buddy_caldwell_gets_restrainin.html. Dr. Tom Frieden, the director of the CDC, responded to a question regarding the case by noting that "[W]e certainly know how to inactivate and destroy the Ebola virus. It's readily destroyed by incineration, destroyed by chemical means. It's not a particularly hearty virus environmentally." CDC, *CDC Update on Ebola Response, 10-13-2014* (Oct. 13, 2014, 12:00 PM), <http://www.cdc.gov/media/releases/2014/t1013-ebola-reponse-update.html>.

have died from Ebola. But the handling of the remains of Ebola victims is a common method of transmission in Africa,⁶ and it is important to consider whether we have sufficient safeguards to prevent this method of transmission in the United States.

The modern, American cultural norm is to chemically embalm remains and display them within a few days after death to family and friends.⁷ The remains are then cremated or buried in a casket and vault.⁸ Embalming is not generally required by law; however, a number of state statutes require embalming if remains are to be transported across state lines or if the decedent suffered from a communicable disease.⁹ These statutes are a legacy of the fear evoked by previous epidemics of cholera, smallpox, and influenza,¹⁰ and of the nineteenth-century view of embalming as a method of sanitizing human remains to protect public health.¹¹

On September 2, 2014, the Centers for Disease Control and Prevention (“CDC”) released guidance for the safe handling of the remains of Ebola victims.¹² The guidance emphasized that post-mortem handling of the body should be minimized and that mortuary workers should wear personal protective equipment.¹³ The CDC warns that remains should not be washed or embalmed, but should be placed in two leak-proof plastic bags and then into a hermetically-sealed casket.¹⁴

The CDC guidance, therefore, runs contrary to the laws of a dozen or more states that require embalming under certain circumstances. More significantly, it highlights some startling misconceptions that Americans harbor about the benefits and risks of embalming. To examine these issues, this Essay begins with a discussion of Ebola virus disease and the most recent outbreak,

6. *Frequently Asked Questions on Ebola Virus Disease*, WHO, <http://www.who.int/csr/disease/ebola/ebola-faq-en.pdf?ua=1> (last updated Aug. 7, 2014).

7. ROBERT W. HABENSTEIN & WILLIAM M. LAMERS, *THE HISTORY OF AMERICAN FUNERAL DIRECTING* 4 (7th ed. 2010).

8. *Id.*

9. JOSHUA SLOCUM & LISA CARLSON, *FINAL RIGHTS: RECLAIMING THE AMERICAN WAY OF DEATH* 57 (2011); see, e.g., ALA. CODE § 22-19-2 (LexisNexis 2006); N.J. STAT. ANN. § 26:6–24 (West 2007).

10. The United States has experienced major epidemics of smallpox, measles, yellow fever, cholera, influenza, typhoid, and polio. Maureen A. Taylor, *Major US Epidemics*, FAMILY TREE MAG. (Nov. 9, 2009), <http://www.familytreemagazine.com/article/major-us-epidemics>.

11. See, e.g., CARL LEWIS BARNES, *THE ART AND SCIENCE OF EMBALMING* 308–09 (1898).

12. *Guidance for Safe Handling of Human Remains of Ebola Patients in U.S. Hospitals and Mortuaries*, 5 MEM'L BUS. J. 6, 6–7 (2014); *Guidance for Safe Handling of Human Remains of Ebola Patients in U.S. Hospitals and Mortuaries*, CDC, <http://www.cdc.gov/vhf/ebola/hcp/guidance-safe-handling-human-remains-ebola-patients-us-hospitals-mortuaries.html> (last updated Oct. 23, 2014) [hereinafter CDC Safe Handling Guidance].

13. CDC Safe Handling Guidance, *supra* note 12.

14. *Id.*

briefly discusses the use of embalming in the United States and the public health justifications for it, and concludes with an analysis of state statutes regarding the treatment of human remains that should raise public health concerns.

I. EBOLA VIRUS DISEASE

Ebola virus disease, more commonly known as Ebola, is a zoonotic disease sporadically transmitted from wild animals to the human population.¹⁵ Ebola is transmitted from human to human via bodily fluids containing the virus when they come into direct contact with another's broken skin or mucous membranes.¹⁶ Ebola can also spread when a person's broken skin or mucous membranes come into contact with a surface that harbors the virus, such as soiled clothing or used needles.¹⁷

Ebola was first identified in 1976 in two simultaneous outbreaks—one in Sudan and one in a village near the Ebola River in the Democratic Republic of Congo.¹⁸ The average fatality rate of Ebola is fifty percent.¹⁹ The World Health Organization ("WHO") reports that there have been twenty-four confirmed outbreaks of Ebola since 1976.²⁰ In the four most severe outbreaks, approximately 200 to 300 people died.²¹ Because of the infrequent and isolated nature of previous outbreaks, scientists have been frustrated by their inability to gain a deep understanding of the virus, including locating the natural reservoir host.²²

15. *Ebola Virus Disease: Fact Sheet*, WHO, <http://www.who.int/mediacentre/factsheets/fs103/en/> (last updated Sept. 2014).

16. *Frequently Asked Questions on Ebola Virus Disease*, *supra* note 6.

17. *Id.*; see also Manny Fernandez & Frances Robles, *3 Weeks of Isolation and Worry End for 43 People Declared Free of Ebola*, N.Y. TIMES, Oct. 21, 2014, at A14 ("[W]hile Ebola is scary, it's not that contagious," said Dr. Amesh A. Adalja, an infectious-disease specialist in Pittsburgh).

18. *Frequently Asked Questions on Ebola Virus Disease*, *supra* note 6.

19. *Ebola Virus Disease: Fact Sheet*, *supra* note 15.

20. *Id.*

21. *Id.* During the 2007 outbreak in the Democratic Republic of Congo, there were 264 reported cases of Ebola and 187 deaths; the 2000 outbreak in Uganda had 425 cases and 224 deaths; the 1995 outbreak in the Democratic Republic of Congo had 315 cases and 254 deaths; and the original 1976 outbreak in the Democratic Republic of Congo had 318 cases and 280 deaths. *Id.*

22. Stefan Lovgren, *Where Does Ebola Hide Between Epidemics?*, NAT'L GEOGRAPHIC NEWS (Feb. 19, 2003), http://news.nationalgeographic.com/news/2003/02/0219_030219_ebolaorigin.html ("The search for a natural host has eluded scientists ever since the first Ebola epidemics in 1976. The quest is a catch-22. While an outbreak offers the best opportunity to find the natural reservoir, the priority for virus hunters is to contain the epidemic. In the process, the trail often goes cold because the virus kills so swiftly it covers its tracks."); David Quammen, Op-Ed., *Ebola Is Not the Next Pandemic*, N.Y. TIMES, Apr. 10, 2014, at A25 ("Scientists have identified a total of five species of ebolavirus, four native to Africa and one to the Philippines. They are all zoonoses, meaning animal infections transmissible to humans. They reside quietly in some species of wildlife, this or that forest creature, from which they spill over occasionally to cause mayhem and death in people.")

The most recent Ebola outbreak, and by far the most severe and widespread, began in Guinea in March 2014.²³ As of October 24, 2014, there were 10,141 reported cases, 5,692 laboratory-confirmed cases, and 4,922 deaths.²⁴ Unlike previous outbreaks, which clustered in sparsely populated areas of Central Africa, this outbreak has impacted the more densely populated West African countries of Guinea, Liberia, and Sierra Leone.²⁵

Despite the infection of several Americans in West Africa, Ebola seemed like an exotic threat until Thomas Eric Duncan was diagnosed with Ebola in Dallas, Texas on September 30, 2014.²⁶ On September 19, Mr. Duncan had flown from his home in Monrovia, Liberia to Dallas to visit his son and his son's mother.²⁷ He began developing symptoms on September 24, was admitted to the hospital and placed in isolation on September 28, was officially diagnosed on September 30, and died on October 8.²⁸ Mr. Duncan's ability to enter the United States, despite his recent exposure to Ebola, has caused many to ask if we are prepared to handle an Ebola outbreak.²⁹

Healthcare workers and family members of Ebola victims are most at risk of infection, but the WHO also cautions that transmission has occurred in Africa during funerals and burial rituals.³⁰ It has not been established how long Ebola can survive outside of a living host,

23. *Previous Updates: 2014 West Africa Outbreak*, CDC (Mar. 25, 2014), <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/previous-updates.html> (follow "March 25, 2014 – Initial Announcement" hyperlink) (noting that the Ministry of Health of Guinea reported an outbreak of Ebola in four southeastern districts—a total of 86 suspected cases including 59 deaths).

24. *2014 Ebola Outbreak in West Africa*, CDC, <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/index.html> (last updated Oct. 24, 2014).

25. *2014 Ebola Outbreak in West Africa – Case Counts*, CDC, <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html> (last updated Oct. 25, 2014); Quammen, *supra* note 22 ("The Guinea outbreak has also raised one puzzling new question about Ebola: What is this particular species of virus, known technically as Zaire ebolavirus, doing way over in West Africa, so far from the Central African forests in which all its previous outbreaks have occurred? Viruses don't travel, except in other living creatures. It seems to have hitched a lift, across Nigeria and Ghana and Ivory Coast and other intervening nations, within something or someone. Maybe it was carried by a bat.")

26. Denise Grady, *Ebola is Diagnosed in Texas, First Case Found in the U.S.*, N.Y. TIMES (Sept. 30, 2014), <http://www.nytimes.com/2014/10/01/health/airline-passenger-with-ebola-is-under-treatment-in-dallas.html>.

27. Greg Botelho, *U.S. Ebola Patient: The Travels and Health Travails of Thomas Eric Duncan*, CNN (Oct. 2, 2014, 9:29 PM), <http://www.cnn.com/2014/10/01/health/us-ebola-patient/>.

28. Mark Berman & DeNeen L. Brown, *Thomas Duncan, the Texas Ebola Patient, Has Died*, WASH. POST (Oct. 8, 2014), <http://www.washingtonpost.com/news/post-nation/wp/2014/10/08/texas-ebola-patient-has-died-from-ebola/>; Grady, *supra* note 26.

29. See, e.g., Karen Yourish & Larry Buchanan, *Is the U.S. Prepared for an Ebola Outbreak?*, N.Y. TIMES (Oct. 10, 2014), <http://www.nytimes.com/interactive/2014/10/09/us/is-the-us-prepared-for-an-ebola-outbreak.html>.

30. *Global Alert and Response (GAR): Frequently Asked Questions on Ebola Virus Disease*, WHO, <http://www.who.int/csr/disease/ebola/faq-ebola/en/> (last updated Aug. 8, 2014).

but experimental evidence suggests that it could survive for as little as a few hours or up to fifty days.³¹ The WHO therefore advises that the remains of Ebola victims should be “handled using strong protective clothing and gloves and must be buried immediately.”³² Similarly, the CDC warns that Ebola can be transmitted in mortuary settings by contaminated instruments or the “direct handling of human remains without appropriate personal protective equipment.”³³ Consequentially, the CDC emphasizes that autopsies on patients who die of Ebola should be avoided and that bodies should not be embalmed because “[t]he risks of occupational exposure to Ebola virus while embalming outweighs its advantages.”³⁴

II. EMBALMING IN THE UNITED STATES

Although many other diseases are also readily communicable, the definitive CDC statement that Ebola victims should not be embalmed represents a significant departure from our normal practice.³⁵ Many Americans are surprised to learn that embalming is far more pervasive in the United States than anywhere else.³⁶ In fact, the widespread embalming of human remains is a fairly recent phenomenon even in the United States. Modern embalming began during the Civil War and steadily became more popular at the turn of the twentieth century. The rationales supporting systematic embalming have varied over time, but it has generally been justified

31. *Ebolavirus: Pathogen Safety Data Sheet – Infectious Substances*, PUB. HEALTH AGENCY OF CAN., <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/ebola-eng.php> (last updated Aug. 22, 2014); *Ebola (Ebola Virus Disease): Q&As on Transmission*, CDC, <http://www.cdc.gov/vhf/ebola/transmission/qas.html> (last updated Oct. 23, 2014) (“Ebola is killed with hospital-grade disinfectants [such as household bleach]. Ebola on dry surfaces, such as doorknobs and countertops, can survive for several hours; however, virus in bodily fluids [such as blood] can survive up to several days at room temperature.”).

32. *Global Alert and Response (GAR): Frequently Asked Questions on Ebola Virus Disease*, *supra* note 30.

33. *Guidance for Safe Handling of Human Remains of Ebola Patients in U.S. Hospitals and Mortuaries*, *supra* note 12.

34. *Id.*

35. For example, the CDC does not discourage embalming in cases where the decedent was contaminated with radioactive materials, died of smallpox, or suffered from tuberculosis. Charles M. Wood et al., *Guidelines for Handling Decedents Contaminated with Radioactive Materials*, CDC 14–17, <http://emergency.cdc.gov/radiation/pdf/radiation-decedent-guidelines.pdf> (last visited Oct. 30, 2014); *Guide F – Environmental Control Smallpox Response Plan* *8 (Mar. 20, 2003), <http://emergency.cdc.gov/agent/smallpox/response-plan/files/guide-f.pdf>; CDC, *Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis, Morbidity and Mortality Weekly Report* 4, 31 (Dec. 16, 2005), <http://www.cdc.gov/mmwr/PDF/rr/rr5415.pdf>.

36. SLOCUM, *supra* note 9 (“Many people are shocked to learn that the US and Canada are the only countries where embalming is so widespread as to be considered routine and ordinary. It is rarely done in most other countries (although the international US and Canadian funeral conglomerates are now pushing it hard elsewhere including Japan, England, and Australia).”).

as a means to protect public health³⁷ and to support the mourning process by providing a pleasant final “memory picture” of the deceased.³⁸

Embalming is a process by which chemicals are used to temporarily delay the decomposition of human remains.³⁹ A leading embalming textbook lists forty-five “toxic” chemicals that are routinely used in the modern embalming process.⁴⁰ Embalming was originally sold to the American public as a procedure necessary to protect the public health from the threat posed by human remains. For example, in 1898, embalmer Carl Lewis Barnes explained that those who died of infectious and contagious diseases remained a source of disease long after death:

The contagious and infectious diseases deserving the attention of the embalmer are anthrax, Asiatic cholera, diphtheria, erysipelas, small-pox, typhoid fever, typhus fever, yellow fever, measles, pneumonia, scarlatina, puerperal fever, septicaemia, tuberculosis, and bubonic plague. All of the above diseases possibly owe their contagious principal to a living germ, which grows at the normal temperature of the body but which does not lose its contagious principal after the body is dead . . . We have abundance of proof in this by referring to the epidemics which have sprung up in comparatively recent times from the disinterment of bodies, etc.⁴¹

We now know that Barnes was incorrect. According to the WHO, “[t]he widespread belief that corpses pose a risk of communicable disease is wrong.”⁴² Despite the modern scientific consensus that an

37. *Id.* at 61 (“The belief that embalming prevents the spread of disease is still widely held, but public health as a reason for embalming has long been refuted by medical authorities.”).

38. *See id.* at 57.

39. ROBERT C. MAYER, EMBALMING: HISTORY, THEORY, AND PRACTICE 125–26 (5th ed. 2012) (noting that six categories of chemicals are used: preservatives, disinfectants, modifying agents including anticoagulants and surfactants, dyes, perfuming agents, and vehicles).

40. *Id.* at 71–74. The two most prevalent chemicals in American embalming are formaldehyde and phenol. Formaldehyde is the most prevalent chemical used in the embalming process and can be found in a number of different products. *Id.* at 64–65, 69–70. Phenol, also known as coal tar, is a highly toxic substance. *Id.* at 69–70.

41. BARNES, *supra* note 11. Barnes briefly described three epidemics that were blamed on “germs” spread after victims of a previous epidemic were disinterred, including the 1828 outbreak of the “plague” in Modena following the disinterment of 300 year-old “plague” victims, and the 1854 outbreak of cholera in London, following the disinterment of victims of the “plague” from 1665. *Id.* at 311–12. I have put the word plague in quotation marks because Barnes uses that word, but it is unclear from the context whether he is specifically referring to the bubonic plague or is using the word in a general sense to denote an epidemic.

42. *Disposal of Dead Bodies in Emergency Conditions*, WHO 1 (Mar. 29, 2012), http://www.who.int/water_sanitation_health/hygiene/emergencies/deadbodies.pdf; *see also Humanitarian Health Action: Flooding and*

unembalmed body does not pose a public health risk in normal circumstances,⁴³ the belief that embalming is necessary as a public health measure lingers. A modern embalming textbook asserts that “[t]he dictates of logic, reason, and research all demand that the dead human body be considered a source of pathogenic microorganisms.”⁴⁴ Many state regulations remain premised on this archaic germ theory.⁴⁵

Communicable Diseases Fact Sheet, WHO, http://www.who.int/hac/techguidance/ems/flood_cds/en/ (last visited Feb. 7, 2014) (“Contrary to common belief, there is no evidence that corpses pose a risk of disease ‘epidemics’ after natural disasters. Most agents do not survive long in the human body after death (with the exception of HIV—which can be up to 6 days) and the source of acute infections is more likely to be the survivors. Human remains only pose health risks in a few special cases requiring specific precautions, such as deaths from cholera or haemorrhagic fevers.”); *Risk of Dead Bodies Associated with an Epidemic*, Organización Panamericana de la Salud, http://www.paho.org/disasters/index.php?option=com_content&task=view&id=971&Itemid=931 (last visited Feb. 7, 2014) (“Epidemics that have generated a large number of victims have been caused by diseases such as plague, cholera, typhoid fever, tuberculosis, anthrax, small pox, and influenza. Even though these are highly contagious diseases, their causing agents do not survive long in the human body after death, making it unlikely that these epidemics can be transmitted by dead bodies. HIV remains active in dead bodies kept at two degrees Celsius between 6–15 days, and influenza remains active in the environment for only one day. [T]herefore, if the necessary basic hygiene and biosecurity measures are taken, dead bodies will not transmit diseases, even when the cause of death is related to infectious diseases.”); WHO, *Disaster Risk Management for Health: Mass Fatalities/Dead Bodies* (May 2011), http://www.who.int/hac/events/drm_fact_sheet_mass_fatalities.pdf (“The health risk to the general public from large numbers of dead bodies arising from a natural disaster is negligible. . . . There are no reports of infection arising from contact with a dead body following natural disasters.”).

43. See, e.g., Ron Hast, *The Art of Embalming and Its Purpose*, MORTUARY MGMT., Oct. 2006 (on file with author) (quoting Dr. Lakshmanan Sathyavagiswaran, M.D., Chief Medical Examiner of Los Angeles: “There is no reason that an un-embalmed dead human body should be infectious to anyone attending visitation or public services. Persons transporting and handling bodies or cutting into them may be vulnerable in rare instances, with little or no risk if proper precautions are taken. To refuse to present a body un-embalmed because of public health risk is unfounded. . . . Riding on an airplane or a bus may be a public health risk; the presence of an un-embalmed body is not.”) (emphasis omitted). There have been few modern studies on the public health benefits of the embalming process. See KS CREELY, INST. OCCUPATIONAL MED., INFECTION RISKS AND EMBALMING 47 (2004), available at http://www.iom-world.org/pubs/IOM_TM0401.pdf. One study concluded that tuberculosis bacilli may survive embalming. See Deniz Demiryürek et al., *Infective Agents in Fixed Human Cadavers: A Brief Review and Suggested Guidelines*, 269 ANATOMICAL REC. 194, 195 (2002). A 2004 report by the British Institute of Embalmers states that the “disinfectant properties of embalming fluids are unclear.” CREELY, *supra*, at 48. Another British study suggests that embalming may potentially spread, rather than curtail, infectious diseases like tuberculosis. See *id.* at 25.

44. MAYER, *supra* note 39, at 67.

45. See, e.g., ALA. CODE § 34-13-2 (LexisNexis 2010) (“It is declared and established that the procedures for making final disposition of human dead, including embalming and funeral directing, are so affected with the public interest as to require regulation and control of such included occupations and

Rather than sanitizing the remains and minimizing the spread of disease, embalming may in fact hasten infection, particularly in mortuary workers and the general public, through the discharge of contaminated wastewater. A standard embalming generates approximately 120 gallons of untreated wastewater, which includes three categories of liquid waste.⁴⁶ This untreated embalming waste is typically flushed into the municipal sewer system or a private septic tank.⁴⁷ Little popular concern has been expressed regarding the safety of discharging untreated embalming waste in the sanitary sewer system. However, it is important to remember that in 770 American cities, the sanitary sewer system is not separate from the storm sewer system.⁴⁸ In these combined sewer systems, most of which date from before 1900, sewage and stormwater are funneled together to the treatment plant.⁴⁹ When heavy rains cause the storm sewers to overflow, both raw sewage (including embalming waste) and stormwater can be released into streets and waterways.⁵⁰ Popular wisdom in the industry holds that the normal embalming fluid's excess is sufficient to disinfect the blood and other human waste so that it is safe even if accidentally discharged before treatment, although no reported scientific studies verify this assumption.⁵¹

that, additionally, such regulation and control are necessary for the prevention of the spread of infectious and contagious diseases"); GA. CODE ANN. § 43-18-2 (2011) ("It is declared that this article shall be deemed an exercise of the health powers of the state for the prevention of the spread of infectious, communicable, and contagious diseases and for the protection of the sanitation, health, and welfare of the people of this state; and that all of this article and the regulations authorized to be made pursuant to it are necessary to effectuate its purpose.").

46. See MARK HARRIS, GRAVE MATTERS 33 (2007). The wastewater contains approximately 1.25 gallons of blood, excess embalming fluid, and visceral material from the decedent's organs. *Id.*; *Blood Facts and Statistics*, AM. RED CROSS, <http://www.redcrossblood.org/learn-about-blood/blood-facts-and-statistics> (last visited Oct. 19, 2014).

47. See HARRIS, *supra* note 46, at 33.

48. U.S. GLOBAL CHANGE RES. PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 94 (Thomas R. Karl et al. eds., 2009), *available at* <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>.

49. Paul Bohannon & Patricia E. Lin, *Polluters and Protectors: Combined Sewer System Authorities and Urban Waterway Restorations*, 45 NAT. RESOURCES J. 539, 539 (2005).

50. U.S. GLOBAL CHANGE RES. PROGRAM, *supra* note 48, at 102.

51. For example, the CDC has cautioned that standard embalming is ineffective against the prions that cause Creutzfeldt-Jakob Disease, the human version of "Mad Cow disease," and it advises that a more rigorous disinfection process should be followed. *Information on Creutzfeldt-Jakob Disease for Funeral Home, Cemetery, and Crematory Practitioners*, CDC (Dec. 10, 2012), http://www.cdc.gov/ncidod/dvrd/cjd/funeral_directors.htm ("[A]ll collected fluids should be disinfected by adding 40 grams of sodium hydroxide pellets per liter of collected fluid. The mixture should be stirred after a few minutes and care should be taken to avoid spillage, as the fluid will be hot. It should then be left undisturbed for at least one hour, after which it can be disposed of like other mortuary waste. Plastic sheets and other disposable items that have been exposed to bodily fluids should be incinerated. Mortuary working surfaces that

III. STATUTES REQUIRING EMBALMING

Despite the lack of scientific evidence demonstrating that embalming serves a public health purpose, and despite the CDC and WHO's warnings that the remains of Ebola victims should not be autopsied or embalmed, a number of states have statutes and regulations that reflect a view that embalming is necessary to protect the public health. For example, Nevada law states:

At the direction of a physician, licensed to practice medicine in Nevada, who was last in attendance on a person known or suspected to have died of a communicable disease, or of any coroner or health officer who has knowledge or suspects that a person has died of a communicable disease in his jurisdiction, the funeral director shall embalm the dead body as soon as possible.⁵²

Idaho law takes a different approach and recognizes that embalming may or may not be appropriate: "The Division of Public Health Administrator or Health District Director may order a dead human body to be embalmed or prohibit embalming to prevent the spread of infectious or communicable diseases or exposure to hazardous substances."⁵³ However, at least a dozen states still require that remains be embalmed before they are transported out of state or by a common carrier.⁵⁴ At least nineteen states require that remains be embalmed, refrigerated, cremated or buried within a certain number of hours after death.⁵⁵ Neither of these types of

have accidentally become contaminated should be flooded with sodium hydroxide or bleach, left undisturbed for at least one hour, then (using gloves) mopped up with absorbent disposable rags, and surface swabbed with water sufficient to remove any residual disinfectant solution.").

52. NEV. ADMIN. CODE § 451.010 (2014).

53. IDAHO ADMIN. CODE r. 16.02.10.068 (2014). The regulation also provides that "[t]he dead human body of a person suspected of or confirmed as having a viral hemorrhagic fever at the time of death must not be embalmed, but wrapped in sealed leak-proof material and cremated or buried." *Id.* Although Ebola is no longer referred to as hemorrhagic fever, this provision presumably is intended to address Ebola.

54. ALA. CODE § 22-19-2 (2006); 10-146-1 ME. CODE R. § 4 (2014); 15-5-85 MISS. ADMIN. CODE § 4.6 (2012); NEV. REV. STAT. ANN. § 451.060 (2009); N.J. ADMIN. CODE § 8:9-1.7 (2014); OKLA. ADMIN. CODE § 310:105-7-1 (2014); OR. ADMIN. R. § 830-030-0060 (2014); 28 PA. CODE § 1.23 (2014); S.C. CODE ANN. REGS. 61-19 § 28 (2013); UTAH ADMIN. CODE r. 436-8-2 (2014); WISC. ADMIN. CODE DHS § 135.05 (2014); WYO. STAT. ANN. §33-16-106 (repealed 2014).

55. 007-12-001 ARK. ADMIN. RULES § 8.1 (LexisNexis 2014); COLO. REV. STAT. § 12-54-105 (2014); CONN. GEN. STAT. § 19a-91 (2014); 16-4204 DEL. ADMIN. CODE § 3.0 (2014); FLA. STAT. § 497.386 (2010); HAW. CODE. R. § 11-22-4(a)(2) (LexisNexis 2014); KANSAS ADMIN. REGS. § 28-9-4 (2014); LA. ADMIN. CODE tit. 51, pt. XXVI, § 103 (2014); 15-5-85 MISS. ADMIN. CODE § 4.6.3 (LexisNexis 2014); N.M. STAT. ANN. § 61-32-20 (LexisNexis 2013); OR. ADMIN. R. 830-030-0010 (2014); S.D. ADMIN. R. 20:45:05:11 (2014); 25 TEX. ADMIN. CODE § 181.4 (2014); UTAH ADMIN. CODE r. 436-8-3 (2014); VA. CODE ANN. § 54.1-2811.1 (2013); WASH. ADMIN. CODE

statutes provide exceptions where embalming is discouraged by the CDC or similar health authority. At a minimum, the transportation statutes should permit remains to be refrigerated during transport.

Alaska has a regulation that could provide a good model for other states. It provides that if a person died of “smallpox, plague, anthrax, diphtheria, meningococcal meningitis, cholera, epidemic typhus, any toxic hazard, or any unusual infectious disease,” the remains should be prepared using appropriate precautions.⁵⁶ It continues to say that

[i]f one of the above named infectious diseases occurred or was reasonably suspected to be present, the body must be placed, as soon as reasonably possible, in a leak proof and puncture resistant container accommodating the entire body which shall be permanently closed unless the commissioner of health and social services makes a specific exception.⁵⁷

North Carolina law demonstrates that the legislature has considered the risk of spreading communicable diseases through mortuary settings, but it could be significantly improved. North Carolina General Statute § 130A-395 begins with the requirement that physicians attending to decedents who were known to have smallpox, plague, HIV, hepatitis B, rabies, or Jakob-Creutzfeldt, are required to provide written notification to those who will handle the remains of the “proper precautions” to prevent infection.⁵⁸ This portion of the statute could be improved by enlarging the list of diseases, or replacing the list with a categorical reference to diseases that remain communicable post-mortem. The statute also states that the remains of decedents who died from smallpox or plague shall not be embalmed, but shall be placed in a “strong, tightly sealed outer case which will prevent leakage or escape of odors”⁵⁹ This limitation should be expanded to include, at a minimum, all diseases where embalming is discouraged by public health authorities. Persons handling the remains of persons who were known to be infected with HIV, hepatitis B, Jakob-Creutzfeldt, or rabies are merely cautioned to follow “blood and bodily fluid precautions.”⁶⁰

CONCLUSION

The law can help discourage the spread of Ebola in the United States by reflecting modern understandings of the post-mortem viability of bacteria and viruses in order to more appropriately balance the risks and benefits of embalming. One quick fix would be for states to adopt a uniform statute that preempts all regulations

§ 246-500-030 (2014); WISC. STAT. ANN. § 157.03 (West 2006); 024-035-105 WYO. CODE R. § 3 (2012); *see* N.H. REV. STAT. ANN. § 325:40-a (2010).

56. ALASKA ADMIN. CODE tit. 7, § 35.090(d).

57. *Id.*

58. N.C. GEN. STAT. § 130A-395(a) (2013).

59. *Id.* § 130A-395(b).

60. *Id.* § 130A-395(c).

and laws to the contrary and requires funeral directors and embalmers to follow the guidelines promulgated by the CDC with respect to Ebola and any future communicable disease outbreaks.