

# New filovirus disease classification and nomenclature

---

*Jens H. Kuhn et al.*

<https://doi.org/10.1038/s41579-019-0187-4>

### **Supplementary Box 1. International Classification of Diseases**

The International [Statistical] Classification of Diseases [and Related Health Problems] (ICD) is a tabulation of human diseases, syndromes, and health conditions for global systematic recording, analysis, interpretation, and comparison of mortality and morbidity data over time. The first five iterations of the ICD were called International List(s) of Causes of Death. The first iteration was released in 1898, growing out of many efforts after 1850 to standardize statistical categories for cause of death internationally. The intention from the outset was to revise and republish the 1898 list approximately every 10 years. The initial iterations were modestly sized (about 200 categories) in the pre-World War I/II periods and were maintained by the French government. The newly founded World Health Organization (WHO) took over maintenance in 1948. The list grew substantially under WHO guidance, reaching nearly 1,000 terms in the sixth iteration of 1949. While previous iterations focused primarily on the comparison of human mortality across countries, this new iteration (now aptly called the International Classification of Disease Revision 6, or ICD-6) classified morbidity as well. The ICD-6 also began to assume the format and structure of a tabular code and independent index familiar to many users of the ICD today: each disease diagnosis is converted into an alphanumeric code, which can be used for storage, retrieval, and analysis of data by health-care providers, researchers, health information management professionals, health information technology workers, analysts, policy-makers, insurers, or patient organizations. Consequently, the ICD is also used for studies of financial aspects of health-care systems and for direct billing and reimbursements. The “WHO Nomenclature Regulations,” adopted by the World Health Assembly in 1967, require all WHO Member States to adopt the most current ICD version for human morbidity and mortality reports<sup>1-3</sup>.

The ICD-10 of 1994 (<https://icd.who.int/browse10/2016/en>) is the ICD revision that is currently used by most United Nations member states for all statistical mortality and morbidity reports. The development of the follow-up revision, ICD-11, began in 2007, and ICD-11 was released for implementation by WHO to the World Health Assembly in July 2018 (<https://icd.who.int/browse11/l-m/en>). The ICD-11 is substantially larger than ICD-10, but importantly also differs substantially in architecture. The ICD-11 is underpinned by a semantic network, referred to as the Foundation Layer, with many properties of a formal ontology. Each entry in the Foundation Layer consists of a modeled body of content that includes human disease identifiers, terms and synonyms, definitions, and allowable concept attributes such as anatomy, laterality, severity, and etiology. The ICD-11 also supports “post-coordination” or composition of multiple terms such as primary disease and allowed attributes to perform highly detailed and specific characterization of disease cases. As a consequence, the ICD-11 can be used for outcomes and translational research, clinical trials, and phenotype associations to improve case definitions and applications that extend ICD-11’s utility beyond the traditional statistical reporting of disease incidence or prevalence<sup>4</sup>.

**Supplementary Table 1. Current taxonomy of the mononegaviral family *Filoviridae*<sup>5</sup>.**

Genus name	Species name	Virus name	Virus name abbreviation
<i>Cuevavirus</i>	<i>Lloviu cuevavirus</i>	Lloviu virus	LLOV
“ <i>Dianlovirus</i> ”	“ <i>Mengla dianlovirus</i> ”	Měnglà virus	MLAV
<i>Ebolavirus</i>	“ <i>Bombali ebolavirus</i> ”	Bombali virus	BOMV
	<i>Bundibugyo ebolavirus</i>	Bundibugyo virus	BDBV
	<i>Reston ebolavirus</i>	Reston virus	RESTV
	<i>Sudan ebolavirus</i>	Sudan virus	SUDV
	<i>Tai Forest ebolavirus</i>	Tai Forest virus	TAFV
	<i>Zaire ebolavirus</i>	Ebola virus	EBOV
<i>Marburgvirus</i>	<i>Marburg marburgvirus</i>	Marburg virus	MARV
		Ravn virus	RAVV
<i>Striavirus</i>	<i>Xilang striavirus</i>	Xīlǎng virus	XILV
<i>Thamnovirus</i>	<i>Huangjiao thamnovirus</i>	Huángjiāo virus	HUJV

Quotation marks indicate officially proposed, but not yet accepted, taxa. Colors indicate filoviruses associated with human disease.

**Supplementary Table 2. Examples of unofficial disease names used for human infections with *Ebola virus* (EBOV) or its close relatives in the scientific literature (prior to ICD-10)\***

(British) English disease name	Translations/Variations
African haemorrhagic fever (AHF)	Afrikanisches hämorrhagisches Fieber [German]
	Fièvre hémorragique africaine [French]
	Африканская геморрагическая лихорадка [Russian]
Ebola disease	Maladie d'Ébola [French]
	Хвороба Ебола [Ukrainian]
	מחלת האבולה [Hebrew]
Ebola epidemic haemorrhagic fever (EBO-HF)	Эбола эпидемическая геморрагическая лихорадка (ЭГЛ) [Russian]
Ebola fever (EF)	Ebola groznica [Croatian]
	Ebola-feber [Danish]
	Ebolafieber [German]
	Ebola-Fieber [German]
	Febre de Ébola [Portuguese]
	Fièvre d'Ebola [French]
	Horečka Ebola [Czech]
	Лихорадка Эбола [Russian]
	エボラ熱 [Japanese]
	קדחת אבולה [Hebrew]
	埃博拉热 [Chinese]
Ebola haemorrhagic fever (EHF)	Ebola hæmoragisk feber [Danish]
	Ebola hemoragická horečka [Czech]
	Ebola hemorragische koorts [Dutch]
	Ebola-hämorrhagisches Fieber (EBO-HF) [German]
	Fièvre hémorragique Ebola [French]
	Геморрагическая лихорадка Эбола [Russian]
	Хеморагична треска ебола [Bulgarian]
	エボラ出血熱 [Japanese]
	קדחת מדממת אבולה [Hebrew]
	埃博拉出血热 [Chinese]
	伊波拉出血热 [Chinese]
	伊伯拉出血热 [Chinese]
	에볼라 출혈열 [Korean]

Ebola Marburg haemorrhagic fever	
Ebola (Maridi) virus infection	
Ebola virus disease (EVD)	Ebola vírusbetegség [Hungarian]
	Ebola virusna bolezen [Slovenian]
	Ebola virusno oboljenje [Serbo-Croatian]
	Ebolaviruserkrankung [German]
	Ebolaviruserkrankung [German]
	Ebolavirus-Krankheit [German]
	Ebola-Virus-Krankheit [German]
	Ebolavirussygdom [Danish]
	Enfermedad por virus Ébola [Spanish]
	La maladie du virus Ebola [French]
	Maladie à virus Ebola [French]
	Malattia da virus Ebola (MVE) [Italian]
	Wirusowa gorączka Ebola [Polish]
	Эболавирусная болезнь [Russian]
	エボラウイルス病 [Japanese]
	מחלת וירוס אבולה [Hebrew]
	埃博拉病毒病 [Chinese]
	伊波拉病毒病 [Chinese]
	伊伯拉病毒病 [Chinese]
	에볼라바이러스병 [Korean]
Ebola virus haemorrhagic fever	Ebolavirus hemorrhagische koorts [Dutch]
	Fiebre hemorrágica por el virus del Ébola [Spanish]
	Fièvre hémorragique à Ebola virus [French]
	에볼라 바이러스 출혈열 [Korean]
Marburg-Ebola virus disease	Maladie à virus de marbourg-ebola [French]
Maridi haemorrhagic fever	Maridi-hämorrhagisches Fieber [German]
Sudan-Zaire haemorrhagic fever	Судан-Заирская геморрагическая лихорадка [Russian]
Yambuku haemorrhagic fever	
Zaire haemorrhagic fever	

\*as found in filovirus-related publications cited in REF. [6](#), and updates of the underlying bibliographic database.

**Supplementary Table 3. Examples of unofficial disease names used for human infections with **Marburg virus (MARV)** or its close relatives in the scientific literature (prior to ICD-10)\***

(British) English disease name	Translations/Variations
African green monkey disease	
African haemorrhagic fever (AHF)	Afrikanisches hämorrhagisches Fieber [German]
	Fièvre hémorragique africaine [French]
	Африканская геморрагическая лихорадка [Russian]
Cercopithecus-monkeys-associated haemorrhagic fever	Cercopithecus borne haemorrhagic fever (CBHF)
	Cercopithecus haemorrhagic fever
	Fiebre hemorrágica del mono Cercopithecus [Spanish]
	Церкопитекова хеморагична треска [Bulgarian]
	Церкопитековая геморрагическая лихорадка (ЦГЛ) [Russian]
Cercopithecus monkey disease	“Enfermedad de la especie de cercopiteco” [Spanish]
	“Enfermedad del mono cercopiteco” [Spanish]
Frankfurt/Marburg syndrome (FMS)	Frankfurt-Marburg syndrome (FMS)
	Frankfurt-Marburg-Syndrom (FMS) [German]
Marburg agent disease	
Marburg disease	“Marburg Disease”
	„Marburger Krankheit” [German]
	Enfermedad de Marburg [Spanish]
	Il morbo di Marburg [Italian]
	La maladie de Marburg [French]
	Maladie de Marburg [French]
	Marburg Krankheit [German]
	Marburg’s disease
	Marburgsche Krankheit [German]
	Marburgská nemoc [Czech]
	Болезнь Марбура [Russian]
	マールブルグ病 [Japanese]
	마버그병 [Korean]

Marburg fever	Marburgfeber [Swedish]
	Marburg-Fieber [German]
	Marburgská horečka [Czech]
	Марбургская лихорадка [Russian]
Marburg haemorrhagic fever (MHF)	Fièvre hémorragique de Marburg [French]
	Haemoragisk marburgfeber [Danish]
	Marburg hemorragische koorts [Dutch]
	Marburg-hämorrhagisches Fieber (MAR-HF) [German]
	Marburgská hemoragická horečka [Czech]
	Марбургската хеморагична треска [Bulgarian]
	Марбургская геморрагическая лихорадка [Russian]
	マールブルグ出血熱 [Japanese]
	马尔堡出血热 [Chinese]
	마버그 출혈열 [Korean]
Marburg virus disease (MVD)	Enfermedad por virus de Marburg(o) (EVM) [Spanish]
	“Marburg-virus disease”
	„Marburg-Virus“-Erkrankung [German]
	„Marburg-Virus“-Krankheit [German]
	„Marburg-Viruskrankheit“ [German]
	Maladie à virus de Marburg [French]
	Marburg-Virus-Krankheit [German]
	Марбургская вирусная болезнь [Russian]
	マールブルグ病 [Japanese]
	马尔堡病毒病 [Chinese]
Marburg virus fever	
Marburg-Ebola virus disease	Maladie à virus de marbourg-ebola [French]
Marburg monkey disease	“Enfermedad de Marburgo por monos” [Spanish, sic]
	“Maladie des singes” de Marburg [French]
	“Marburger Affenkrankheit” [German]
	„Marburg Affenkrankheit” [German]
	„Marburger Affenseuche” [German]
Primate associated haemorrhagic fever	

Vervet monkey disease (VMD)	“Green monkey disease”
	“De gröna apornas sjukdom” [Swedish]
	Grüne Meerkatzen-Krankheit [German]
	Maladie du singe vert [French]
	Enfermedad del mono verde [Spanish]
Viral infection of the city of Marburg	

\*as found in filovirus-related publications cited in REF. [6](#), and updates of the underlying bibliographic database.

**Supplementary Table 4. Recommended new human filovirus disease classification and nomenclature.**

ICD-11 code / Disease name (abbreviation)	ICD-11 description
1D60 Filovirus disease (FVD)	<p>A severe disease with high lethality caused by filovirus infection. Filovirus disease is typically characterized by acute onset of fever with non-specific symptoms/signs (e.g., abdominal pain, anorexia, fatigue, malaise, myalgia, sore throat) usually followed several days later by nausea, vomiting, diarrhea, and occasionally a variable rash. Hiccups may occur. Severe illness may include hemorrhagic manifestations (e.g., bleeding from puncture sites, ecchymoses, petechiae, visceral effusions), encephalopathy, shock/hypotension, multi-organ failure, spontaneous abortion in infected pregnant women. Common laboratory findings include thrombocytopenia, elevated transaminase concentrations, electrolyte abnormalities, and signs of renal dysfunction. Individuals who recover may experience prolonged sequelae (e.g., arthralgia, neurocognitive dysfunction, uveitis sometimes followed by cataract formation), and clinical and subclinical persistent infection may occur in immune-privileged compartments (e.g., CNS, eyes, testes). Person-to-person transmission occurs by direct contact with blood, other bodily fluids, organs, or contaminated surfaces and materials with risk beginning at the onset of clinical signs and increasing with disease severity. Family members, sexual contacts, healthcare providers, and participants in burial ceremonies with direct contact with the deceased are at particular risk. The incubation period typically is 7–11 days (range ≈2–21 days).</p> <p>Caused by <b>Bundibugyo virus (BDBV)</b>, <b>Ebola virus (EBOV)</b>, <b>Marburg virus (MARV)</b>, <b>Ravn virus (RAVV)</b>, <b>Sudan virus (SUDV)</b>, <b>Taï Forest virus (TAFV)</b> [ICD-11 “Post-coordination/Infectious agent” as of 2019].</p>
1D60.0 Ebola disease (EBOD)	<p>A severe disease with high case fatality caused by infection with Ebola virus or a closely related virus. Ebola disease is typically characterized by acute onset of fever with non-specific symptoms/signs (e.g., abdominal pain, anorexia, fatigue, malaise, myalgia, sore throat) usually followed several days later by nausea, vomiting, diarrhea, and occasionally a variable rash. Hiccups may occur. Severe illness may include hemorrhagic manifestations (e.g., bleeding from puncture sites, ecchymoses, petechiae, visceral effusions), encephalopathy, shock/hypotension, multi-organ</p>

	<p>failure, spontaneous abortion in infected pregnant women. Common laboratory findings include thrombocytopenia, elevated transaminase concentrations, electrolyte abnormalities, and signs of renal dysfunction. Individuals who recover may experience prolonged sequelae (e.g., arthralgia, neurocognitive dysfunction, uveitis sometimes followed by cataract formation), and clinical and subclinical persistent infection may occur in immune-privileged compartments (e.g., CNS, eyes, testes). Person-to-person transmission occurs by direct contact with blood, other bodily fluids, organs, or contaminated surfaces and materials with risk beginning at the onset of clinical signs and increasing with disease severity. Family members, sexual contacts, healthcare providers, and participants in burial ceremonies with direct contact with the deceased are at particular risk. The incubation period typically is 7–11 days (range ≈2–21 days).</p> <p>Caused by <b>Bundibugyo virus (BDBV)</b>, <b>Ebola virus (EBOV)</b>, <b>Sudan virus (SUDV)</b>, <b>Tai Forest virus (TAFV)</b> [ICD-11 “Post-coordination/Infectious agent” as of 2019].</p>
1D60.00 Bundibugyo virus disease (BVD)	EBOD caused by <b>Bundibugyo virus (BDBV)</b>
1D60.01 Ebola virus disease (EVD)	EBOD caused by <b>Ebola virus (EBOV)</b>
1D60.02 Sudan virus disease (SVD)	EBOD caused by <b>Sudan virus (SUDV)</b>
1D60.03 Atypical Ebola disease	To be used in conjunction with codes that identify the causative virus. Unusual manifestations of disease include organ-specific (e.g., meningoencephalitis) or systemic inflammatory syndromes associated with viral recrudescence occurring after clinical recovery from acute disease. These manifestations may occur several months following infection. Additionally, this code may be used for unusual presentations of acute disease not included in the general description of Ebola disease.
1D60.0Y Other specified Ebola disease	EBOD known to be caused by a virus closely related to EBOV that is not BDBV, EBOV, or SUDV.

1D60.0Z Ebola disease, virus unspecified	EBOD caused by a novel, unidentified virus closely related to EBOV and its relatives.
1D60.1 Marburg disease (MARD)	<p>A severe disease with high case fatality caused by infection with Marburg virus or a closely related virus. Marburg disease is typically characterized by acute onset of fever with non-specific symptoms/signs (e.g., abdominal pain, anorexia, fatigue, malaise, myalgia, sore throat) usually followed several days later by nausea, vomiting, diarrhea, and occasionally a variable rash. Severe illness may include hemorrhagic manifestations (e.g., bleeding from puncture sites, ecchymoses, petechiae, visceral effusions), encephalopathy, shock/hypotension, multi-organ failure. Common laboratory findings include thrombocytopenia, elevated transaminase concentrations, electrolyte abnormalities, and signs of renal dysfunction. Individuals who recover may experience prolonged sequelae (e.g., arthralgia, neurocognitive dysfunction, uveitis), and clinical and subclinical persistent infection may occur in immune-privileged compartments (e.g., CNS, eyes, testes). Person-to-person transmission occurs by direct contact with blood, other bodily fluids, organs, or contaminated surfaces and materials with risk beginning at the onset of clinical signs and increasing with disease severity. Family members, sexual contacts, healthcare providers, and participants in burial ceremonies with direct contact with the deceased are at particular risk. The incubation period typically is 7–11 days (range ≈2–21 days).</p> <p>Caused by <b>Marburg virus (MARV)</b>, <b>Ravn virus (RAVV)</b> [ICD-11 “Post-coordination/Infectious agent” as of 2019].</p>
<b>1D60.10 Marburg virus disease (MVD)</b>	MARD caused by <b>Marburg virus (MARV)</b> or <b>Ravn virus (RAVV)</b> .
1D60.11 Atypical Marburg disease	To be used in conjunction with codes that identify the causative virus. Unusual manifestations of disease include organ-specific (e.g., orchitis, uveitis) or systemic inflammatory syndromes associated with viral recrudescence occurring after clinical recovery from acute disease. These manifestations may occur several months following infection. Additionally, this code may be used for unusual presentations of acute disease not included in the general description of Marburg disease.

1D60.1Y Other specified Marburg disease	MARD known to be caused by a virus closely related to MARV that is not MARV or RAVV.
1D60.1Z Marburg disease, virus unspecified	MARD caused by a novel, unidentified virus closely related to MARV and its relatives.
1D60.Y Other specified filovirus disease	FVD known to be caused by an identified filovirus that is not closely related to EBOV, MARV, and their immediate relatives.
1D60.Z Filovirus disease, virus unspecified	FVD suspected through incomplete diagnostic testing in the absence of known viral etiology.

ICD-11, The International [Statistical] Classification of Diseases [and Related Health Problems] Revision 11.

## References

- 1 Israel, R. A. The International Classification of Disease. *Two hundred years of development. Public Health Rep* **93**, 150-152 (1978).
- 2 Israel, R. A. The history of the International Classification of Diseases. *Health Bull (Edinb)* **49**, 62-66 (1991).
- 3 Moriyama, I. M., Loy, R. M. & Robb-Smith, A. H. T. *History of the Statistical Classification of Diseases and Causes of Death*. (Centers for Disease Control and Prevention, National Center for Health Statistics, 2011).
- 4 Jakob, R. ICD-11 – Anpassung der ICD an das 21. Jahrhundert. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* **61**, 771-777, doi:10.1007/s00103-018-2755-6 (2018).
- 5 Kuhn, J. H. *et al.* ICTV virus taxonomy profile: *Filoviridae*. *J Gen Virol*, doi:10.1099/jgv.0.001252 (2019).
- 6 Kuhn, J. H. *Filoviruses. A compendium of 40 years of epidemiological, clinical, and laboratory studies. Archives of Virology Supplementum*, vol. 20. (SpringerWienNewYork, 2008).