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Naming of human diseases on the wrong side of history

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Abstract

Background: In the medical sphere, understanding naming conventions strengthen the integrity and quality of naming human diseases remains nominal rather than substantial yet. Some strongly-held but flawed names like *German measles* frequently appear in scientific literature.

Objective: This study examines whether some stereotypes of diseases like *German measles* are at the cost of social impacts. As an exemplificative case, we also offer a heuristic approach to determine a pithy synonym instead of *German measles*.

Methods: In the global online news coverage experiments, we examined the compiled global online news volumes and emotional tones on *German measles*, *Middle Eastern Respiratory Syndrome*, *Spanish flu*, *Hong Kong flu*, and *Huntington's disease* in the past two years. The results demonstrate 65 multilingual textual and visual narratives via GDELT's machine translation and neural network image recognition. In the historiographical survey, we prototypically scrutinize the lexical dynamics and pathological differentials of *German measles* and common synonyms by leveraging the capacity of the Google Books Ngram Corpus.

Results: The results of the global online news coverage experiments show that the public informed the long-standing but flawed names like *German measles* with extremely negative tones in textual and visual narratives. Furthermore, the findings of the historiographical study indicate that many synonyms of *German measles* did not survive, while *German measles* has been on the wrong side of history, and *rubella* has taken the dominant place since 1994.

Conclusions: This study first orchestrates rich metadata to unveil that the nosological evolution of *German measles* is on the wrong side of history. The survey strongly indicates that some stereotypes of diseases like *German measles* have always come at the cost of sociocultural impacts, whatever their seemingly harmless origins. To mitigate such impacts, *rubella* should exclusively become the common usage rather than *German Measles* in scientific perspective.

Keywords: naming conventions; COVID-19; *German measles*; *Middle Eastern Respiratory Syndrome*; *Spanish flu*; *Hong Kong flu*; *Huntington's disease*

Introduction

Background

Terminology is the crystallization of human scientific and technological knowledge in natural language. In medical sphere, appropriate names deliberately invented for the designation of human diseases with pathological characteristics. However, less aligned emphasis has been placed on the medical nomenclature of human diseases. In the same week, the idiomatic usage of *German measles* in the leading journals *Nature* and *Science* implies that some strongly-held but flawed names may brand discrimination and stoke panic [1–3]. In the 19th century, the name *rubella* was proposed as a substitute for German *Rötheln*, then the epidemic neologism *German measles* was accepted gradually [4–13]. Arguably, the looming worry is that such usages might reignite the torch of discrimination and fuel the current infodemic unconsciously [14–18].

Study Objectives

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Based on extensive literature review, this study aims to punctuate heuristic introspection of naming practices for human diseases and address the following research issues:

- Are the idiomatic usages like *German measles* at the cost of negative impacts?
- What are the diachronic discourses of *German measles* and common synonyms? What can we learn from the lexical dynamics of *German measles*?
- Should we hash out the inappropriate names like *German Measles*?

Methods

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [19], we orchestrated rich metadata available to unveil the scientific paradigms via the following experiments:

Global online news coverage experiments. In the experiments, we aim to unveil the scientific paradigms of the diachronic discourse and emotional tone. Here, the metadata analysis aims to demonstrate the emotional polarity of the public in the context of global online news on *German measles*, *Middle Eastern Respiratory Syndrome*, *Spanish flu*, *Hong Kong flu* and *Huntington's disease* over time, respectively.

Firstly, the curated codebook was designed by three main principles we established before [20]. According to the codebook, the search formulas in the survey are as following:

[1] German measles: *("German measles" OR "German Measles") AND PublicationDate>=5/27/2019 AND PublicationDate<=5/27/2021*

[2] Middle Eastern Respiratory Syndrome: *("Middle Eastern respiratory syndrome" OR "Middle Eastern Respiratory Syndrome") AND PublicationDate>=5/27/2019 AND PublicationDate<=5/27/2021*

[3] Spanish flu: *("Spanish flu" OR "Spanish Flu" OR "Spanish influenza" OR "Spanish Influenza") AND PublicationDate>=5/27/2019 AND PublicationDate<=5/27/2021*

[4] Hong Kong flu: *("Hong Kong flu" OR "Hong Kong Flu" OR "Hong Kong influenza" OR "Hong Kong Influenza") AND PublicationDate>=5/27/2019 AND PublicationDate<=5/27/2021*

[5] Huntington's disease: *("Huntington's disease" OR "Huntington's chorea" OR "huntington's disease" OR "huntington's chorea" OR "Huntington Disease" OR "Huntington disease" OR "Huntington chorea" OR "huntington disease" OR "huntington chorea") AND PublicationDate>=5/27/2019 AND PublicationDate<=5/27/2021*

Secondly, based on the curated codebook, the metadata of compiled global online news coverage and emotional tone retrieved through the open project GDELT Summary between May 2019 and May 2021, including the textual and visual narratives of different queries in 65 multilingual online news [21,22]. Finally, by leveraging the capacity of GDELT's machine translate and neural network image recognition [22], the instant news portfolio in **Figure 1** summarizes the textual and visual narratives of different queries in 65 multilingual online news.

Historiographical study. The Google Books Ngram Corpus (GBNC) is a unique linguistic landscape that benefits from centuries of development of rich grammatical and lexical resources as well as its cultural context [23]. It contains *n*-grams from

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approximately 8 million books, or 6% of all books published in English, Hebrew, French, German, Spanish, Russian, Italian, and Chinese. The GBNC covers data logs from 1500 to 2019. A unigram (1-gram) is a string of characters uninterrupted by a space, and an *n*-gram (*n* consecutive words) is a sequence of a 1-gram, such as *morbilli* (1-gram), *rubeola* (1-gram), *rubella* (1-gram), *Rötheln* (1-gram), and *German measles* (2-grams). In this study, by retrieving the use frequency of a specific lexicon in historical development, we first obtain a glimpse of the nature of historical evolution in **Figure 2**.

Then, as we continue to stockpile seminal patterns in **Figure 2**, some have argued that correlation is threatening to unseat causation as the bedrock of scientific storytelling before. We must punctuate heuristic cautions of wrestling with information from retrospective sources, cross-validation, and the reassembly of the whole story. Finally, we provide compelling arguments to the extent of understanding the underneath nature of lexical dynamics and pathological differentials based on authentic materials and critical examination.

Results

Marginal cost of contextualizing stigma

May 8, 2021 marks 6 years since the first naming conventions of new human infectious diseases announced by the World Health Organization (WHO)[24]. In recent years, we have witnessed many outbreaks of human diseases, with proper names given by stakeholders. Sometimes, diseases are initially given interim names or common names by stakeholders outside of the scientific sphere. The proper name is officially ratified by the International Classification of Diseases (ICD) of WHO. Even so, each round of naming practice is not always successful, such as *Ebola*, *Rift Valley Fever*, *Athlete's foot*, *Chagas disease*, *Marburg disease*, *Legionnaire' disease*, *Creutzfeldt-Jakob disease*, *swine flu*, *monkey pox*, *bird flu*, etc [24–26]. Of them, *Middle Eastern Respiratory Syndrome* (MERS) [27], *Spanish flu* (1918-1919)[28,29], *Hong Kong flu* (1968-1969)[30–32] and *Huntington's disease* [33–36] were frequently accused of unintentional social impacts.

Naming conventions are not merely for naming diseases but for the vitality of science and the promotion of social progress [26,37–39]. Evidently, as shown in **Figure 1**, the results of the global online news coverage experiments show that the global news outlets (in 65 languages) enjoy long-standing but flawed naming conventions with extremely negative tones, such as *German measles*, *Middle Eastern Respiratory Syndrome*, *Spanish flu*, and *Huntington's disease*. This new finding suggests that some stereotypes of diseases confounded the generally accepted paradigm at the cost of unintentional social impacts [16,24,38].

Admittedly, understanding how naming conventions strengthen the integrity and quality of naming practices with the original mission remains nominal rather than substantial yet. In the COVID-19 infodemic, multifarious monikers have become explicit consideration in the COVID-19 paper tsunami, and the global profusion of tangled hashtags has found its ways in daily communication. Just as the remarks of the editorial of *Nature*, "As well as naming the illness, the WHO was implicitly sending a reminder to those who had erroneously been associating the virus with Wuhan and with China in their news coverage — including *Nature*. That we did so was an error on our part, for which we take responsibility and apologize."[40] Unfortunately, many more stigmatized names somewhat aggravate the collective perceptual biases and contribute to recent backlash

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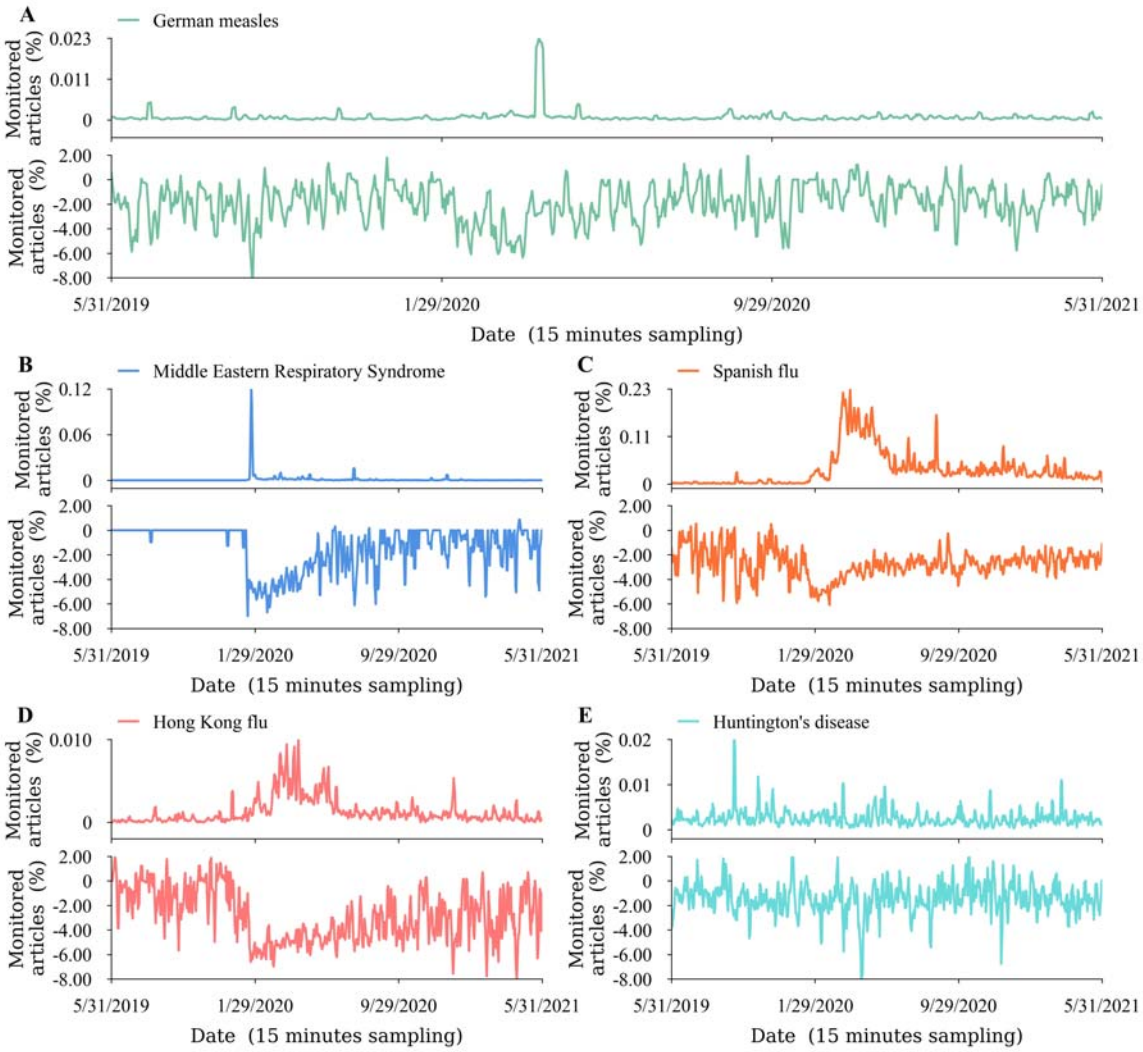
against Asians and diaspora [41,42]. Thus, scientists must verse themselves in naming conventions rather than feeding the trolls of racism.

Figure 1. Diachronic discourse and emotional tone of stigmatizing names in the past two years through GDELT Summary. The global instant news portfolio summarizes the textual and visual narratives of different queries in 65 multilingual online news: **A**, *German measles*; **B**, *Middle Eastern Respiratory Syndrome*; **C**, *Spanish flu*; **D**, *Hong Kong flu*; and **E**, *Huntington's disease*. The upper panels display the percent of all global online news coverage over time. The lower panels show the average emotional tone of all news coverage from extremely negative to extremely positive. The temporal resolution of sampling is 15 minutes per day.



Nosological evolution of *German measles* and counterparts

Framed within the historical coevolution of scientific contexts, understanding the nosological continuity of diseases remains limit [43–47]. As a case in point, the pathological associations between *German measles* and common synonyms (e.g., *morbilli*, *rubeola*, *rubella*, *Rötheln*, etc.) are in the fog of confusion, although the debate

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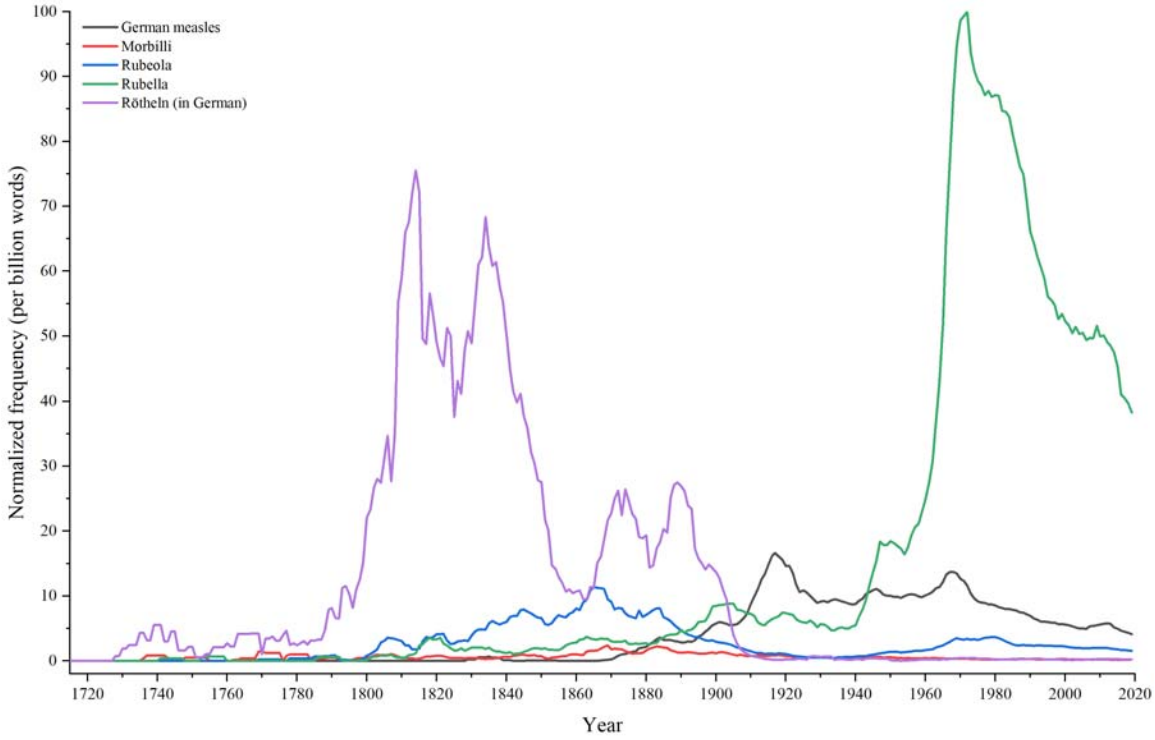
has been going on over a century and a half earlier [4,48–52]. These diachronic discourses and lexical dynamics also remain unclear [1,4,53–56].

Nowadays, the Google Books Ngram Corpus (GBNC) is a unique linguistic landscape that benefits from centuries of development of rich grammatical and lexical resources as well as its cultural context [23,57,58]. It contains *n*-grams from approximately 8 million books, or 6% of all books published in English, Hebrew, French, German, Spanish, Russian, Italian, and Chinese from 1500 to 2019. Arguably, the lexicographical and historiographical study promises to articulate the ins and outs of scientific storytelling by leveraging the capacity of these rich-metadata corpuses. As shown in **Figure 2**, many miscellaneous disease names (e.g., *morbilli*, *morbilli scarlatinosi*, *rötheln*, *feuermasern*, *scarlatina morbillosa*, *rubeola notha*, *rosalia idiopathica*, *bastard measles* or *scarlatina*, *hybrid measles* or *scarlatina*, etc.) have sunk back into a merited oblivion in the ups and downs of history, while *German measles* has gone astray, and *rubella* deserves to take the dominant place in scientific perspective.

Figure 2. Historiographical study. Google Books Ngram Corpus (GBNC) facsimiles the diachronic discourse of *morbilli* (English corpus), *rubeola* (English corpus), *rubella* (English corpus), *Rötheln* (German corpus), and *German measles* (English corpus) from 1719 to 2019. Based on the pragmatic frequency of these synonyms, *rubella* has tended to dominate in literature since 1994.



The nosology of *German measles* and similar diseases is still far from being generally recognized, as well as their pathological differentials [59,60]. *Measles* is an old English disease name that classical nosologists have vainly attempted to replace by such synonyms as *morbilli* and *rubeola* [61]. The English term *measles* was introduced by Dr. John of Gaddesden as an equivalent of the Latin term *morbilli* around the 14th century [47,62,63]. But such designation was generally criticized for "a product of semantic and

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nosographic confusion."[64] The term *rubeola* originally borrowed from the Latin word *rubeus* (meaning *reddish*) in Avicenna of Bagdad's writings, is thought to have been used for the first time as a translation of the term *measles* [63,65,66]. Indeed, the great majority of scientists recognize *German measles* to be an independent disease.

According to the *Oxford English Dictionary Online* (OED Online), the earliest known references to *German measles* date back as far as 1856 (**Table 1**). Therefore, it is generally believed that the epidemic entity *German measles* was accepted growly after 1856 [4,67,68]. In fact, the earliest usages could be stemmed back to about 1814 (**Table 2**).

Table 1. The earliest print appearance of *German measles* and its synonyms according to OED Online.

Terminology	Debut	Description	References
morbilli	1526	The iuce of it with water of endyuye is good for the chyldren pockes and messeles varioli and *morbilli*.	[69]
rubeola	1771	Exanthemata, or eruptive fevers; comprehending 10 genera, *viz*. 1. Erysipelas; 2. Peftis; 3. Variola; 4. Varicella; 5. *Rubeola*; 6. Miliaria; 7. Scarlatina; 8. Urticaria; 9. Pemphigus; 10. Aphtha.	[70]
Rötheln	1 January 1840	I shall therefore use the German word *Rötheln* to designate the mixed disease under consideration.	[71]
German measles	12 July 1856	With regard to the name, '*German measles*' – its usual trite designation here – seems unexceptionable for common use.	[4]
rubella	1866	*Rötheln* is harsh and foreign to our ears…I therefore venture to propose *Rubella* as a substitute for *Rötheln*, or, at any rate, as a name for the disease which it has been my object in this paper to describe.	[72]

Table 2. Historiographical origins of *German measles* and common synonyms.

Terminology	Debut	Credit	Evidence	References
rubeola	1768	François Boissier de Sauvages de Lacroix (12 May 1706 –19 February 1767)	Shortly before (1768), the two diseases had been separated by Sauvages in his Nosology, and he was the first to call measles "*rubeola*," instead of "*morbilli*," by which name it had always been known before. This new name, "*rubeola*," was adopted by Cullen in his Nosology, published four years later (1772).	[56,73]
Rötheln	1 January 1840	Robert Paterson (1814 – 1889)	I fear that the adoption of the word *rubeola* for this disease would produce confusion in medical nomenclature. I shall therefore use the German word *Rötheln* to designate the mixed disease under consideration, in preference to that of *rubeola*, or the use of a new term.	[71,74]
German measles	4 April 1814	William George Maton	On April 4, 1814, Dr. George Maton ... This first identification of *German*	[75–77]

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		(1774 – 1835)	*measles* as a discrete illness was published one year later, an interval from presentation to publication not dissimilar to that in modern experience.	
rubella	1740	Friedrich Hoffmann (1660 – 1742)	Friedrich Hoffmann (1660-1742), …, Notable among his many clinical descriptions are those of *rubella* (called "German" measles as a consequence of his description,) chlorosis, and the diseases of the pancreas and liver.	[78,79]

The term *German Measles* was established as a separate disease in 1814, and official recognition by the International Congress of Medicine in 1881. Shortly before 1768, for more learned occasions, *Rötheln* and *morbilli* seem more decidedly to mark a distinct disease, than any other yet proposed [4,56]. French physician Sauvages de Lacroix, who established the first methodical nosology for disease classification in 1763 [80,81], first applied the term *rubeola* to what had been previously termed *morbilli* in 1768 [56]. And while almost immediately after him, the German physicians, Selle, Orlow, and Ziegler, clearly laid down the distinctive marks between *rubeola* and *morbilli*. On April 4, 1814, Dr. George Maton read a paper entitled "*Some Account of a Rash Liable to be Mistaken for Scarlatina*" at the Royal College of Physicians in London [75–77], which results in the names *rubella* or *German measles* as a substitute for *Rötheln* [4,53]. Then, the epidemic term *German measles* was accepted gradually as a synonym of *rubella*. *German measles*, *Rötheln* or *rubeola per se*, was officially ratified as a distinct disease at the 7th International Medical Congress, London, August 2 to 9, 1881 [55,82–89]. A quarter-century later, the term *German Measles* has ultimately become the common usage, but being on the wrong side of history.

Rubella has been "discovered—and named—multiple times" in the past centuries [90]. In modern literature, *rubella* has become a *de facto* synonym for *German Measles* after 1944 [4–13]. In 1740, the English name *rubella* is derived from Latin *rubellus* reddish, and the first clinical description of *rubella* was first described by German chemist and physician Friedrich Hoffmann, the author of *Fundamenta Medicinae* [78,79]. Then, *rubella* was considered by Dr. Maton to be mere variant of measles or scarlet fever in 1814 [75,76,91]. Half a century later, English surgeon Henry Veale suggested the need to name the discrete disease, and formally proposed the name *rubella* as a substitute for *Rötheln* in 1866 [67]. As a major human infectious disease, *rubella* must have emerged only in the past 11,000 years for which some close relative may still exist among animals [1,59]. Indeed, consistent with the historiographical results (**Fig. 2**), *rubella* had been considered of "minor importance among the common communicable diseases" until 1940 [92]. Following the *rubella* epidemic of 1940, the occurrence of congenital rubella syndrome (CRS) first recognized by Norman McAlister Gregg in 1941 [93,94]. As of 2018, 81 countries were verified as having eliminated *rubella* via routine vaccination, and even today *rubella* remains endemic in other countries [95].

To quell confusion and avoid stigma, we should hash out the inappropriate name *German Measles*. In fact, some pioneers advocated the discarding of the offensive name *German Measles* before [60,96,97], as the remarks, "it [*rubella*] is perhaps the best that has been used"[60] and "a better name for which [*German Measles*] is *rubella*."[97]

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Discussion

Conclusion

Long-standing but flawed names of human diseases are still going viral in both the scientific community and news outlets at the cost of social impacts, whatever their seemingly harmless origins. Following by the best practices of WHO, curated names of human diseases should be scientifically pithy and socially acceptable, with the faith of minimizing marginal impacts on nations, economies, and people. Lexicographical and historiographical study could bridge the gaps in understanding the natural history and finally penetrate to the essence of human diseases' nosology. Heuristic introspection would help us to determine pithy synonyms instead of offensive names. Arguably, as an exemplificative case, it is reasonable that *rubella* should become an exclusive usage rather than *German Measles* with the same clinical manifestations and equivalent semantics in scientific perspective.

References

1. Bennett AJ, Paskey AC, Ebinger A, Pfaff F, Priemer G, Höper D, Breithaupt A, Heuser E, Ulrich RG, Kuhn JH, Bishop-Lilly KA, Beer M, Goldberg TL. Relatives of rubella virus in diverse mammals. Nature [Internet] 2020 Oct 15;586(7829):424–428. [doi: 10.1038/s41586-020-2812-9]
2. Gibbons A. Newly found viruses suggest rubella originated in animals. Science [Internet] 2020 Oct 9;370(6513):157–157. [doi: 10.1126/science.370.6513.157]
3. Gibbons A. Newly discovered viruses suggest 'German measles' jumped from animals to humans. Science [Internet] 2020 Oct 7; [doi: 10.1126/science.abf1520]
4. Philo Scotus. The Rubeola Epidemic. Lancet [Internet] 1856 Jul;68(1715):57. [doi: 10.1016/S0140-6736(02)76420-9]
5. Wesselhoeft C. Rubella (German Measles). N Engl J Med [Internet] 1947 Jun 19;236(25):943–950. [doi: 10.1056/NEJM194706192362506]
6. Wesselhoeft C. Rubella (German Measles). N Engl J Med [Internet] 1947 Jun 26;236(26):978–988. [doi: 10.1056/NEJM194706262362605]
7. Wesselhoeft C. Rubella (German Measles) and Congenital Deformities. N Engl J Med [Internet] 1949 Feb 17;240(7):258–261. [doi: 10.1056/NEJM194902172400706]
8. Dudgeon JA. Immunization against Rubella. Nature [Internet] 1969 Aug;223(5207):674–676. [doi: 10.1038/223674a0]
9. Eichhorn MM. Rubella: Will Vaccination Prevent Birth Defects? Science [Internet] 1971 Aug 20;173(3998):710–711. [doi: 10.1126/science.173.3998.710-a]
10. Recent deaths. Science [Internet] 1971 Aug 20;173(3998):710–710. [doi: 10.1126/science.173.3998.710-b]
11. Donald MW, Goff WR. Attention-Related Increases in Cortical Responsivity Dissociated from the Contingent Negative Variation. Science [Internet] 1971 Jun 11;172(3988):1163–1166. [doi: 10.1126/science.172.3988.1163]
12. Maugh TH. Diabetes: Epidemiology Suggests a Viral Connection. Science [Internet] 1975 Apr 25;188(4186):347–351. [doi: 10.1126/science.188.4186.347]
13. Gordis L, Gold E. Privacy, confidentiality, and the use of medical records in research. Science [Internet] 1980 Jan 11;207(4427):153–156. [doi:

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10.1126/science.7350648]

14. Jardetzky TS, Lamb RA. A class act. Nature [Internet] 2004 Jan;427(6972):307–308. [doi: 10.1038/427307a]
15. Wadman M. The physician whose 1964 vaccine beat back rubella is working to defeat the new coronavirus. Science [Internet] 2020 Mar 21; [doi: 10.1126/science.abb8290]
16. Chandrashekhar V. The burden of stigma. Science [Internet] 2020 Sep 18;369(6510):1419–1423. [doi: 10.1126/science.369.6510.1419]
17. Shimizu K. 2019-nCoV, fake news, and racism. Lancet [Internet] 2020 Feb;395(10225):685–686. [doi: 10.1016/S0140-6736(20)30357-3]
18. The Lancet. COVID-19: fighting panic with information. Lancet [Internet] 2020 Feb;395(10224):537. [doi: 10.1016/S0140-6736(20)30379-2]
19. PRISMA. Transparent reporting of systematic reviews and meta-analyses: PRISMA [Internet]. 2015. Available from: http://www.prisma-statement.org/
20. Hu Z, Huang Z, Hu Q, Liu M, Jiang H. Marginal cost of multiple nomenclature conventions for SARS-CoV-2 variants. JMIR Prepr [Internet] 2021;30421. Available from: https://preprints.jmir.org/preprint/30421
21. Leetaru KH, Schrodt PA. A 30□Year Georeferenced Global Event Database: The Global Database of Events, Language, and Tone (GDELT). 54th Annu Conv Int Stud Assoc [Internet] San Francisco, California, USA; 2013. p. 1–51. Available from: http://data.gdeltproject.org/documentation/ISA.2013.GDELT.pdf
22. Wang W, Kennedy R, Lazer D, Ramakrishnan N. Growing pains for global monitoring of societal events. Science [Internet] 2016 Sep 30;353(6307):1502–1503. [doi: 10.1126/science.aaf6758]
23. Michel J-B, Shen YK, Aiden AP, Veres A, Gray MK, Pickett JP, Hoiberg D, Clancy D, Norvig P, Orwant J, Pinker S, Nowak MA, Aiden EL. Quantitative Analysis of Culture Using Millions of Digitized Books. Science [Internet] 2011 Jan 14;331(6014):176–182. [doi: 10.1126/science.1199644]
24. WHO. World Health Organization Best Practices for the Naming of New Human Infectious Diseases [Internet]. 2015. p. 1–3. Available from: https://www.who.int/topics/infectious_diseases/naming-new-diseases/en/
25. Kupferschmidt K. Rules of the name. Science [Internet] 2015 May 15;348(6236):745–745. [doi: 10.1126/science.348.6236.745]
26. Kupferschmidt K. Discovered a disease? WHO has new rules for avoiding offensive names. Science [Internet] 2015 May 11; [doi: 10.1126/science.aac4575]
27. Enserink M. Amid Heightened Concerns, New Name for Novel Coronavirus Emerges. Science [Internet] 2013 May 10;340(6133):673–673. PMID:23661733
28. Dowell SF, Bresee JS. Pandemic lessons from Iceland. Proc Natl Acad Sci [Internet] 2008 Jan 29;105(4):1109–1110. [doi: 10.1073/pnas.0711535105]
29. Hoppe T. “Spanish Flu”: When Infectious Disease Names Blur Origins and Stigmatize Those Infected. Am J Public Health [Internet] 2018 Nov;108(11):1462–1464. [doi: 10.2105/AJPH.2018.304645]
30. Have we had Hong Kong flu before? Lancet [Internet] 1969 May;293(7601):929–930. [doi: 10.1016/S0140-6736(69)92556-2]
31. Peckham R. Viral surveillance and the 1968 Hong Kong flu pandemic. J Glob Hist [Internet] 2020 Nov 6;15(3):444–458. [doi: 10.1017/S1740022820000224]

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32. Chang, BS C, Salerno, MSc A, Hsu, MD, MPH EB. Perspectives on xenophobia during epidemics and implications for emergency management. J Emerg Manag [Internet] 2020 Dec 10;18(7):23–29. [doi: 10.5055/jem.2020.0521]
33. Wexler A. Stigma, history, and Huntington's disease. Lancet [Internet] 2010 Jul;376(9734):18–19. [doi: 10.1016/S0140-6736(10)60957-9]
34. Rawlins M. Huntington's disease out of the closet? Lancet [Internet] 2010 Oct;376(9750):1372–1373. [doi: 10.1016/S0140-6736(10)60974-9]
35. Spinney L. Uncovering the true prevalence of Huntington's disease. Lancet Neurol [Internet] 2010 Aug;9(8):760–761. [doi: 10.1016/S1474-4422(10)70160-5]
36. Editorial. Dispelling the stigma of Huntington's disease. Lancet Neurol [Internet] 2010 Aug;9(8):751. [doi: 10.1016/S1474-4422(10)70170-8]
37. Hyman SE. The Unconscionable Gap Between What We Know and What We Do. Sci Transl Med [Internet] 2014 Sep 10;6(253):1–4. [doi: 10.1126/scitranslmed.3010312]
38. Fukuda K, Wang R, Vallat B. Naming diseases: First do no harm. Science [Internet] 2015 May 8;348(6235):643–643. [doi: 10.1126/science.348.6235.643]
39. Gollwitzer A, Marshall J, Wang Y, Bargh JA. Relating pattern deviancy aversion to stigma and prejudice. Nat Hum Behav [Internet] 2017 Dec 27;1(12):920–927. [doi: 10.1038/s41562-017-0243-x]
40. Editorial. Stop the coronavirus stigma now. Nature [Internet] 2020 Apr 9;580(7802):165–165. [doi: 10.1038/d41586-020-01009-0]
41. London AJ, Kimmelman J. Against pandemic research exceptionalism. Science [Internet] 2020 May 1;368(6490):476–477. [doi: 10.1126/science.abc1731]
42. Hu Z, Yang Z, Li Q, Zhang A. The COVID-19 Infodemic: Infodemiology Study Analyzing Stigmatizing Search Terms. J Med Internet Res [Internet] 2020 Nov 16;22(11):e22639. PMID:33156807
43. The nomenclature of diseases: I. BMJ 1868;2(403):316–318.
44. The nomenclature of diseases:II. BMJ 1869;2(406):396–397. [doi: 10.1016/S0140-6736(01)67324-0]
45. The nomenclature of diseases:III. BMJ 1869;1(420):55–57.
46. Philipson GH. On the Registration of Diseases. BMJ [Internet] 1869 Nov 6;2(462):485–487. [doi: 10.1136/bmj.2.462.485]
47. Sykes W. On the origin and history of some disease-names. Lancet [Internet] 1896 Apr;147(3789):1007–1010. [doi: 10.1016/S0140-6736(01)39505-3]
48. Willshire WH. The Epidemic of Rubeola. Lancet [Internet] 1856 Jun;67(1710):640. [doi: 10.1016/S0140-6736(02)55500-8]
49. Kesteven WB. The Epidemic of Rubeola. Lancet [Internet] 1856 Jun;67(1711):671–672. [doi: 10.1016/S0140-6736(02)55536-7]
50. Tripe JW. The Rubeola Epidemic. Lancet [Internet] 1856 Jun;67(1713):719–720. [doi: 10.1016/S0140-6736(02)59408-3]
51. Scattergood T. Morbilli and Rubeola. BMJ [Internet] 1870 Jan 29;1(474):121–121. [doi: 10.1136/bmj.1.474.121]
52. Squire W. Remarks on Epidemic Roseola; Rosella, Rosalia, or Rubeola. BMJ [Internet] 1870 Jan 29;1(474):99–100. [doi: 10.1136/bmj.1.474.99]
53. Forbes JA. Rubella: Historical Aspects. Arch Pediatr Adolesc Med [Internet] 1969 Jul 1;118(1):5–11. [doi: 10.1001/archpedi.1969.02100040007002]

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54. Ziring PR, Florman AL, Cooper LZ. The Diagnosis of Rubella. Pediatr Clin North Am [Internet] 1971 Feb;18(1):87–97. [doi: 10.1016/S0031-3955(16)32524-X]
55. Banatvala JE, Brown D. Rubella. Lancet [Internet] 2004 Apr;363(9415):1127–1137. [doi: 10.1016/S0140-6736(04)15897-2]
56. Murchison C. Clinical Lectures on Medicine. Lancet [Internet] 1870 Oct;96(2461):595–598. [doi: 10.1016/S0140-6736(02)79936-4]
57. Lin Y, Michel J, Aiden EL, Orwant J, Brockman W, Petrov S. Syntactic Annotations for the Google Books Ngram Corpus. Proc ofthe 50th Annu Meet ofthe Assoc Comput Linguist Jeju, Republic of Korea: Association for Computational Linguistics,Stroudsburg, PA, USA; 2012. p. 169–174.
58. Hu Z, Zhang J, Huang Y, Wang X. Origins of Terminology Pending Further Discovery. Science [Internet] 2019; Available from: http://science.sciencemag.org/content/291/5501/39.2/tab-e-letters
59. Wolfe ND, Dunavan CP, Diamond J. Origins of major human infectious diseases. Nature [Internet] 2007 May;447(7142):279–283. [doi: 10.1038/nature05775]
60. Putnam CP. Is German Measles (Rotheln or Rubella) an Independent Disease? Bost Med Surg J [Internet] 1893 Jul 13;129(2):30–33. [doi: 10.1056/NEJM189307131290202]
61. Rota PA, Moss WJ, Takeda M, de Swart RL, Thompson KM, Goodson JL. Measles. Nat Rev Dis Prim [Internet] 2016 Dec 22;2(1):16049. [doi: 10.1038/nrdp.2016.49]
62. Gastel B. Measles: A Potentially Finite History. J Hist Med Allied Sci [Internet] 1973;28(1):34–44. [doi: 10.1093/jhmas/XXVIII.1.34]
63. Drutz JE. Measles: Its history and its eventual eradication. Semin Pediatr Infect Dis [Internet] 2001 Oct;12(4):315–322. [doi: 10.1053/spid.2001.26640]
64. Rosen G. A history of public health. 1st ed. New York: M.D. Publications; 1958.
65. Observations Made During the Epidemic of Measles on the Faroe Islands in the Year 1846. J Am Med Assoc [Internet] 1940 Nov 16;115(20):1747. [doi: 10.1001/jama.1940.02810460079037]
66. Panum PL. Observations Made During the Epidemic of Measles on the Faroe Islands in the Year 1846. Copenhagen: Bibliothek for Laeger; 1847.
67. Veale H. History of an Epidemic of Rötheln, with Observations on Its Pathology. Edinb Med J [Internet] 1866 Nov;12(5):404–414. PMID:29646314
68. Tomkins H. The Diagnosis of Rötheln. BMJ [Internet] 1880 May 29;1(1013):808–808. [doi: 10.1136/bmj.1.1013.808]
69. Treveris P. The Grete Herball: a tendril of ancient herbal traditions reaching into 16th century England. 1st ed. Treveris P, editor. London; 1526.
70. Encyclopaedia Britannica (Volume 3). 1st ed. Edinburgh, Scotland: A. Bell and C. Macfarquhar; 1771.
71. Paterson R. Observations on Corpora Lutea: Part I. Edinburgh Med Surg J [Internet] 1840 Jan 1;53(142):49–67. PMID:30331001
72. Veale H. On the Etiology of Stricture of the Urethra. Edinb Med J [Internet] 1867 Jan;12(7):602–606. PMID:29646509
73. Shulman ST. The History of Pediatric Infectious Diseases. Pediatr Res [Internet] 2004 Jan;55(1):163–176. [doi: 10.1203/01.PDR.0000101756.93542.09]
74. Paterson R. An Account of the Rötheln of German Authors, Together with a Few

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Observations on the Disease as It Has Been Seen to Prevail in Leith and Its Neighbourhood. Edinburgh Med Surg J [Internet] 1840 Apr 1;53(143):381–393. PMID:30330988

75. Maton WG. Some account of a rash liable to be mistaken for scarlatina. Med Trans Coll Physicians 1815;5:149–165.
76. Cooper LZ. The history and medical consequences of rubella. Rev Infect Dis 1985;7:2–10. PMID:3890105
77. Grimwood RM, Holmes EC, Geoghegan JL. A Novel Rubi-Like Virus in the Pacific Electric Ray (Tetronarce californica) Reveals the Complex Evolutionary History of the Matonaviridae. Viruses [Internet] 2021 Mar 31;13(4):585. [doi: 10.3390/v13040585]
78. Ackerknecht EH. A short history of medicine. Baltimore,Maryland: Johns Hopkins University Press; 1982. ISBN:978-0-8018-2726-6
79. Neuburger M. Some relations between British and German medicine in the first half of the eighteenth century. Bull Hist Med 1945;17(3):217–228.
80. Hess V, Mendelsohn JA. Sauvages' Paperwork: How Disease Classification Arose from Scholarly Note-Taking. Early Sci Med [Internet] 2014 Nov 27;19(5):471–503. [doi: 10.1163/15733823-00195p05]
81. Kveim Lie A, Greene JA. From Ariadne's Thread to the Labyrinth Itself — Nosology and the Infrastructure of Modern Medicine. Malina D, editor. N Engl J Med [Internet] 2020 Mar 26;382(13):1273–1277. [doi: 10.1056/NEJMms1913140]
82. International Congress of Medicine. Transactions of the International Congress of Medicine. Trans Int Congr Med London; 1881. p. 14–34.
83. International Medical Congress (1881). Lancet [Internet] 1881 Mar;117(3001):392–393. [doi: 10.1016/S0140-6736(02)33362-2]
84. Billings JS. International Medical Congress, London, 1881. Bost Med Surg J [Internet] 1881 Sep 8;105(10):217–222. [doi: 10.1056/NEJM188109081051001]
85. International Medical Congress, 1881. Lancet [Internet] 1881 Mar;117(3003):478. [doi: 10.1016/S0140-6736(02)13222-3]
86. The International Medical Congress. Nature [Internet] 1881 Aug;24(615):338–339. [doi: 10.1038/024338a0]
87. The International Medical Congress. BMJ [Internet] 1881 Aug 13;2(1076):300–305. [doi: 10.1136/bmj.2.1076.300]
88. The International Medical Congress. BMJ 1881;2(1082):518–530. [doi: 10.1016/S0140-6736(01)93495-6]
89. The International Medical Congress. BMJ [Internet] 1881 Oct 1;2(1083):545–566. [doi: 10.1136/bmj.2.1083.545]
90. Barnett R. Rubella. Lancet [Internet] 2017 Apr;389(10077):1386. [doi: 10.1016/S0140-6736(17)30890-5]
91. Warrack JS. The differential diagnosis of scarlet fever, measles, and rubella. BMJ [Internet] 1918 Nov 2;2(3018):486–488. [doi: 10.1136/bmj.2.3018.486]
92. Editorial. Rubella in an Isolated Community. N Engl J Med [Internet] 1957 Feb 14;256(7):323–324. [doi: 10.1056/NEJM195702142560712]
93. Gregg NM. Congenital Cataract Following German Measles in the Mother. Epidemiol Infect [Internet] 1991 Aug 15;107(1):3–14. [doi: 10.1017/S0950268800048627]

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94. Lambert N, Strebel P, Orenstein W, Icenogle J, Poland GA. Rubella. Lancet [Internet] 2015 Jun;385(9984):2297–2307. [doi: 10.1016/S0140-6736(14)60539-0]
95. The Measles & Rubella Initiative supports implementation of the Measles & Rubella Strategic Framework 2021-2030 [Internet]. 2020. Available from: https://s3.amazonaws.com/wp-agility2/measles/wp-content/uploads/2020/11/measles_rubella_initiative_final_print.pdf
96. Notices. N Engl J Med [Internet] 1941 Jan 30;224(5):217–219. [doi: 10.1056/NEJM194101302240518]
97. An Apparent Error in Our Editorial on Obstetrics at the Boston City Hospital. N Engl J Med [Internet] 1931 Apr 30;204(18):947–947. [doi: 10.1056/NEJM193104302041818]

Abbreviations

COVID-19: *Coronavirus* Disease 2019
GBNC: Google Books Ngram Corpus
GDELT: Global Data on Events, Location and Tone
ICD: International Classification of Diseases
MERS: Middle Eastern Respiratory Syndrome
OED Online: Oxford English Dictionary Online
WHO: World Health Organization