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Vaccines discourse: A diachronic case study

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ABSTRACT

Since the pandemic, vaccinations have become an issue that has triggered much public debate. Although several scholars have focused on the discourse of social media and traditional news media, parliamentary discourse on this issue has received little attention. Using the Hansard Corpus of speeches collected from the House of Commons between 1803 and 2005, and a recent corpus of speeches on Covid-19, we examine how vaccines have been presented in British Parliament over the years. Taking into account the main peaks in which the word *vaccine* occurs and observing frequency, collocates, and phraseology, we trace significant differences in discourse on vaccines, reflecting changing values and differences in the respective arguments of science and political power. While in the early 19th century the focus was on the vaccine itself, starting from the 1950s' attention was more on research and investment. The turn of the century witnesses negative attitudes towards vaccines, while the pandemic shows an increasing need for promotional discourse.

Keywords: health policy discourse, diachronic discourse analysis, parliamentary debates, vaccine.

1. Introduction

Since the Covid-19 outbreak, vaccinations have become a crucial issue, leading to extreme polarisation in public debate with the discourse of science as a key element. The World Health Organization has talked about an 'infodemic' of published output during the pandemic. The urgent need for diagnostic and therapeutic solutions has led to a dramatic surge in

scientific publishing (Hyland – Jiang 2021), with research discourse gaining significant prominence. In order to promote their work, researchers have been exploiting all tools of hyperbolic and promotional language, boosting aspects of their research, such as certainty, contribution, novelty and potential. At the same time, public discourse was called to keep track of the rapid knowledge development and to share the most recent discoveries with the general public, while shaping public perceptions, attitudes, and behaviours. Several scholars have focused on public attitudes towards vaccines in social media and their connection to fake news (Thelwall et al. 2022; Atehortua – Patino 2021; Liu – Liu 2021) in blogs and fora (Curry – Pérez-Paredes 2021; Semino et al. 2023), and in traditional news media (Lurie et al. 2022). Jiang and Hyland's (2022) study, for example, concentrated on a more recent news reporting throughout 2020. The study revealed the evolving interest shown by the media during the pandemic: in the initial months, news primarily revolved around the virus's symptoms, while topics concerning disease management, including guidelines, protocols, and eventually vaccines, gained more prominence over time. Others have focused on the first public concerns against vaccination during the Victorian Age by exploring anti-vaccination pamphlets and publications (Hardaker et al. 2024).

To the best of our knowledge, however, the debate on this issue within parliamentary discourse has received little attention. Yet, parliamentary debates offer plenty of opportunities to both highlight the arguments used for or against specific policies and to explore the role of scientific arguments in policy debates (Weingart 1999; van Dijk 2003; Ilie 2017; Qadir – Syväterä 2021). There is no denying that political debates have always played a key role in the development of health policies. This makes the analysis of parliamentary debates an important source of information in tracing how scientific discourse is represented in political decisions. Examining language choices, framing techniques, and discursive practices employed by politicians in relation to their decisions regarding scientific knowledge can help evaluate their impact on public perception. Moreover, exploring their changes in attitudes towards science may also shed light on the role of scientific knowledge in public perception across centuries.

The present study aims to address this issue by investigating lexical choices in debates on vaccines in the British Parliament from a diachronic discourse-analytical perspective. Our analysis centres on the representation of vaccines from their first introduction in the British political debate at the beginning of the 19th century. By looking at the word *vaccine* in context, and at its use in parliamentary debates, we can trace changing attitudes towards

vaccines and provide insights into how scientific information has been integrated into public debates across the centuries. The study, thus, addresses one simple research questions: Since the beginning of the 19th century, how have parliamentary debates reflected attitudes towards vaccines and science in general?

The paper is organized as follows: Section 2 introduces the background to the study by briefly tracing a historical profile of vaccines and vaccination practices. Section 3 presents the corpus-based discourse analytical methodology. Sections 4 and 5 look at the word *vaccine* in a historical perspective tracing its development along the 19th century and the first half of the 20th. Section 6 focuses on the debate during the recent COVID-19 pandemic and the conclusion summarizes the outcomes of the analysis.

2. Background on vaccines

The practice of inoculating material taken from smallpox lesions in the skin or nostrils of susceptible (healthy) individuals (“variola”) was practiced in various parts of Asia for many centuries. Smallpox was known in India and China BC, but it was only convincingly described in Europe until 580 AD by Gregory of Tours. In the 6th century a smallpox epidemic started from North Africa and reached Arabia and Europe, then again in the following centuries, and the term “variola” was used in the Latin translation of a Persian medical monograph around 1050 AD (Behbehani 1983). Smallpox was reintroduced in Europe by crusaders returning from the Holy Land, and appeared in England in the 16th century, at the same time that it was introduced to the New World probably by Spanish expeditions and slave ships. It is estimated that smallpox caused 400,000 deaths each year in Europe, and many millions worldwide since then. Many feared the disease not only for its mortality (about 15% of those infected) but also for blindness or disfiguration of the survivors.

Variola probably started in China and spread to most Asian countries. In Turkey it was generally practiced by scratching the arm with a needle and rubbing the liquid from the pustule of a patient with uncomplicated smallpox. This practice of variola was communicated to the Royal Society on several occasions, most notably with a letter by Dr. Timoni, of Italian origin, serving as physician to the British Ambassador in Constantinople (now Istanbul) in 1714. However, these reports aroused little interest until Lady Mary Wortley Montagu – herself victim of smallpox

which caused severe disfiguration – reached Constantinople in 1717 as wife of the new British Ambassador to the Ottoman Empire, Lord Edward W. Montagu, and became very interested in the variolation. She had both her children variolated, one for the first time in Britain. This event sparked the interest of medical practitioners and the royal circles, who sponsored a human experiment on six condemned prisoners (the Royal experiment, see Silverstein – Miller 1981). The results of this and other variolations were so impressive that the Princess of Wales had her daughters variolated in 1722. A few years later the Royal Society publicly endorsed the practice, which however did not gain wide acceptance since it carried a certain risk of contracting the disease and passing it to other healthy individuals. The Rev. Cotton Mather of Boston, unaware of Lady Montagu's campaign for variolation in Britain, read Timoni's letter and urged the local physicians to variolate after an outbreak of smallpox in 1721, but this started a fierce opposition from doctors and authorities, on the grounds that variolation was the deliberate infection of healthy subjects, putting them in danger of a serious disease, an offense to God and mankind (Behbehani 1983).

Continuous outbreaks of smallpox caused the shift of popular sentiment, seeking protection from the disease, leading to large scale variolation across Europe and to the establishment of a Smallpox and Inoculation Hospital in London in 1746. The practice was widespread also in the American colonies, and Washington's troops were variolated in 1775; the rising concerns of adverse effects led many colonies to pass anti-variolation laws, and this was probably the cause of frequent resurgence of smallpox among colonial troops, whereas the British soldiers were protected.

Edward Jenner induced a paradigm change by devising vaccination, i.e., the immunization (protection) of human beings with the use of an attenuated (or non-pathogenic) form of agent, thus becoming also the precursor of immunology and preventive medicine. He was a Fellow of the Royal Society and a country doctor in Berkeley, received the degree of Doctor in Medicine from St. Andrews in 1792, and was already interested in studying how milkmaids who developed cowpox lesions were protected against smallpox. After years of study, he decided to perform his clinical experiment by immunizing James Phipps (an 8-year-old boy from Berkeley) with material from the cowpox hand lesions of a milkmaid. He did not use cow's material since he knew that not all of it transferred to humans, so he preferred human-to-human transmission, with material which was attenuated by the passage. He then infected (variolated) the boy 6 weeks later with smallpox fluid, without any consequence, demonstrating protection.

The paper describing this and other observations was submitted to the Royal Society in 1797, and refused on the grounds of insufficient data. Jenner went on with experiments and published a monograph in 1798, and three books in the following years. He coined the term *Variolae vaccinae* (cow's smallpox) and the word Vaccination was introduced in a pamphlet by surgeon R. Dunning in 1800. Jenner had shown that his procedure (vaccination) was providing long-lasting protection (Phipps lived into old age and was challenged with smallpox on several occasions) and was safer than variolation. Jenner's protocol was adopted by a number of physicians with success, but this stirred also fierce opposition by others, either because they did not believe that cowpox and smallpox were related or because they disputed the safety of using material of animal origin. Despite opposition, about 100,000 people were vaccinated in Britain by 1801, and Jenner petitioned the House of Commons for funding further experiments, while also fighting against other doctors who claimed priority in the discovery of vaccination. The field of opponents was still strong a century later, but the practice was recognized by several countries and Jenner was awarded prizes and honours. Vaccination was introduced in all major countries within a decade from its inception, variolation was stopped in Britain in 1840 by an act of Parliament, and in 1853 vaccination was made compulsory under penalty. The theory that the Government could constrain the individual for the needs of the social community, favoured in the German Empire, was fiercely opposed in U.K. so the compulsory vaccination, after a long debate, was abolished in 1898. The World Health Organization in 1967 enforced a program for smallpox eradication, successfully concluded in 1979, and smallpox was declared extinct (certificate of eradication) in 1980 (Behbehani 1983).

Another chapter of the vaccine story was opened by Louis Pasteur, himself a chemist, who promoted the "germ theory" of diseases, after discovering that microorganisms were responsible for fermentation. In the second half of the 19th century bacteria were recognized, and methods to grow them in culture were developed. They were then identified by microscope and physical methods. Pasteur adopted the *in vitro* passage of bacteria to attenuate their infectivity and used the resulting material to immunize healthy animals. He thus prepared fowl cholera vaccine in 1879, and anthrax vaccine in 1880, and adopted the word "vaccine" as a tribute to Jenner, for any protective inoculation. He developed also rabies vaccine (in 1885) and the sterilization method known as pasteurization, to preserve foods from rotting. The other leading advocate of the germ theory, Robert Koch, identified the agent of tuberculosis in 1882. From 1908 to 1921 Calmette

and Guérin at the Pasteur Institute in Lille, cultured and passaged several hundred times a strain of *Mycobacterium* derived from cow, obtaining a mutant type devoid of virulence, employed for the BCG vaccination against tuberculosis, which became in use after 1945. Nowadays this is one of the most widely used but also most controversial vaccines. It has been credited with immunostimulant properties and tried also in many other conditions, including cancer. Pasteur predicted that it was in the power of men to make microbial maladies vanish from the earth – a prophecy still only partially fulfilled (Oldstone 2010). The successes of Pasteur led Walter Reed, a doctor of the U.S. Army, to study and characterize as a virus the agent of yellow fever. In 1900 mosquitoes were identified as carriers of the virus, and a vaccine was finally developed around 1937 by Max Theiler at the Rockefeller Institute (NY).

Other vaccination procedures had been developed in the meantime. In 1890 von Behring (first Nobel prize for Physiology or Medicine in 1901) and Kitasato in Berlin observed that animals exposed to cultures of tetanus and diphtheria produced “antitoxins” in their serum, able to neutralize the toxins causing the diseases. This was the basis for serum therapy and the concept of antibodies proposed by Paul Ehrlich, but also the starting point for immunization with the toxoids (inactivated toxins) to protect the recipients, made available in 1924 and then refined and used to vaccinate soldiers in WWII from 1939. Now the toxoids are administered together with acellular Pertussis vaccine, a combination available from 1992.

Another step forward was made by Jonas Salk who tried to use killed virus to prepare an inactivated vaccine for poliomyelitis in 1952, in order to minimize the risks that a live attenuated vaccine might mutate and revert to the virulent parental strain. His research was funded by the March of Dimes campaign started by President F. D. Roosevelt, himself a victim of polio, and resulted in the first vaccine in 1955, whose success was aided by the vaccination received by R&R star Elvis Presley during the popular TV Ed Sullivan Show in 1956. In 1957 Albert Sabin introduced the oral live attenuated polio vaccine, which was adopted for the eradication campaign started by the WHO at global level in 1963, despite the possibility of recirculation of this virus and its revertants. All live (even attenuated) vaccines carry the risk of lethal consequences in severely immunocompromised hosts.

Other controversies arose during the developments of newer vaccines, which included those against measles, mumps, rubella (from 1971 formulated together as MMR), chickenpox (varicella), hepatitis A, hepatitis B, meningitis, pneumococcus and *Hemophilus influenza* – most

of these due to the work of Maurice Hilleman, at Bristol-Myers Squibb and then at Merck pharmaceutical companies. The concerns regarded the use of Thimerosal, an ethylmercury-based preservative used since the 1930s in many vaccines. This was investigated from 1997 until its ban in 2004, for alleged neurodevelopmental disorders including autism (Offit 2007). This campaign followed the controversy on measles vaccine and autism, started in 1998 by an article in the *Lancet* (Wakefield et al. 1998) reporting this spurious association, and reinvigorated by a second report by the same author in 2002. Both papers were strongly criticized as flawed and then withdrawn in 2010, resulting in the cancellation of the author from the UK medical register for deliberate falsification of data. However, the heated debate sparked by the publication resulted in the failure of the campaign for measles eradication in Europe, and caused a surge of local epidemics. Other less substantiated claims of vaccine damages had been made for whole cell Pertussis (whooping cough) vaccination in the late '70s and then also for acellular Pertussis vaccines in the early 2000. Many other unwarranted scares have been raised for substances contained in vaccines, mainly flu vaccines, such as aluminium or squalene and other molecules used as adjuvants (stimulating stronger immune responses).

Technological advances have been made during the past 45 years, with the use of recombinant DNA methods to produce pure proteins for immunization (e.g., hepatitis B), or incorporation of the DNA instructions for producing them into living organisms (preferentially virus or bacteria rendered harmless to humans) which are then injected as vaccine vectors (McCann et al. 2022). This last condition was adopted for the Astra-Zeneca ChAdOx-1 vaccine for SARS-CoV-2 (now withdrawn) as well as for other COVID-19 vaccines, and the two licensed Ebola virus vaccines. The most widely used COVID-19 vaccine manufactured by Pfizer and developed by BionTech is based on the delivery of messenger RNA coding for the viral protein able to induce protective responses: the molecule is taken up by the human cells to produce the protein for a limited time, and is recognized by the immune system with production of antibodies. The advantages of the new techniques are the absence of infectivity (no living pathogens are used), lower costs for mass production, the possible fast availability for variant pathogen antigens (as in the case of the dual mRNA vaccine for COVID-19 with the Omicron variant) and for DNA the long durability even in ambient conditions. Obviously, these new formulations have reignited the debate upon safety and the extent of pre-authorization testing, as well as possible long-term effects.

3. Methods

In order to carry out this study of parliamentary debates on vaccines, we divided the process into two phases. In the first phase, we analysed the use of the term *vaccine* from 1803 to 2005, then we looked at its use during the first year of the Covid-19 pandemic (2020-2021).

For the first phase, we retrieved texts from the Hansard Corpus, available on English Corpora.¹ The Hansard Corpus contains nearly every speech given in the British Parliament from 1803 to 2005 with a total of almost 1.6 billion words. Before carrying out a concordance analysis, we adopted the ‘chart’ function available on English Corpora and examined the relative frequency of *vaccine* over ten-year time spans. We then inputted the data into Excel to visualize the trend through the use of graphs, and selected the decades with the highest peaks for a detailed analysis.

Overall, our corpus consists of 341 texts, 49988 tokens and 4918 types. As previously mentioned, after having observed the peaks in the use of *vaccine*, we selected the following time-spans: 1803-1810, 1900-1910, 1950-1960, and 2000-2005. For each of these time-spans we selected 100 random speeches, when available, and copied and pasted each of them individually onto a .txt file. This was achieved thanks to the random sampling function available on English Corpora, where users can select the number of instances of the selected node word for each time-span under analysis. For the 1803-1810 time-span there were only 41 speeches that contained the word *vaccine*, meaning that we collected all the available instances without using the randomizing function.

Our data was then analysed with the support of AntConc 3.5.8 (Anthony 2020) software tool. This tool allowed us to generate a contrastive keyword list for each time-span under analysis: this was achieved by contrasting the wordlist for each time-span with the remaining others, which were used as a reference corpus. Specifically, we contrasted:

- 1) 1803-1810 [time-span 1] against 1900-1910 [time-span2], 1950-1960 [time-span 3], and 2000-2010 [time-span 4]
- 2) time-span 2 against time-span 1, time-span 3, and time-span 4
- 3) time-span 3 against time-span1, and time-span 2, and time-span 4
- 4) time-span 4 against time-span1, and time-span 2, and time-span 3.

Keyword lists allowed us to detect which word forms were statistically significant according to the log likelihood parameter and p value < 0.05,

¹ English Corpora available at: <https://www.english-corpora.org/hansard/>.

while still having a picture of the ‘aboutness’ (Bondi – Scott 2010) of the speeches regarding vaccines. Then, we carried out a concordance analysis of the word form *vaccine* looking at patterns of collocation (the tendency of the word to co-occur with other lexical elements) and semantic preference (the tendency to co-occur with lexical elements sharing semantic features, see (Sinclair 1991). This allowed us to manually identify phraseological patterns and, when possible, areas of meaning that dominated the debate at any particular time.

For the second phase of our analysis, we focused on Covid-19 vaccine debate and collected data from the English Parliamentary ParlaMint 2.1 database available on Sketch Engine.² This contains 552,103 British Parliament debates from 2015 to March 2021 and accounts for a total of 111,980,128 tokens and 100,616,051 types. Here we selected all instances containing the word *vaccine* in combination with *Covid-19*, *Covid*, and coronavirus and selected the first 200 random concordances. Following the same procedure of our first phase of analysis, we uploaded our texts on AntConc 3.5.8 where we could:

- a) generate a contrastive keyword list using the 1803-2005 corpus as a reference;
- b) carry out a concordance analysis of the selected items.

As the pandemic outbreak began in February 2020, the data contains only speeches belonging to the first year of the pandemic, when the vaccine was in its early stage of production. Table 1 provides the reader with further details on the collected corpus.

Table 1. Number of the texts, tokens, and types for each time-span under analysis

Time-span	Number of texts	Number of tokens	Number of types
1803-1810	41 [Tories]	9360	1367
1900-1910	100 [Conservative]	11812	1645
1950-1960	100 [15 Labour & 85 Conservative]	11263	1807
2000-2005	100 [21 Labour & 79 Conservative]	17553	2947
2021-2022	N/A	8202	1556

² ParlaMint corpus available at: <https://www.sketchengine.eu/parlamint-corpora-of-parliamentary-debates/>.

4. Quantitative analysis: Diachronic trend of *vaccine* in British Parliament speeches

Figure 1 below shows the diachronic frequency per million words (pmw) of the use of the word *vaccine* in British Parliament over the years (Hansard Corpus).

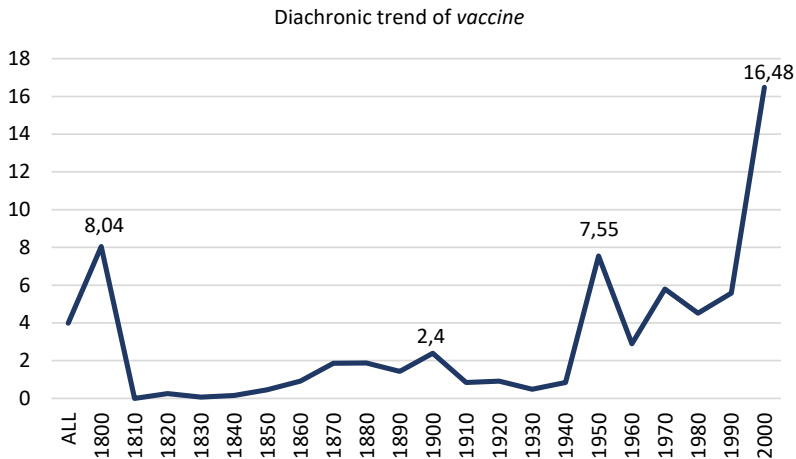


Figure 1. Diachronic trend of *vaccine* from 1803 to 2005 (frequency pmw)

The graph (Fig. 1) shows four main peaks, namely 1803-1810 (8.04 hits pmw), 1900-1910 (2.4 pmw), 1950-1960 (7.55 pmw), and 2000-2005 (16.48 pmw). As can be seen, the two highest peaks are reached at the two far ends of the graph: the first one (1803) coincides with the small-pox vaccine discovery, while the last one (2000) might suggest an increase in the number of vaccines available. The frequency of the word form also increases sharply with the 21st century.

Before exploring the use of the word *vaccine* in the four peaks of Fig. 1 in greater detail, it would be useful to consider a keyword list for each time span under analysis. This allows us to get a first insight on the general trends surrounding the vaccines' debate for each period under analysis. In Table 2 we have reported the first ten most frequent keywords for each time span, excluding function words.

From the first lexical items appearing at the top of each keyword list, we can get a general idea of the changes in trends over the years. In the first three time-spans, the main focus is on the vaccine itself (e.g., *inoculation*, *lymph*, *tuberculosis*), while in the years 2000-2005, the high use of *we* suggests the central importance of speakers (and probably their rhetoric). Looking

Table 2. Comparison of keyword lists of the time-spans 1803-1810, 1900-1910, 1950-1960, and 2000-2005

1803-1810			1900-1910			1950-1960			2000-2005		
Keyword	Freq.	Keyness	Keyword	Freq.	Keyness	Keyword	Freq.	Keyness	Keyword	Freq.	Keyness
<i>inoculation</i>	70	+161.93	<i>lymph</i>	205	+594.23	<i>tuberculosis</i>	34	+77.88	<i>we</i>	183	+80.52
<i>discovery</i>	36	+105.89	<i>board</i>	110	+299.18	<i>council</i>	20	+47.25	<i>aids</i>	35	+73.3
<i>pox</i>	37	+99.53	<i>local</i>	99	+192.3	<i>poliomyelitis</i>	15	+44.72	<i>million</i>	37	+54.74
<i>college</i>	39	+91.23	<i>calf</i>	60	+173.35	<i>disease</i>	47	+35.64	<i>damage</i>	26	+54.45
<i>physicians</i>	28	+85.6	<i>government</i>	122	+132.71	<i>salk</i>	11	+32.79	<i>flu</i>	27	+48.78
<i>its</i>	66	+78.63	<i>ask</i>	59	+122.14	<i>research</i>	43	+30.96	<i>bill</i>	29	+39.81
<i>small</i>	33	+65.73	<i>calves</i>	36	+103.96	<i>minister</i>	34	+30.31	<i>autism</i>	19	+39.78
<i>mode</i>	18	+60.34	<i>beg</i>	38	+94.93	<i>hospitals</i>	14	+27.43	<i>people</i>	64	+36.93
<i>House</i>	50	+52.78	<i>glycerinated</i>	28	+80.84	<i>crystal</i>	9	+26.83	<i>nhs</i>	17	+35.59
<i>effects</i>	25	+50.58	<i>president</i>	36	+76.24	<i>preventive</i>	11	+36.42	<i>cent</i>	26	+34.34

at the general keyword list of each time-span, we notice that in 1803-1810, the focus is on the vaccine's discovery (e.g., *inoculation, discovery, small pox*), while in 1900-1910 there seems to be a higher use of vaccine-related technicalities (e.g., *lymph, glycerated*) and origin (e.g., *calf, calves*), as well as a need for clarification (e.g., *beg, ask*). In 1950-1960, attention is on the disease that the vaccines are meant to cure (e.g., *tuberculosis, poliomyelitis, disease*), research, prevention (e.g., *preventive*) and on the presence of other medical institutions (e.g., *hospitals*). In 2000-2005 attention is still on diseases (e.g., *aids, flu*), medical institutions (e.g., *nhs*), but also on consequences of the vaccine (e.g., *damage, autism*), money (e.g., *million, bill*) and people.

5. Collocation analysis for *vaccine* from 1803 to 2005

The analysis in the present section is based on the diachronic corpus of vaccine speeches that we collected from Hansard. As the corpus is strongly focused on vaccines, relative frequencies are better expressed per thousand words (ptw).

a) 1803-1810

The first period under analysis coincides with the first years of the smallpox vaccine trial. Results show that reported speeches on the vaccine were delivered by members of the Tory party (See Table 1). The main debate in British Parliament revolves around the effects and reliability of the smallpox vaccine *inoculation* (33 hits/35 ptw) and *vaccine matter* (7/7.47 ptw).

On the one hand, members mostly report its positive effects (e.g., *beneficial, good, salutary*), its link to *progress* and its importance within the political scenario (e.g., *its real importance, and as such consistent with the general character and liberality of this country*), while negative effects (e.g., *baneful*) are mostly described in relation to the disease itself, hence reinforcing the efficacy of the vaccine. However, side effects of the vaccine (e.g., *soon after, since...*), such as death or inefficacy, are occasionally reported citing vague sources of information (*the variety of opinions, it was said that, various rumours...* See 1-2), or else they are imputed to its misuse (e.g., *imprudent management*), deficiency (e.g., *dissemination of spurious and improper vaccine matter*), or to people's skepticism towards a national discovery (Example 3).

- (1) The numerous cases which have come tinder my own observation, **since the introduction of the vaccine inoculation**, have effectually

persuaded me of its advantageous effects, notwithstanding **the variety of opinions** it has excited, **and the several instances** which have been adduced to demonstrate its failure (Matthews 1806)

- (2) I remember perfectly well, that **soon after the discovery of vaccine inoculation, it was said that** many more people had died of the small pox than before; this however, was found to be entirely owing to the patients going into the open air, and catching infection at a time when they were most susceptible of it (Willberforce 1806)
- (3) I am not at all surprised that the practice of **vaccine inoculation has made so very little progress in this the very country where it originated**, as it is owing to one of those curious circumstances which arise from the state and principles of human nature that new discoveries are viewed with greater caution and surprise in those places where they are first made, than in those countries where they are afterwards disseminated: While in other countries great labour and pains are bestowed in cultivating and improving a discovery, and in putting it into practice for the benefit of the human race, it is often found that the reputation of its original success dies gradually away in the very country which gave it birth (Willberforce 1807)

On the other hand, from these few excerpts, trust seems to be a key issue, as members of Parliament – specifically those belonging to the Conservative party – seem to demand (e.g., *enquire*) information from medical experts and professionals (e.g., *London Vaccine Institution, Royal College of Physicians, College of Surgeons*). The need for scientific reports (e.g., *report their observations, evidence in its support*) shows members' potential awareness of misinformation and its consequences. In particular, members explicitly refer to the necessity of relying on "the respectable body of the Royal College of Physicians" rather than on the "incompetency" of a parliamentary committee (Example 4).

- (4) I must beg leave to differ from him, as I think a committee of this house would be less competent to form a correct and sound judgment upon the subject, than medical men would be: **Their incompetency would be felt and considered by the public, and consequently an opinion from them, as to the good or bad effects of the vaccine inoculation would have much less weight on their minds:** It would not tend to allay their suspicions, nor administer a guidance for their future conduct: Far different, however, would be the effect of a report

proceeding from that learned and respectable body, the Royal College of Physicians, most formally called upon by parliament. (House of Commons 1806)

b) 1900-1910

With the expansion of vaccination policies, trust issues become more prominent. The smallpox vaccine is still a debated issue in the House of Commons in the early 20th century, at least in the voice of different members of the Conservative party, even if the debate has been extended by further developments in scientific research towards the end of the 19th century.

Collocations point to the establishment of the practice and the discussion of its origins and potential risks. *Vaccine lymph* (42 /35.55 ptw), *vaccine establishment* (19 /16.08 ptw), *vaccine institution* (12/10.15 ptw) and *vaccine institute* (23/19.47 ptw) are the most frequent clusters containing the term *vaccine*. The high frequency of vaccine establishments shows a clear rise in interest in research and in the regularization of the vaccine. *Vaccine lymph*, instead, stands within the central debate of its reliability. Question verbs (e.g., *beg to ask, ask, enquire* – 98 hits/82.96 ptw) and the conjunction *whether* (62/52.48 ptw) introduce doubts on the vaccine which revolve around its origin (e.g., *genuineness of the vaccine derived from the animal...*), its lymph (e.g., *of the bacterial impurity of the vaccine lymph now or recently supplied for vaccination; colonies of germs, rendering their use improper for vaccination*), and the presence of potential diseases as side effects (e.g., *cancer, meningitis, syphilis*).

MPs also report cases where the vaccine was *contaminated, abnormal, or not successful*, showing fear and mistrust towards it. In one case, this is also enhanced by its association to death (e.g., *killed by vaccine*) as the MP reports name and surname of the person who has allegedly died from the vaccine, demanding a scientific explanation for this correlation (5).

- (5) **young woman named Rose Sandall, residing with her mother at 28, New Queen-street, Bedminster, Bristol, was constrained by her employers, Messrs: Mavdon and Sons, of Bristol, to be vaccinated in February last; is he aware that the vaccination was not successful** in the medical sense of the word, but resulted in the formation of proud flesh at the place of insertion, sores in the foot, and general illness and emaciation, disabling her from working; if he is aware that she has died and that a post-mortem examination has revealed symptoms of

cancer; and, since it is known that in some cases vaccination produces cancer, **whether he will take steps to insure full inquiry by persons in no way responsible for the production of the vaccine used in this case into the nature and origin of this vaccine?** (Lupton 1809)

MPs require transparency and further investigation on the “nature and origin of this vaccine”, as there seems to be much uncertainty on its scientific evidence (e.g., *that it was then impossible to ascertain by microscopic examination whether lymph contains the virus of syphilis or not*). Quite likely, fear and mistrust of the vaccine are also triggered by its animal origin, as members ask the Local Government Board to exclude vaccinated veal from the House of Commons’ Dining Room.

Reponses on matters regarding the vaccine lymph are supported by reporting voices of medical professionals (e.g., *Dr Cadell, Dr Rao, vaccine institution, as superintendent of vaccination at the New Town Dispensary*) to enhance credibility. This is followed by explanations and scientific evidence on how the lymph is obtained to reassure other MPs (e.g., *the usual method of obtaining lymph for use at the national vaccine establishment is by vaccinating calves with vaccine lymph obtained from children*) Example 6 below provides an instance of how the President of the Local Government Board describes the production of the vaccine.

- (6) THE PRESIDENT OF THE LOCAL GOVERNMENT BOARD (Mr: WALTER LONG,) Bristol, S: **Dr: Rao tested the properties of glycerine and lanoline in eliminating extraneous micro-organisms from vaccine lymph:** His experiments showed that under the conditions of a tropical country neither medium **could be trusted always to render the lymph absolutely sterile**, but lanoline was superior to glycerine, inasmuch as it interfered less with the proper activity of the lymph in **vaccination**: On the other hand, the bacteriologist of the Local Government Board has found that under the conditions of this country glycerine is better than lanoline for the purpose of eliminating extraneous micro-organisms from the **lymph** and does not unduly interfere with the proper activity of the lymph: I do not at present propose to make any change in the methods adopted by the Local Government Board for preserving vaccine lymph (Long 1902)

As can be seen, in this case, the description becomes more detailed than in the previous century and is also supported by the use of technical terms (e.g., *glycerine, lanoline, micro-organisms*) and research verbs (e.g., *test, show*).

c) 1950-1960

Results show that the majority of speeches are from members of the Conservative party, while speeches by Labour members represent 10% of instances and are all concentrated in the year 1950. In this decade, the word *vaccine* (145/128.64 ptw) is mostly preceded by specifying nouns which define the type of vaccine, such as *BCG*, used against tuberculosis, *poliomyelitis*, *influenza*, and *foot and mouth* (35/31.07 ptw). This shows medical progress and an increase in research investment.

There seems to be a positive attitude towards the tuberculosis vaccine, which is mostly mentioned by the Labour party in 1950. This is confirmed by the use of verbs introducing positive opinions on the matter (*we hope to get vaccine, we regard treatment of tuberculosis as number one priority among, I am glad to say that it has been possible to improve the position...*) and by reporting transparency on its production (e.g., *thanks largely to the advance of medical knowledge*). Positive effects of the vaccine are also mentioned: these are supported by the use of positive adjectives (e.g., *BCG vaccine offers great opportunity for advance; it gives us a much greater opportunity of meeting the*).

Vaccines are starting to be associated with prevention (e.g., *purely preventive, preventive work, vaccine that will prevent influenza* – for a total of 17 hits/ 15.09ptw), protection (as shown by verbs related to the semantic field of battle e.g., *combat, tackle*), and with the word *immunization* (for a total of 9 hits altogether/7.99 ptw – See Example 7).

- (7) Dr: Stross asked the Parliamentary Secretary to the Ministry of Works, as representing the Lord President of the Council, whether he has noted the experiments carried out last year in the Union of Soviet Socialist Republics, **whereby immunisation against influenza is achieved by the use of dried, live vaccine, polytype A, A1 and B; and what progress of a similar nature has been made in Britain, and with what results** (Stross 1955)

There is also an increase in reporting scientific evidence and statistics of patients (e.g., *3 per cent, 1200 individuals took part in the trial, results are encouraging, further testing* – 20 cases/ 17.75 ptw) while demanding further research on existing vaccines (e.g., *Medical Research Council may show whether there is any practicable alternative to the use of monkeys in preparing a poliomyelitis vaccine*). Furthermore, the word *vaccine* is associated with financial aspects (e.g., *it is cheaper to produce...* – 5/4.43ptw), which represent an important factor when carrying out new experimental studies.

Additionally, few side effects (3 cases) are reported in relation to poliomyelitis (e.g., *deleterious effects arising from the use of the recently-discovered vaccine for poliomyelitis treatment*). The debate also manifests uncertainty, as the value of this vaccine had not yet been satisfactorily scientifically established: see for example the tendency to address the issue with direct questions (*Can he say what is the nature of this vaccine, how it is produced, what it consists of and how it is administered?*).

d) 2000-2005

Excerpts from this time span characterize the discourse of Labour party members, while the debated vaccines are those against meningitis, influenza, MMR, and AIDS. What seems to be a key issue in this period is the awareness of consequences that might derive from vaccines. As a matter of fact, *vaccine damage* is the most frequent collocation (21/11.96 ptw), which in some cases (5/2.84 ptw) collocates with the category of people who have endured consequences from the vaccine (e.g., *victims of, people suffering from, disable from*). The collocation of *vaccine damage* with *payment* (14/7.97 ptw) refers to the government's compensation for personal injury derived from the vaccine. *Autism* (19/10.82 ptw), which appears also in the keyword list of the decade under analysis (see Table 2), collocates with *vaccine*, reporting a possible connection between vaccines and injuries (e.g., *a link between MMR vaccine and autism*). In one case, issues on vaccine-damage are related to *anti-vaccine campaigns* which are also mentioned by members of Parliament as a *prominent public issue*.

In this time-span, *vaccine* also collocates with words related to research (e.g., *develop, trials, the data we have suggest that...* – 58/33.04 ptw), suggesting an increase in attention towards scientific investigation, as it appears to be a top priority to reduce diseases (e.g., *reduce the spread, need vaccines...* 29/16.52 ptw). Moreover, verbs of process highlight the research carried out to tackle such issue (e.g., *improve, review*, 14/– 7.97 ptw).

Furthermore, one semantic area associated with vaccines in this period is the area of economic considerations. In fact, *vaccine* collocates with lexical items belonging to the field of finance (e.g., *spending, money, total, £ 15 million a year at...* 19 – 10.82 ptw), thus suggesting a turn in government investment in research.

The importance of science is also central in the debate against misinformation, where MP Curry (8) ironically addresses non-professional

sources of information (*we have a handful of iconoclasts, we have Ministers bringing to bear the canon of, we have the press seizing on...*).

- (8) I am glad that the Minister for Public Health is here, because I wish to refer to the **measles, mumps and rubella vaccine**: All the **players** are on scene: We have a vast majority of **established scientific opinion** in favour of the multiple vaccine: **We have a handful of iconoclasts** who say that it is causing serious disease in infants: **We have Ministers bringing to bear the canon of** established Government scientific advice **and we have the press seizing on the minority** view, with stories that are unashamedly emotional: **If Ministers believe their scientific advice**, and they have no reason not to, they are condemned to be reassuring in the words that they utter to the public; they have no alternative (Curry 2001)

6. Collocation analysis the corona virus vaccine 2020-2021

During the pandemic, parliamentary debates on the development of the vaccine reflect the urgency of the situation and the polarization of the debate by usually taking a line that strongly supports government policy. As the context shows ambivalent attitudes towards science, it becomes necessary to boost confidence in the vaccine and in the country's ability to manage the issue.

The key topic is of course the Covid-19 vaccine. Results show 410 hits (66.03 pmw, a much higher frequency than the other time-spans considered) for *vaccine* co-occurring with *Coronavirus*, *Covid-19*, and *Covid* in the whole corpus. February 2020 – March 2021 coincide with the first phase of the pandemic, hence vaccines were presented as an option to tackle the disease and they were beginning to be administered.

Table 3 below shows the keyword list of the year 2020-2021 in contrast with the 1803-2005 corpus.

By looking at the most relevant items (Table 3), we see that *covid* and *coronavirus* are unsurprisingly at the top of the list (229 hits – 279.20 ptw). The word *UK* (45/54.86 ptw) is frequently cited in relation to the vaccine, as MPs remark upon the fact that the nation plays an important role in the distribution of the vaccine. *Development*, *success*, *access*, *rollout* (77/ 93.87 ptw) are all related to the production of the vaccine, suggesting the different aspects that speeches focus on, namely its production, its accessibility, and progress. In particular, issues of accessibility show the centrality of people

as one of the Government's priorities in the vaccine administration (e.g., *the most vulnerable...*, *refugees* – 12/14.63 ptw).

Table 3. Keyword list of the 2020-2021 corpus in contrast with the 1803-2005 reference corpus

Keyword	Freq.	Keyness
<i>Covid</i>	162	+637.59
<i>coronavirus</i>	67	+263.02
<i>UK</i>	45	+133.99
<i>development</i>	42	+79.02
<i>world</i>	43	+78.9
<i>access</i>	30	+75.7
<i>news</i>	15	+58.8
<i>roll</i>	16	+55.42
<i>support</i>	32	+49.87
<i>we</i>	112	+47.37

The term *world* (43/52.42 ptw) highlights how the Covid-19 vaccine campaign places itself within a global context, emphasizing the international dimension of the problem and the need for a universal solution. The emphasis falls on how the solution requires collaboration with other countries (*72 countries support the campaign to develop...International collaboration is absolutely vital, 470 sites in 34 different countries are racing to find a vaccine for covid-19* – 17 cases).

News is not used to report media voices, but to refer to the outcomes of research and the vaccine's development (e.g., *it is great/excellent/positive/encouraging news...* 15/18.28 ptw) which already suggests a shift in discourse compared to the previous time spans. There seems to be a more explicit attitude towards this specific vaccine campaign.

The use of *we* is consistent with the trend of the early 2000s, confirming the central role of the speaker. In particular, it is mostly followed by the verbs *are* (28/34.12 ptw) and *have* (26/31.69 ptw). *We are* is mostly followed by present participles (e.g., *we are helping to get the vaccine to those...* 16 cases out of 28) or by past participles (*we are actively involved in...* 5 cases out of 28), highlighting the speakers' continuous work and involvement in the vaccine matter. This cluster is also followed by adjectives (e.g., *We are proud to be pioneering trials in this...* 7 cases out of 28) showing speakers' feelings and emotions. *We have* is mostly followed by past participles (e.g., *We have already announced that we will roll out..., we have had constructive discussions with the*

EU on finding a vaccine... – 16 cases out of 26), once again showing the active involvement and action of the speakers.

Moving on to the concordance of *vaccine* (194/236.52ptw), we notice that it is mostly addressed in terms of its production (e.g., *manufacturing, development* – 76/92.66 ptw), which is intertwined with research (e.g., *research* – 13/15.84 ptw) and investment (e.g., *heavily investing in the development of..., have committed £...to rapidly develop...-24/29.26 ptw*). The use of the progressive form (e.g., *we are seeing, progressing* – 7/8.53 ptw) reinforces the continuity and consistency of work and research in its production, while the use of words and adverbs related to time (e.g., *rapidly, a matter of urgency, quickly, nimbly and dynamically* – 12/14.63 ptw) convey a sense of urgency due to the critical pandemic situation.

When compared to the 1803-2005 corpus, members of Parliament seem to expose their view on this specific vaccine in a decisive and marked way. The use of mostly positive adjectives and boosters helps convey a positive attitude toward the vaccine (e.g., *the best way out of this coronavirus vaccine remains the pandemic, it was fantastic news the success of covid, on the top of the positive news the launch of the Covid-19...it is fantastic we soon have...vaccine roll-out is the most important economic lever*). Such adjectives might contribute to the promotional role of discourse regarding the administration of the Covid-19 vaccine. The adoption of a vaccine is often presented as the only solution to overcome the pandemic and the lockdown circumstances (9). The representation of the vaccine “campaign” is also reinforced by the use of words belonging to the military field (e.g., *we have launched a vaccine task force, combat, our plans for..., strategy, fight*).

(9) **Any restrictive measure that has been implemented to fight coronavirus must go** when a vaccine has been developed and distributed among much of the population. (Lewer 2020)

The fact that the Covid-19 vaccine campaign might be presented through forms of promotional discourse is also confirmed by the use of some superlatives and positive adjectives when presenting the role of the UK in the vaccine rollout (e.g., *the first country in the world to have approved, we are the biggest funders*), highlighting their primacy and leading role (*the UK is leading the way in*) in the campaign. They also address and acknowledge the scientists involved in its development once more through positive adjectives that highlight their competence (e.g., *our brilliant scientists and our brilliant science base-* 10/12.19ptw) in order to reassure the general public and boost national pride at the same time.

However, the Covid-19 vaccine is also related to matters of transparency, with MPs asking for further information on the matter. This is achieved either through direct questions (Example 10) or by explicitly requesting a shift in communication policies.

- (10) **Will the Minister also explain** the Government's reasons for failing to demand transparency of the conditions attached to public research and development funding, **as well as for licences and agreements related to the Oxford University and AstraZeneca covid vaccine?** (Mishra 2020)

MPs demand general collaboration to provide the public with correct information regarding the vaccine (e.g., *to better inform the public* – 4/4.87ptw), as misinformation seems to be a problem that needs to be limited (e.g., *to help counter misinformation, I hope that the Government will be very careful that disinformation is not going out to the public about the Pfizer vaccine* – 9/10.97ptw). As a matter of fact, social media networks are explicitly addressed as one of the causes of misinformation (e.g., *the social media giants are largely failing proactively to take down the burgeoning levels of misinformation about coronavirus vaccines that is shared and promoted on their platforms*) and are invited to collaborate with the government (e.g., *commit* – 5 cases) to avoid single users to contribute to the spread of disinformation, e.g.:

- (11) I am encouraged by the fact that social media companies who have attended meetings with us have agreed to **commit** to the principle that no user or company should directly profit from covid-19 vaccine disinformation and to ensure a timely response when we flag such content to them. (Hancock 2020)

Misinformation of course leads to vaccine hesitancy, which is also reported in one speech (e.g., *31% of the British public would be hesitant to have a coronavirus vaccine, polling from YouGov shows that so-called anti-vaccination sentiment is on the increase in the UK*) and presented as an increasing problem in the UK.

While most MPs tend to be reassuring on the vaccine issue by using adjectives related to its safety (e.g., *safe, effective, reassuring* – 12 /14.63ptw), some report its failures (*the critical point of, we cannot be sure, the only way to check how well a coronavirus vaccine works* – 7 cases) leading to potential uncertainty on the subject.

Overall, from this brief qualitative analysis, it emerges that the first year of the pandemic is altogether dominated by a positive representation

of the discovery of the vaccine and the implementation of the first campaign and the tension between vaccine support and vaccine hesitancy is only in the background. The political need of positive representation offers an example of public discourse addressing both the emotional needs of the general public (boosting confidence in the vaccine) and the needs of political debate (boosting confidence in the nation).

7. Conclusions

In this paper we have briefly explored diachronic change in discourse regarding vaccines in the British Parliament from 1803 to 2021. The findings reveal a dynamic transformation in the focus and themes of vaccine-related discussions over the centuries.

Results from the first part of analysis show that since the smallpox vaccine, there has been a focus in shift of attention. As a matter of fact, in the first decade of the 19th century the focus was on the vaccine itself and on the process of its creation and development. As vaccination policies expanded in the late 19th and early 20th centuries, trust issues have become more pronounced, as shown in the analysis of the first decade of the 20th century. Nevertheless, the credibility of experts remained unchallenged in discussions concerning vaccine benefits and side effects. This is in line with the development of scientific knowledge in the 19th century. Trust in scientific expertise was consolidating and going hand in hand with the development of a professional view of science and scientific research: throughout the century, scientific professionalism became increasingly prominent, reinforcing confidence in the scientific community's authority (e.g., Bondi 2021).

The mid-20th century marked a shift toward a broader examination of vaccines, encompassing not only health policies, public safety, and research, but also economic considerations. The possibilities offered by vaccines are explored within a wider range of scientific tools, but this transformation reflected evolving societal values and priorities.

Approaching the 21st century, a heightened awareness of vaccine consequences began to emerge. The debate centred on scientific investigation and its contribution to the improvement of public health, but economic considerations kept a prominent position too. Particularly with the rise of "no vax" movements, debates also included topics such as misinformation and the role of public discourse in countering it.

During the COVID-19 pandemic (2020-2021), our analysis indicated that politicians increasingly employed highly evaluative language alongside

scientific references. Emotional argument was not always separable from scientific argument. This change towards increasing use of positive and evaluative adjectives was likely driven by the urgency of the situation. The diffusion of mistrust and uncertainty also placed emphasis on transparency, while the polarization of the vaccine debate (often associated to social media) might have been a factor influencing the need to support government policy. Promotional discourse was needed to boost confidence in the vaccine and in the country's ability to manage the situation.

In this context, the importance of health communication emerged as a critical element in the debate, as managing information dissemination was perceived as a crucial issue during times of crisis. Politicians were under pressure to handle the dissemination of information regarding the pandemic's consequences and the appropriate actions required in times of crisis (Zhang et al. 2020). Effective health communication turned out to be a cornerstone for information exchange and collaborative efforts (de Las Heras-Pedrosa et al. 2020), underscoring the importance of addressing misinformation and boosting public confidence in vaccination efforts.

The findings of our study are limited to a very specific focus (the word *vaccine*) and a very specific context (British parliamentary debates). The brief overview, however, highlights not only shifts in scientific understanding but also the broader societal and political contexts within which these discussions occur.

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