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Complexity and controversy in media coverage of Human papillomavirus (HPV) vaccination: A qualitative content analysis of news coverage in Denmark 2008–2018

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Introduction: Traditional news media play an important, yet notoriously complex role in vaccination communication. News media remain a common source of information about vaccines and potentially influence individual decisions to choose vaccination or not. In Denmark, Human papillomavirus (HPV) vaccination rates remained relatively high until suspected adverse reactions began to receive extensive coverage in the news. Existing research studies associate the decline in HPV vaccination rates with misleading or negative news stories.

Methods: We probed Danish media coverage beyond dichotomies such as misleading vs. informative, or negative vs. positive. We combined quantitative and qualitative approaches to media coverage of the Danish HPV vaccination crisis and recovery. Our research design focused on six national newspapers and allowed us to identify 865 articles published in periods of peak media coverage from 2008 to 2018 (extracted from a total sample of 1,437 articles published between 1991 and 2019). We used qualitative content analysis to discern the main topics covered, and we analyzed contextual factors that affected the meanings of our main topics.

Results: Our results confirm the rise of suspected adverse reactions as the dominant main topic in 2015. However, we find that news stories about adverse reactions were diverse and closely related to other main topics such as conflicts of interests and debate among experts and other stakeholders. In 2017, the media began downplaying suspected adverse reactions when concerns about declining vaccination rates and misinformation by the media were voiced.

Discussion: Our findings suggest that controversial media messages about vaccination are hard to classify as either negative or positive but must be interpreted carefully in context of what is known about the controversy. Learning from past media controversies remains important to understanding the media's role in the social construction of risks and benefits associated with vaccination.

KEYWORDS

Human papillomavirus (HPV) vaccination, media coverage, qualitative content analysis, contextual approach, Denmark

1. Introduction

A quadrivalent Human papillomavirus (HPV) vaccine, preventing infection by four types of HPV that are known to cause cancers, was first licensed in the United States in 2006 (WHO, 2011, chapter 3). Since then, HPV vaccination campaigns in many countries have been subject to extensive media coverage. Safety and effectiveness are prevalent topics but the intensity and the scope of the debate around such topics vary significantly. In some countries, such as Japan, Romania, Ireland and Denmark, vaccination safety and the related discussion about suspected adverse reactions following HPV vaccination dominated the media for a significant amount of time (Penta and Băban, 2014; Tsuda et al., 2016; Corcoran et al., 2018; Suppli et al., 2018; Mynthen and Sørensen, 2019; Hansen et al., 2020; Mohr and Frederiksen, 2020). Safety concerns led the Japanese government in 2013 to suspend proactive recommendation of HPV vaccination, which was only resumed 9 years later (Normile, 2022). In Australia and the United States, because HPVs are sexually transmitted, media coverage included persistent references to sexuality such as moral arguments about the potential role of HPV vaccination in promoting sexual risk behaviors among adolescent girls (Robbins et al., 2012; Gollust et al., 2016). Across such national differences, studies of HPV vaccination coverage in traditional news media have tended to emphasize the prevalence of negative messages and inaccurate information (Catalan-Matamoros and Peñafiel-Saiz, 2019; Xiao and Su, 2020).

The Danish HPV vaccination program for girls aged 12–16 years began in January 2009 with a start-up program already from October 2008. Over the following years, HPV vaccination uptake in Denmark remained relatively high in comparison to many other European countries (ECDC, 2012). From 2013 to 2015, across national news and social media platforms many stories about vaccinated girls with symptoms normally associated with Postural Orthostatic Tachycardia Syndrome (POTS) and Complex Regional Pain Syndrome (CRPS) began to appear. The girls and their families suspected that the symptoms were adverse reactions following HPV vaccination, and many more cases were being reported to the Danish Medicines Agency. In March 2015, the national broadcasting channel TV 2 produced and aired a documentary entitled *The Vaccinated Girls—Sick and Abandoned* (in Danish, *De vaccinerede piger—Syge og svigtede*). The documentary featured 47 girls or young women with severe symptoms that had appeared or significantly worsened shortly after HPV vaccination (Pedersen, 2019). The reporting of adverse reactions increased rapidly, which was then partly attributed to increased media attention (Danish Medicines Agency, 2015).

The Danish controversy over HPV vaccination attracted international attention when the high number of reported suspected adverse reactions in 2015 led Denmark to request the European Medicines Agency (EMA) to reinvestigate the safety of HPV vaccines (Larson, 2015). EMA (2015) concluded that the evidence does not support a causal link between HPV vaccination and suspected adverse reactions. This led many, including the health authorities, researchers, health NGOs, and journalists, to address the impact of the media on public opinion about HPV vaccination (Mynthen and Sørensen, 2019; Hansen et al., 2020; Mohr and Frederiksen, 2020). WHO, for example, in their February 2018 update on Denmark and HPV vaccination referred to a 2016 study by the Danish Health Authority. The study linked reports "circulating in the media of symptoms, such as pain and tiredness, in girls who had the vaccine" to the question of "why so many parents of girls around 12 years of age were postponing vaccination" (WHO, 2018). In the 2018 WHO update, Katrine Bach Habersaat, Technical Officer, WHO Regional Office for Europe, concluded: "Documenting and learning from Denmark's experience is not only important to address the HPV crisis; it is critical to ensuring the success of new vaccines introduced in the future" (WHO, 2018). Concerns over HPV vaccine safety, hesitancy, and information have already been linked to similar issues relating to COVID-19 vaccinations (Osazuwa-Peters et al., 2021).

Two studies of news media coverage in the Danish HPV case stand out. Suppli et al. (2018) coded the sentiment of 140 news articles from 2009 to 2015, using a tripartite coding scheme: benefits (positive), neutral, or adverse reactions (negative). They identified a shift in media coverage from 2012 where positive articles focusing on benefits from HPV vaccination greatly outnumbered negative ones, to 2015 where negative articles linking HPV vaccination to adverse reactions had become dominant. They also found that after June 2013 media coverage (including all HPV-related articles in Infomedia) correlated significantly and negatively with vaccination activity ($r = -0.52$, p-value < 0.001). Hansen and Schmidtblaicher (2021) gauged the content of online news articles to estimate the "number of "negative" articles" linking HPV vaccination with "possible side effects or raising doubt about the vaccines [sic] effectiveness" (Hansen and Schmidtblaicher, 2021, Supplementary material, WebAppendix, p. 14). They found 107 negative articles published from 2009 to 2017, labeling an unspecified number of them as "fake news." Based on their dynamic model for vaccine compliance (defined as the difference between expected and actual vaccination rates), they concluded that the decline in vaccination compliance began in 2013 when Danish media first reported on suspected adverse reactions following HPV vaccination, and the largest decline happened right after the screening of the TV 2 documentary in early spring of 2015. Their analysis lends support to the view that "the Danish media played an important role in the collapse of the Danish HPV vaccination program" (Hansen and Schmidtblaicher, 2021, p. 268).

Our study aims to advance from what is already known about "Denmark's experience" by engaging empirically and conceptually with coverage of HPV vaccination in Danish newspapers. Existing studies have demonstrated the extent to which the media were deeply involved in the Danish controversy over HPV vaccination (Suppli et al., 2018; Hansen and Schmidtblaicher, 2021). As these studies rely on a simple dichotomous coding, i.e., positive vs. negative news, we still lack a richer and more thorough analysis of actual media coverage, which could add valuable information to "documenting and learning from Denmark's experience" (WHO, 2018). More documentation and learning particularly is needed to understand media coverage of suspected adverse reactions. In this paper, we present the results of a comprehensive qualitative content analysis of newspaper coverage, exploring how the Danish HPV controversy emerged in different contexts over time. Our analysis

includes news content from six national newspapers and focuses on six periods of peak media coverage from 2009 to 2018. We analyze the intensity of media coverage, the main topics covered by the media, and the underlying context necessary to make sense of the main topics. To contextualize our own approach, we first review the discussion around media coverage of vaccination campaigns and controversies. Then, we present our materials, methods, and results. Our discussion pertains to the role of news media in complex and controversial cases involving vaccination.

2. The role of the news media in vaccination controversies

Since the emergence of vaccination as a public health measure in the late-eighteenth and nineteenth centuries, issues such as safety, effectiveness, ethics, and politics of vaccination campaigns have been surrounded by persistent public debate (Durbach, 2005; Blume, 2017; Williamson, 2017; Kinch, 2018). In the second half of the twentieth and into the early twenty-first century, with the industrialization of vaccine production and the establishment of national and global immunization programs, vaccination controversies have been widely reported and sometimes even fueled by the media (Chatterjee, 2013; Newton, 2013; Conis, 2015; Holmberg et al., 2017). The polio vaccine, for example, generally received positive coverage when it appeared in the 1950's but the 1955 Cutter incident, where 200,000 people in the United States were inadvertently injected with live virulent poliovirus due to manufacturing deficiencies, inadequate safety tests, and poor communication, led to public scrutiny of vaccine safety and lawsuits against Cutter Laboratories (Offit, 2005). Another historical example is the documentary Vaccine Roulette, which aired on NBC three times in 1982, warning parents and others about the dangers of the DTP (diphtheria, tetanus, and pertussis) vaccine based on anecdotal evidence and scientific papers published in the 1960s and 1970s hypothesizing a correlation between the DTP vaccine and several neurological complications. The documentary's claims about suspected adverse reactions following DTP vaccination and its accusations of inadequate scientific attention given to the uncertainties about the safety of the vaccine received extensive media coverage. Physician and author Offit (2011), presenting a viewpoint shared widely by the medical establishment, later argued that the Vaccine Roulette marked the beginning of the anti-vaccination movement in the United States with the media depicting a battleground between concerned parents and the health authorities (Park, 2020, p. 15).

The MMR (measles, mumps, and rubella) vaccination controversy also unfolded in the media. During the 1990s and into the 2000s claims about the correlation between the MMR vaccine and autism received extensive media coverage around the world (Begg et al., 1998; Stöckl and Smajdor, 2017; Hansen et al., 2019; Hausman, 2019, chapter 2). The media typically portrayed parents of autistic children, supported by a few scientists, such as the now discredited British doctor Andrew Wakefield, advocacy groups, and lawyers, all struggling against established medical science and the health authorities. Media attention often followed in the wake of documentaries such as the Danish *A Shot in the Fog* (*Et skud i tågen*, broadcast in November 1997 by DR, the national public-service broadcasting company) and the February 2002 BBC Panorama program, which raised doubts about the safety of the MMR vaccine (Speers and Lewis, 2004; Berg, 2020). In her analysis of the Danish MMR controversy, Berg (2020) concludes that the public debate revolved around three issues: informed consent based on the freedom of choice and the right to access to information about suspected adverse reactions, uncertainty about causes of autism, and trust in government and public institutions. Communication researchers Lewis and Speers (2003), based on their comprehensive study of media coverage of the British MMR controversy and public surveys, conclude that media reporting had been misleading because the right-to-know argument does not consider organized lobbying and PR conducted by anti-vaccination advocacy groups, and balanced reporting creates a false impression of two conflicting bodies of evidence.

Media coverage of HPV vaccination followed similar patterns, mixing debates about cancer prevention, parental autonomy, uncertainty about causes of the symptoms reported as suspected adverse reactions, and trust in healthcare systems (Gollust et al., 2016; Mynthen and Sørensen, 2019). The lesson from the MMR controversy, namely that media reporting can be misleading in the sense that it does not adequately convey what most scientists and health professionals believe about the risks, safety, and effectiveness of vaccination, has guided most research into media coverage of HPV vaccination (Catalan-Matamoros and Peñafiel-Saiz, 2019). Indeed, the idea that media reporting is either positive or negative toward HPV vaccination seems to have become prevalent (Hilton et al., 2010; Penta and Băban, 2014; Perez et al., 2016; Tsuda et al., 2016; Suppli et al., 2018; Hansen and Schmidtblaicher, 2021). Positive media reporting emphasizes positive aspects of HPV vaccination programs such as immunity against cancers caused by HPV infection, whereas negative reporting focus on suspected adverse reactions, controversy among experts, and mistrust in the healthcare system.

The positive-negative framework is closely associated with the notion of misinformation or inadequate information, which many studies link to HPV vaccine hesitancy (Karafillakis et al., 2019). Understanding media coverage in this way therefore could lead to less favorable conclusions about the role of the media in relation to vaccination programs and controversies over vaccination. For example, Dees and Berman (2013, p. 383) argue that health professionals face a "problematic situation where one of the leading resources (i.e., the media) families use [sic] to gather information on the safety and utility of immunizations is flawed in its usefulness to serve as a reliable source of information." Gollust et al. (2016, p. 1432) agree that the news media have to provide reliable health information to the public but also find that the media often miss critical details and rather "reminds the public that the issue is controversial and politically-charged." The merits of the news media therefore are "debatable" (Gollust et al., 2016, p. 1433).

The dichotomous positive-negative framework may be useful in trying to assess the impact of media coverage on public perceptions of vaccination and, ultimately, individual decisions to choose vaccination or not. It addresses the concern shared by many researchers and health professionals that the media risk becoming a vehicle for spreading anti-vaccination misinformation, thus adding to the polarization of the vaccination debate also found on social media and in other communication environments

(Kahan and Landrum, 2017; Schmidt et al., 2018; Mønsted and Lehmann, 2022). However, the positive-negative framework may also limit our understanding of the role of the news media in vaccination controversies, as it seems to imply that the media could or should focus more on positive reporting. The traditional news media certainly must provide reliable information but also produce timely news and relevant stories, including watchdog journalism. Reporting on vaccination typically involves the same news values as other forms of journalism. Controversy and human interest serve to attract and sustain readers' attention but are also used to illuminate structural power issues, appealing to political intervention and accountability of health authorities (Amend and Secko, 2012; Figenschou et al., 2021). When covering perceived health crises, journalists may choose to change their role perceptions and act as public mobilizers, cooperating more closely with health authorities and even promulgating arguments against vaccine skepticism (Hausman, 2019, chapter 2; Klemm et al., 2019).

The role of the news media in vaccination controversies is—always has been, probably always will be—complex and problematic (Dees and Berman, 2013). The media adhere to journalistic principles such as objectivity, autonomy, and serving the public interest, but also seek sensation, agenda setting, and profit. Striking a balance is difficult. When it comes to reporting on health issues, the stakes are high because parents seek information on immunizations through the media. Moreover, media systems differ from one country to another (Hallin and Mancini, 2004). In Denmark, press freedom co-exists with strong state support for and regulation of the media market. Due to government subsidies, Denmark has a high number of national newspapers, which all publish in the Danish language and all focus on information provision along with democratic inclusion of all social groups in a mediated, political process of gaining consensus about important issues. Journalists reporting on technical issues such as science and health typically are close to their sources, particularly experts (Vestergaard and Nielsen, 2016). Compared to other Western media systems, the Danish media system is relatively closed with a high degree of democratic corporatism and homogeneous professional standards (Hallin and Mancini, 2004; Blach-Ørsten et al., 2021). Danish journalists refer to common criteria of newsworthiness such as significance (or relevance), identification, sensation, actuality, and conflict (Gravengaard, 2010). Reporting on vaccination, the Danish media will be expected to hold those with power accountable and give voice to underrepresented voices, while also seeking to report on scientific information and scientific controversy.

3. Material and method

3.1. Research design

Our research design involves five steps: (1) selection of media sources, (2) data collection to create a corpus of HPV-related news articles, (3) quantitative analysis to identify temporal peaks in media coverage, (4) qualitative content analysis of articles included in peak coverage allowing for quantification of categories, and (5) collection of relevant contextual information to discern complexity and controversy in relation to dominant themes. Our main units of analysis are the peaks of media coverage. Coding all articles in all peaks provides us with information about the main topics covered and their frequencies. We supplement this information with additional context provided in the articles to fully understand what the main topics implied in each peak.

3.2. Selection of media sources

Our study relies on newspaper articles from six Danish national newspapers out of eight (Blach-Ørsten et al., 2021). We included newspapers with daily distribution and a formalized journalistic approach to broad news coverage. We selected four broadsheets with different political orientations and two tabloids (with barely noticeable political orientations today). The broadsheets are *Politiken* (center-left, readership 498,000), *Jyllands-Posten* (right-wing liberal, readership 351,000), *Berlingske Tidende* (right-wing conservative, readership 299,000), and *Information* (left-leaning, readership 171,000). The two tabloids are *B.T.* (traditionally populist right-wing, readership 367,000) and *Ekstra Bladet* (traditionally left-leaning, readership 245,000).

3.3. Methods of data collection

The study includes articles published over a 24-year period from January 1, 1991, to September 30, 2019 (1991 being the first year where the abbreviation HPV appears in national newspapers). We sampled articles by means of Infomedia, the commercial media intelligence provider with the most extensive coverage of Danish print, broadcast, and online media. We used the simple and inclusive search string "HPV vaccine" to identify 2,180 eligible articles with "HPV" AND "vaccine" in the headline or body text (1,319 online and 861 in print). Upon removing duplicates and irrelevant search hits (i.e., articles addressing other vaccines, articles in which the terms "HIV" and "vaccine" co-occurred by chance), we ended (up) with a total corpus of 1,437 articles published between 1991 and 2019.

3.4. Data analysis

To sample articles for further analysis, we first identified peaks in our corpus, defined pragmatically as coherent periods of minimum 3 months, where any given newspaper published ten or more HPV vaccine-related articles. We then used qualitative content analysis to code the articles (Schreier, 2012). Three authors [TA, MES, KHN] proceeded inductively to develop a simple coding frame with categories describing the main topic of all articles. We assigned one main topic to each article to avoid a "long-read bias" where longer articles would dominate the analysis simply because of their length and the number of topics potentially covered. MES developed the codebook by looking at headlines and lead paragraphs to identify the articles' main organizing idea or "peg," our unit of analysis during step no. 4 of our research design. Then, four authors [TA, AKG, MLT, and KHN] discussed and revised the list of main topics to reduce idiosyncrasies and establish homogeneity across peaks. Iteratively, we refined the list

of main topics in the codebook by consulting the corpus as needed. We continued this iterative process until we reached a point of saturation for our list of main topics covered. We used Microsoft Excel to manage the dataset and assign one main topic per article (see Supplementary material).

3.5. Data synthesis

Our qualitative content analysis separated the main topics from their original context, allowing for quantitative comparison of the occurrence of main topics across peaks. In this way, our data was decontextualized. We then proceeded to recontextualize the most frequent main topics in our final data synthesis, step no. 5 in our research design. In doing so, we consulted longer articles in our corpus to identify and interpret relevant context for the most frequent main topics. We sought to discern key events, actors, and voices in the debate to understand some of the complexities and controversies that took place around the main topics.

4. Results

We used the full dataset to depict newspaper article frequencies over time, (see Figure 1). The six peaks occurred from 2008 to 2019, and they include 865 articles, or 60% of our corpus of 1,437 articles, which were selected for further content analysis, (see Table 1). 572 articles that were not published during peak coverage were excluded from the analysis.

- **Peak #1:** January 1–March 31, 2008 (henceforth Q1 2008): 53 articles.
- **Peak #2:** July 1, 2012–September 30, 2013 (Q3 2012–Q3 2013): 173 articles.
- **Peak #3:** January 1–December 31, 2015 (Q1–Q4 2015): 287 articles.
- **Peak #4:** April 1–June 30, 2016 (Q2 2016): 85 articles.
- **Peak #5:** January 1–September 30, 2017 (Q1–Q3 2017): 175 articles.
- **Peak #6:** January 1–June 30, 2018 (Q1–Q2 2018): 92 articles.

We identified ten main topics, (see Table 2). The table also includes the highest incidence of each topic, i.e., the maximum occurrence percentagewise in any given peak period. For example, the highest incidence of the topic "Funding of HPV-vaccination program" is 75% (Peak #1), which means that this topic occurred in 75% of our articles in Peak #1 and in <75 % of the articles in all other peaks.

We visualized the ten main topics and their relative incidence for all six peaks in Figure 2, using a bubble chart. The chart displays the dynamics of media coverage over time. Two peaks had dominant topics, namely Peak #1 (Budget discussions) and Peak #3 (Adverse reactions and risks). As regards the four other peaks, it makes less sense to speak of one dominant topic. Here, multiple topics competed for readers' attention. In the following, we will expand on our results by highlighting factors mentioned in longer articles that provide context for our interpretation of main topics over the six different peak periods. We use the name of the most important topic for any given peak period as titles to Subsections 4.1–4.6 below.

4.1. Budget discussions (Peak #1, Q1 2008, $n = 53$)

Peak #1 marks the beginning of the HPV vaccination program in Denmark. Only three out of six newspapers covered this event. The dominant topic was "Budget discussions" (40 out of 53 articles coded). For example, one headline in *Politiken* read: "Political collapse in HPV vaccine negotiations" (February 22, 2008). At stake was government financing of HPV vaccinations, in total DKK 80 million annually. All political parties agreed that the national immunization program for children should include HPV vaccination for girls above the age of 12. They disagreed, however, on where the money should come from. In early February 2008, the Minister for Health proposed to finance HPV vaccinations by reducing the government's co-payment subsidy scheme that reimburses medical expenses for individuals. Since this scheme mostly benefits chronic patients, the proposal was met with public outcry and intensive coverage by three newspapers. One week later, a solution was found so that the reduction in co-payment subsidies did not affect chronic patients. The Danish Cancer Association had criticized the government for hesitating to introduce the vaccine due to prolonged discussion over financing.

At this early stage of media coverage, HPV vaccination was generally seen as a "cancer vaccine" and a "public health breakthrough" (Nielsen et al., 2020). The Danish immunization program for children was already well established, based on high levels of social trust in the Danish social-democratic welfare society where parents generally agree to get their children vaccinated for the benefit of public health (Nielsen et al., 2020). Although the budget discussions did involve key issues about costs and benefits of HPV vaccination, the media typically reiterated some of the conclusions from the medical assessment of HPV vaccination, performed in 2007 by the Danish Health Authority (2007). The report argued that vaccinating all girls would reduce, possibly eliminate cervical cancer, and thus minimize societal costs affiliated with screening programs and medical interventions. The report also concluded that since cervical cancer screening programs are prone to reflect social inequality because vulnerable and marginalized women are less likely to accept admission in the screening programs, HPV vaccination would be a more "democratic" solution to minimizing risks of cervical cancer (Danish Health Authority, 2007, p. 11).

However, the medical assessment had also identified possible concerns about HPV vaccination. The media did report on such concerns, which is reflected by our two main topics, "Adverse reactions and risks" and "Vaccine effectiveness," receiving nearly equal coverage in Peak #1. In focus group interviews with parents and young adults, the committee behind the medical assessment report had found that the nearly all participants were favorably disposed toward vaccination in general, yet half of the participants expressed doubts about HPV vaccination out of fear of possibly unknown, adverse reactions (Danish Health Authority, 2007). One headline, which appeared in slightly different versions in several

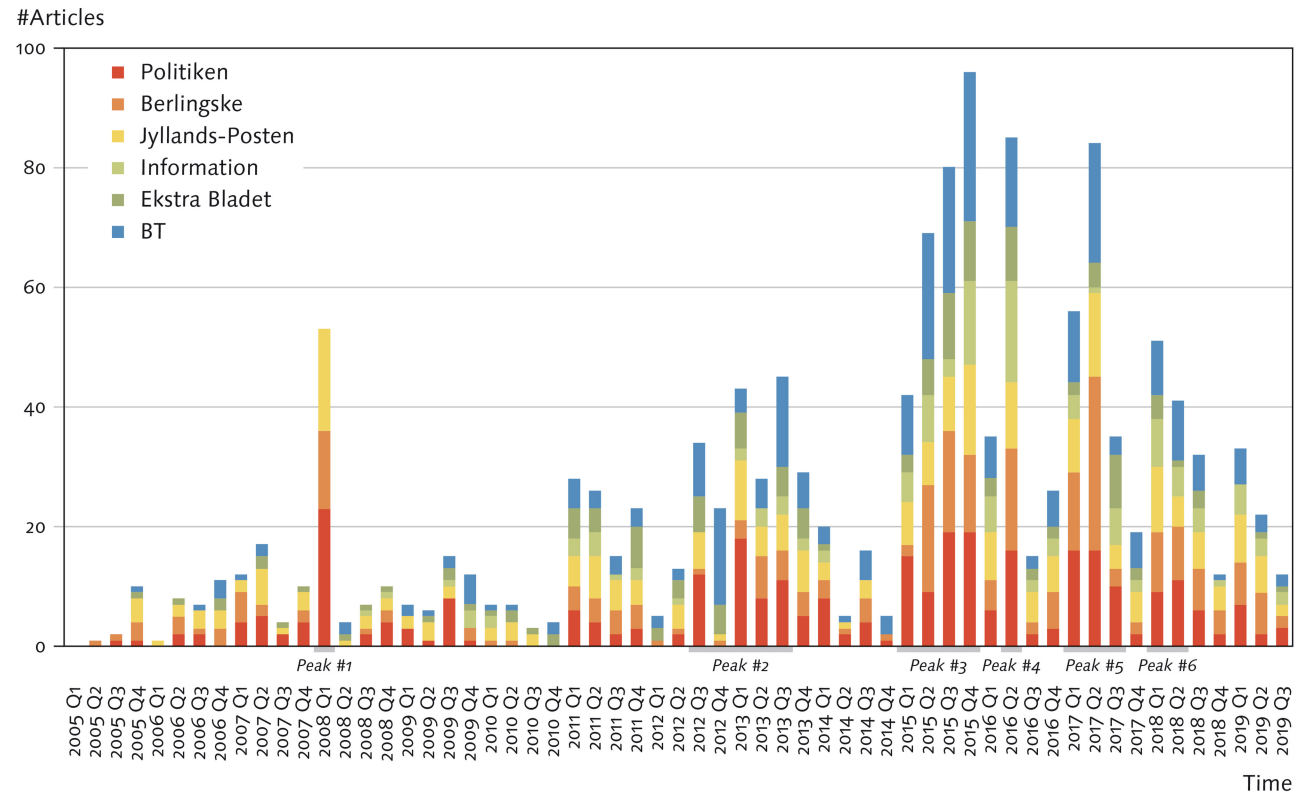

FIGURE 1
Intensity of media coverage across quarters (*Q*). Articles before 2005 not included due to the low number of articles found.

TABLE 1 Six peak periods and the number of articles published about HPV vaccination.

Newspaper	Peak #1 Q1 2008	Peak #2 Q3 2012–Q3 2013	Peak #3 Q1–Q4 2015	Peak #4 Q2 2016	Peak #5 Q1–Q3 2017	Peak #6 Q1–Q2 2018	Total
Politiken	23	49	62	16	42	20	212
Berlingske	13	17	50	17	45	19	161
Jyllands-Posten	17	28	38	11	27	16	137
Information	0	8	30	17	11	13	79
Ekstra Bladet	0	22	30	9	15	5	81
B.T.	0	49	77	15	35	19	195
Total	53	173	287	85	175	92	865

Note that the peaks cover different periods.

newspapers, read: "Doctors warn against cancer vaccine" (February 6–7, 2008). Chief surgeon Danny Svane of Rigshospitalet, the largest and most specialized hospital in Denmark, and Kåre Mølbak of the State Serum Institute agreed that it was necessary to have a national reporting system for HPV vaccination and adverse reactions. They both recommended the vaccine while also stressing the urgency of understanding its safety and effectiveness. The article mentioned in passing that the EMA was looking into reports about suspected adverse reactions in Europe and in the United States, including deaths.

Despite the warnings, most parents were not deterred. *Berlingske* reported on two parents who already had their youngest daughter aged 14 vaccinated with the headline: "We prefer side effects to cancer" (February 9, 2008). The parents said that they were aware that some doctors had warned against possible adverse reactions following vaccination, but as the mother said, "We trust our general practitioner and so we are not concerned about possible adverse reactions, which is something you have to live it when you consider the benefits of the vaccine." Their daughter agreed: "I'd rather have side effects than cancer."

TABLE 2 Main topics and their highest incidence.

Main topic	Description (maximum incidence, peak no.)
Budget discussions	Coverage of political debate ahead of the introduction of HPV vaccination in Denmark (75%, peak #1)
Expanded HPV vaccination program	Actual and potential expansions of the existing HPV vaccination program for females, such as catch-up programs (36%, peak #2)
Advocacy for HPV vaccination	Generating and maintaining support for HPV vaccination, including the StopHPV campaign (19%, peak #5)
Vaccine effectiveness	Positive effects (cervical cancer prevention and other possible benefits) and the effectiveness of HPV vaccination (11%, peak #6)
HPV vaccination uptake	Rates of HPV vaccination: rise and decline (19%, peak #4)
Adverse reactions and risks	Risks associated with HPV vaccination: individual cases and epidemiological studies (66%, peak #3)
HPV vaccination debate	Stakeholders debating HPV vaccination - stakeholders include individuals, experts, health authorities, editors and journalists, politicians, NGOs etc. (32%, peak #4)
Conflicts of interests	Allegations of conflicts of interest against HPV-vaccination advocates (general practitioners and health authorities) (14%, peak #2)
HPV vaccination in boys and men	The inclusion of boys and young men in the HPV vaccination program (35%, peak #6)
Other	Other issues not included in the above (14%, peak #3)

4.2. Expanded HPV vaccination program (Peak #2, Q3 2012–Q3 2013)

In Peak #2, we see coverage that is becoming more heterogeneous with "Budget discussions" disappearing as the single most dominant topic and more main topics being covered: "Adverse reactions and risks," "HPV vaccination for males," "Conflicts of interest," and "Expanded HPV vaccination program." The latter topic, which appeared only in Peak #2, was most prevalent, where newspapers would report on the expanded catch-up program and new sites for vaccination such as fitness centers and health and personal care stores. In December 2012, the Danish actor Mira Wanting died from cervical cancer, which led many newspapers to report on advocacy for HPV vaccination and calls for even more expanded vaccination programs including HPV vaccination for women not eligible for catch-up programs and males. "Mira could have been saved," one headline in *Ekstra Bladet* read, implying if only she had had the vaccine (December 29, 2012).

The "Conflicts of interests" topic indicated the most significant shift in media coverage with the appearance of conflicting voices about expert advice on HPV vaccination. Journalists began to take a more agenda-setting, critical stance toward HPV vaccination. The first article about a chief physician receiving honorariums from producers of HPV vaccines, Sanofi Pasteur and GlaxoSmithKline, appeared in *Politiken* in early 2013 under the headline "Physician criticized for conflict of interest in relation to HPV vaccine" (February 28, 2013). All other newspapers followed up on this story, which soon expanded to include other physicians and general practitioners as well as organizations such as the Danish Cancer Society, the Danish Family Planning Association, and the Danish Health Authority. Politicians also became active in the debate. Members of the opposition called for more control, while the Minister for Health argued that there was little reason to be concerned about potential conflicts of interests due to checks and balances in the system.

A second conflict story began soon after. An article in *Politiken*, headlined "Simone could hardly move without getting dizzy after having received her HPV vaccine," reported on a 13-year-old girl who used to be an elite gymnast but now suffered from suspected adverse reactions shortly after her three HPV vaccinations (April 16, 2013). The day after *Politiken* ran a headline quoting the parents: "HPV vaccine has made our daughter's life hell" (April 17, 2013). The parents said that their daughter suffered from chronic headaches and long spells of dizziness because of her vaccination. Since they received no information about possible adverse reactions, but also because of the critical stories about experts' conflicts of interests that had appeared in the news, the parents voiced criticism of the health authorities. "We feel powerless and responsible. The vaccine is like Russian roulette, and I often think it was not worth it," said Simone's mother in *Politiken* (April 17, 2013).

Two general practitioners, Claus Werner Jensen and Stig Gerdes, intervened in the debate. They both argued that the suspicion was enough for them to recommend their patients not to take the vaccine. They also followed Simone's parents in criticizing the health authorities for providing insufficient information about the vaccine and about the conflicts of interests in the healthcare system. They maintained their position despite results from the first cohort study performed with register data from Sweden and Denmark (N = 900,000), which found no association between HPV vaccination and the suspected adverse reactions. The study came out in the *British Medical Journal* in late August 2013 and was reported by Danish media in early September 2013 (Arnheim-Dahlström et al., 2013). The tabloid *B.T.* pitted Stig Gerdes in a "controversy" against Iben Holten, chief physician with the Danish Cancer Society, under the headline: "Should young girls and women continue to get the HPV vaccine against cervical cancer?" (September 11, 2013). Gerdes said no because of the many suspected adverse reactions being reported. Holten said yes because the Scandinavian study reported in *BMJ* and a June 2013 WHO report both said that the vaccine is safe, and because the vaccine is known to protect against cervical cancer.

4.3. Adverse reactions and risks (Peak #3, Q1–Q4 2015)

The dominant topic in Peak #3 covering all of 2015 was "Adverse reactions and risks." We found three types of additional context in articles dealing with this main topic. Some articles reported on individual cases of suspected adverse reactions

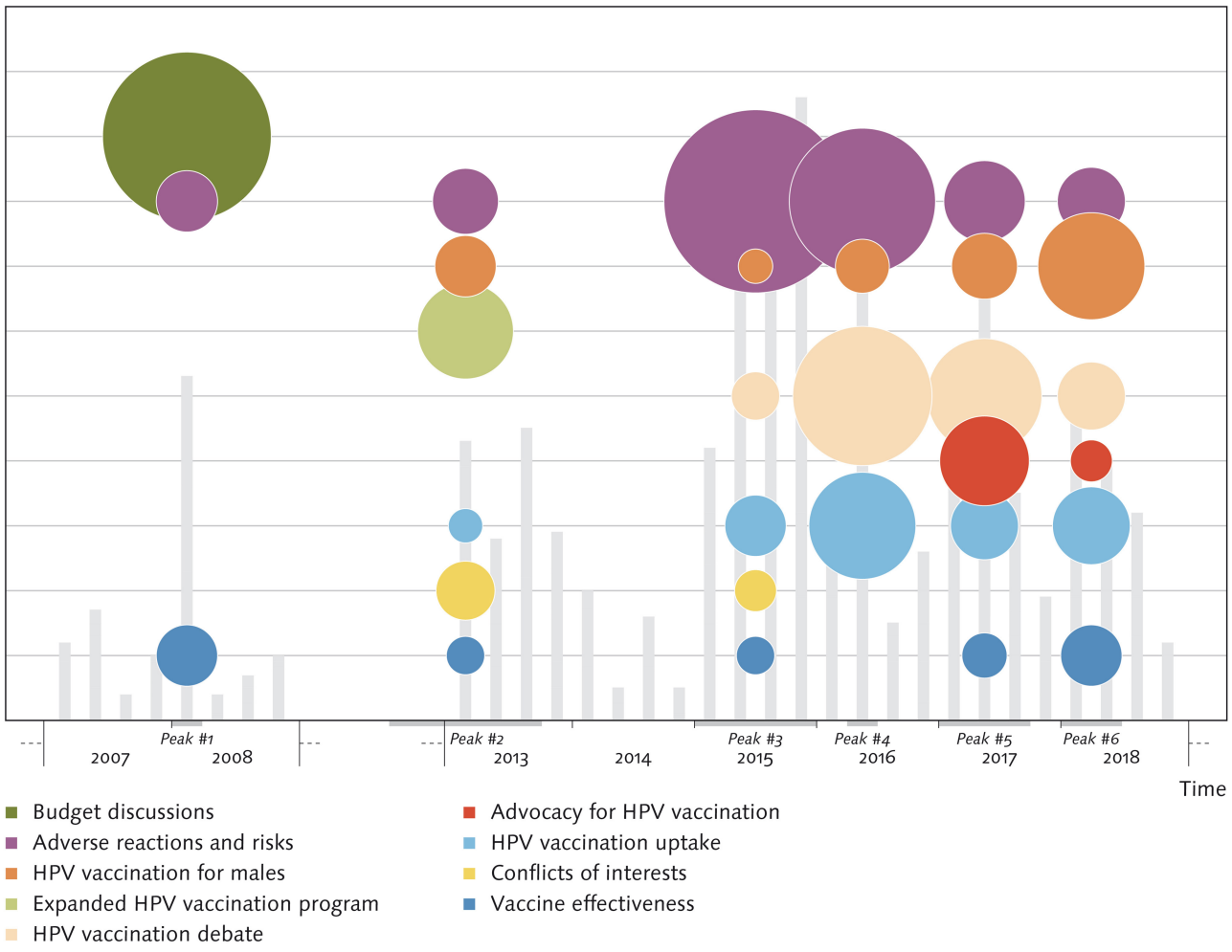

FIGURE 2
Main topics across the six peaks [time indicated by (gray bars)]. The sizes of the bubbles within each peak are relative to the total number of articles published in the peak period, and they have been normalized across all six peaks. See Supplementary material for more information about bubble chart.

following HPV vaccination. They were similar in kind to most of the articles with this topic that had appeared already in 2013. These articles typically described the reported symptoms in detail and provided personal and social information about the girls and their parents. For example, the article in *Politiken* with the telling headline, "When fainting, wheelchair and school absence became Amalie's life," quoted Amalie's mother saying that they were met with mistrust until they learned about possible adverse reactions following HPV vaccination (June 17, 2015). Another article in *Berlingske*, "Fear of adverse reactions leads many girls to skip HPV vaccination," addressing both suspected adverse reactions and HPV vaccination uptake, reported on a father who was hesitant to get his 14-years old daughter vaccinated because of reports about adverse reactions (June 27, 2015). Many such articles used the label "HPV girls" to define all individual cases of suspected adverse reactions, which could imply a causal relationship between HPV vaccination and the pains and suffering experienced. A typical headline in *Berlingske* ran: "HPV girls must receive faster and better help" (October 11, 2015).

The second type of articles with "Adverse reactions and risks" as their main topic focused on what experts had to say about suspected adverse reactions. The first headline in this type of articles, published in *Politiken*, read: "Danish Health Authority: HPV vaccine still safe" (February 5, 2015). The article reported on a preliminary study performed by EMA's Pharmacovigilance Risk Assessment Committee (PRAC), which concluded that there was no evidence for causal or correlational relation between HPV vaccination and the dizziness and fatigue symptoms affiliated with Postural Orthostatic Tachycardia Syndrome (POTS). Christian Gluud, chief physician at Rigshospitalet, agreed with EMA and the Danish Health Authority: "When so many women in Denmark and around the world have received the vaccine, and so relatively few have experienced POTS, the numbers are not alarming." Henrik G. Jensen, unit chief at the Danish Health Authority, agreed: "Almost 20 percent of all Danish women have been vaccinated. 33 girls have been diagnosed with POTS. Even if there is a connection, the advantages in terms of saving lives by far exceed the risks."

After the screening of the TV 2 documentary in late March 2015, the media approached other experts that were less confident about the safety of the vaccine. Two physicians, who both appeared in the TV 2 documentary, and both worked at the Syncope Unit in Copenhagen for patients with consciousness or fainting problems (syncope means fainting), stood forward. A headline in *Information* on the day of the screening of the documentary quoted physician Louise Brinth of the Syncope Unit: "We can never be absolutely sure about vaccines" (March 26, 2015). In the article, Brinth explained that she had severe doubts about standing forward in the documentary but eventually chose to do so because, as she said, "I feel there is a reluctance to deal with the problem, also because these girls are suffering from something we do not know what to call." Brinth argued that medical science is never sure, which would apply equally to the vaccine and suspected adverse reactions. Under the headline "Warning sports girls against vaccine" in *B.T.*, Brinth's colleague Jesper Mehlsen was more outright in his assessment: "It looks as if there is a connection between intensive training and adverse reactions following HPV vaccination" (May 6, 2015).

The third type of articles dealing with "Adverse reactions and risks" focused on the new HPV-centers, which opened in each of the five regions of Denmark on June 1, 2013. The centers were established to determine the medical reasons for the symptoms being reported as suspected adverse reactions. They soon became widely sought. Within 3 months, more than 1,300 girls and young adult women were referred to the centers, which meant that there were long waiting lists. Newspapers reported how centers differed in their response to the situation with the Copenhagen Syncope Unit being the most proactive (Schartau et al., 2019). The Copenhagen Syncope Unit for example was the first HPV center to diagnose the symptoms as POTS and to offer treatment. Under the headline "When will the victims of the HPV vaccine be taken seriously?" *Information* brought the story about Sara who failed to gain recognition for her symptoms, which she and her parents believed were adverse reactions to the HPV vaccine, until she was admitted to the Syncope Unit (April 17, 2015).

Like Peak #1, Peak #3 had just one major dominant media frame. We also found reporting on expert debate over causal attribution and responsibility in relation to the suspected adverse reactions, reflected in the emerging main topic "HPV vaccination debate," (see Figure 2). In an article with the headline, "What is it with the debated HPV vaccine?," *Politiken* tried to summarize the positions (September 25, 2015): All experts agreed that vaccines can cause adverse reactions, and all agreed that the "HPV girls" were really suffering from POTS or CRPS. All experts agreed that the HPV vaccine reduces risks of cancer. No experts, not even the physicians at the Syncope Unit, believed that there was enough evidence to suggest a causal relation between HPV vaccination and POTS. The crux of the debate seemed to be this: To what extent should the healthcare system take seriously the main claim of the HPV girls that the vaccine had caused their symptoms? In what ways should the healthcare system respond to and treat POTS and CRPS?

In November 2015 the EMA-PRAC review study, initiated due to concerns about the many suspected adverse reactions reported to the Copenhagen Syncope Unit, found no evidence that the overall rates of POTS and CRPS in vaccinated girls were different from expected rates in these age groups, even considering possible underreporting (Gollust et al., 2016, p. 39). *Politiken* reported on the study with the headline: "EU clears HPV vaccine of serious adverse reactions" (November 6, 2015). In their news article about the EMA study, Ritzau, the independent news agency providing domestic and international news to most print and broadcast media outlets in Denmark, focused on the decline in HPV vaccination rates. *Ekstra Bladet* ran the Ritzau story under the headline: "Fewer getting the vaccine against cervical cancer" (November 7, 2015). The article quoted Iben Holten of the Danish Cancer Society for saying that "the debate over HPV vaccination had been very fierce and some parents are scared." Jesper Mehlsen, whose Syncope Unit was being criticized in the EMA report for biased reporting of suspected adverse reaction, was less convinced. In the article, he disapproved of EMA's reliance on data from the producers of the vaccine. He said to Ritzau: "You don't have to be Einstein to figure out that all is not right here."

4.4. Adverse reactions and risks (Peak #4, Q2 2016, $n = 85$)

In Peak #4, "Adverse reactions and risks" remained the most prominent main topic, but other topics took on added relative importance, namely "HPV vaccination debate" and "HPV vaccination uptake." The coverage of adverse reactions shifted from individual cases to questions about science and politics. One of the prominent news stories was the publication of a new register study performed by researchers at the State Serum Institute (Mølbak et al., 2016). The study showed that, in advance of their vaccination, the girls who had reported suspected adverse reactions, the so-called "HPV girls," were more likely than other girls to have been in contact with their general practitioner or have been referred to a psychologist, psychiatrist, chiropractor, physiotherapist, or hospital than others. Moreover, the symptoms reported in these cases often did not lead to diagnosis.

The study was reported on April 29, 2016, after a Nordic vaccine conference in Iceland, but before post-review publication. *Berlingske*'s headline ran: "Many HPV girls were already ill before vaccination" (April 29, 2016). Unsurprisingly, the study did not resolve the matter, but rather led to increased polarization among experts. On May 9, 2016, a story about scientific exclusion and even persecution broke in *Information*. The headline quoted Louise Brinth of the Syncope Unit for saying: "Either you are with us, or you are against us." Brinth said that she had received "scathing, but erroneous critique" for her suggestion that there might be a connection between the many cases being reported to the Syncope Unit and HPV vaccination. In the article, Rebecca Chandler, formerly at the Swedish Medicines Agency, also stood forward, saying that it had been virtually impossible for her to adopt a critical attitude to the safety of HPV vaccination.

The main topic "Adverse reactions and risks" also included news stories about the high number of adverse reactions being reported in Denmark and front-page news about the consequences of fear of adverse reactions. Under the headline "More Danish complaints about HPV vaccine," *Jyllands-Posten* reported that the number of reported suspected adverse reactions in Denmark was 242, while the two other Scandinavian countries, Norway and

Sweden, only had seen 8 and 23 reports, respectively (April 24, 2016). Three days later, the frontpage of *Politiken* read: "We no longer fear childhood diseases, but adverse reactions from vaccines" (April 29, 2016). The article reported on the annual report of the Danish Health Authority that warned against a decline in many vaccinations, not only HPV vaccination. According to Allan Randrup Thomsen, professor in experimental virology at the University of Copenhagen, many people, highly educated city-people in the so-called "spelt segment," were making risky choices by opting out of the national vaccination program: "New parents think that the diseases have been eliminated. But without the vaccines they will return."

In Peak #4, the main topic "HPV vaccination debate" had grown in relative importance to become almost as important as "Adverse reactions and risks." Articles covering this topic mainly reported on experts and others who were critical of the conclusions reached by EMA and the Danish Health Authority. Under the headline "HPV report is called unacceptably poor workmanship," *Politiken* quoted Peter Gøtzsche, director of the Nordic Cochrane Center, and internationally known for his critique of the pharmaceutical industry: "EMA has acted paternalistically in terms of 'we know better, and the vaccine is so good that we will not take suspected adverse reactions seriously'" (May 27, 2016). Gøtzsche was indignant over EMA's accusing the Syncope Unit of biased reporting on suspected adverse reactions. EMA's critique implied that Louise Brinth, the main responsible for the Syncope Unit's research, was being scientifically dishonest, Gøtzsche said, which was both unfair and untrue.

Three days later, Kim Varming, chief physician at Aalborg University Hospital, joined the chorus of criticism. The headline in Information read: "Expert accuses the agency of misleading" (May 30, 2016). In the article, Varming disputed the claim found on the Danish Health Authority's homepage about HPV vaccination resulting in less cancer incidents. Varming argued that there were no controlled scientific studies documenting the long-term effects of HPV vaccination. He even accused the State Serum Institute of "scientific dishonesty." Kåre Mølbak, chief physician and section head at the State Serum Institute, countered Varming by saying that control studies where some women in a control group would not receive vaccination would be unethical. It was enough to know that HPV causes cancer, and that the vaccine protects against HPV and precancerous lesions.

The main topic "HPV vaccination uptake" gained in relative importance in Peak #4. Concerns over the consequences of the intensive news coverage of adverse reactions grew as more and more seemed hesitant to take the vaccine. *Politiken*'s headline ran: "More girls born in 2003 will get cervical cancer" (April 21, 2016). The article quoted Bolette Søborg, chief physician of the Danish Health Authority: "We are very worried because the girls that opt out of the HPV vaccination program are more likely to develop cervical cancer, which is a very serious form of cancer." Søborg based her worry on figures, published by the State Serum Institute and widely reported by the media, which showed that the percentage of vaccinated 12-year-olds had dropped from about 90 to just 27 in 2 years. Under the headline "Girls skip the HPV vaccine," *B.T.* quoted Minister of Health Sophie Løhde: "Even if I understand that many people worry about adverse reactions, I do feel aggravated about so many girls not accepting the vaccine."

4.5. HPV vaccination debate (Peak #5, Q1–Q3 2017, $n = 175$)

The main topic "HPV vaccination debate" became the most prominent topic in Peak #5, where we also saw the topic "Advocacy for HPV vaccination" emerge for the first time We noted that the context of the debate had changed. No longer did experts feud in public over scientific claims about vaccination safety and efficacy. Rather, newspapers focused on the responsibility of the media in public controversies over vaccinations. *Politiken*, one of the most active newspapers in reporting individual cases of suspected adverse reactions in previous peaks, ran a story with the headline "The post-factual sneaks up on the healthcare system" (February 19, 2017). The immediate background for the article was the decline in HPV vaccination up-take in Denmark, where the 2016 numbers, published in January 2017, were the lowest on record. The article quoted Søren Brostrøm, head of the Danish Health Authority, for saying that the post-factual society was "one of the biggest challenges of our time." Brostrøm added that "the HPV scandal is the most obvious example that post-factual knowledge has made public accept of a vaccine disappear entirely in virtually no time." Also, Brostrøm referred to the Wakefield scandal and the news about newly elected president of the United States Donald Trump's announcement of plans to establish a Commission on Vaccination Safety and Scientific Integrity, headed by Robert Kennedy, Jr., the vocal vaccine critic (Wadman, 2017).

The two topics "Adverse reactions and risks" and "HPV vaccination uptake" were closer related in this peak compared to before. Many articles dealing with suspected adverse reactions associated this topic to the decline in HPV vaccination uptake, and vice versa. For example, the *Politiken* article with the heading "The HPV program lies in ruins" reported on several general practitioners who vaccinated very few girls with the HPV vaccine (March 16, 2017). In the article, one of the general practitioners said that the many stories in the media about suspected adverse reactions had made parents hesitant to get their daughters vaccinated. She thus acknowledged the association between media coverage of a particular topic and the decline in in HPV vaccination uptake, which had also been made in Peak #4. A follow-up story in *Politiken*, under the headline "I still think the vaccine does more good than harm," interviewed four young women in high school who all had their vaccination before 2013 when the first reports about suspected adverse reactions came out (March 17, 2017). They were all glad that they had the vaccine, and they all thought the debate about suspected adverse reactions following HPV vaccination had been "hysterical." As one of the young women said: "Of course, the media focus on the girls who suffer from adverse reactions rather than the many who do not. You need to take it with a grain of salt. It is not the full picture."

Some journalists and commentators criticized the TV 2 documentary for unbalanced or even biased journalism, which helped feed public skepticism over HPV vaccination. The critics argued that the documentary had taken the perspective of the "HPV girls" for granted, creating an artificial boundary between the girls on the one hand and the health authorities and vaccination experts on the other (Mohr and Frederiksen, 2020). The critics

deconstructed the central message of the documentary, suggested by its subtitle "Sick and abandoned [or, Sick and betrayed]," as an unfair representation of the health authorities as the main culprits. Under the headline "TV2 program about HPV vaccine is outright sickening," journalist Anne Lea Landsted in *Politiken* wrote that the documentary allowed "feelings to push facts aside" (May 25, 2017).

The main topic "Advocacy for HPV vaccination," which was the second most prominent topic in Peak #5, included articles about the "Stop HPV, Stop Cervical Cancer" campaign, launched by the Danish Health Authority, the Danish Cancer Society, and the Danish Medical Association, in May 2017. *Politiken*, in an article headlined "Feelings must sell HPV vaccine," reported that the campaign took inspiration from "the anti-vaccine folks" (May 10, 2017). Appeal to emotion was the campaign's keyword: "More stomach, less brain." The campaign therefore featured stories about women who were suffering from cervical cancer. It told parents that they would risk losing potential grandchildren if they declined HPV vaccination for their daughters. *Berlingske*'s headline about the campaign read: "Campaign must restore trust in HPV vaccine" (May 11, 2017).

4.6. HPV vaccination for males (Peak #6, Q1–Q2 2018, $n = 92$)

In five out of six peaks, newspapers covered the main topic "HPV vaccination for males," but the topic only became the most prominent in Peak #6, (see Figure 2). The reason for the topic's prominence was that, as of February 2018, the Danish Health Authority launched a pilot HPV vaccination program for homosexual boys and young men. The program soon became very popular. Articles covering this topic addressed issues such as gender equality and sexuality. In their headline, *Politiken* quoted Thomas Søbirk Petersen, professor in ethics at Roskilde University and head of the Danish Council on Ethics: "We should offer HPV vaccine to all boys" (January 24, 2018). Petersen emphasized that the Danish welfare system was founded on equal access to healthcare. At the age of 12 years, Petersen argued, it is difficult for boys to know if they are homo- or heterosexual. Fundamentally, he concluded, it is wrong to say that you are only entitled to this preventive treatment against cancer if you are a woman or a homosexual boy.

The second most prominent topic in Peak #6 was "HPV vaccination uptake." In January 2018, many newspapers reported on an increased number of HPV vaccinations performed in 2017 compared to 2016. Under the headline "Large increase in the number of girls who receive HPV vaccine," *Berlingske* quoted chief physician of the State Serum Institute, Palle Valentiner-Branth, for saying that the critical TV 2 documentary had caused HPV vaccination uptake to plummet (January 25, 2018). Now, due to the "Stop HPV" information campaign, "parents are again focused on the main purpose of the vaccination, namely cervical cancer prevention in their daughters," Valentiner-Branth said. His conclusion found support in a *Politiken* article published a few weeks later under the headline: "Media coverage of HPV vaccine will cost lives" (February 11, 2018). In the article, professor of economics at the University of North Carolina, Peter Reinhard Hansen, said that an estimated 13,500 girls opted out of the HPV vaccination program because of the uncertainty and hesitancy produced by the documentary. According to Hansen's calculations, this would mean that almost 100 girls in the 2003 cohort will get cervical cancer and ∼25 girls will die from it. Hansen's claim was later countered by three professors in medicine from the University of Copenhagen, Aarhus University, and Roskilde University. In an article in Information under the headline "Doctors shoot down professor's calculations: You cannot say that the media coverage of HPV caused 93 cancer cases," they all agreed that it was impossible to associate the decline in HPV vaccination uptake directly to the TV 2 documentary.

Our main topics "Adverse reactions and risks" and "HPV vaccination debate," which had dominated media coverage in the previous peaks, still were prominent in Peak #6. The decline in reported suspected adverse reactions made the headlines in *Berlingske*: "Fear of adverse reactions has declined" (February 1, 2018). The article quoted numbers from Danish Regions, an interest organization for the five Danish regions in charge of healthcare systems and hospitals, saying that a total of 2,000 girls had been referred to the HPV centers. Their symptoms were "heterogenous." Soon after, *Ekstra Bladet* published an article with headline: "HPV adverse reactions are called social epidemic" (February 6, 2018). The article quoted professor of public health at Aarhus University Frede Olesen for saying that the many reported adverse reactions in 2015 was a social epidemic, which was ignited by the media.

In this peak, the public debate about HPV vaccination revolved around the role of the media as a contributory factor in causing adverse reactions. In an article in *B.T.* under the headline "Remorse: TV 2 employee tried to stop HPV documentary," Jakob Schrøder, a former employee at TV 2 made the following claim (February 9, 2018): "TV 2 knew that the program went against available research. But there was an HPV agenda." Editorial manager of TV 2, Troels Jørgensen, countered Schrøder's accusation: "He was not involved in the research or the journalistic process, and the critique is on his own account. We still vouch for the program and the facts that we presented about sick young women who at the time received little help." In an editorial with the headline "Vaccine critique must be honest," *Information* suggested that the documentary focused too much on the "HPV girls" and failed to make it clear that there was no scientific consensus about their reported symptoms (February 13, 2018).

The "Stop HPV, Stop Cervical Cancer" campaign continued to receive media coverage in this peak period, which is reflected in the main "Advocacy for HPV vaccination." In March 2018, the three organizations behind the campaign conducted a public opinion survey showing that 80% of the respondents were confident about the safety of the HPV vaccine, compared to just 50% in 2016. The survey was reported in *Berlingske* under the headline: "More vaccinations against HPV and trust has been restored" (March 17, 2018).

5. Discussion

We have found that media coverage of HPV vaccination in Denmark, in terms of intensity and main topics, varied greatly. Based on our initial quantitative survey of articles in six national

newspapers ($N = 1,437$), we identified six media-coverage peaks from 2008 to 2018. Our qualitative content analysis of articles included in those peaks ($N = 865$) gave us ten main topics. We show that media coverage dealt mainly with "Budget discussions" (Peak #1), "Expanded HPV program" (Peak #2), "Adverse reactions and risks" (Peaks #3 and #4), "HPV vaccination debate" (Peak #5), and "HPV vaccination for males" (Peak #6). Using our contextual approach to the interpretation of main topics, we saw that media coverage of adverse reactions and risks associated with HPV vaccination was in fact diverse. It included reporting of suspected adverse reactions by the "HPV girls," but also experts disagreeing about scientific evidence in support of suspected adverse reactions, and criticism of how the healthcare system deals with patients suffering from POTS and CRPS. In Peak #4 (Q2, 2016), media coverage of the debate around HPV vaccination became nearly as prominent as media coverage of adverse reactions and risks, and the topic "HPV vaccination uptake," which included concerns about the decline of HPV vaccination rates, rose in relative importance.

Our research supports the findings of previous studies of HPV media coverage in Denmark, which showed that suspected adverse reactions was the most important topic in 2015 (Suppli et al., 2018; Hansen et al., 2020; Hansen and Schmidtblaicher, 2021). Our results further indicate that media coverage throughout the whole period included more than one main topic. There was parallel media coverage of HPV vaccination uptake, HPV vaccination effectiveness, the expert debate around HPV vaccination, and HPV vaccination for males. The heterogeneity of main topics suggests the complexity of different roles or tasks performed by the media. As journalists and editors balance different expectations in relation to a news story, they will differ in terms of what topic or angle they opt for. The media must provide accurate and reliable information about vaccines but also serve as watchdogs holding those in power accountable and giving underrepresented, less privileged social groups a voice in the debate. Moreover, the media must attract the attention of their readers to get their messages across and sell news. The media typically handle the complexity of straddling different role expectations by referring to well-established practices and norms such as criteria of newsworthiness, which includes all the elements mentioned.

Moreover, we have found that some of the media's main topics tend to interfere. For example, news stories about experts discussing suspected adverse reactions sometimes referred to conflicts of interests to indicate that even experts may be biased. Another example is the interference between stories where reporters or interviewees talked about weighing risks and benefits of HPV vaccination. Here, issues relating to the effectiveness of HPV vaccine were introduced in relation the question of whether suspected adverse reactions were real (real in the sense that they were casually associated with vaccination). Our final example pertains to the discussions about HPV vaccination uptake. In 2016, 2017, and 2018, this topic became relevant to media coverage of suspected adverse reactions, advocacy for HPV vaccination, and the debate about HPV vaccination. The reported decline in HPV vaccination uptake, for reporters and stakeholders, turned into an important issue that affected the way in which the media covered the other topics.

We have also found that the Danish HPV-vaccination media coverage was neither positive nor negative. Previous studies have categorized all media coverage of adverse reactions as negative (Suppli et al., 2018; Hansen et al., 2020; Hansen and Schmidtblaicher, 2021). Considering the context provided by the media, we found that news articles categorized under our main topic "Adverse reactions and risks" were in fact rather diverse. Even in 2015, the critical year where TV 2 broadcast their controversial documentary, newspapers covered adverse reactions in different ways. Some news articles did report uncritically on individual stories about suspected adverse reactions, but others included critical and extensive discussions among experts about the causality implied by the documentary. We believe that it was quite clear from the media coverage that nearly all researchers and health professionals from the beginning expressed disbelief in a causal link between HPV vaccination and reported adverse reactions. Even the two main expert protagonists from the TV 2 documentary expressed uncertainty about suspected adverse reactions in newspaper interviews. Other articles about suspected adverse reactions focused on the new HPV centers and the challenges in the healthcare system faced by girls and young women suffering from complex disorders such as POTS and CRPS. We therefore caution against understanding media coverage of suspected adverse reactions simply as a polarized negative-positive debate.

In our study, we aimed to probe Danish news media coverage for messages beyond simple dichotomies such as misleading vs. informative, or negative vs. positive. Our material and method have strengths and limitations. We have collected and cleaned a large sample of news articles from a large subset of daily national newspapers in Denmark. The news articles have all been extracted from a digital media archive using simple search terms. Our search relies on automated search functions to assist data cleaning that aims to avoid duplicates. This ensures that the intensity of HPV vaccination coverage reported in Figure 1 is reliable. Figure 1 allowed us to build the subsample of 865 articles in six different periods of peak media coverage. Our coding process included a systematic approach to handling different interpretations, but we were unable to perform intercoder reliability tests for data cleaning and coding of main topics. In addition, the simple search string was not validated. Although limitations such as these indicate that still more could—and should—be learned about media coverage of HPV vaccination in Denmark during the critical period from 2008 to 2018, we believe that we can draw significant conclusions from our study and provide a few suggestions for further research into the role of the media in vaccination communication.

Covering vaccination debates and campaigns, the media certainly can be misleading. They may provide misinformation, and their tendency to sensationalize news may lead to false perceptions about scientific controversy over vaccination and conflicts between patients and the healthcare system. Consequently, researchers and others need to pay close attention to media coverage of vaccination to understand the complexities and contexts involved. Our study of Danish media coverage of HPV vaccination suggests that the media responded in many ways. Newspapers reported on girls and their families who felt that they were unable to get proper response from the healthcare system regarding their symptoms

and syndromes. They also covered hesitant parents, experts discussing scientific uncertainty about suspected adverse reactions and vaccine effectiveness, experts worried about misinformation and misleading anti-vaccination campaigns, health authorities concerned about vaccination uptake, journalists reflecting on their own role, and more. The media coverage was neither negative nor misleading. It was as complex and controversial as the issue of HPV vaccination itself.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

MES, TEA, and KHN contributed to conception and design of the study. KHN acquired the funding and wrote the first draft of the manuscript. MES collected the data. All authors contributed to data analysis. All authors read and approved the submitted manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2023.1032460/full#supplementary-material

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