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Public perceptions and online news media representations of vaccines in Lithuania

DOCTORAL DISSERTATION

Social sciences,
Communication and information (S 008)

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INTRODUCTION

Relevance

It is estimated that every year vaccines prevent millions of deaths worldwide and over the past decades immunization has been indispensable in the global fight against numerous afflicting diseases, such as polio and smallpox (Orenstein and Ahmed, 2017). Despite their efficacy, however, increasing numbers of parents refuse to vaccinate their children or decide to delay one or more of the recommended vaccines in the childhood immunization schedule (Larson et al., 2014). The term for this is vaccine hesitancy - a social phenomenon, which in the recent decades, has manifested across many countries and regions around the world (Lane et al. 2018). Vaccine hesitancy has also been observed in Lithuania, with evidence of decreased children's vaccination rates over a ten year period prior to 2018 (Sebeliauskaite and Caplinskas, 2018).

Decreasing numbers of vaccinated children can compromise herd immunity, which creates the conditions for the resurgence of vaccine preventable infectious diseases and potentially large outbreaks that occur wherever immunization coverage in groups drops below the necessary thresholds (Mallory et al., 2018). This is particularly evident with diseases like measles, which is known to be one of the most contagious viruses on Earth. Contrary to popular beliefs, measles is a life-threatening disease that prior to mass vaccination was one of the leading causes of death in young children. Accordingly, the World Health Organization (WHO) identified vaccine hesitancy as one of the most worrying trends and biggest “threats” to public health in the 21st century (WHO, 2019). As a result, much scholarly work has focused on understanding vaccine hesitancy causes and most importantly, identifying practical solutions for improving public acceptance of vaccines.

There is relatively little research analyzing vaccine hesitancy causes in Lithuania, however, Kupreviciene and Zagminas (2014) showed that consistent with the *theory of planned behavior* (Ajzen, 2011), among Lithuanians, attitude toward vaccination was one of the strongest predictors of vaccination behavioral intent. Therefore, tracking public attitudes to vaccines and more importantly – understanding how these attitudes develop, becomes an important pathway to understanding vaccine hesitancy in Lithuania.

Much can be learned about the formation of vaccine-related attitudes from interdisciplinary synthesis of insights in public health, communication

research, as well as fields analyzing public reactions to controversial science and emerging technologies. For example, leading communication scholars have argued that public attitudes toward scientific issues emerge from varying interactions of *values*, *deference to scientific authority*, *knowledge* and *mass media messages* and have conducted numerous research studies demonstrating evidence for this modelling of attitude formation (for example, Scheufele et al., 2017; Ho et al., 2008; Brossard and Nisbet, 2007; Scheufele and Lewenstein, 2005; Nisbet et al., 2002; see also Scheufele, 2006). This dissertation focuses on mass media communication, as one of the potential factors that can influence public attitudes to vaccination.

It is a long-standing belief that media can play a key role in shaping public attitudes toward a broad range of issues (Lippmann, 1922; McCombs and Shaw, 1972; Iyengar, Peters and Kinder, 1982) including vaccination (Dube et al, 2013). Accordingly, media representation of issues, be they - social, political, economic or scientific - has long been a prevalent topic of research (Schäfer and Schlichting, 2014; Manganello and Blake, 2010; Riffe and Freitag, 1997).

Various theories have been used to explain the media influence process. For example, it is believed that media not only transmits information, but can also encourage behaviors (Bandura, 2008), construct meanings (Gamson and Modigliani, 1989) and cultivate (Gerbner, 1998) our perceptions and views. This is all the more relevant for issues in science, technology and health, for which media (and news media in particular), often serves as one of the primary sources of information (Schäfer, 2017; Schmidt, Ivanov and Schäfer, 2013). While there exist debates on whether media effects can be direct, it is argued that media messages can also provide individuals with interpretive suggestions that work indirectly to affect issue perceptions and decision-making processes (Scheufele, 2006; Nisbet et al., 2002; Popkin, 1991).

Journalists and the mass media more broadly, however, are often criticized for their portrayal of vaccines. In 2011, Lithuanian Vice-Minister of Health Audrius Klisonis released an address to Lithuanians, urging the public to trust scientifically-based arguments of medical experts about vaccines, instead of “discussions of media representatives” (Delfi, January 19, 2011). Indeed, immunization advocates around the world argue that mass media communication about vaccines has in fact been one of the consequential factors in cultivating public apprehension towards immunization, shaping anti-vaccine beliefs and public policy (Offit and Coffin, 2003; Lewis and Speers, 2003). This was the example in the UK, where mass media played a far-reaching role in building the controversy surrounding the mumps, measles

and rubella (MMR) vaccine, based on the now debunked vaccine-autism connection (Deer, 2011). All in all, media portrayal of vaccines becomes not only an important avenue for scholarly inquiry into understanding vaccine-related attitudes, but also an obvious public interest.

Previous research

The importance of the interplay between vaccination attitudes and mass media communication is illustrated by the considerable amount of attention in scholarly literature this topic has received. Owing to its role in health information dissemination, most of these studies focus specifically on representations of vaccines in the news, across both legacy and new media. Some of the earliest studies analyzing media communication about vaccines emerged in the 1970s, however, a dramatic shift in the rate of publishing on this topic occurred after 2000 and particularly in the past decade (see also Catalan-Matamoros and Peñafiel-Saiz, 2019). Even though the literature on media and vaccines originates from a variety of countries (United States, UK, Taiwan, Vietnam, Italy, Romania) and focuses on different types of vaccines (e.g. flu, human papilloma virus (HPV), hepatitis, mumps-measles-rubella (MMR) vaccine), several broad themes can be distinguished: research studies analyzing media influence on vaccine-related perceptions and behaviors, as well as research studies analyzing vaccine-related media content characteristics.

Research into the link between mass media and vaccination goes back at least a few decades (Leask and Chapman, 1998; McKinnon, 1978). At the most basic level of effects, researchers find that exposure to news media messages about vaccines, can influence public awareness of those vaccines, as well as vaccine-preventable diseases. For example, Gollust et al. (2013) found an association between awareness of the HPV vaccine, media use and media coverage volume. Kelly et al. (2009) reported similar results, finding an association between knowledge about HPV and the use of health information. Such findings reveal the educational capacity of the media and highlight its importance for informing individuals about health.

On the other hand, an overwhelming amount of research shows that mass media sometimes misinforms readers about vaccines and that exposure to negative media messages has the capacity to “dent” public trust in vaccination (Lewis and Speers, 2003; Bodemer et al., 2012). For example, a survey by Tran et al. (2018) revealed that exposure to media reports about adverse

effects of vaccination led to a significant decrease of vaccine acceptance, whereas an experimental study by Chang (2012) in Taiwan showed that alarming news about the flu vaccine led to increased fear and risk perceptions about H1N1 influenza (see also Mesch et al., 2013). Most recently, Margolis et al. (2019) showed that media was the most frequent source of stories about the harms of the HPV vaccine and this, according to the study results, was associated with delays in vaccination and lower vaccination intent.

In fact, several large-scale studies thus far have linked news media coverage of vaccines with variations in factual vaccine uptake. Begg (1998), for example, reported a drop in children's vaccination rates in the UK, following media reports of MMR vaccine-Crohn's disease connection, whereas Mason and Donnelly (2000) found that negative content on the MMR vaccine in a local newspaper was followed by a decrease of MMR vaccination uptake in the area. A study by Morimoto et al. (2015) found that a third of respondents who were exposed to negative media coverage of the HPV vaccine, decided to discontinue vaccination and Suppli et al. (2018) observed that negative media coverage of the HPV vaccine in Denmark was associated with a decline of HPV vaccination uptake (see also Hansen et al., 2019). On the contrary, in regions like sub-Saharan Africa, media use was found to be associated with increased uptake of vaccines (Jung et al., 2015) and exposure to media during disease outbreaks was shown to boost vaccination rates within certain communities and socio-economic groups in the Middle East (Sagy et al. 2018).

In 1985 Harding observed that media coverage of vaccination in the UK was primarily driven by vaccine-related events, but lacked key scientific information. This is a finding that consistently appears in vaccine-related media coverage research across multiple cultural contexts (see for example: Anhang, 2004; Calloway et al. 2006; Habel et al. 2009; Johnson et al., 2011; Robbins et al., 2012; Krieger et al., 2013). However, contrary to existing assumptions on news media reporting of vaccines (e.g. Offit and Coffin, 2003), Harding (1985) found little evidence of overly sensational content and a similar study in New Zealand showed that reporting on vaccines in the media was primarily neutral (Goodyear-Smith et al., 2007). This finding was also supported in Lehmann et al. (2013), who found that news media reports on the influenza vaccine were usually objective (see also Murdoch and Caulfield, 2018; Odone et al., 2018).

Several studies, however, have noted variances in the portrayal of different types of vaccines. For example, a large-scale study analyzing media coverage of vaccines in the United States and Canada reported differences in the

portrayal of HPV and flu vaccines (Powell et al., 2016). Compared to other vaccines in the UK, Harding (1985) found differences in media reporting on pertussis vaccination, which was more frequently focused on risks and vaccine-related problems (Harding, 1985). Abdelmutti and Hoffman-Goetz (2010) found that reporting on the HPV vaccine and cervical cancer in North America was laden with “fear-inducing messages”, relating both to the disease and to the vaccination, whereas Casciotti et al. (2014) found that almost two thirds of news stories on the HPV vaccine in the US featured allusions to conflict. Likewise, a study by Penta and Baban (2014) examining news media coverage of the HPV vaccine in Romania, which has some of the highest rates of cervical cancer in Europe, found that almost a third of news reports on the vaccine were negative in tone and only a fraction of reports supported vaccination.

Therefore, theory, as well as empirical research shows that media can play an important role in public perceptions of vaccines and vaccination behaviors. Some studies reveal a news media supportive of vaccines, others – portraying vaccines in negative light and amplifying vaccine-related risks. In general, variations in findings show media portrayal to be dependent on the specific vaccine, as well as temporal-contextual factors.

Research problem

In 2014, SAGE (Strategic Advisory Group of Experts) - the principal advisory group to the World Health Organization on vaccines and immunization, drew particular attention to the complex nature of vaccine hesitancy, emphasizing the need for countries to “identify local context factors” shaping negative public attitudes toward vaccines and “develop tailored strategies to address them” (SAGE, 2014). Understanding mass media influence on public acceptance of vaccines was among one of the recommended areas of research.

Researchers in Lithuania have not analyzed mass media coverage of vaccines in much detail and its relation to attitudes towards vaccination or vaccine hesitancy has not been explored. What is not yet clear, therefore, is how the mass media communicates about vaccines in Lithuania and more importantly, how media representations may influence public perceptions and acceptance of vaccines. Although the studies reported in this dissertation do not provide a direct assessment of media influence, this dissertation aims to contribute to the growing area of research on vaccine hesitancy by attempting to understand public perceptions of vaccines in Lithuania through the

perspective of foundational media effects theories. The **goal** of this dissertation, therefore, is to investigate the coverage and portrayal of children's vaccines in Lithuanian online news and to explore the potential influences on public perceptions about vaccination against the backdrop of media effects theories that have been applied extensively in the study of the mass media-public interface. The analysis will center on online news platforms, which along with other channels of information, share significant popularity in Lithuania. The **central research question** of this dissertation can be formulated as follows: in what ways does the news media potentially shape public perceptions of vaccines in Lithuania?

To answer this question, I first review scholarly literature, explaining factors influencing vaccine acceptance and highlighting the importance of attitudes and mass media in shaping vaccination choice. I then turn to literature on the role of the mass media in the reporting of science, technology and health, and overview the core media effects theories that can explain how media reporting of vaccines may shape vaccine-related attitudes and intentions. Drawing on this review of literature and previous research, I concurrently build the analytical model used for the empirical study of online news presented in this dissertation.

What follows the theoretical chapter are two empirical studies, conducted to answer the central research question of this dissertation. In the first empirical study, I present findings of a research study, which systemized existing data on public perceptions of vaccines in Lithuania and analyzed their development over time. I then present findings of a content analysis of Lithuanian online news about vaccination and interpret the results with the background of survey findings measuring public perceptions of vaccines in Lithuania.

The **objectives** of this dissertation:

- 1) Using theories in public health and communication, to explain the role of the mass media in shaping public perceptions of science and health.
- 2) To examine public perceptions of vaccines in Lithuania.
- 3) To analyze media attention and media representations of vaccination in Lithuanian online news.
- 4) To analyze the relation between media coverage of vaccines and public perceptions of vaccines in Lithuania.

Thesis statements:

- 1) Lithuanians have high-risk perceptions of vaccines, but attitudes are unsettled and prone to temporal fluctuations.
- 2) Media interest in children's vaccines has been low to marginal: online news media ignores some vaccines, despite occurrence of cases, outbreaks and fatalities.
- 3) The majority of online news media content on children's vaccines is positive and driven by expert views.
- 4) Discussions about children's vaccines in Lithuanian online news media do not reflect the concerns of Lithuanians about vaccination; media influence on Lithuanians' perceptions of vaccine may stem not from negative discourse on vaccines, but from the absence of relevant conversations.

Methods

I use a mixed methodology to answer the research question of this dissertation. First, I conduct a systematic literature review to analyze and integrate surveys conducted over the past decades in order to provide a summative view of public perceptions and beliefs about vaccines in Lithuania. Systematic reviews are types of literature reviews that apply structured, pre-designed methods to the collection and analysis of secondary research data. Results of the systematic review are analyzed using descriptive statistical and interpretive methods. I then carry out a mixed methods content analysis, to analyze online news media portrayal of vaccination in Lithuania. Content analysis is a popular method in communication research used for the examination of texts. Results of the content analysis are examined using descriptive statistical methods. Finally, descriptive and interpretive methods are used to explore the relationship between public perceptions towards vaccines and online news media portrayal of vaccination in the Lithuanian context. Narrative literature review is used to build the theoretical and empirical rationale of this thesis.

Scientific and practical contribution

There are several ways in which the empirical studies presented in this dissertation attempt to extend the existing body of research on public perceptions of vaccines and the vaccine – media interplay in Lithuania. A

2014 review of literature on attitudes to vaccination in Europe noted “a paucity of papers from Eastern Europe”, attributed to the potential exclusion of non-English research (Yaqub et al., 2014). While several national and international studies have analyzed vaccine-related perceptions in Lithuania, no studies to date examined how these perceptions have developed over time. Are Lithuanians’ attitudes towards vaccines improving or getting worse? And do Lithuanians’ attitudes towards vaccines shift after outbreaks of vaccine preventable diseases? The first empirical study presented in this dissertation addresses the latter questions.

The second empirical study presented in this dissertation attempts to provide insights into public perceptions of vaccines using a theoretical media and communication studies framework. Media representations of vaccines have not received much attention among Lithuanian scholars. Instead of a single-case study, this work attempts to appraise the total volume of online news coverage on vaccines during a 10-year period and within this setting, explore the variances in media attention towards specific vaccines. To the best of the author’s knowledge, there exist only a handful of studies, which have conducted such large-scale analyses, including (but not limited to) Italy (Odone et al. 2018), Canada (2016), New Zealand (Goodyear-Smith et al. 2007), Australia (Leask and Chapman, 1998) and the UK (Harding, 1985). Based on a study by Catalan-Matamoros and Peñafiel-Saiz (2019), a view of vaccine-related media communication in the northeastern European region is generally missing.

In addition, Lithuania as a case study in the understanding of vaccine hesitancy is interesting in at least a few respects. On the one hand, it allows observing the dynamics of public attitudes to vaccines in a context with moderate trust in expert authority and, secondly, it analyzes media representations of vaccination in an emerging science, health and technology communication environment (Valinciute, 2020). A global survey measuring trust in public institutions showed that 33% of Lithuanians have high trust in scientists, exceeding averages in Western European, Southern European and Eastern European countries, however, Lithuanians’ trust in doctors and nurses is considerably low, measuring at 38% compared to 65 % in Northern, 45% in Southern and 68% in Western Europe (Wellcome Global Monitor, 2019). Although trust may be shaped by socio-political, economic, cultural and even temporal factors, it may also be related to the generally poor infrastructure of the expert-lay public interface in Lithuania.

A 2012 report by the European Commission identified Lithuania as having a “fragile” science communication culture (Mejlgaard et al., 2012): Lithuania

scored low on national science communication infrastructure, marked by poor institutional infrastructure, range of actors involved and a “low interest in communication form both the academic community and the general public”. Indeed, the institutional infrastructure and support for science communication in Lithuania is relatively modest. Since 2011, Lithuanian Academy of Sciences implements a project partly subsidized by the European Social Fund, aimed at creating the national science popularization system. The impact and effectiveness of the system, and the continuity of specific projects without EU funding, however, is to be determined. Professional science journalism in Lithuania likewise takes up a small niche, which may perhaps relate to the absence of science journalism/science communication and health communication programs at Lithuanian universities. There are very few science, technology or health oriented online news websites and few printed popular science publications, most of which are translated international magazines, such as National Geographic. Production of Lithuanian science, technology and health-related TV programing is similarly limited (Valinciute, 2020). Research at the intersection of science and society in Lithuania is also fragmented and there exists considerable room for growth, especially in terms of research scale and topics. Despite media serving as one of the primary sources of information on science and its role in shaping science-related public views, Lithuanian scholars are far less active in media content research (Valinciute, 2018). While media content analyses are a frequent topic of science communication research in the international context (Schäfer, 2012; Weitkamp, 2016), such studies in Lithuania are not as common, signaling a need for more scientific contributions.

This study, therefore, will contribute to understanding whether moderate trust in expert authority as well as emergent science communication environments reflect in public perceptions of vaccines and public discourse on vaccination in Lithuanian media. Concurrently it will contribute to building a more robust understanding of the expert-society interface in Lithuania and add to the foundation of science, technology and health communication studies in the national context.

Overview of dissertation

This dissertation is presented in five chapters, followed by a summative conclusion. I begin Chapter 1 of this dissertation by overviewing scholarly work analyzing the global phenomenon of vaccine hesitancy. First, I describe the emergence of the modern anti-vaccination movement and discuss its

manifestations in Lithuania. Then, drawing on research from public health and communication studies, I analyze the role of the media in shaping public reactions to science, technology, health (and vaccination) and discuss the core media effects concepts that have been used to explain and analyze its potential mechanisms of influence. In Chapter 2, I outline the methodological framework designed for carrying out the empirical research studies presented in this dissertation. First, I briefly overview the methodology of the literature review that was conducted to assess the development of vaccine-related perceptions in Lithuania. Then, I present a detailed description of the content analysis that was used to examine online news media reporting on vaccines. Chapter 3 presents findings of the first empirical study – a literature review of public perceptions of vaccines in Lithuania, which is followed by a discussion section on the findings. Chapter 4 reports findings of the content analysis, examining vaccines in Lithuanian online news and comments these findings in the discussion section. Lastly, Chapter 5 combines theoretical insights and empirical findings, presented in this dissertation, towards understanding the ways in which the online news media may shape public perceptions of vaccines in Lithuania. Implications for further research and recommendations are discussed.

1. THEORETICAL BACKGROUND: PUBLIC ATTITUDES AND MEDIA AS FACTORS SHAPING VACCINE ACCEPTANCE

This chapter builds the rationale for analyzing mass media communication for understanding vaccine hesitancy and public attitudes to vaccines more broadly. First, it presents a brief history of the anti-vaccination movement and its development in Lithuania. It then outlines three models based on literature in public health, which explain vaccination decision factors and accentuate the role of individual psychosocial (i.e. attitudes) and contextual (i.e. communication environments) factors in shaping vaccine acceptance. The next section discusses the interplay between mass media and public attitudes, showing that in the context of science and health, mass media plays a contradictory role. On the one hand, mass media can be used as an effective information platform, on the other hand, mass media portrayal of science and health sometimes builds and escalates public conflict. This is followed by a section explaining the possible pathways for mass media effects.

1.1 Anti-vaccination movement

Public controversy over vaccination precedes its invention: ever since its earliest prototypes, vaccination faced fierce public backlash. Diseases, such as smallpox, were widely believed to be God's punishment for sins, and so inoculation itself, the predecessor of vaccination, was seen as dangerous and sinful (Hussain et al. 2018; Bazin, 2001). Until the invention of an effective vaccine, smallpox killed approximately 400,000 Europeans annually and it is widely considered to be a disease that significantly shaped the human history (Snowden, 2019; Riedel, 2005). Despite centuries of terror and effects of smallpox on society, when Edward Jenner invented the smallpox vaccine, his discovery was met with bitter public opposition. The British government was eager to begin routine vaccination and the Parliament introduced an official act, which ordered mandatory vaccination for infants and foresaw penalties for parents who did not vaccinate their kids. This led to the formation of social groups, which demanded a repeal of mandatory vaccination and the fierce resistance against vaccines is exemplified with events like the Leicester demonstration in 1885, where almost 100,000 protesters marched against compulsory vaccination (Hobson-West, 2007).

Although the recent wave of anti-vaccine sentiments is commonly linked to Andrew Wakefield and the MMR-autism debate, it emerged in the 1970s, when a hospital report in England linked the diphtheria, tetanus and pertussis vaccine (DTP) to neurological development disorders in children (Hussain et al., 2018). The report was widely publicized by the media and was followed by a sharp drop in the DTP vaccination rates and resulting deaths from two major pertussis outbreaks (Fenichel, 1983; Hinman, 1984). Among one of the most persisting myths surrounding vaccination, however, is the connection between the MMR vaccine and the autism spectrum disorder. This false association between vaccination and autism gained global traction in 1998, when a British physician Andrew Wakefield, published an article in the *Lancet*, reporting findings from a small-scale study, suggesting that the live virus contained in the MMR vaccine disrupts children's neurological development (Deer, 2011; Godlee et al., 2011). To date several dozen studies across multiple countries analyzed the claim and have found no such connection. For example, a recent meta-analysis of case-control and cohort studies involving more than 1.2 million children concluded that neither vaccines, nor their components were associated with the development of autism (Taylor et al., 2014). Similarly, a study assessing the health outcomes related to vaccination conducted by the National Academies of Science, Engineering and Medicine in the United States found “no evidence for major safety concerns associated with adherence to the childhood immunization schedule” (National Institutes of Medicine, 2013). Nevertheless, despite concrete scientific evidence confirming vaccine safety, myths surrounding vaccines persist and continue to impede the elimination of preventable infectious diseases.

Indeed, as the MMR-autism myth spread and anti-vaccine sentiments gained momentum, most Western countries began to record declining rates of children's vaccination and increasing incidents of vaccine preventable diseases. Due to mass vaccination in the United States, in 2000 measles was declared eradicated, but as vaccination uptake declined, the disease began reappearing. In 2019, US experienced the largest outbreak of measles in almost two decades, with 1077 reported cases (CDC, 2019). In Europe, more than 82 000 people contracted measles in 2018, 72 of whom died. According to the World Health Organization, the number of measles cases in 2018 increased by 15 times compared to previous year cases (WHO, 2019).

Anti-vaccine movement in Lithuania

There is evidence to suggest that vaccine skepticism in Lithuania dates back to the past century, however, as in other countries around the world, the modern wave of anti-vaccine sentiments emerged in the past decades (Rudzinskaite, 2018). According to the Vaccine Confidence Project (2018) measuring trust in vaccines across the European region, along with countries like Bulgaria, Romania, Slovakia, Finland, the Netherlands and Greece, Lithuania is among one of the 12 European countries where coverage rates of the measles vaccine were steadily decreasing.

Amid the growing reluctance of parents to vaccinate their children and the increasing cases of diseases like measles both locally and abroad, in 2014 Minister of Health Vytenis Andriukaitis, signed a bill preventing unvaccinated kids from attending school, leading to massive protests and petitions from vaccine rejecting parents. In 2015, a group of anti-vaccine activists established a non-profit association “Objektyviai apie skiepus”, which began an aggressive campaign for legislative mandatory vaccine reform. That same year the association in cooperation with similar profile organizations sent an appeal to the Lithuanian Parliament contesting the implementation of the bill, which in 2016 with the help of four parliamentarians reached the Supreme Administrative Court in Lithuania. In 2016 the Supreme Court ruled the billed unconstitutional, retracting the compulsory vaccination mandate and enabling the continued spread and consequences of the anti-vaccine movement in Lithuania.

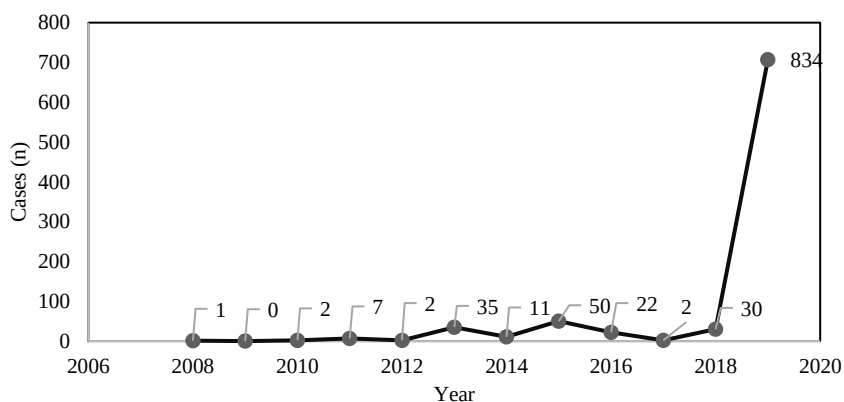


Figure 1. Number of measles cases in Lithuania 2009-2019 (n) (ULAC_{1,3})

Perhaps the most obvious consequence was the outbreaks of infectious diseases (see Figure 1). According to data from the Center for Infectious Diseases and AIDS (lith. *Užkrečiamų ligų ir AIDS centras* (ULAC)¹, 2019) Lithuania faced a big measles outbreak in 2013 with 35 diagnosed cases. All of those infected with measles received only one dose of the MMR vaccine or were completely unvaccinated. The second measles outbreak took place in 2015, coinciding with rising measles epidemics in Europe and the prominent Disneyland measles outbreak in the United States. A consecutive measles outbreak started at the end of 2018 in Visaginas, a small rural Lithuanian town, where 30 people were infected with the measles virus. In 2019, Lithuania experienced the single largest outbreak of measles in the past decades with almost 800 cases of measles diagnosed as of August 2019 (ULAC³). In fact, according to the European Center for Disease Control and Prevention (ECDC), among the European countries battling measles in 2019, Lithuania had the largest number of measles cases per 1 million population (e.g. EU average for July= 25.3, Lithuania average = 271.3) (ECDC, 2019). The recent increase and severity of outbreaks, makes the case of Lithuania highly important in the European context and heightens the urgent need of extensive research for understanding and battling public rejection of vaccination (Valinciute and Schäfer, in press).

1.2 Vaccination behavior models: explaining public hesitancy toward vaccines

The causes of vaccine hesitancy have been the subject of intense transnational debates among policy makers, medical specialists, scientists and the wider community. Various models have been used to understand health-related behavior (Health Belief Model (Rosenstock, 1974), Theory of Planned Behavior (Ajzen, 1991) and several attempts have been made at creating models specifically explaining public hesitancy towards vaccines. Authors of these models argue that vaccine hesitancy is shaped by multiple context-sensitive factors and thus necessitates a broader modelling approach.

A considerable amount of literature has been published on factors predicting public acceptance of vaccines (Antai, 2009; Brown et al., 2011, Tefera et al., 2018). This section overviews 3 comprehensive models –which are built on expert opinions, surveys and/or synthesis of existing empirical

research. Methodological rigor and thorough scope were the primary determinants of their selection:

The first model (Dubé et al., 2013) emerged from a study on the „cultural and religious roots of vaccine hesitancy” in Canada. Alongside logistical factors such as the availability of vaccines, the working group identified four categories of psychosocial factors, which may shape public responses to vaccination: (1) *public health and vaccine policies*, (2) *communication and media environment*, (3) *health professionals’ recommendations*, and (4) *individual level decision-making factors*, such as *knowledge and information about vaccines*, *perceived importance of vaccination*, *risk perception*, as well as *religious and moral principles*. Furthermore, the authors argue that all factors interplay with *trust*, which has shown to be an important component of the vaccination decision-making process.

The 5A’s taxonomy (Thomson et al., 2016) was developed through a literature review of research studies on children’s vaccination predictors. The authors of the 5 A’s taxonomy identified five groups of factors that could promote or hinder vaccination: (1) *access factors*, (2) *affordability factors*, (3) *awareness factors*, (4) *acceptance factors* and factors referred to as (5) “*activation*”. *Access factors* are practical and include elements, such as *convenience of access*. *Affordability factors* relate to vaccination costs, as well as costs related to circumstances such as, lack of time to vaccinate a child. *Awareness factors* include levels of *knowledge* about vaccines and related issues, whereas *acceptance factors* are grouped into four categories – *acceptance related to the vaccine* (e.g. safety concerns, vaccine efficacy), *acceptance related to the disease* (e.g. disease perception), *individual-level acceptance* (e.g. individual health beliefs and trust) and *acceptance related to the social context* (social norm perception). Finally, *activation factors* are interventions to promote vaccination.

The SAGE Working Group Vaccine Hesitancy Model (2014) used empirical studies, expert insights and a comprehensive review of existing empirical research (see Larson et al. 2014) to identify factors shaping public hesitancy towards vaccination. Factors were grouped into three broad categories: (1) *contextual*, (2) *individual and group* and (3) *vaccine/vaccination-specific*. *Contextual factors* were understood as socio-political, cultural and economic factors, such as the communication and media environment or religious beliefs that may influence vaccine uptake. *Individual and group-level factor* category included influences, such as attitudes, beliefs and vaccine/disease risk perceptions, as well as personal experience with vaccination. *Vaccine/vaccination-specific* factors can concern the vaccine or the vaccination process, for example, mode of delivery and cost.

Because these models are primarily based on data obtained in Northern America, the generalizability of these models may be subject to certain limitations. Although an appraisal of these vaccine hesitancy models lies beyond the scope of this dissertation, three broad themes can be observed. Across the different types of vaccines and observed populations, vaccination choice appears to be influenced first by logistical and then by contextual and individual level factors (see Figure 2).

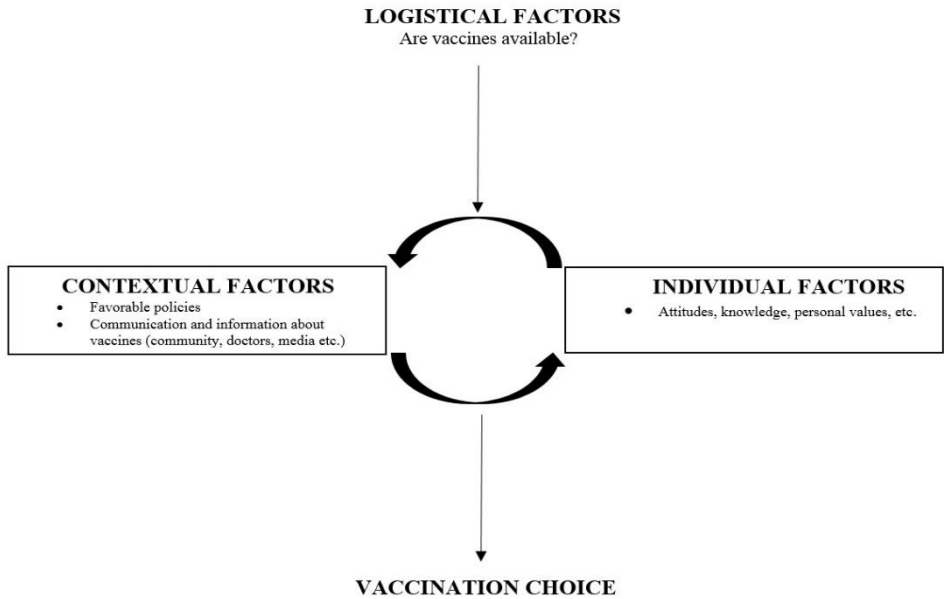


Figure 2. Factors influencing vaccine choice

The logistical-level is what the SAGE (2014) working group refers to as *vaccine convenience* and what in the 5A's taxonomy (Thomson et al., 2016) is denoted by *access* and *affordability*. The Canadian model (Dubé et al., 2013) goes further and perceives availability of vaccines as an antecedent condition for vaccination. Contextual-level influences can be understood broadly as the communication and information environments, social interactions and policies (e.g. media content, public health interventions and anti-vaccination messaging) that may shape public acceptance of vaccines.

Lastly, individual-level influences are factors such as personal predispositions, awareness, knowledge, attitudes, beliefs and overall perceptions of vaccination, which have shown to be consistent predictors of public behaviors towards vaccines, including in the Lithuanian context (Kupreviciene and Zagminas, 2014).

Therefore, although the precise mechanism of public acceptance and/or hesitancy towards vaccines remains to be explained, it appears that given the availability of vaccines, vaccine acceptance is broadly conditioned upon the intersected loop of what people think and what they are told about vaccination. Among other potential trajectories of research, this places special focus on the importance of understanding media representations of vaccines for understanding the emergence of vaccine hesitancy. The next sections of this chapter discuss the broader role of the mass media in public perceptions of health, science and technology and analyze in greater detail media effects theories that may help to better clarify the ways in which the mass media shapes public responses to complex issues such as vaccination.

1.3 The role of the media in shaping public perceptions of science, technology, health and vaccination

Numerous empirical studies have demonstrated that mass media, in its variety of forms, acts as one of the interacting factors in shaping public perceptions and behaviors related to issues in science (Carmichael and Brulle, 2016; Hart, Nisbet and Myers, 2015; Ho, Brossard and Scheufele, 2008), technology (Scheufele and Lewenstein, 2005), health (Boles et al., 2014; Redmond et al., 2010) and vaccination (Suppli et al, 2018). Accordingly, a large and growing body of literature has emerged analyzing media coverage of these topics (Boykoff et al., 2019; Painter et al. 2018; Barkermeyer et al., 2017; Cacciatore et al., 2012; Dudo et al. 2011; Dudo, Choi and Scheufele, 2011; Weaver et al., 2009; Nelson et al., 2015; Boykoff and Mansfield, 2008; Eyck and Williment, 2003; Gaskell et al., 1999) and such studies have also been the subject of meta-analyses and systematic reviews (for example, see Schäfer (2012) for a meta-analysis of media coverage of science; Schäfer and Schlichting (2014) meta-analysis of media coverage of climate change). As outlined in the introductory chapter to this dissertation, media coverage and portrayal of vaccines has likewise received a considerable amount of attention in scholarly literature (Catalan-Matamoros and Peñafiel-Saiz, 2019).

(News) Media as a source of information

Mass media is saturated with discourse related to science, technology and health, which are not only frequent topics of news, but also entertainment content. It can also be argued that mass media, including Internet, television, radio and print, is one of the most convenient avenues to become aware and receive information about health, technology and science. Indeed, studies have shown that in comparison to other sources, around half of Europeans and Americans keep up with science via mass media channels like television and print news (PEW, 2017; European Commission, 2007), with print news also being a frequent source for health-related content (Dutta, 2009). A 2013 Eurobarometer poll showed that Lithuanians rely on television, newspapers and websites for science news more than the EU average (European Commission, 2013).

In the recent decades, however, the Internet has revolutionized the way people receive and access information across Western industrialized nations (PEW, 2017; National Science Foundation, 2016; Brossard, 2013). The rise and impact of social media in particular has received considerable critical attention. For example, there is evidence to suggest that social media is rapidly becoming an important source for generalized news, as well as news on specialized topics (PEW, 2018; PEW 2017). However, even as online environments have significantly broadened and diversified the supply of information channels (blogs, video platforms, and social media), news media outlets have been successful at adapting to digital platforms and continue to dominate as sources of information in audience preferences (Reuters, 2017). In the United States, for instance, online news websites surpass print newspapers, social media and radio as sources for news (PEW, 2018) and a 2017 report on media literacy revealed that Lithuanians likewise consider online news websites as the most important online information platform (Lithuanian Ministry of Culture/Sprinter, 2017).

From a conceptual point of view, mass media can also be considered as one of the primary platforms for the notional intersection of science, experts and society. First, by making issues public and second, by facilitating literal and figurative conversations between otherwise disconnected actors, mass media represents the quintessential *public sphere*, where citizens not only become informed, but also debate scientific, technological and health-related topics (Varughese, 2017; Gerhards and Schäfer, 2009; Habermas et al., 1974). As a result, scientists are increasingly encouraged to engage with the media for transferring knowledge, popularizing science, publicizing their work

(Peters, 2013; Bodmer, 1985) and more recently for enabling public participation in science-policy decision-making (Leshner, 2003). According to Durodie (2013), however, public deliberation of science is precisely what can make conveying expert issues like vaccines problematic, once again highlighting the necessity to consider mass media content on science, technology and health from a critical viewpoint.

Media and “bounded rationality”

Researchers in science communication have drawn attention to theories in social psychology and cognition for explaining the importance of media communication, as well as why it may influence the formation of opinion and decision-making processes related to science (e.g. Scheufele, 2006). For example, unlike previously dominant theories that considered individuals as mainly rational, careful thinkers, later theorists in psychology observed that cognition operates in *two* distinct modes – the fast and the analytical (Stanovich & West, 2000; Kahneman, 2011). According to Kahneman (2011), the analytical mode (“slow thinking”) is intentional, systematic and rational. The “fast thinking” mode, on the other hand, is instinctive, non-systematic and requires less mental effort. It is this particular mode that is believed to be the dominant mode of reasoning in our daily lives, allowing us to be efficient and functional in our information and decision dense environments (Kahneman, 2011). It also caters to our innate *cognitive laziness*: because humans have a limited capacity for pro-longed, strenuous mental work, they are inclined to think in ways that require as little mental energy as possible (Fiske & Taylor, 1991), which, according to Scheufele and Lewenstein (2005), also applies to topics related to science.

Herbert Simon (1955) called this type of reasoning “bounded rationality” hypothesizing that pure rationality in daily-life environments is limited, because it is too complex. As a result, individuals work out their positions on difficult topics like science by using thinking strategies, referred to as *heuristics* or *mental shortcuts* that simplify the reasoning process (Scheufele and Lewenstein, 2005; Kahneman, 2011). Mass media communication, therefore, is important, not only because it is a primary source of information - media messages are also a key source of such *mental shortcuts* and interpretation templates that enable fast, heuristic thinking (Scheufele, 2006; Kahneman, 2011; Popkin, 1991).

1.3.1 Journalistic choices and media effects

Besides understanding why media communication is important, a number of concepts allow to understand how media effects take place across several levels of influence. The concepts of *gatekeeping*, *agenda-setting*, *attribute agenda-setting*, *priming* and *framing* form the foundation of mass media theory and can be considered as the basic-level processes, which explain the potential influence of media on public perceptions across a broad range of issues, including vaccines.

Gatekeeping, in the most simple terms, refers to the process through which journalists decide which particular events to cover for news, with “newsworthiness” serving as one of the main factors in the decision process (Shoemaker, 1991). Galtung and Ruge (1965) operationalized newsworthiness by suggesting 8 formal factors that influence news selection irrespective of cultural contexts (Figure 3): *frequency* (event happens at the same time-pace as news and is fast-evolving), *threshold* (event has an appropriate amplitude), *unambiguity* (event has a clear interpretation and meaning), *meaningfulness* (event is socially or culturally relevant), *consonance*, *unexpectedness* (event is rare), *continuity* (event is familiar), *composition* (event fits into the newspaper context and balances out coverage of other issues or events). *Reference to elite nations*, *elite people* or *negative events* were identified as culturally specific factors for event selection as news in norther-western contexts. According to Galtung and Ruge (1965), the news value of an event increases with the combination of multiple factors. In 2010 Harcup and O’Neill content analyzed a large segment of the UK press in order to test Galtung and Ruge’s (1965) newsworthiness factors and provide what the authors referred to as a “contemporary” news values list (Figure 3). According to Harcup and O’Neill (2010), in order to be selected as news, stories must concern the following factors: *the power elite*, *celebrities*, *entertainment*, *surprise*, *bad news*, *good news*, *magnitude*, *relevance*, *follow-up*, and *newspaper agenda*.

Several authors have showed that science, technology and health news reporting is sometimes driven by different and/or more elaborate set of newsworthiness factors. Badenschier and Wormer (2012) showed that *astonishment*, *the number of people involved*, *conflict*, *as well as economic, societal and scientific relevance* (see Figure 3) are some of the factors that drive issue coverage in science journalism contexts. Similarly, Guenther and Ruhrmann (2013) showed that *novelty* and *relevance* are some of the main factors that influence science issues’ selection for news.

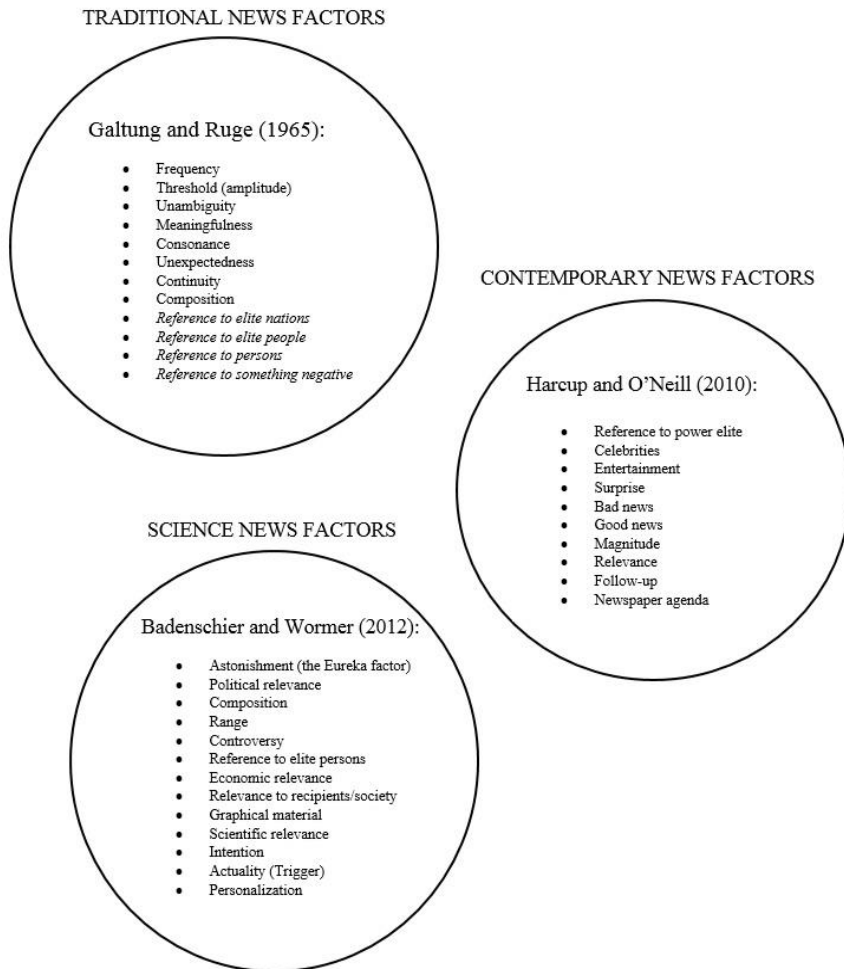


Figure 3. Factors influencing selection of news by journalists

Studies have also been conducted to explore the drivers of media attention towards specific science issues, like climate change. Schäfer et al. (2014), for example, found that increased media attention to climate change is influenced by political events and resonating political reactions. Scientific research or natural disasters, such as floods, do not appear to be significant influences. Hodgetts et al. (2008) showed that when reporting health news, journalists commonly focus on the immediacy of events and their relevance to the wider population. Health-related stories, however, are also frequently selected

through the influence of official sources (e.g. government officials), who “push” for the coverage of specific issues. Tanner (2004) has similarly found evidence that among reporters, ideas for health news frequently emanate from official sources.

In general, it may be that differences in newsworthiness factors between general and specialized, in this case - science/technology/health - reporting may stem from the fact that in comparison to general news, this news category may in itself be bounded by a different set of newsworthiness factors. At the same time, as Guenther and Ruhrmann (2013) note in their review, science journalists as opposed to generalist reporters “tend to see themselves predominantly as information providers, less dominantly as critics and even more rarely as entertainers/service providers”, which the authors argue “lead journalists to evaluate the worthiness of news differently”.

The concept of agenda-setting complements the concept of gatekeeping, by extending and explaining its effects on audiences. It refers to the classical idea put forward by Bernard Cohen - that the influence of mass media begins not by shaping public perceptions, but determining *which* issues the public thinks about (Cohen, 1963; McCombs and Shaw, 1972). In other words, appearance of issues in the news, first and foremost, informs individuals about their existence and influences public awareness. The media can exercise agenda-setting through processes like gate-keeping, by selecting the coverage of certain issues over others and placing these in the public mind. According to Scheufele (2000), the agenda-setting effect works through *accessibility* – issues that appear in the media more often or at all, are more accessible in memory and recalled. The primary operational variable of agenda-setting research in media content, therefore, is frequency (Kim et al., 2002).

McCombs and Shaw (1972) conducted some of the first studies illustrating the effect of agenda-setting on public awareness. Analyzing news media coverage of a presidential campaign, the researchers found a correlation between issues covered in the news and public opinion of their importance. Similarly, Funkhouser (1973) found that issue coverage frequency in the media had a strong influence on their public visibility, even though media content, in general, did not provide an accurate reflection of events during the studied decade. As a result, media attention to issues, specifically volume and frequency of coverage, has become an important question of research, analyzed across a broad range of areas including science, technology and health (e.g. Gollust et al., 2013; Schafer et al., 2011; Dudo et al., 2011; Stryker et al., 2008; Gaskell et al., 1999).

However, by presenting selective and often incomplete real-world representations, media reporting can not only skew public awareness of issues or their importance, but in result shape the “standards” that people use when making other evaluations and judgements (Iyengar and Kinder, 1987). This is called priming, a concept that explains how issue importance achieved through agenda-setting can cascade to the decision-making process (Scheufele and Tewksbury, 2007; Scheufele, 2000). Priming is grounded within the field of psychology and describes a memory effect when prior stimuli can influence subsequent decision outcomes or behaviors (e.g. Bargh et al., 1996). In psychology, priming is oftentimes illustrated with the anchoring phenomenon - people’s tendency to get stuck on suggested starting points (Kahneman, 2011). For example, in 1974 Tversky and Kahneman conducted an experiment asking participants to observe the wheel of a rigged roulette, fixed to stop on two arbitrary numbers. Participants were then asked to guess how many African countries were part of the UN. Those, for whom the roulette stopped at 10, would consistently provide a smaller estimate than participants for whom the roulette stopped at a higher number. Priming then acts as a “mental warm-up” that prepares and in this way - influences the subsequent reasoning process (Kahneman, 2011; Iyengar et al. 1982). Therefore, by making certain issues more important than others in the public mind through agenda-setting, the media can also make them more influential during further considerations (Scheufele and Tewksbury, 2007; Price and Tewksbury, 1997; Iyengar and Kinder, 1987).

If the previously discussed concepts can be used to explain how the media may influence public awareness of issues, then the concepts of framing and attribute agenda-setting are used to explain how the media may influence their understanding or interpretation (Scheufele, 2000; McCombs, 2004). For example, according to McCombs (2004) media can place importance not only on issues themselves, but also on certain issue attributes, i.e. aspects of their descriptions, consequently making some issue *attributes* become *more important* than others in the public mind. This, according to McCombs (2004), results in second and third-level agenda-setting effects that explain media influence on issue perception. For example, McCombs (2004) provides examples of research, which shows that news media article tone correlates to valence of public opinion (see also, for example, Besova and Cooley, 2009).

Similarly, in the area of communication studies, the concept of framing is used to explain how the media may influence issue perceptions. Frames are defined as *organizing structures*, “ideas or storylines” that embed issues with

particular meanings (Gamson & Modigliani, 1987). They are the perspectives and angles through which issues are ‘seen’.

Entman (2003) argues that journalists frame stories simply by emphasizing some aspects of issues instead of others, and in this way selecting and providing particular issue interpretation models. From the standpoint of psychology research, frames are effective because they work as “mental shortcuts” that simplify information processing (Kahneman, 2011), whereas sociologist Erving Goffman (1974) argues that frames enable individuals to generally make sense of the world. According to Scheufele (2000), the framing effect is based on *applicability* – frames provides cues which may then be applied to form issue meaning.

Just as media *attention* to issues, characteristics of media *presentation* of issues, has received considerable scholarly attention, with framing in particular, applied extensively in communication and media research (Scheufele, 2000; Cacciatore et al., 2016).

The present study

Recent outbreaks of vaccine preventable diseases and public rejection of vaccination, have heightened the need for understanding the reasons underlying vaccine hesitancy and applying appropriate action. Vaccine hesitancy models, overviewed in this chapter, reveal a series of factors, known to influence public acceptance of vaccines and this dissertation is focused on two such inter-related factors, i.e. public attitudes and media representations of vaccines, which affect vaccine acceptance at psychosocial and contextual levels. More precisely, this dissertation attempts to understand how the online news media may shape public perceptions of vaccines in Lithuania. Two studies are conducted for this purpose. The first study maps the development of public perceptions of vaccines in Lithuania along three aspects, which in the past decades have sparked substantial public debates– vaccine importance, effectiveness and safety. The rationale of the first empirical analysis is two-fold. First, analysis of this kind has not been carried out in Lithuania to date, making it difficult to make any definitive conclusions, regarding the dynamics of public perceptions about vaccines in Lithuania. For example, have they been getting more positive or have they been getting worse? And if so, at which points in the available timeframe? A second, resultant motivation for this study is the assumption that understanding the dynamics of public attitudes toward vaccines, will enable to better situate and understand the

potential interacting effects of factors, in this case – news media presentations– and their influences on public perceptions of vaccination.

Therefore, to address the research problem posed in this dissertation, I first investigate public perceptions of vaccines in Lithuania, by asking: **RQ 1.** What do Lithuanians think about vaccines and how have public perceptions of vaccines in Lithuania changed over the last decades? I then conduct a second empirical study - a media content analysis to explore Lithuanian online news media presentations of vaccines with focus placed both on the general scope of news media content on vaccines, as well as media presentations of children's vaccination. The second research question of this dissertation, therefore, is as follows: **RQ 2.** How do online news outlets present vaccines to Lithuanian readers? The choice to study the coverage of vaccines in online news is based on the popularity of these information channels in Lithuania, as well as the goal of understanding what kind of information about vaccines reaches the Lithuanian general public, which, on the whole, may not have strong convictions against vaccines and, thus, be susceptible to information effects stemming from the news media.

In trying to understand potential media influences on public perceptions of vaccination, this content analysis draws on the theoretical foundations of media studies and previous research, and looks for the manifestation of media effects concepts, overviewed in the previous section of this chapter. These concepts will allow exploring potential media effects along two aspects: public awareness of vaccines and how the news media may form Lithuanian's perceptions of vaccination. To study media attention to vaccines in Lithuanian online news, and its potential agenda-setting influences, this dissertation asks: **RQ 2.1.** What is the volume of online news coverage of vaccines and which vaccines receive the most media attention? To further understand media attention to vaccines, to differentiate how much of that media attention is composed of original reporting and to better understand the news selection and agenda-building processes, this study investigates the different types of content authors and sources used in vaccination-related news: **RQ 2.1.2.** Who writes about vaccines in Lithuanian online news and who are the most frequent sources used in news articles on vaccination? This study then moves forward to analyze the valence and themes of news articles on children's vaccines, which have dominated public controversy over vaccination, both locally and abroad. Informed by attribute-agenda setting and framing concepts, this study assumes that the dominant tone and themes about vaccines promoted in the

news media, may contribute to shaping public perceptions of vaccination in Lithuania. The last research question of this study, therefore, ask: **RQ 2.1.3.** What is the tone and primary themes of articles about vaccination in Lithuanian online news?

2. RESEARCH DESIGN AND METHODOLOGY

This chapter describes in detail the methodology that was used to implement the empirical studies in this dissertation. First, this chapter describes the process of a systematic literature review that was chosen as the appropriate method for understanding public perceptions of vaccines in Lithuania and tracking perception change over time. Then, the chapter describes the content analysis that was used to conduct a media coverage investigation of news articles related to vaccines in Lithuania, including the source selection, data collection and coding procedures. Potential limitations of the methods are discussed.

2.1 Empirical study number one: a literature review of public perceptions of vaccines in Lithuania

A review of existing literature was used to examine and integrate studies that have been conducted over the past decades to provide a summative view of public perceptions about vaccines in Lithuania. The primary research question guiding this review was the following: what do Lithuanians think about vaccines and how have public perceptions of vaccines in Lithuania changed over the last decades? Systematic literature reviews employ controlled methods to the collection, combination and evaluation of secondary research data. The purpose of a systematic review is to provide a thorough summary of existing evidence and, according to Uman (2011) - the “bottom line” on a specific question of research. In this study public perceptions of vaccines were understood as opinions or attitudes of individuals towards vaccination. This study focused on public opinions/attitudes towards three aspects related to vaccines: vaccine importance, vaccine effectiveness and vaccine safety. These aspects were chosen in particular because they relate to the foundational narratives of the anti-vaccine movement (Smith, 2017), and because importance, safety and efficacy constitute core attitudinal factors that are known to be linked to vaccination acceptance (Opel et al., 2011).

2.1.1 Data collection

The research studies for this systematic review were collected via the Vilnius University library database, the Lithuanian Academic Electronic Library and the World Wide Web using keyword search and snowballing strategies. Snowballing refers to a search technique, where article reference lists are checked to identify additional relevant pieces of literature (Wohlin, 2014). The following keyword search strings, all denoting Lithuanian equivalents of terms “public attitudes/opinion/views/beliefs about vaccination” were used to search for Lithuanian publications on the topic: visuomen* požiūri* skiep*; visuomen* nuomon* skiep*; visuomen* požiūri* vakcin*; visuomen* nuomon* vakcin*; visuomen* požiūri* imunoprofilaktik*; visuomen* nuomon* imunoprofilaktik*. The following keyword search strings were used to search for records written in English: attitude* vaccin* Lithuania*; belief* vaccin* Lithuania*; opinion* vaccin* Lithuania*; perception* vaccin* Lithuania*; view* vaccin*; knowledge vaccin* Lithuania*; attitude* immuniz* Lithuania*; belief* immuniz* Lithuania*; opinion* immuniz* Lithuania*; perception* immuniz* Lithuania*; view* immuniz* Lithuania*; knowledge immunization* Lithuania*.

Inclusion criteria for this study were: all digitally accessible research studies that have been published in peer-reviewed journals or conference proceedings, public opinion polls or multinational research projects conducted by international organizations with survey items or interview questions measuring perceptions of vaccine importance, effectiveness and safety. The title and abstract of each record returned in the search was examined for initial eligibility, and then the full text of the record was reviewed. A total of 14 studies were found that fit the inclusion criteria, 11 of which were relevant to this study. All of these studies were quantitative surveys and no qualitative studies on the subject were found.

2.1.2 Data analysis

Data analysis began with an assessment of selected study characteristics. Details of study author(s), year of study, sampling method and scope were collected. Then, all survey items pertaining to vaccine importance, effectiveness and safety, as well as any indirect measures of these concepts were extracted in original and translated questionnaire formulations. Selected survey items were analyzed using a comparative secondary data analysis technique. It has to be noted that all of the analyzed surveys were cross-

sectional, and that no longitudinal data with identical measures analyzing public attitudes towards vaccines exists for Lithuania. Furthermore, most of the nationally conducted studies did not use representative samples and cannot be generalized with confidence to the entire population of Lithuania. Nevertheless, because these studies provide valuable insights into the dynamics of public views on vaccines in Lithuania, they were included in the review.

2.2 Empirical study number two: Content analysis of online news media coverage on vaccines

Content analysis is one of the primary methods in communication research used to analyze information and for descriptive, interpretive and inferential purposes (Holsti, 1969; Krippendorff, 1989; Lacy et al. 2015). From its first mentions by Lasswell (1948) and Berelson (1952) content analysis has been considered to be a quantitative research method, where texts are examined according to predetermined variables and rigorous analytic rules. Riffe et al. (2014) define content analysis as a: “systematic and replicable examination of symbols of communication, which have been assigned numeric values according to valid measurement rules, and the analysis of relationships involving those values using statistical methods <...>”.

Content analysis may also be approached from a qualitative perspective, to examine various forms of communication and interpret its meaning, or search for manifestations of concepts using inductive or deductive techniques (Elo and Kyngäs, 2008; Elo et al., 2014; Mayring, 2000). Due to the relatively subjective nature of such studies and the use of small-scale samples, qualitative content analyses may lack external validity. Quantitative content analyses, on the other hand, frequently suffer from poor design and vague reporting, which not only impede replication, but may also compromise the overall validity of research (Lacy et al., 2015; Lovejoy et al., 2014).

2.2.1 Source selection and source profile

This empirical study sought to investigate the portrayal of vaccines in Lithuanian online news. Because analyzing the full spectrum of online news media channels in Lithuania was beyond the reasonable scope of this dissertation, it was decided to focus the analysis on the most prominent mainstream online news platforms, using readership trends as source selection criterion. The choice to study mainstream online press vs niche or regional

media was also influenced by the popularity of online news dailies in Lithuania, where unique visitors per day in some cases make up significant proportions of the Lithuanian population (N= 2.7 million). Readership trends for source selection were obtained through an internet market research company *Gemius.lt*¹, which provides statistics on unique Lithuanian website visitors (see Table 1 below). Despite a few fluctuations, readership trends show that over the past 10 years, www.delfi.lt (DELFI), www.15min.lt (15MIN) and www.lrytas.lt (LRYTAS) shared the leadership positions among the most read online news websites in Lithuania. Content on all of the analyzed news sites is regularly updated and provided free of charge. According to a German international press review service Eurotopics (www.eurotopics.net), all three news sites can be considered as having a liberal-leaning political orientation.

Table 1. Ranking of online news websites in Lithuania by readership statistics (gemius.lt data)

YEAR	RANKING			
	1	2	3	4
2008	N/A	N/A	N/A	
2009	N/A	N/A	N/A	
2010 (September)	DELFI	LRYTAS	BALSAS	15MIN
2011 (March)	DELFI	LRYTAS	15MIN	
2012 (May)	DELFI	15MIN	BALSAS	LRYTAS
2013	N/A	N/A	N/A	
2014	N/A	N/A	N/A	
2015 (December)	DELFI	15MIN	LRYTAS	
2016 (March)	DELFI	15MIN	LRYTAS	
2017 (January)	DELFI	15MIN	LRYTAS	
2018	DELFI	15MIN	LRYTAS	

DELFI was established in 1999 and is a commercial online news website, operating in the three Baltic States. Since 2007, DELFI is owned by a media

¹ <https://www.gemius.lt/leidejai.html>

company specializing in publishing, printing services and online media content production. DELFI receives more than 500,000 unique visitors on a daily basis and it has been the leading online news website in Lithuania for the past decade. It significantly surpasses its closest competitor – 15MIN both in terms of unique visitors and the time-share spent on the website (source: Gemius Audience). 15MIN is the second most popular online news website in Lithuania, drawing in more than 300,000 unique visitors per day. 15MIN was established as a tabloid newspaper in 2005 and was later acquired by a private media company. An online version of the newspaper was launched in 2008 and in 2013 the print version of the newspaper was entirely discontinued. Since then 15MIN became a digital-only news source. Similar to 15MIN, LRYTAS was first established as a daily newspaper in 1990 and to this day remains as one of the largest print newspapers in Lithuania. The online version of the newspaper was established in 2006 and according to audience analytics, it is the third most frequently visited online news site in Lithuania.

2.2.3 Data collection

There are several types of data sampling techniques that can be applied in media content analysis. For the purpose of this dissertation, it was decided to select and study the entire population of relevant articles found within the chosen time frame for this study: January 1, 2008 – December 31, 2018. This interval was chosen on the assumption that it would provide a sufficient time period to observe any meaningful changes in Lithuanian online news media reporting on vaccines. Furthermore, as some of the news outlets established their online presence only in 2008, a wider timeframe may have impeded data access. Due to the lack of online databases in Lithuania such as Lexis-Nexis or Factiva that index online news, the data (i.e. the articles) for this study was collected using multiple procedures to ensure that the most representative sample of data was obtained.

Step 1

At first data was collected via the Google search engine, using the operator “site” that allows to search for keywords in a specified website. Three words that are used to refer to vaccination in the Lithuanian language were selected as keywords for data collection in this study: vakcinacija (vaccination),

skiepai (shots) and imunizacija (immunization). Due to the complexities of the Lithuanian language, such as the large variety of suffixes and word endings, every keyword was searched in most of its commonly used grammatical forms as a noun (singular and plural), as a verbal noun and as a verb to ensure that all possible forms of the terms were captured. When the keyword was searched as a noun or as a verbal noun, the search was conducted for 6 out of 7 existing noun declensions in the Lithuanian language (the vocative noun form was not included in the search). When the keyword was searched as a verb, the search was conducted for the three main verb forms of the word, including the associated negative verb forms (see Appendix A).

In this step of data collection, articles were selected by reviewing the headline of the article and the lead, to determine whether the article was relevant for the study. At this stage, *eligible* or *on topic* articles were articles that focused or mentioned vaccines for human diseases or human vaccination. Irrelevant articles were considered to be articles that did not mention human disease vaccines or vaccination, for example, articles that talked about “vaccines against racism” or “immunization against Russian propaganda”.

Table 2. Number of articles collected through the first data collection procedure by website

	TOTAL SEARCH RESULTS	TOTAL SELECTED ARTICLES	MINUS DUPLICATES ACROSS CATEGORIES
DELFI	8600	4905	1255
LRYTAS	617	501	172
15MIN	6732	5119	1216
TOTAL	15949	10525	2643

If at this point the researcher was unsure whether the article should be included in the data corpus, the article was included and reviewed during the data cleaning procedure. Because there was significant overlap in the search results for each keyword, prior to beginning the second data collection procedure, duplicate articles across keyword categories were removed, leaving a total of 2643 articles that were collected during this step of the data collection procedure (see Table 2).

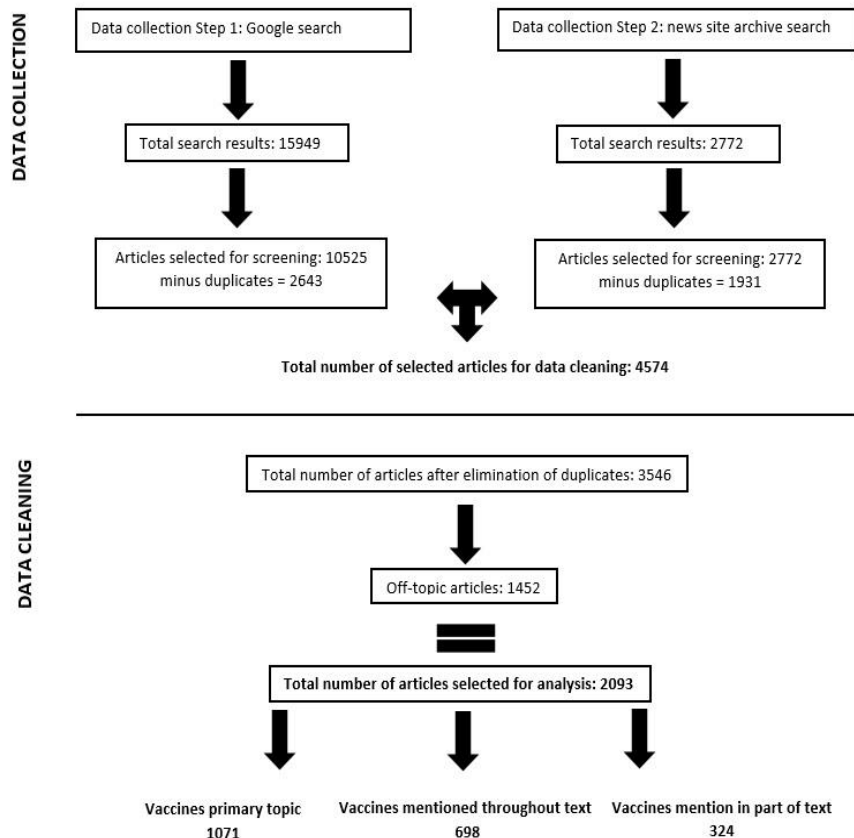


Figure 4. Data collection and data cleaning process flowchart

Step 2

To ensure a thorough sample of articles was obtained for this study, a second data collection procedure was used to collect articles using the internal archives of the analyzed news outlets. The root of each main keyword (vakcinacija (= vaccination), skiepai (= shots) and imunizacija (= immunization) was entered into the “Search by topic” field in each of the news websites, eg. vakcin*, skiepai*, imunizac*. A search on each news site provided a set of available pre-defined topic keywords related to the search terms, shown in Appendix B. Each topic contained from a few to several hundred articles that were marked by the news site as belonging to the topic category. Because most articles appeared only as headlines, this made it impossible to differentiate between on-topic and off-topic articles by headlines alone. For this reason, all articles appearing under the given categories were collected. As in *Step 1*, because there was significant overlap in the search results for each keyword, prior to beginning the data cleaning procedure, duplicate articles across keyword categories were removed, leaving a total of 1931 articles that were collected during the second data collection procedure. This brought the total sum of retrieved articles for data cleaning to 4574 (Appendix B).

2.2.4 Data cleaning

The data cleaning process began with the combination of articles selected through steps 1 and 2 of the data collection procedure *within* each news outlet and the elimination of duplicates, which reduced the total number of collected articles to 3546 (see Table 3). During the data cleaning process, the full article was reviewed in order to determine its eligibility for the study. A broad inclusion criterion was chosen because it was decided that articles, which do not specifically focus on vaccines, but also mention vaccines, nevertheless inform about vaccines and may influence vaccine-related perceptions.

All on-topic articles were selected for data analysis. An article was considered on-topic or eligible if it mentioned a human disease vaccine or human vaccination in a meaningful way. This meant that articles had to contain at least one argument and one explicit standpoint about vaccines for human vaccine preventable diseases or human vaccination. Ineligible or off-topic articles were considered as articles that contained a broken link; articles

that did not fit the time-frame of this study; articles that did not mention vaccines for humans or human vaccination, e.g. animal vaccines for rabies; articles that mentioned vaccines in metaphorical manners, e.g. “vaccines for pessimism” or mentioned vaccines in passing or non-meaningful ways, e.g. “this year the Ministry of Health would increase the budget for cancer-prevention research, public health education and vaccination”. Examples of articles that mentioned vaccines, but were considered off-topic, are shown in Appendix C. Data cleaning left a total of 2093 articles considered eligible for this study and selected for data analysis (Table 3). In 84,5% (n=1769) of the sample vaccines were the primary topic of the articles or vaccines were mentioned throughout the article body. In 15,5 % (=324) of the articles, vaccines were mentioned in a part of the text, e.g. paragraph.

Table 3. Number of articles about vaccines by website

NEWS SITE	SELECTED ARTICLES STEP 1	SELECTED ARTICLES STEP 2	TOTAL	MINUS DUPLICATES ACROSS SEARCH STEPS	AFTER DATA CLEANING
DELFI	1255	1171	2426	1823	1028
15MIN	1216	425	1641	1271	737
LRYTAS	172	335	507	452	328
TOTAL	2643	1931	4574	3546	2093

2.2.5 Coding of demographic variables

Due to situational obstacles, the data was mostly coded by a single coder - the author of this dissertation and this presents an inherent limitation of this study. An intra-coder reliability assessment using 15% of the sample was conducted for each category, except “year” four weeks post the initial coding of the results. Intra-coder agreement for each category varied between 91 –

96%. Data were coded in two stages, using a scheme developed to answer the research questions of this study:

RQ 2. How do online news outlets present vaccines to Lithuanian readers?

RQ 2.1. What is the volume of online news coverage of vaccines and which vaccines receive the most attention?

RQ 2.2. Who writes about vaccines and who are the most frequent sources used in news articles on vaccination?

RQ 2.3. What is the tone and primary themes of articles in online news coverage of vaccines?

To study the volume and characteristics of online news articles, the data was coded for demographic variables: year, author, source and vaccine as shown in Table 4. Variables for category “vaccine” and “source” were derived using an iterative process: a set of variables would be applied to a sample of articles and if a new variable appeared, it would be added until an exhaustive list was formed. Direct sources were considered to be those, who were directly quoted in the article. Indirect sources were those, who were mentioned as information sources without giving a direct statement. Article authors were coded by analyzing the byline of the article. Category “author” contained four variables – original articles, which were considered to be articles that were written by online news site journalists, articles that did not contain a reference to a specific journalist; articles that were written for the online news website by other individuals, e.g. opinion pieces. Re-posted articles were articles republished from other online news platforms, media channels, websites, blogs, etc.

Table 4. Media content analysis coding variables

Date	Date when the articles was published	Year and month
Vaccine	Vaccine the article mentions	Flu (FLU) Chicken pox (POX) Diphtheria, tetanus, pertussis (DTP) Human papilloma virus (HPV) Hepatitis (HEP) Mumps, measles, rubella (MMR) Type-b meningococcal infection (MEN) Polio (POLIO) Pneumococcal infection (PNEUM) Rabies (RABIES) Rotavirus (ROTO) Tick-borne encephalitis (TICK) Tropical disease vaccines (TROPICAL) Tuberculosis (TB) Other (OTHER) General discussion about vaccines (GEN)
Author	Article author type as stated in the byline.	Original article Reposted article News agency article Sponsored article
Sources	Direct: sources that are directly cited or quoted in the news article. Indirect: sources that are referred to in the news article.	Non-expert Public health specialist Medical specialist Scientist Government official Pharmaceutical industry Law official Homeopath Media source Unidentified expert Other source

News agency articles were articles distributed by news wire services, as indicated in the byline and sponsored articles, were articles that were marked with sponsorship or partnership marks. For all demographic categories, the unit of analysis was the article. If the main topic of the article did not focus on vaccines and vaccines were mentioned in separate subsections of the articles, e.g. articles discussing top 10 ways to prevent the flu, the unit of analysis was the section of the article in which vaccines were mentioned.

2.2.6 Sub-sampling and coding of articles on children's vaccines

Sub-sampling

Tone and theme was analyzed on a sub-sample of articles on children's vaccines, which have been at the forefront of public controversy over vaccination. Demographic coding of the entire data corpus allowed to sub-sample articles on vaccines for children, which were identified by referring to the National Immunization Schedule². For the purpose of this analysis it was decided to focus on 9 vaccines that are given at early childhood: tuberculosis, diphtheria-tetanus-pertussis, poliomyelitis, pneumococcal infection, mumps-measles-rubella, rotavirus, chicken pox, hepatitis and type-b meningococcal infection. This excluded the vaccine for Human papilloma virus, which is given to adolescent girls.

Table 5. Number of sub-sampled articles on children's vaccines

NEWS SITE	ARTICLES ON CHILDREN'S VACCINES
DELFI	431
15MIN	281
LRYTAS	193
TOTAL	905

² <http://www.vlk.lt/veikla/veiklos-sritys/sveikatos-prieziuros-paslaugos/Puslapiai/Vaik%C5%B3-profilaktini%C5%B3-skiepijim%C5%B3-kalendorius.aspx>

Articles were selected by screening each topic category in the full dataset of this study, as well as the “general articles category” and choosing articles that: focused or specifically addressed children’s vaccination, articles that mentioned children’s vaccination or articles that did not refer to any specific vaccination or any specific vaccine demographic group. For example, articles that focused on vaccination against tuberculosis for adults were not included in the analysis, however, articles that did not mention any specific demographic group in relation to the tuberculosis vaccine – were chosen. The total number of articles selected for further analysis was 905 (see Table 5).

2.2.7 Coding article tone and themes

First, articles on children’s vaccines were coded for tone, which was defined as the general attitude or sentiment towards the vaccines/vaccination in the article: positive, neutral, mixed or negative (see Table 6). Positive articles were articles that expressed a supportive sentiment toward the importance, effectiveness and/or safety of vaccines, also articles that linked vaccines or vaccination toward positive health and epidemiological outcomes, as well as articles that expressed a severely negative/sarcastic tone towards anti-vaccine proponents. Neutral tone meant that an article does not express any kind of sentiment or judgement towards the importance, effectiveness and/or safety of vaccines or vaccination. Negative articles expressed a negative sentiment towards the importance, effectiveness and/or safety of vaccines, also articles that associated vaccines or vaccination with negative events and unsubstantiated negative health outcomes. Mixed tone meant that an article presented positive and negative sentiments towards vaccines or vaccination. Articles that were ambiguous in tone were coded by the original coder and then given to an external coder. In cases of disagreement, coders would analyze and discuss the article until a decision was reached.

Table 6. Coding of article “tone”

Tone	The general attitude or sentiment toward vaccines/vaccination in the article	Positive Neutral Mixed Negative
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After determining the tone, each group of articles was coded for themes, shown in Table 7. Article themes were defined as topics that contextualize the mention of children’s vaccines and/or vaccination. The thematic analysis process was implemented in several stages, following the thematic analysis framework outlined by Braun and Clarke (2006).

Table 7. Coding of article “theme”

Theme	Topical issues emphasized in the article	Disease risk / vaccine benefit Vaccine hesitancy Case/disease outbreak Policy Progress Vaccine safety/effectiveness Rights/responsibility Vaccine side-effects Vaccine risks/uncertainty Vaccine complications Vaccine conspiracy Fairness/discrimination Alternative/necessity
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First, articles were sorted by tone and then arbitrary 10% samples of articles were selected from each tone category. In the first stage of analysis, each of the four samples were read by the primary coder and analyzed for main topics that appeared throughout the text. This resulted in a wide scope of topics that were then analyzed for conceptual similarity and systemized into broad categories - themes. A total of 8 themes emerged for positive tone articles, derived from a list of more than 20 topics and 5 themes for negative toned articles, derived from a list of more than 15 topics (see Table 7). In the second stage of the analysis all articles from each tone category were read and color coded for the manifest appearance of variables (topics) and subsequently labelled for themes.

The next two chapters present results of the described research studies in this dissertation. It first presents the findings of the literature review that was

used to analyze public perceptions about vaccines in Lithuania and discusses its findings. It then presents findings of a content analysis analyzing 10-years of media coverage of vaccines in Lithuanian online news, along with relevant result discussion chapters. Results of both empirical studies are analyzed in Chapter 5.

3. PUBLIC PERCEPTIONS OF VACCINES IN LITHUANIA

Vaccine hesitancy models predict that attitudes to vaccines are important factors underlying vaccine acceptance or rejection. Several studies to date have analyzed public perceptions of vaccines in Lithuania, but none of them have tracked vaccine-related attitudes over time. The systematic analysis reported in this chapter was conducted to provide a summative view of public perceptions about vaccines in Lithuania and how they developed over the last few decades (Valinciute and Schäfer, in press). This analysis specifically focused on Lithuanians' perception of vaccine importance, effectiveness and safety, which are known factors in vaccination-related decision-making processes. A total of 11 studies were selected for the analysis, all of which were quantitative surveys (see APPENDIX D for the list of selected publications). First, this chapter presents results of the study for each of the analyzed variable and presents a brief comparison of the results with available data from other countries. This is followed by a discussion of findings and recommendations for future research.

3.1 Results

Importance of vaccines

The earliest data on public perceptions of vaccines is found in a survey conducted between 2003 and 2004 (Zagminas et al., 2007). This data showed that a large majority (89%) of Vilnius inhabitants (capital city) agreed on the importance of children's vaccines and a similar proportion (88.6%) believed that children should be vaccinated in accordance with the recommended immunization schedule. The first nationally representative study analyzing public perceptions of vaccines was carried out in 2011, revealing opposite findings: only 54% of respondents agreed that vaccines are important for preventing infectious diseases and 32% expressed negative views towards their use (Caplinskas et al, 2011; Baltijos tyrimai, 2011). In 2011 a total of 7 cases of measles were diagnosed in Lithuania. A second nationally representative study conducted in 2013 by Kupreviciene et al. (2014) showed that 49,8 % of respondents had positive views towards vaccines for diphtheria and tetanus.

In the next years perceptions of vaccine importance were analyzed in four smaller-scale studies. During the period, Lithuania faced two outbreaks of measles – one in 2013 with 35 registered cases in Vilnius, the capital city of

Lithuania and one in 2015 with 50 registered cases in Kaunas, the second largest city in the country (ULAC, 2019). Seskute et al. (2018) showed that 83.2% of post-partum mothers in Kaunas had a generally positive view towards children's vaccines.

Lidziute and Stasiuviene (2015) surveyed parents in Klaipeda, the third biggest city in Lithuania, in which the supermajority of respondents (97,3%) said they knew about the importance of vaccination for their child, but only 74,2% thought that children should be regularly immunized. In 2015 Krisciuniene et al. surveyed inhabitants of Taurage and its surrounding district - a peripheral Lithuanian town with a little over 40,000 inhabitant at the time of the study. While the sample size of the survey was representative of the town population, the authors did not specify their respondent sampling techniques. The survey also did not include a direct measure of attitudes towards vaccine importance, however, it did reveal an interesting finding about variances in vaccine perceptions between different demographic groups. This survey revealed that only a little over half of urban residents in Taurage (53%) thought that the majority of Lithuanians had favorable attitudes towards vaccines. To put in in other terms, every second urban resident in Taurage believed that Lithuanians were skeptical about vaccination. The prevalence of such beliefs was even higher among rural residents, where roughly 2 out of 3 respondents could not say with confidence (28%) or thought that the attitudes towards vaccines in Lithuania are largely negative (42%). Roughly 70% of respondents in a survey by Nevuliene et al. (2018) conducted in 2016, believed in the necessity of vaccines.

Since then three international nationally representative studies have examined how the public perceives vaccines in Lithuania (Vaccine Confidence Project, 2018; Wellcome Global Monitor, 2019; EU Special Barometer, 2019). A study conducted for the EU Vaccine Confidence Project in May 2018 revealed that between 2011 and 2018, perceptions of vaccine importance in Lithuania considerably improved with roughly 87% of respondents expressing agreement with the given statement. Interestingly, the general importance of vaccines and the importance of specific vaccines was rated differently, e.g. in contrast to the perceived importance of general vaccination (87%), only 50 % of respondents agreed on the importance of the seasonal influenza vaccine (Vaccine Confidence Project, 2018).

What is surprising is that a second nationally representative survey carried out within a half-year period showed a sharp decrease in public perceptions of vaccine importance. Compared to 87% of Lithuanians in May of 2018, only 69% in October agreed that vaccines for children are important (Wellcome

Global Monitor, 2019). This coincided with a measles outbreak in 2018, when 30 cases of measles were registered (ULAC₁, 2019).

In March of 2019, after another half-year interval, Lithuanians were asked if they thought that “it is important for everyone to have routine vaccinations” to which 87% of respondents expressed agreement (EU Special Barometer, 2019). Although a positive finding, the latter data must be interpreted with caution, because the question formulation of the 2019 survey is different to the surveys conducted in 2018. While the 2018 surveys probed into Lithuanian’s perception of children’s vaccines, the survey in 2019 referred to both children’s and adult vaccinations. It may be the case therefore that the variations between October 2018 and March 2019 are unrelated, meaning that public mistrust of children’s vaccines peaked in the last month of 2018, not only coinciding with a measles outbreak the following month, but also predicting the largest outbreak of measles in Lithuania over the last decade (2019, N=834), or at least predicting conditions that were favorable to its development (ULAC₁, 2019).

Effectiveness

Ten studies analyzed what Lithuanians think about vaccine effectiveness. On a general level, if items measuring people’s perception of vaccine importance show relatively positive responses, evaluations of vaccine effectiveness have been low. Results indicate considerable and consistent difference in perceptions of vaccine importance vs perceptions of effectiveness across all samples of respondents, covering the nearly total geographical area of the country.

Despite vaccines being one of the most cost-effective measures for the control of infectious diseases, a study by Zagminas et al. (2007) found that in 2003-2004 only roughly 60% of Vilnius inhabitants thought that vaccines are “more effective and less expensive in comparison with other medical services”. Furthermore, only a little more than a third of respondents (35,9%) believed that children’s vaccines “always provide protection against infectious diseases”. Perceptions of vaccine effectiveness were also measured in 2011 (Baltijos tyrimai, 2011), where 60% of respondents expressed belief in vaccine effectiveness. A study of post-partum mothers in Kaunas and their attitudes towards vaccines, showed that in 2014 slightly more than half of the respondents (57,3%) thought that vaccines are effective in protecting children from diseases (Seskute et al, 2018). In 2015 Lithuania faced the second

measles outbreak in the past decade, with 50 diagnosed cases, of which more than half were registered in the Kaunas area (ULAC₁, 2019). A study of parents in Klaipeda showed a similar trend with only 54% of respondents expressing confidence in the effectiveness of vaccines for protection against infectious diseases (Lidziute and Stasiuviene, 2015). Respondents in the 2016 online survey conducted by Nevuliene et al. (2018) had similar attitudes, with 63,3% believing that vaccines prevent the spread diseases.

The first nationally representative study exploring perceptions of vaccine effectiveness was conducted in May 2018 and showed that confidence in vaccines measured around 80% (81.6) (Vaccine Confidence Project, 2018). This positive, but rather contradictory result compared to findings of previously conducted national studies measuring vaccine effectiveness may reflect biases stemming from sampling techniques or it may indicate an overall spike in vaccine trust during the interim period. In either case, public enthusiasm regarding vaccine effectiveness was short-lived: as of October 2018 only 60% of Lithuanians thought that vaccines are effective, which once again coincided with a measles outbreak in November 2018 (Wellcome Global Monitor, 2019). Interestingly, in April, 2019 perceptions of vaccine effectiveness among Lithuanians was once again higher, reaching an all-time high 83% of the population (EU Special Barometer, 2019). Again, this spike may reflect features of opinion volatility or it may reflect effects of the public health alarmism that followed the 2019 measles outbreak in Lithuania.

Taken together, however, these results suggest that roughly one fifth to one third of Lithuanians are doubtful about the effectiveness of vaccines and these sentiments have consistently shown up in survey research conducted over the past two decades. The sharp variations in public opinion between 2018-2019 may, however, also indicate the fragility of anti-vaccine sentiments, which in the face of real-world evidence, such as disease outbreaks, exhibit cardinal change.

Safety

Vaccine safety has been one of the most hotly debated issues in the global controversy over vaccination. Eight studies between 2003 and 2019 analyzed Lithuanians' perceptions about the safety of vaccines, finding they are similar to those regarding the effectiveness of vaccination. Zagminas and co-authors (2007) found that only two-thirds (66,7%) of Vilnius inhabitants believed that vaccines are safe. Seskute et al (2014) found that only 57% of postpartum

mothers in Kaunas believed in the safety of vaccines. Respondents in the survey by Lidziute et al. (2015) were asked a double-barreled question, e.g. “I believe that vaccines are safe and effective”, making it difficult to differentiate whether respondents expressed beliefs about vaccine safety or vaccine effectiveness, which represent two different concepts. Nevertheless, only 60% of respondents agreed with the statement. Nevulienė et al. (2018) found that 32% of online respondents did not believe in vaccine safety, and 42,4% thought that vaccines can be toxic.

The first nationally representative survey measuring Lithuanians’ views on vaccine safety was conducted in May 2018, finding that 81,2% of Lithuanians believed in vaccine safety (Vaccine Confidence Project, 2018). A similar number of respondents believed in the safety of the MMR vaccine (78.2%), however, when asked their opinion regarding influenza vaccination, only 60.8% of respondents expressed belief in its safety. A survey conducted in October of 2018, however, revealed considerably different attitudes with only 52% of Lithuanians believing in the safety of vaccines (Wellcome Global Monitor, 2019). Although the 2019 Eurobarometer survey did not include an explicit item on vaccine safety, it revealed that more than half of those surveyed (55%) believed that vaccines can often “produce serious side effects”, which can be considered an indirect measure of vaccine safety perceptions.

Collectively, these studies outline a public that is divided on the issue of vaccine safety. Surveys have consistently shown that more than one third of Lithuanians are unsure whether vaccines are safe, indicating the presence of high vaccine risk perceptions, which are known to influence the uptake of vaccines (Larson et al, 2014). Nationally representative studies reveal that in May of 2018 perceptions of vaccine safety in Lithuania were relatively higher, measuring around 80%, which could be considered the supermajority of the population (Vaccine Confidence Project, 2018). However, two subsequent studies, conducted at approximately half-year intervals, showed a drastic shift in public views, suggesting the presence of a potential factor that significantly undermined vaccine safety confidence (Wellcome Global Monitor, 2019; EU Special Barometer, 2019).

Information sources

Two studies, analyzing Lithuanians’ habits about vaccine information were representative and can be generalized to the entire population. Other studies

were limited in scope in terms of geographical and demographic characteristics of the respondents. Based on the survey results, doctors consistently appear to be the most common source of information about vaccines in Lithuania. This finding is observed across all surveys that measured this item (Zagminas et al, 2007; Caplinskas et al, 2011; Baltijos tyrimai, 2011; Seskute et al, 2019; Lidziute et al., 2015; EU Special Barometer, 2019). Predictably, surveys measuring the trustworthiness of information sources on vaccines corroborate these findings: doctors are considered to be the most trustworthy source of information about vaccines among Lithuanians (Lidziute and Stasiuviene, 2015; EU Special Barometer, 2019).

Other most common sources of information include the mass media and friends or family, who commonly advise respondents on vaccines. Lithuanians place equal trust on information from friends, family, media and Internet sources (Lidziute and Stasiuviene, 2015). The reliance on friends and family as sources of information about vaccines illustrates the strong effect of social networks that are known to influence vaccine hesitant behaviors and suggests the possible presence of this effect in Lithuania (SAGE, 2014). This is especially evident in small-scale communities, like Taurage, where a survey conducted in 2015 revealed that among those who did not vaccinate their kids, almost 52% indicated advice from family and friends as a primary determinant for skipping vaccination (Krisciuniene et al., 2016).

Despite the use of various sources of information, in 2011 around 27% of Lithuanians felt they were not sufficiently informed about vaccines (Caplinskas et al., 2011; Baltijos tyrimai, 2011), whereas in a 2014 study 68,8% of survey respondents expressed the necessity for more trustworthy information (Lidziute and Stasiuviene, 2015). It may be the case that these variations indicate a rising need for more dependable information about vaccination, stemming from the sharply proliferating and muddled information landscapes concerning science, technology and health. In summary, the results show that Lithuanians do not feel sufficiently knowledgeable about vaccines and would prefer more information. They use a variety of sources such as mass media, Internet and relatives for information about vaccines, but trust doctors for most accurate information.

How do Lithuanians compare to other countries?

Three international research studies included in this review allow to make direct comparisons between perceptions of Lithuanians towards vaccines and

their counterparts in other countries (Vaccine Confidence Project, 2018; Wellcome Global Monitor, 2019; European Commission, 2019). A Europe-wide survey conducted in May 2018 showed that Lithuanians' perceptions of vaccine importance (87,0%) are among the lowest in the EU (average 90,0%), placing Lithuania 23rd out of 28 EU countries on the vaccine importance rating (Vaccine Confidence Project, 2018). Lithuania's ranking (23) was slightly below Belgium (22) and above France (24), which has been a European hot-spot of anti-vaccine activism. Lithuania was also among the EU countries with the lowest confidence in vaccine effectiveness. On questions of safety, Lithuania ranked 17th, placing it in-between countries like Estonia, Romania and Slovenia, which have all since 2010 experienced declining rates of measles vaccination. Another study conducted in 2018 study revealed that on questions of safety, Lithuanians (52%) considerably deviate from attitudes in the Northern European region, where average vaccine safety perceptions measure around 73%, as well as the world average perceptions about the safety of vaccines – 79% (Wellcome Global Monitor, 2019). This places Lithuanians on par with countries in Eastern Europe (50%), most of which have observed declining vaccine rates over the past decades and exceedingly far from countries in Eastern Africa (92%), Central America and Mexico (88%) and South Asia (95%) regions, which are highly confident in the safety of vaccines (Wellcome Global Monitor, 2019). On questions of effectiveness, Lithuanians (60%) were once again closer to countries in the Eastern European (65%) rather than the Northern European region (84%) and below the world country average (63%) (Wellcome Global Monitor, 2019).

The EU Special Barometer conducted in April 2019 again showed that Lithuanians' perception of vaccine safety (only 32% believed that vaccines do not produce serious side-effects) was well below the EU average (European Commission, 2019). Lithuanians (87%), however, were above the EU average (82%) on question of vaccine importance, surpassing countries like Germany (86%) and the UK (85%) (European Commission, 2019). It might be hypothesized that the aftermath of measles outbreaks in the country, may have considerably affected Lithuanians' attitudes.

3.2 Overview of findings

Scholars across various disciplines highlight the importance of tracking public attitudes towards vaccines for understanding and addressing the factors that lead to suboptimal vaccination (Larson et al, 2016). The present study was designed to systemize existing research and provide a summative view on the evolution of public perceptions towards vaccines in Lithuania. Eleven studies were found and analyzed for this purpose. None of the studies featured identical question wording and of the existing national studies, only two employed representative sampling techniques, signaling a strong need for more standardized longitudinal national research interest in this area.

A broad look at the data including the small-scale studies reveals two notable trends. Firstly, there are stark differences in perceptions of vaccines within different demographic and geographic respondent groups. For example, three studies conducted within a comparatively similar period showed considerable variation in perceptions of vaccine importance among parents who lived in three distinct regions of Lithuania (Kaunas, Klaipeda and Taurage), as well as respondents who lived in urban and rural areas (Seskute et al, 2018; Lidziute and Stasiuviene, 2015; Krisciuniene et al., 2016). These results highlight the importance of following vaccine-related attitudes not only at the national, but also at the local levels. For example, the study analyzing attitudes of urban and rural residents in Taurage found that 26% of urban residents and 43% of rural residents actually had not vaccinated their children, indicating potential pockets of unimmunized communities, highly susceptible to disease outbreaks (Krisciuniene et al., 2016). Systematic tracking of public attitudes towards vaccines could help to foresee the emergence of such communities and direct corresponding public health measures (Larson et al., 2016; Kennedy et al., 2011).

Based on available representative data, over the past years perceptions of vaccine importance in Lithuania fluctuated twice – once in 2011-2013 and once in October of 2018, when beliefs in importance fell by approximately 18% within a half year period (Caplinksas et al., 2011; Baltijos tyrimai, 2011; Wellcome Global Monitor, 2019). The considerable decline at the end of 2018 meant that almost a third of Lithuanians were skeptical about the importance of children's vaccines. This coincided with the beginning of the largest outbreak of measles in Lithuania over the past decade - which is indicative of rising public hesitancy toward vaccines - perhaps further supports the idea that public attitudes to vaccines are one of the factors shaping the current public health crisis. The possible link between decline in public opinion towards

importance of vaccines and the subsequent measles outbreak also suggests that public opinion tracking may help to foresee potential disease outbreaks. This may also suggest that Lithuanians' attitudes towards vaccines are considerably unstable, exhibiting high levels of volatility. While some researchers attribute such cases of variance to errors of measurement (Achen, 1975), others argue they reveal more about the underlying nature of public opinion and how people think (Converse, 1964).

Some of the earliest theories of public opinion argued that people have a partial and highly limited understanding of the world, which stems from the limited scope of their experiences. People's understanding of the world is then merely "a picture in their heads", formed through indirect experiences and stereotypes (Lippmann, 1922). For decades, survey researchers have observed the delicate nature of public attitudes. Studies have shown how such seemingly simple manipulations on survey questionnaires as the alteration of item wording, item sequence or tone can significantly shift what people think about the topic under consideration. Furthermore, repetition of studies shows that individuals also exhibit a high degree of response instability, that is - a tendency to provide different answers to the same questions asked several times (Converse, 1964; Achen, 1975). Zaller and Feldman (1992) argue that most people in fact do not have "fixed positions" on issues, but rather a number of frequently conflicting ideas, with surveys capturing the ones that are the most prominent at the given timeframe - pointing to the importance of opinion shaping factors, such as media effects in particular, for understanding public attitudes towards vaccines and vaccine-related behaviors.

One of the more significant findings to emerge from this study is that there is a considerable discrepancy between Lithuanians' views towards the importance of vaccines and what they think about vaccine effectiveness and safety. If Lithuanians' beliefs about the importance of vaccines could be classified as positive, then their perceptions of vaccine effectiveness and safety are moderate, at best.

Except for May 2018, public perceptions of vaccine safety ranged from 52% to 66,7%, meaning that at least every 3 out of 10 people had doubts about the safety of vaccination. Until 2018, positive perceptions of vaccine effectiveness were relatively similar, ranging from 35,9% to 63,3,0%. Studies have revealed therefore, that public risk perception of vaccines is considerably high, with Lithuanians challenging both specific vaccines (children's, flu) and vaccination in general. The discrepancy between importance and safety/effectiveness also suggest that even those who understand the benefits of vaccines may be prone to delaying or refusing children's immunization.

Public perception of vaccine safety and effectiveness, therefore, is an area requiring more public communication and intervention focus.

Overall, these are important findings with significant implications for public health interventions and communication about vaccines on at least on two inter-related levels. First, these findings *inform the situation*, by building a clearer picture of vaccine perceptions in Lithuania. More precisely, they suggest that Lithuanians are not “anti-vaccine”, but rather “concerned about vaccination”. In terms of public health literature, they could be called the “fence-sitters” – not entirely rejecting vaccines, but worried about their health impact (Rossen et al. 2019; Betsch et al., 2015). Lithuanians, also recognize the importance of vaccination, but are worried about vaccine safety and effectiveness of its use.

This leads to the second important implication related to public health interventions and communication about vaccines. As a result of these findings, we suggest that different vaccines may be perceived differently, requiring different communication strategies. We also suggest that the attitudes of experts on vaccines are an important area of research and experts could also benefit from more evidence based science and health communication training. Lastly, this overview has helped to pinpoint specific vaccine-related concerns among Lithuanians, which could be used to target vaccine-related communication towards public views. To put it in more simple terms, if public health messages in Lithuania will focus on vaccine importance, instead of evidence on their safety, they might simply miss the point. Such and related studies, therefore, could be used to tailor effective communication, vaccine promoting messaging and conversations.

4. ONLINE NEWS MEDIA COVERAGE OF VACCINES IN LITHUANIA

The following chapter presents findings of a content analysis that investigated Lithuanian online news media coverage and portrayal of vaccines for the period 2008 - 2018. The first section of this chapter presents findings from the total body of articles selected for this study. This allows to build a broader picture of vaccine-related discourse across the main online news platforms in Lithuania and contextualize the understanding of media content that is focused specifically on children's vaccines, which for the past decades have been at the forefront of public controversy. This section is followed by an analysis of results conducted on a sub-sample of articles related to children's vaccination. In addition to volume, vaccine type, authorship and source trends, analysis of two additional variables is presented – tone of articles on children's vaccines and the main themes in news articles on children's vaccination. Implications of findings and further avenues for research are discussed.

4.1 Results

4.1.1 Children's vaccines in context: Lithuanian online news media coverage of vaccination

Volume

Figures 5 and 6 show that in the period between 2008 January 1 and 2018 December 31 a total of 2093 articles related to vaccines were published in the three most widely read Lithuanian online news platforms. The best fit to data using non-linear least squares returns the curve (Figure 5, black line) that exhibits features of a sigmoid-shape line, showing that the pace of volume growth has variable rates. The following equation describes the variation of fitted curve:

$$N = 365 + \frac{(a - 365)}{1 + \left(\frac{Y}{c}\right)^b}$$

where N is the number of articles per year, Y is the particular year, and the constants are a=89, b=1254 and c=2014. The equation (1) predicts lag at the

beginning of the curve and saturation at the end. These features are clearly seen in Figure 5. The sharpest growth of articles appears to have taken place between 2012 and 2016. Although it can be seen from Figure 6 that the volume of coverage on vaccination in the last decade has fluctuated, there is an upward trend in the number of articles on vaccination being published across all three of the analyzed online news outlets.

The total number of articles on vaccines in each news outlet relates to its readership rank and scope of the website: DELFI publishes the most articles on vaccines and LRYTAS – the least. Almost half of all articles (49,1 %) were published in DELFI, 35,2% of articles were published in 15 MIN and 15,7% in LRYTAS.

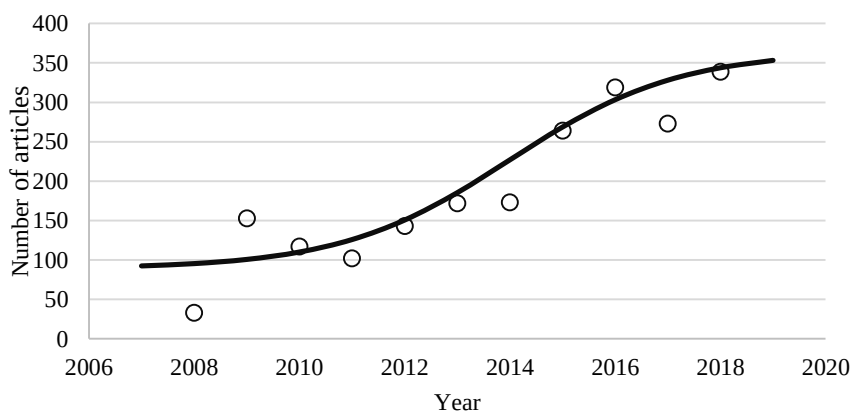


Figure 5. Best-fit curve, volume of articles on vaccines in Lithuanian online news (n) for years 2008-2018

As seen in Figure 6, the coverage of vaccines across all online news platforms is marked by several clearly visible peaks. The first peak appears in 2009, when the total volume of coverage about vaccines increased by roughly 4 times in DELFI (from n=21 in 2008 to n=87 in 2009) and 5.5 times in 15MIN (from n = 12 in 2008 to n= 66 in 2009) (see appendix E for all counts). The majority of articles discussed the flu vaccination, therefore, the spike could be associated with the H1N1 influenza pandemic, commonly referred to as swine flu, that emerged across all world regions in 2009 (WHO, 2010). Following the H1N1 influenza pandemic, the volume of news media articles decreased both in DELFI and in 15MIN.

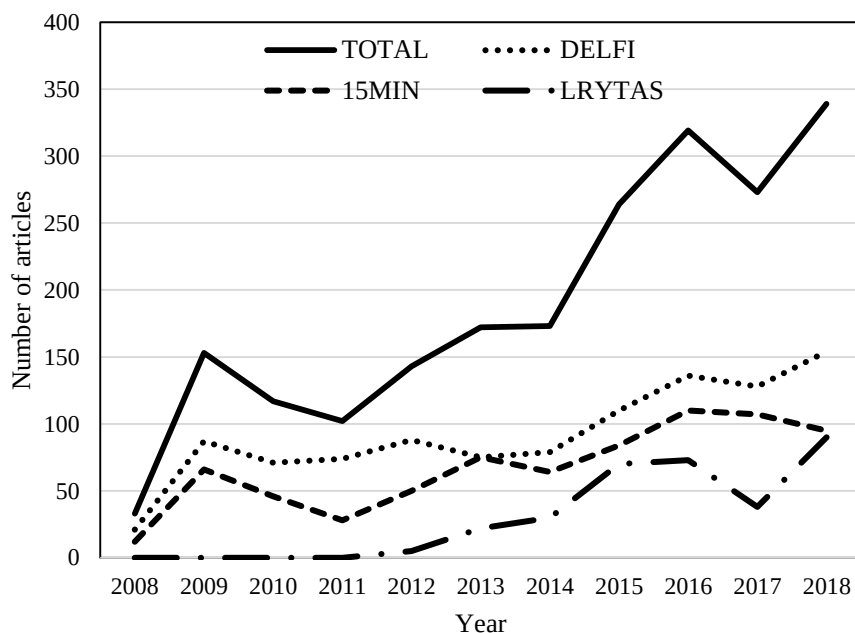


Figure 6. Volume of articles on vaccines in Lithuanian online news (2008-2018) (n)

A second increase (roughly 1,4 times) in the volume of coverage for DELFI, appeared from 2014 (n=79) to 2015 (n=110). The largest increase of stories between this period appeared in relation to the HPV vaccine (n=1 in 2014 to n=12 in 2015), which may be associated with discussions regarding the introduction of the vaccine into national immunization schedule (ULAC2, 2016). In 2018, the total volume of coverage in DELFI increased by 1,2 times from n=128 in 2017 to n=154 in 2018. During the period there was a sharp increase of articles on the flu vaccine and the large-scale flu epidemic in Lithuania in 2018 (from n= 18 in 2017 to n=46 in 2018), which accounted for roughly 93 % of the total difference of articles between 2017 and 2018.

With 15MIN, a growth in coverage appeared between 2011 (n=28) and 2012 (n=50), when the amount of vaccine-related articles nearly doubled. A closer analysis of the news stories written in that period revealed that the peak was mostly driven by an increase of general stories about vaccination (from n=4 in 2011 to n=18 in 2012), however, no clear patterns in article topics could be determined. In the next year, the volume of coverage kept increased (from

2012 (n=50) to 2013 (n=75)) with noticeable differences in the volume of articles related to the MMR vaccine and type-b meningococcal vaccination. Events related to these vaccines (e.g. the 2013 measles outbreak in Lithuania or the meningococcal infection outbreak scare) accounted for a part of the peak in coverage. Between 2015 (n=84) and 2016 (n=110) the total coverage on vaccines in 15 MIN increases again by 1,3 times. This was mostly driven by a spike in the coverage on the type-b meningococcal vaccine and the shortage of the vaccine during the 2016 meningococcal infection outbreak, accounting for roughly 42% of the difference in the coverage volume between 2015 and 2016; and a spike in the coverage on the tick-borne encephalitis vaccine, which accounted for around 58% of the difference. More than half of the articles on the tick-borne encephalitis vaccine (56,5), however, were sponsored articles.

In comparison to the other news sites, stories on vaccines in LRYTAS began to appear in 2012 - a delay that may be related to the newspaper's slower transition onto the digital platform. Although the volume of coverage shows an upward trend, a sharp peak in coverage volume appeared in 2015 (n=70), when the total number of published articles was more than twofold that of the previous year (2014 n=30). A closer examination of articles published in the period showed an increase of general articles about vaccination (25% of the total volume difference between 2014 and 2015), with a proportion of the articles discussing policies regarding compulsory vaccination. An increase of articles also appeared on the flu vaccine (22,5% of the total difference) and articles on HPV vaccination (20%). All of the latter articles focused on the controversy ensuing a prominent scandal of alleged HPV vaccine fraud. Following a two-fold decrease from 2016 to 2017 when n=37, in 2018 the total volume of articles on vaccination in LRYTAS reached its highest peak in the past decade (n=90). Increase of volume appears across most vaccine article categories. Some general articles were focused on issues related to the public debates surrounding vaccination, whereas all articles about the MMR vaccine, DTP vaccine and articles about tropical disease vaccination focused on outbreaks and/or cases of associated diseases in Lithuania and abroad.

Vaccines in the news

Content analysis showed that over the last 10 years vaccines for flu (FLU), tick-borne encephalitis (TICK), mumps-measles-rubella (MMR), type-b

meningococcal infection (MEN) and the human papilloma virus (HPV) appeared most frequently in online news. Of the total 2093 articles across the three news outlets selected for this study, roughly one fourth (24.8%, n=520) mentioned or focused on vaccines for various types of flu, including vaccines for swine flu. As shown in Figure 7, the other top covered vaccines received considerably less media attention. For example, articles related to vaccines for tick-borne encephalitis (n=153) and vaccines for measles-mumps-rubella (n=145), type-b meningococcal infection (n=139) and HPV (n=136) make up from 7.3% to 6.5% of the total sample. News stories on the diphtheria-tetanus and pertussis vaccine (DTP) make up 4,5% of the total sample (n=95). Over the last 10 years, news stories related to vaccines for hepatitis (HEP) appeared in the news 58 times and tuberculosis - 43 times. Articles related to vaccines for polio (POLIO), pneumococcal infection (PNEUM), chicken pox (POX), rotavirus (ROTO), appeared less than 40 times, making up less than 2% of the sample. General news stories on vaccines (GEN) made up a little more than a quarter of the sample (25,7%).

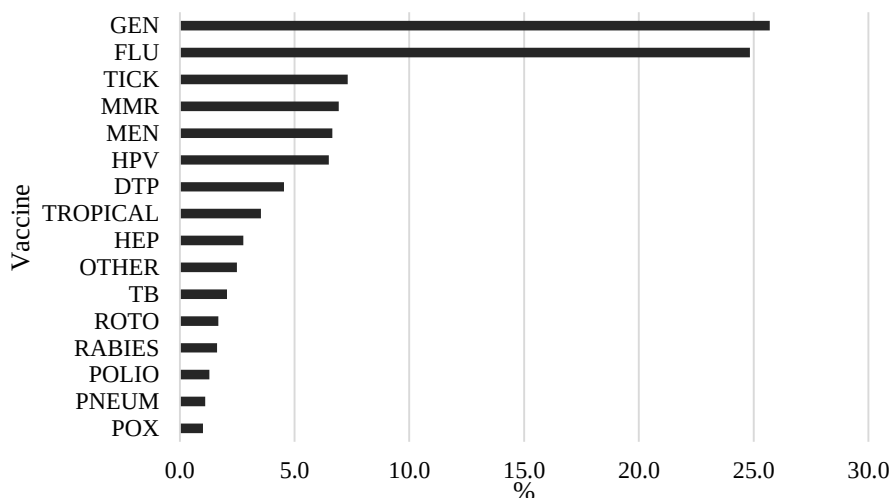


Figure 7. Proportion of articles on specific vaccines in Lithuanian online news, 2008-2018 (%)

These types of articles were either focused on more than one non-related vaccine (e.g. type b meningococcal infection vaccine and HPV vaccine in one article) or did not focus on any specific vaccines (for example, articles about

the importance of vaccinating children before returning to school after the summer break, articles about vaccine hesitancy, etc.)

As seen in Figure 8, despite a few exceptions, the proportion of articles on specific vaccines across the three news outlets is relatively similar, but there are also a few slight differences. For example, DELFI published the lowest proportion of articles on type b meningococcal vaccine, tuberculosis vaccine and vaccines for tropical diseases, as well as the highest proportion of articles focusing on articles covering “other” (OTHER) vaccinations, such as experimental cancer vaccines. There were less articles concerning the HPV vaccine, MMR vaccine, chicken pox vaccine and general articles about vaccination in 15 MIN, however, compared to the other two news outlets, the proportion of articles on the flu vaccine, tick-borne encephalitis vaccine and vaccines for tropical diseases on this news site was the highest. In comparison to other news outlets, LRYTAS gave less attention to the flu vaccine, the hepatitis vaccine, tuberculosis vaccine and vaccine for tick-borne encephalitis, but more attention to the HPV vaccine and general articles about vaccination.

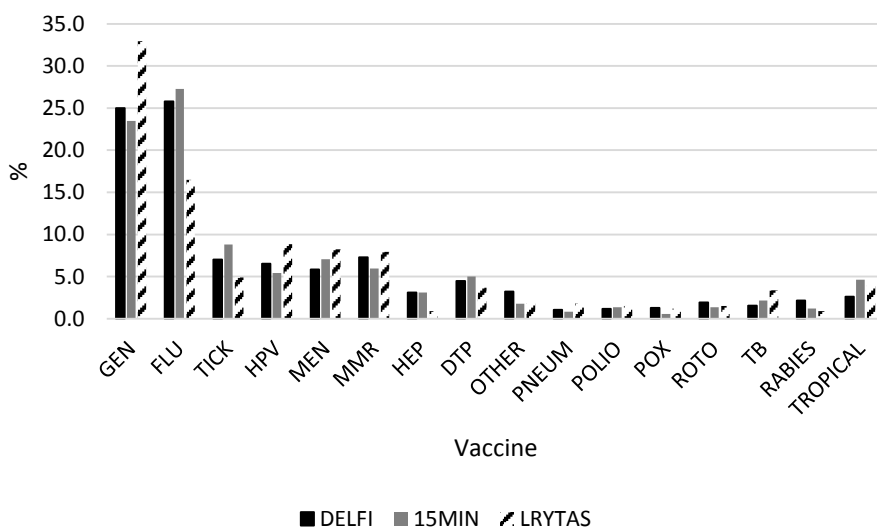


Figure 8. Proportion of articles on specific vaccines by news site, 2008-2018 (%)

As shown in Figure 9, original articles make up roughly two thirds of all articles about vaccines published in the analyzed news sites (65%). Articles distributed by news agencies make up 17% of the sample, which is similar to the publication of articles republished from other news sites, websites and blogs, etc. (15%). Sponsored articles in the analyzed online news sites make up a minor fragment – 3% of the total sample.

Site specific analysis showed that of the three news platforms, LRYTAS published the biggest amount (75,9%) of original articles on vaccination (Figure 10). The proportion of original articles in DELFI and 15 MINUTES was 62,4% and 63.5% respectively. The quantities of original articles, however, may be overrepresented. During the data analysis process, a number of articles that appeared as original publications, were sometimes also found on other news sites, meaning they were not original publication, but rather incorrectly by-lined “third-party” articles. It is important to note that these types of misrepresentations were prevalent across all the analyzed news outlets.

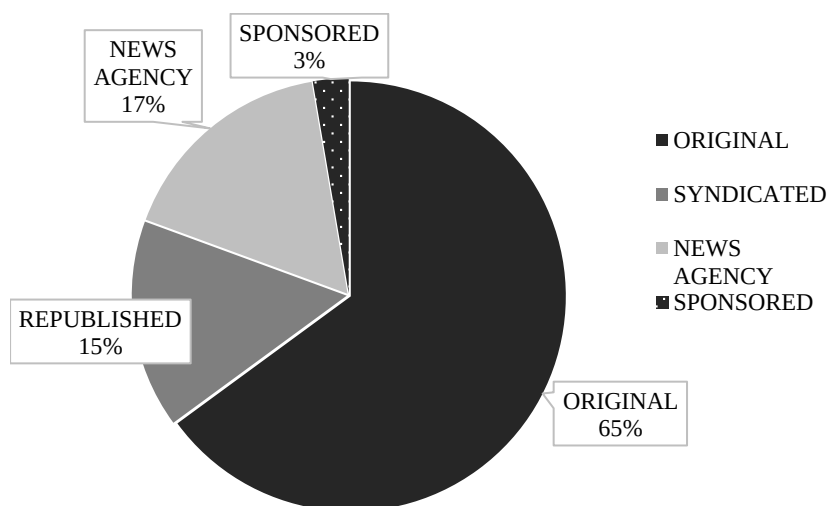


Figure 9. Authorship of articles on vaccines (%)

The second most common type of article authors were Lithuanian news agencies, such as ELTA and BNS, as shown in Figure 9. News agency content

makes up from roughly 15% to 20% of all the published articles, with 15MIN having the highest proportion of such content (19,9%) and DELFI - the least (14,9%) (see Appendix E for counts). All of the analyzed news sites also republished content on vaccination, i.e. published articles that have been published on other news sites or other sources. Roughly one-fifth (22,5%) of vaccine-related articles in DELFI were republished from other websites – the highest proportion among the analyzed outlets. The proportion of republished content in 15 MIN and LRYTAS was lower – 10,7 % and 5,5 % respectively.

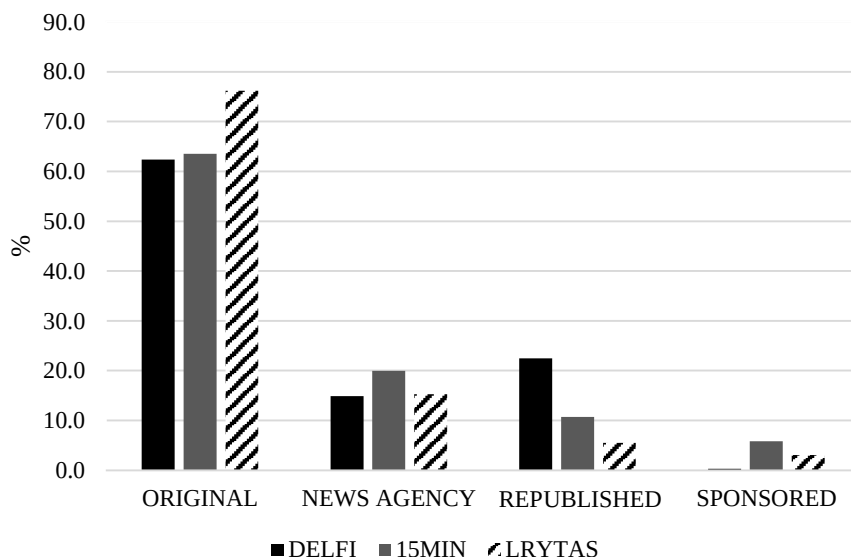


Figure 10. Article authorship by news site (%)

Finally, as designated by special marks, a proportion of the analyzed articles on vaccines was sponsored or labelled as “partner content” (e.g. 15 MIN), and described as press releases and news texts about a product, company or an organization prepared by a partner. Generally, as shown in Figure 9, the proportion of such content across all online news platforms appears to be relatively low (3%). Figure 10 shows that sponsored content in DELFI made up 0,3 % of the total content and 3% in LRYTAS. The proportion of sponsored/partner articles in 15MIN was 5,8% - almost double the total amount of sponsored content across the aggregated sample (3%, Figure 9).

News article authorship was also analyzed by specific vaccines. Vaccines with the highest proportion of original news articles (above aggregated sample

proportions) were HPV (75,7% original articles), hepatitis (75,9%), pneumococcal (82,6%), chicken pox (76,2%), tuberculosis (69,8%) and rabies (79,4%) vaccinations. Vaccines for flu (22,5%), DTP (22,1%), poliomyelitis (33,3%), rotavirus (22,9%), tuberculosis (23,3%) and tropical diseases (36,5%) had the highest proportion of news agency distributed articles. Highest proportions of republished news content appeared in news stories about MMR (22,8%) and ‘other’ (21,2%) vaccinations. Meanwhile, highest proportions of sponsored content appeared in relation to tick-borne encephalitis (11,8%) and type-b meningococcal infection (11,5%) vaccinations.

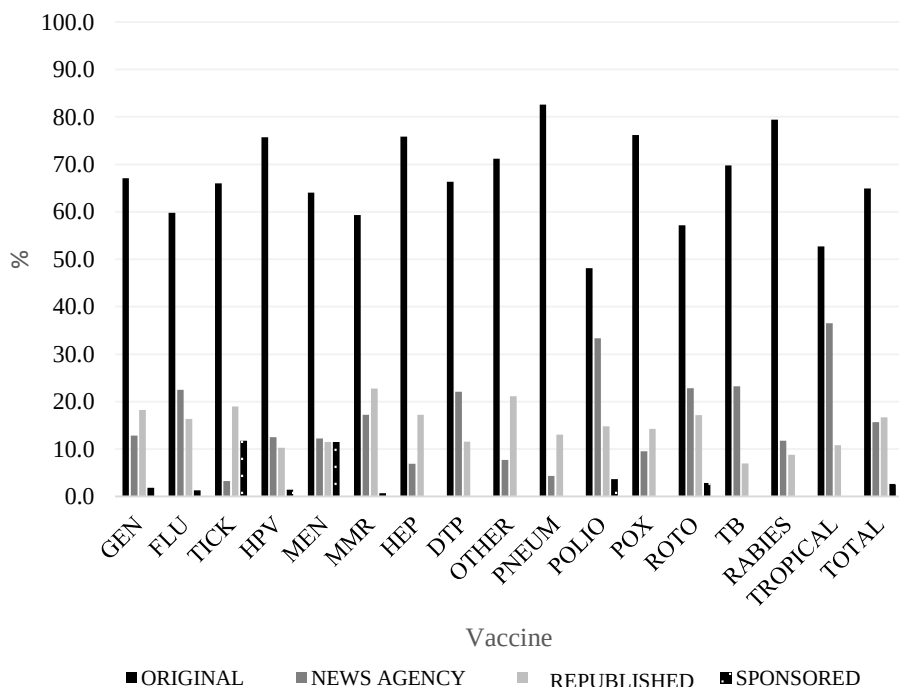


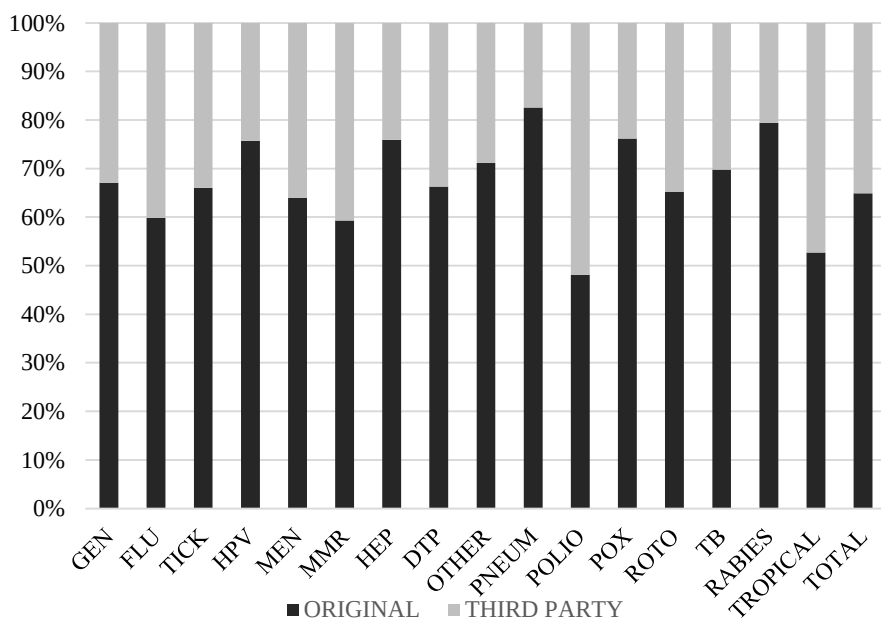
Figure 11. Article authorship by vaccine (%)

As shown in Figure 12, for the purpose of clarity, the articles in each news outlet were placed in two groups: group 1 - original articles and group 2 – “third-party” articles, e.g. articles that are republished, sponsored (“partner content”) or distributed by Lithuanian news agencies. Results showed that roughly one third of all articles on vaccines (35,1%) in the analyzed news sites originated from third-party sources. While original reporting was most

common for articles on the HPV, hepatitis, pneumococcal, chicken pox, tuberculosis and rabies vaccinations, a higher proportion of articles by third-parties was being published on the flu, MMR, polio and tropical disease vaccinations.

Figure 12. Original and third-party articles on vaccines (%)

Sources



More than half (62,7%) of all articles featured at least one direct source per article. As displayed in Figure 13, the most common direct sources appearing in articles on vaccines across the analyzed news websites are medical (28%) and public health officials (22%), government officials (18%) and non-experts (17%). Other direct sources are scientists, pharmaceutical representatives, homeopaths and law officials, but their appearance as a direct source of information is more rare. For example, scientists appeared in 8% of the articles and the appearance of law officials and homeopaths was insignificant (1%) in relation to the total sample.

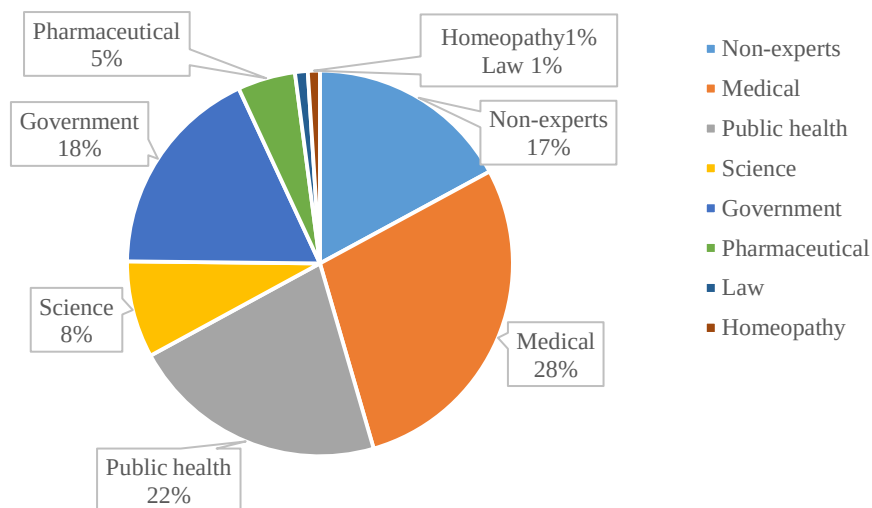


Figure 13. Most common direct sources featured in news articles on vaccines (%)

The proportion of articles without any direct sources in the analyzed Lithuanian online news sites was 37% (n=784). Most of these articles contained a reference to a secondary source (79%, n=622), such as another news website or document (e.g. “A report published by the World Health Organization <...>”, “The Daily Mail reports <...>”). This means that overall, the proportion of articles that were completely unsourced is limited – 7,7 % (n=162) of the sample.

Once again, slight differences can be observed among the analyzed news sites, displayed in Figure 14. In DELFI – 33.8 % of articles did not feature any direct sources (N=1028, n=348), of which 83% (n=289) featured a reference to at least one indirect source, such as another news site. Therefore, the majority of articles in DELFI (94,2%, n=969) can be considered as sourced. 15MIN had a slightly higher proportion of articles (44.5%) that did not feature direct sources (N=737, n=328). Of these articles, however, 75 % (n=246) featured at least one indirect source. In total 89.1% (n= 657) of articles in 15MIN can be considered as sourced. The percentage of articles without direct sources in LRYTAS was similar to DELFI – 32.9% (N=328, n=108). The proportion of articles that did not feature any direct or indirect sources once again is marginal (n=21). All in all, 93.5% (n=307) of articles in LRYTAS contained at least one source.

Medical experts and public health officials are the most common direct sources featured in articles on vaccines across all platforms. Medical experts appeared in more than one third of sourced articles on vaccines in DELFI (n=295; 43,4%) and roughly a third of articles in LRYTAS (35,5%, n=78) and 15MIN– 31,8% (n=130). Public health officials were featured as direct sources in 30,0% (n=204) of articles in DELFI, 32,8% (n=134) of articles in 15MIN and 23,6% (n=52) of articles in LRYTAS.

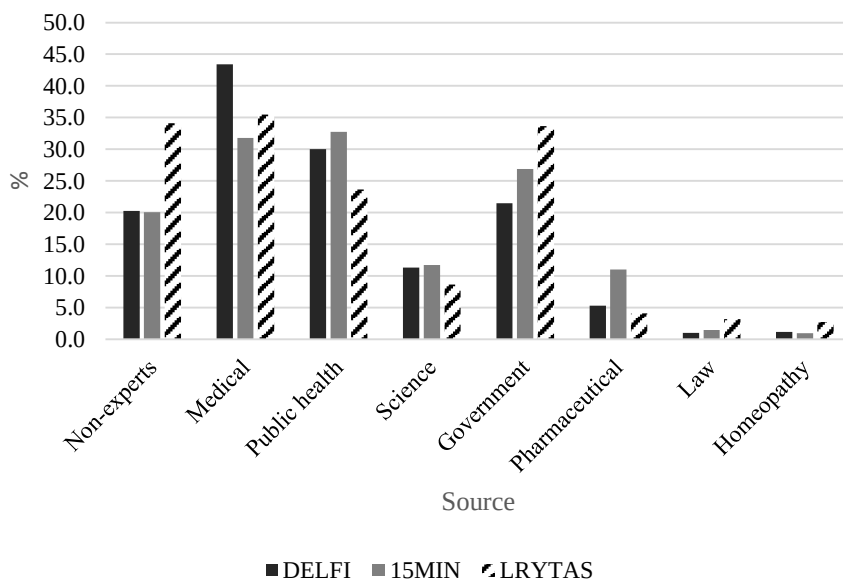


Figure 14. Appearance of direct sources by news site (%)

Except for LRYTAS, where government officials were one of the most frequent direct sources (33,6%, n=74), in DELFI and 15 MIN government officials appeared as direct sources at slightly lower frequencies to public health officials– in 21,5% (n=146) of articles in DELFI, 26,9 % (n=110) in 15MIN. Non-experts, e.g. parents, celebrities etc. appeared in 20,3 % (n=138) of articles in DELFI and 20,0% (n=82) of articles in 15MIN. On the contrary, LRYTAS featured non-experts as sources in 34,1 % (n=75) of articles on vaccines – roughly equal to the appearance of government officials and medical experts.

4.1.2 Lithuanian online news media coverage of children's vaccines

Volume

In the period between 2008 January 1 and 2018 December 31, Lithuanian online news platforms published a total of 905 articles related to children's vaccination. Articles discussing children's vaccines in Lithuanian online news make up 43,2 % of all articles published on vaccination (N=2093) in the last decade. As seen in Figure 15, the distribution of coverage volume on children's vaccines among the analyzed news outlets follows the previously observed patterns of general publishing related to vaccination: the majority of articles (47,6%) on children's vaccines were published in DELFI (n=431), 31,0% were published by 15MIN (n=281) and 21,3 % by LRYTAS (n=193).

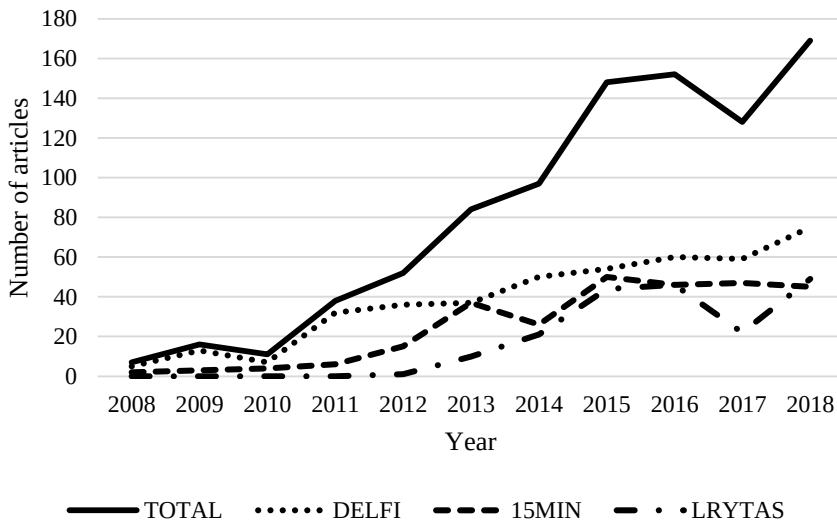


Figure 15. Volume of articles related to children's vaccines in Lithuanian online news (2008-2018) (n)

However, in comparison to DELFI (41,9%) and 15MIN (38,1%), over half (58,9%) of all publishing on vaccines in LRYTAS was related to children's vaccination.

Overall, the volume of articles related to children's vaccines shows an upward trend across all three online news platforms. As with the total volume

of articles, the number of articles on children's vaccines follows the same best-fit law, although with different fitting constants:

$$N = 161 + \frac{(a-161)}{1+\left(\frac{Y}{c}\right)^b} \quad (2)$$

where the constants are: $a=6.1$, $b=1623$ and $c=2013$. While retaining all features of a sigmoid-shape curve, the best fit curve equation (2) exhibits much larger relative increase rate (from 6 to 161), and earlier onset of acceleration with the midpoint at $c=2013$. Within a six-year period between 2010 and 2016 online news media interest in children's vaccines grew noticeably, from a total of 11 articles published in 2010 to more than 150 published in 2016 - twelvefold difference.

One of the two greatest peaks in coverage occurred between 2010-2011, when the total volume of article increased by 3.45 times (from $N=11$ in 2010 to $N=38$ in 2011). This was mostly driven by a several-fold rise of reporting on children's vaccines in DELFI (from $N=7$ in 2010 to $N=32$ in 2011), where the biggest increase appeared in general articles on children's vaccination, some of which addressed growing vaccine hesitancy trends. The second peak in coverage occurred between 2014-2015, when the total volume of articles increased by 1.5 times (from $N=97$ in 2014 to $N=148$ in 2015). The majority of the difference occurred in reporting on children's vaccines in 15MIN and LRYTAS. In 15MIN the greatest change was observed in reporting on the MMR vaccine, mostly discussing national and international measles outbreaks. In LRYTAS, the change was observed in general articles about vaccination and articles on the MMR vaccine, all of which focused on measles cases and outbreaks; as well as articles on the tuberculosis vaccine, which focused on the shortage of the registered TB vaccine in 2015. Over the last ten year period online news media coverage of children's vaccines was the greatest in 2018, when the three most widely read online news platforms in Lithuania published 169 articles related to children's vaccination.

Vaccines in the news

As displayed in Figure 16 conversations related to children's vaccination across all analyzed news outlets usually appear in general type articles on vaccination, i.e. articles that discuss various vaccines or no vaccines in particular (46,4%, $n=420$). Most of the focused attention given to vaccines

centers around the MMR vaccine and vaccination for type-b meningococcal infection, which make up 16,0% (n= 145) and 15,0% (n=136) of the total coverage related to children's vaccination. Articles related to the DTP vaccine (7,9%, n=72), tuberculosis vaccine (4,6%, n=42), rotavirus vaccine (3,8% n =35), pneumococcal vaccine (2,5%, n=23), polio (2,7%,n=25), hepatitis (0,4%, =4), chicken pox (n=1) and flu (n=2) vaccines make up marginal to negligible proportions of the coverage.

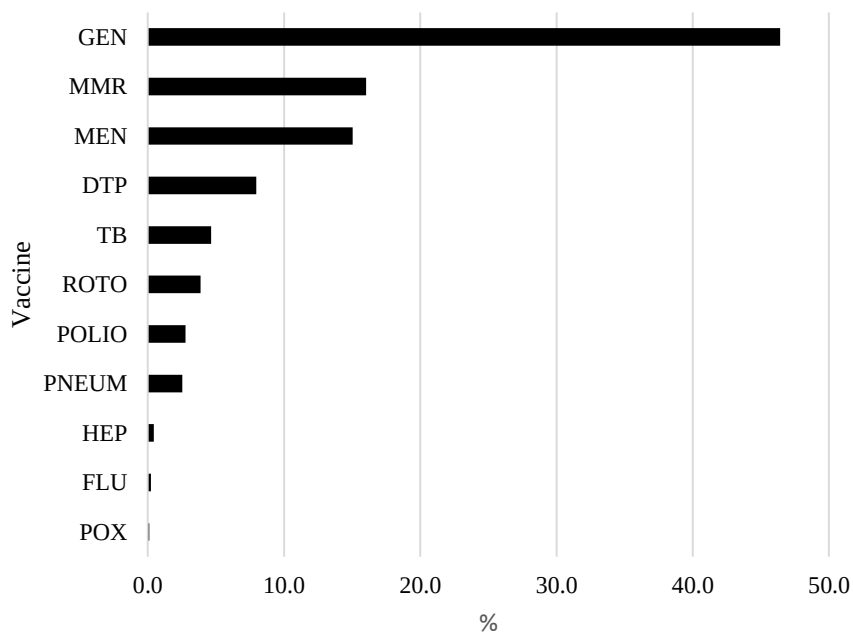


Figure 16. Proportion of articles on specific children's vaccines in Lithuanian online news, 2008-2018 (%)

There are a few slightly visible differences in children's vaccine coverage patterns among the analyzed news websites shown in Figure 17. Compared to other news websites, general articles related to children's vaccines appeared more frequently in LRYTAS (51,8% of total volume, n=100). 15MIN on the other hand, published a slightly higher proportion of articles related to type-b meningococcal vaccination (18,1%, n=51), but unlike other news outlets, it did not give any attention to children's hepatitis vaccine (0%). As shown in Figure 17, between the three news outlets, DELFI wrote a slightly higher proportion of articles related to the MMR (17,4%, n=75), DTP (9,4%, n=41) and rotavirus vaccines (4,6%, n=20) for children, but published a slightly

smaller proportion of articles related to the tuberculosis vaccination (3,5%, n=15).

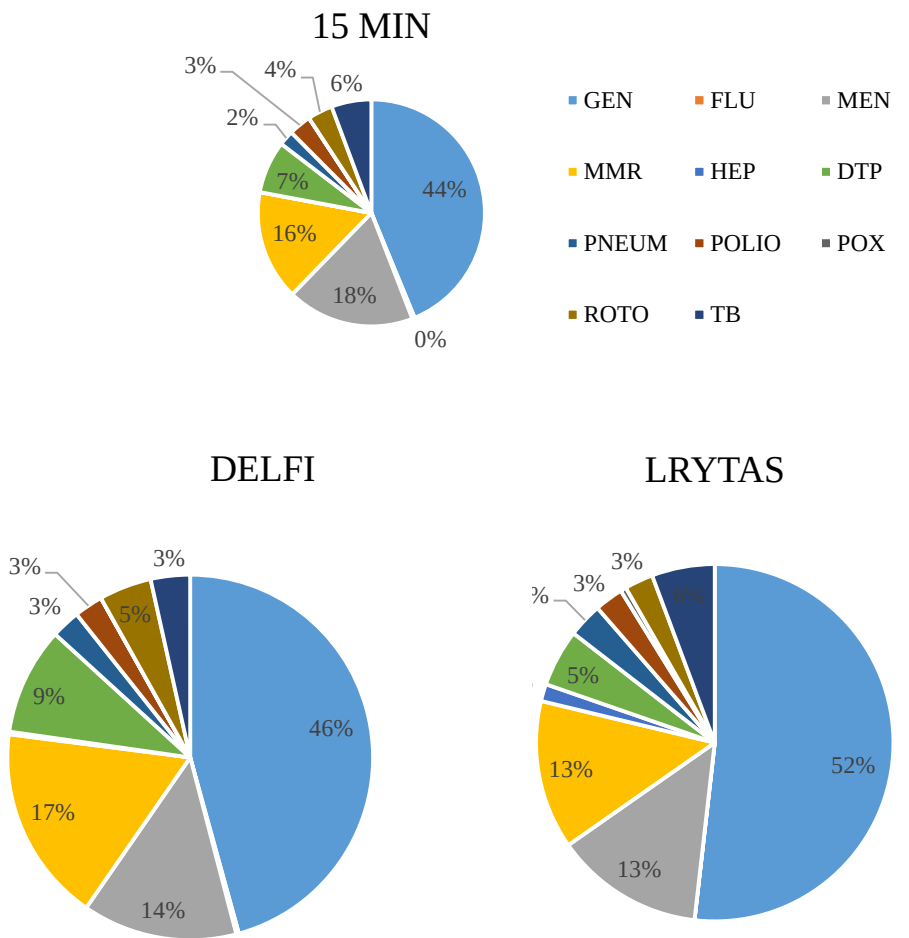


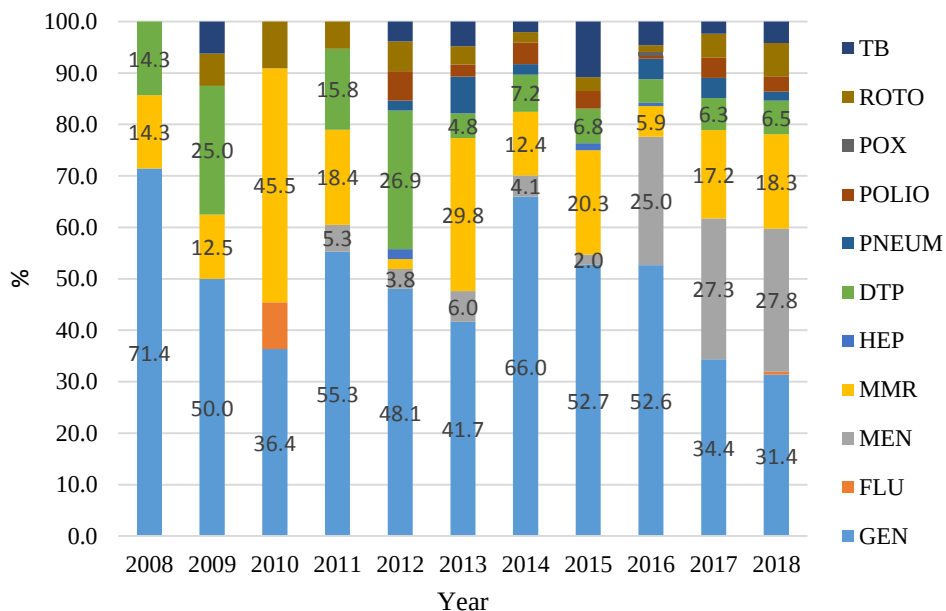
Figure 17. Proportion of articles on specific children’s vaccines by news site (2008-2018) (%)

A more detailed analysis of article topics over time presented in Figure 18 allows to see which vaccines dominated online news media coverage in a particular period and how media reporting interests have evolved over time. For example, until 2010 online news media coverage of children’s vaccines was highly homogenous in terms of the discussed vaccines, mostly featuring

articles related to MMR, DTP, tuberculosis and rotavirus vaccinations. Reporting on other types of vaccines, e.g. polio, hepatitis, pneumococcal infection, began to appear only in 2011. Since then, reporting on children's vaccination appears to be substantially more varied.

Figure 18. Variety of articles on specific children's vaccines over time (%)

As Figure 19 shows, articles related to the type-b meningococcal infection vaccine began to appear in 2011, however, media interest in the vaccine



peaked only in 2016 and since then, such articles made up roughly one quarter of the yearly media coverage volume related to children's vaccines. On the other hand, in the last five years, reporting on vaccines for diphtheria, tetanus and pertussis has slightly decreased (Figure 18). Until 2013, articles related to the DTP vaccine made up from 14% to roughly 27% of the total coverage on children's vaccination. In recent years, however, news articles on the DTP vaccine appear in less than 7% of the yearly sample. With few exceptions in 2010 (45,5%) and 2013 (29,8%) articles related to the MMR vaccine do not dominate the news and appear at moderate rates of frequency, making up less than one fifth (16%) of the total article volume on a yearly basis.

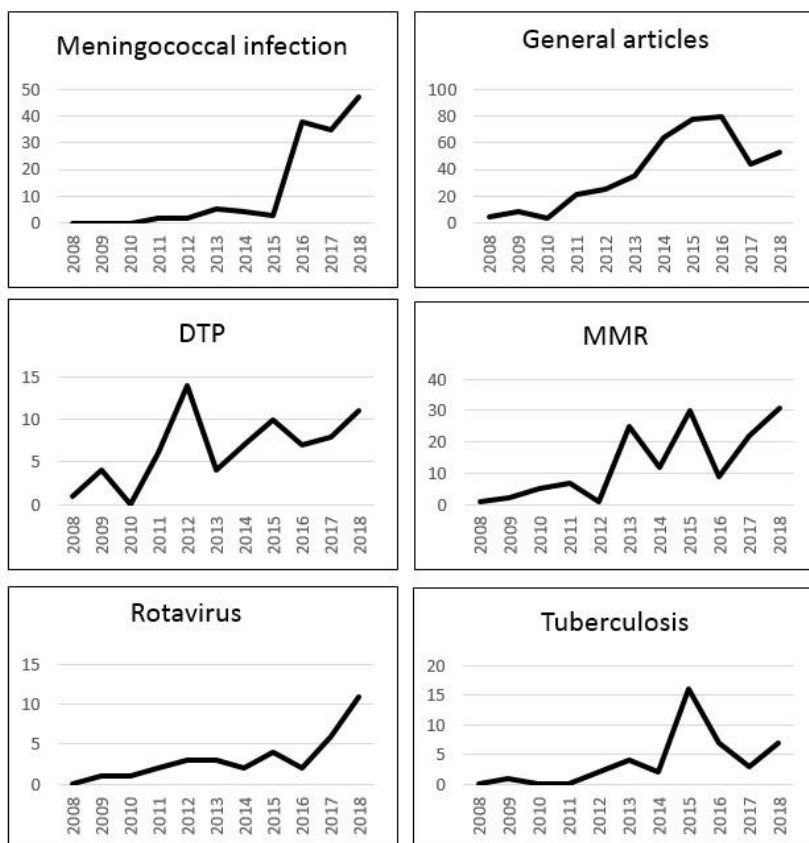


Figure 19. Media attention to specific children’s vaccines over time (n)

Figure 19 allows to see media attention to specific vaccines from a different perspective. It shows that except for the type-b meningococcal infection vaccine, media coverage is usually cycle-based, exhibiting sharp peaks and subsequent decreases of coverage, which may suggest an event driven approach to reporting. For example, online news media articles related to the DTP vaccine peaked in 2009, 2012, 2015, and 2018, whereas articles related to the MMR vaccine peaked in 2011, 2013, 2015, and 2018. Reporting volume on both vaccines shows incremental changes, yet remains volatile.

Epidemiological statistical data from the National Center for Communicable Disease and AIDS in Lithuania was used to determine whether there exists a relationship between peaks in media coverage of these specific vaccines and disease outbreaks (ULAC₁, 2019). Statistical analysis revealed a positive correlation between the number of diphtheria, tetanus and pertussis

cases and online news media coverage related to the DTP vaccine (Pearsons $r = .74$), and a positive, but slightly weaker correlation between the number of measles, mumps, rubella cases and online news media coverage related to the MMR vaccine (Pearsons $r = .47$). By contrast, statistical analysis showed that the correlation between the number of meningococcal infection cases and the volume of media coverage related to the type b meningococcal infection vaccine was negative (Pearsons $r = -.28$).

Article authors and sources

In line with findings from the broader dataset, original articles account for roughly two thirds (65,3%) of all articles published on children's vaccines in the analyzed outlets. News agency articles make up 17% of the total article volume (n=154) and articles republished from other news sites– 14,8% (n=134). Consistent with previously reported findings from the full sample, LRYTAS published the biggest amount (77,2%) of original articles on children's vaccination. The proportion of original articles on children's vaccination in DELFI and 15 MIN was 64,5% and 58,3% respectively (Figure 23).

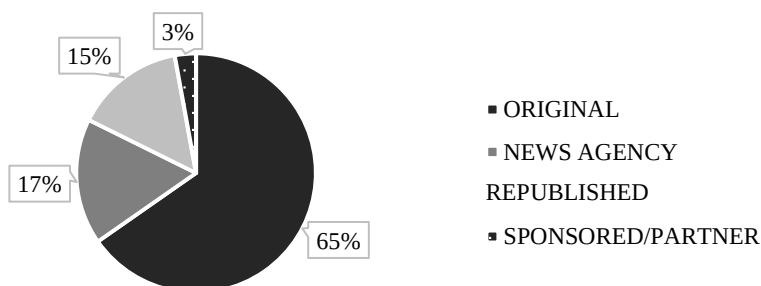


Figure 20. Authorship of articles on children's vaccines (%)

Once again, roughly one third (31,8%) of content related to children's vaccines in the analyzed outlets was either republished from other websites or distributed by Lithuanian news agencies. The proportion of such articles was slightly higher in DELFI (35,5%) and considerably lower in LRYTAS (20,6%), indicating a possible difference in attention towards children's vaccine among journalists across the three analyzed news platforms. DELFI did not publish or did not mark sponsored content related to children's

vaccines, however, such content made up 7,8 % of articles published on children's vaccines in 15MIN and 2 % of articles in LRYTAS.

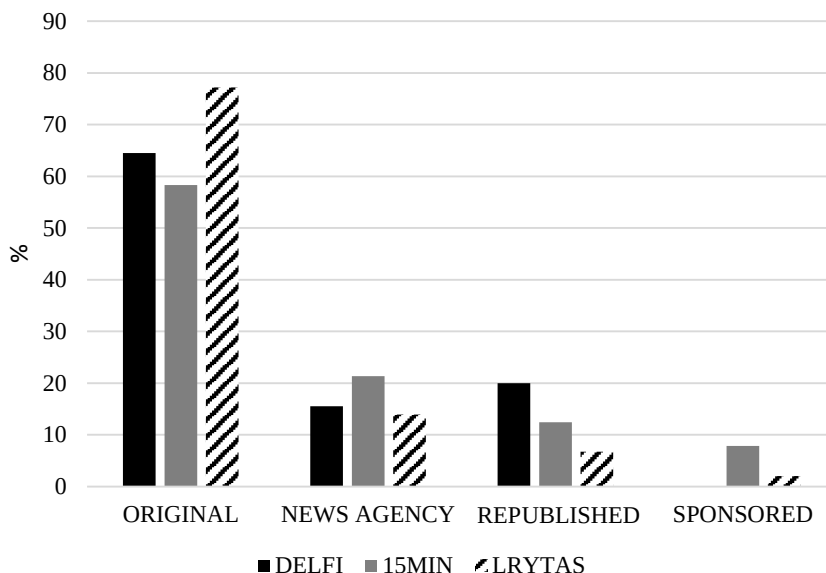


Figure 21. Article authorship by news site (%)

Authorship of news articles was also analyzed by specific vaccination and is shown in Figure 22. Proportion of original articles was the highest (e.g. above the aggregated sample proportions – 65,3%) in reporting on the pneumococcal infection vaccine (82,6%) and tuberculosis vaccine (69%). Higher than average proportions of news agency distributed articles (17%) appeared in relation to vaccines for type-b meningococcal infection (18,3%), DTP (23,9%), rotavirus (22,8%) and tuberculosis (23,8%). Higher than average proportions of republished news content (14%) – in articles on the MMR vaccine (23,4%) and rotavirus vaccine (17,1%), whereas sponsored

content is most prominent in articles on meningococcal (11,7%) and rotavirus infection vaccinations (2,8%).

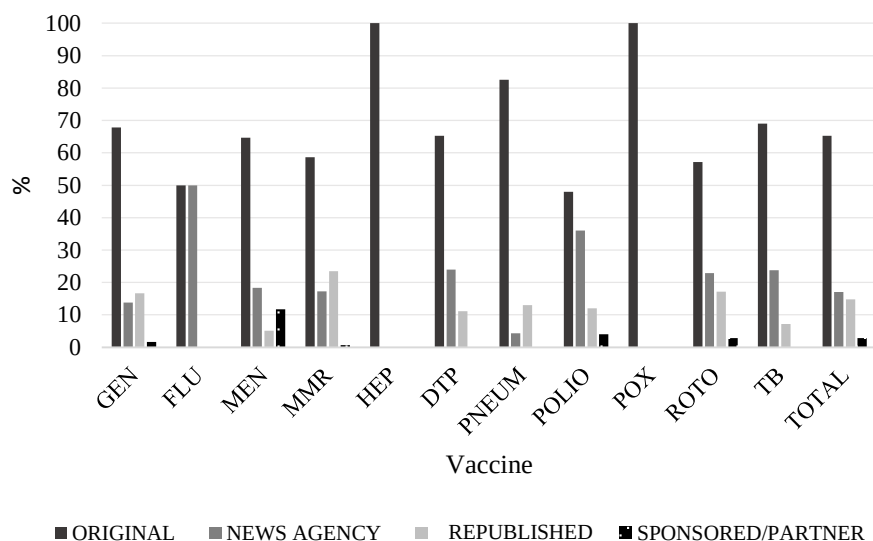


Figure 22. Article authorship by vaccine (%)

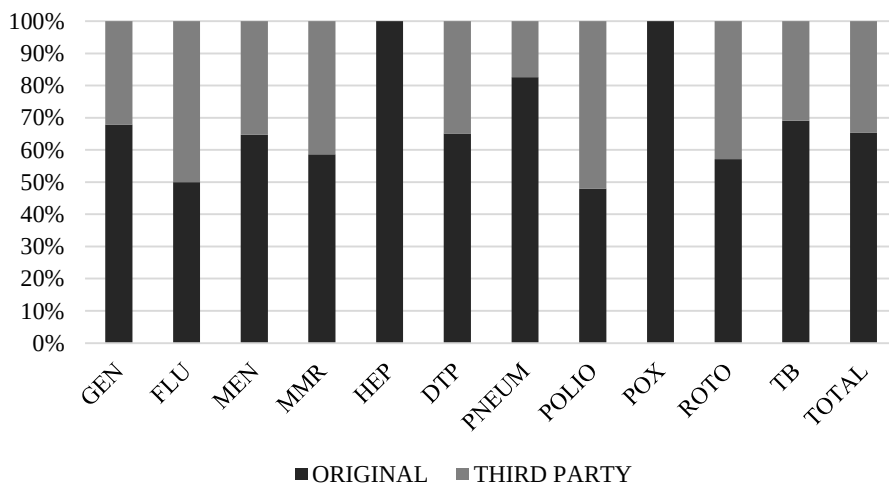


Figure 23. Original and third-party articles on children's vaccines (%)

As in the analysis of the broader sample, articles on children's vaccines in each news outlet were placed in two groups: group 1 – original content and

group 2 – “third party” articles, displayed in Figure 23. In the sub-sample of children’s vaccines, roughly one third (34,7%) of articles originate from third-parties. Third-party news coverage comes in higher proportions in reporting on MMR, polio and rotavirus vaccines (see Figure 23).

Sources

Once again, the patterns of reporting on children’s vaccines in terms of sources does not appear to deviate significantly from the overall patterns, discussed in the previous section (Figure 24). Consistent with the broader dataset, more than half of articles on children’s vaccines feature at least one direct source (62%), meanwhile 38% of articles on children’s vaccines in Lithuanian online news do not feature direct sources (n=344). Of these articles n=76 do not feature any kinds of sources, meaning around 8,4% of articles related to children’s vaccines in the analyzed news sites are completely unsourced. The highest proportion of unsourced articles on children’s vaccines is found in 15MIN (n=33, 11,7%). DELFI and LRYTAS both publish slightly smaller proportions of unsourced articles – 6,4% (n=28) and 7,7% (n=15) respectively.

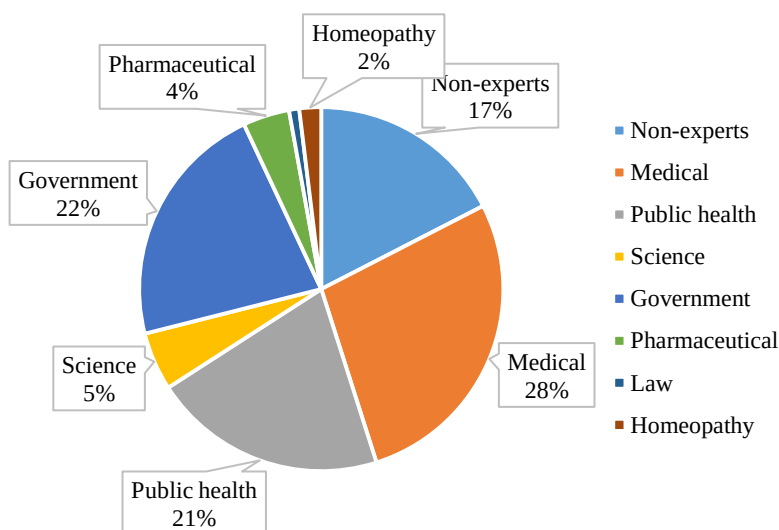


Figure 24. Most common direct sources featured in news articles on children’s vaccines (%)

As shown in Figure 24, medical experts and government officials are the most common direct sources featured in articles on vaccines across all platforms. Medical experts appear in slightly less than one third (27,7%, n=214) and government officials in roughly one fifth (21,9%, n=172) of all sourced articles on children's vaccines. Public health officials appear in similar proportions – 20,8 % (n=161) of the articles. Non-experts, such as laypersons and celebrities, appear in 17,4% (n=135) of all directly sourced articles on children's vaccination. In contrast - scientists, pharmaceutical industry representatives appear in a marginal proportion of the articles – 5 % (n=40) and 4% (n=32) respectively.

As previously, there are a few visible differences in the appearance of sources among the analyzed news outlets, displayed in Figure 27. In comparison to the other news outlets, DELFI published slightly more articles featuring scientists as sources (8,1%) and significantly more articles that featured experts from medicine (43,9%) and public health (30,9%). It also considerably less frequently relied on government officials (24,0%) and pharmaceutical industry representatives (2,9%). Conversations about children's vaccines in LRYTAS on the other hand, featured the highest and sizeable proportions of non-experts (31%) and government officials (40,3%). Among the analyzed news outlets, articles in 15MIN featuring pharmaceutical industry representatives (12,6%) exceeded average rates of appearance across the sample (5,7%) by roughly two times.

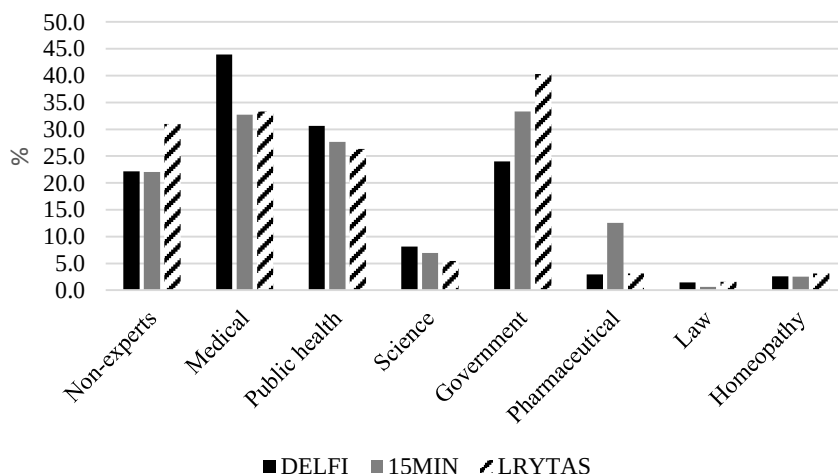


Figure 25. Appearance of direct sources in news articles on children's vaccines by news site (%)

Tone

Figure 26 shows that more than half of all articles (61,8%, n=560) that have been published on children's vaccines in the last decade were positive in tone, i.e. supporting the importance, effectiveness, safety of vaccines and/or promoting vaccination. One quarter of articles (25,0%, n=227) was neutral in tone, meaning there was no clearly expressed sentiment regarding vaccines or vaccination. For the purpose of clarity, positively and neutrally-toned articles were grouped (n=803), showing that 86,9% of articles on children's vaccines in the analyzed news sites was leaning toward positive, i.e. expressing supportive views towards vaccines or featuring no vaccine damaging information or messaging. A positive finding to emerge from the data is that only a fraction of articles (4,4%, n=40) were negative in tone, questioning or denying the importance, effectiveness, safety of vaccines and/or discouraging or associating vaccines with unsubstantiated health risks or health outcomes; 8,6% (n=78) of articles expressed both sides of the sentiment.

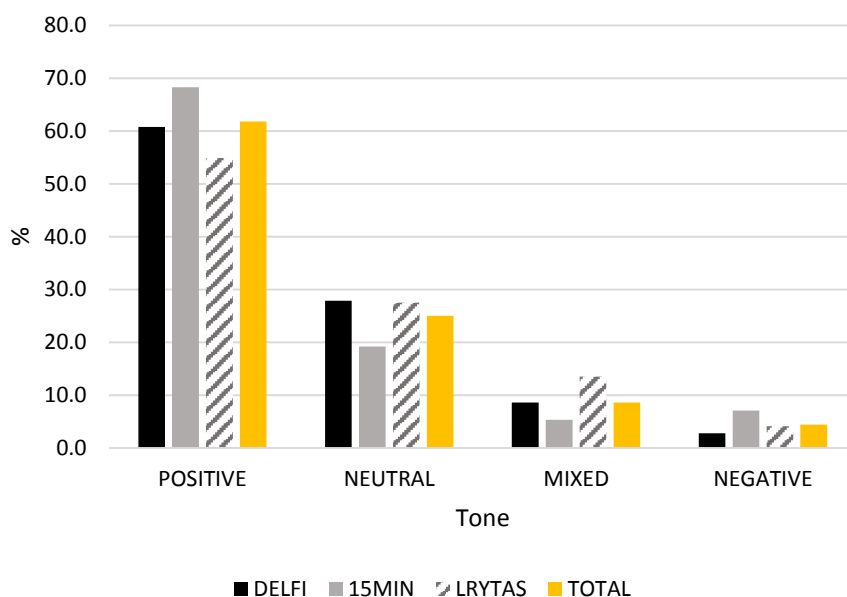


Figure 26. Article tone by news site (%)

Slight differences in reporting tone between the analyzed news sites was observed. As can be seen from Figure 26, LRYTAS published the lowest proportion of positive articles on children's vaccines (54,9%, n=106) and the highest proportion of articles (13,5%, n=78) that featured mixed sentiments. 15MIN published not only the highest proportion of articles that were positive in tone (68,3%, n=193), but also the highest proportion of articles expressing negative sentiments towards vaccination (7,1%). The lowest proportion of negative articles was published in DELFI (2.8%, n=12).

The majority of negative articles (N=40) were original articles (67,5%, n=27) and 15,0% (n=6) were distributed by news agencies or republished from other news sites (17,5%; n=7). The authorship patterns of mixed-tone articles were relatively similar with 73,0% (n=57) of original publications, 10,25% (n=8) distributed by news agencies and 15,3% (n=12) republished from other news sites.

The majority (80%, n=32) of negative articles were found in the 'general articles' category. Several negative articles were published specifically about the tuberculosis (n=4), polio (n=2), DTP (n=1) and the MMR (n=1) vaccines, however, their appearance was found to be marginal. Similar patterns can be observed in mixed tone articles about children's vaccines, shown in Figure 27. 'General' type of articles made up 75,6% (n=59) of all mixed tone articles related to children's vaccines. Mixed toned articles also appeared in relation to the type b meningococcal vaccine (n=6), tuberculosis (n=5), MMR (n=5), hepatitis (n=1), DTP (n=1) and pneumococcal (n=1) vaccinations.

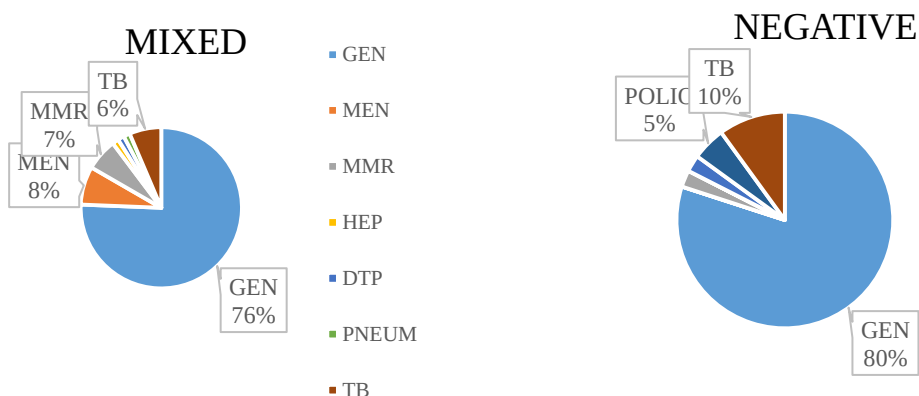


Figure 27. Vaccines in negative and mixed tone articles on children's vaccines (%)

A closer comparison of news article sources across the four tone groups displayed in Figure 28 below, shows that non-experts, e.g. parents, celebrities, appeared in 56,1% and 59,0% of articles respectively, where the tone was negative or mixed. In positive articles, however, non-experts appeared in roughly 8% of the stories. Appearance of non-experts in news articles on children's vaccines, seems to be a predictor of negative leaning news articles on children's vaccination.

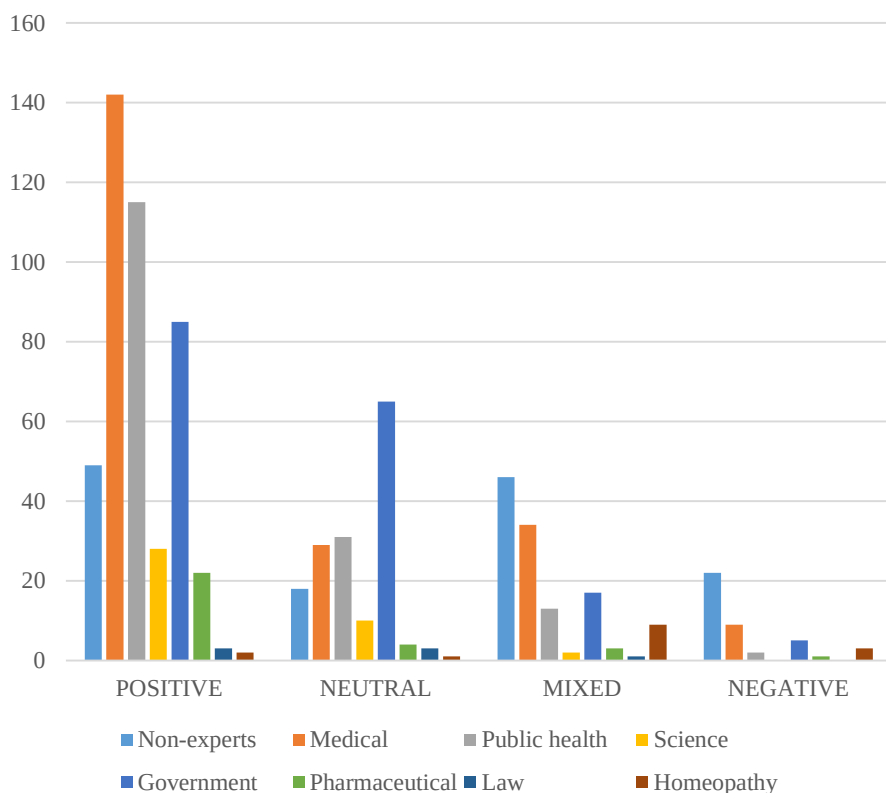


Figure 28. Appearance of direct sources across different article tone groups (n)

More generally, of the negative articles that were directly sourced (N=32), most featured non-experts (68,8%, n=22), medical professionals (28,1%, n=9), government officials (15,6%, n=5) and homeopaths (9,4, n=3%). Directly sourced mixed sentiment articles (N=70) most frequently featured non-experts (65,7%, n=46), medical professionals (48,6%, n=34), government officials (24,3%, n=17), public health officials (18,6%, n=13) and homeopaths

(12,9%, n=9). The slightly similar proportion of non-experts and medical professionals in this type of articles reflects that mixed tone articles usually present a debate between the latter sources.

In positive articles (N=337), the most frequent sources were medical specialists (42,1%, n=142), public health specialists (34,1%, n=115) and government officials (25,2%, n=85); in neutral articles (N=122) - government officials (53,3%, n=65), public health (25,4%, n=31) and medical specialists (23,8%, n=29).

Distribution of negative and mixed tone articles over time is displayed in Figure 29. It shows that articles expressing mixed sentiments peaked in 2012 and in the period between 2014-2015, whereas negative articles peaked slightly in 2012 and more noticeably in 2014 and 2016. A dotted line in Figure 29, marks the major measles outbreaks in Lithuania, which occurred in 2013, 2015, 2016 and 2018 (ULACi, 2019).

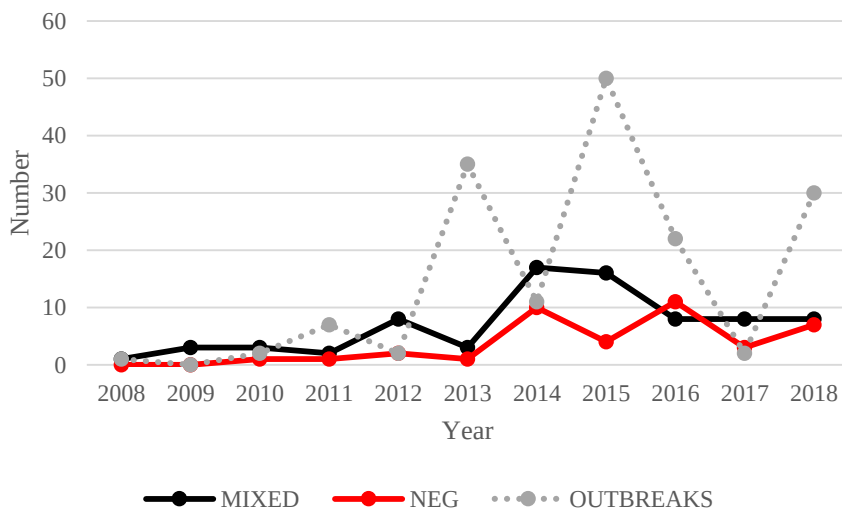


Figure 29. Negative and mixed tone coverage of children's vaccines and MMR outbreaks (n)

The graph indicates that outbreaks of measles were followed by periods of heightened negative and mixed media coverage of vaccines. However, these types of articles would decrease during measles outbreaks, when there would appear a peak in positive coverage (shown in Figure 30). A correlation test, between yearly difference in groups of negative leaning articles and measles cases in Lithuania, showed a very slight negative correlation (Pearsons $r = .22$),

indicating there is a relationship between negative and mix toned coverage of vaccines and subsequent disease outbreaks, however, any broader conclusions regarding this association cannot be drawn and should be investigated with other methods.

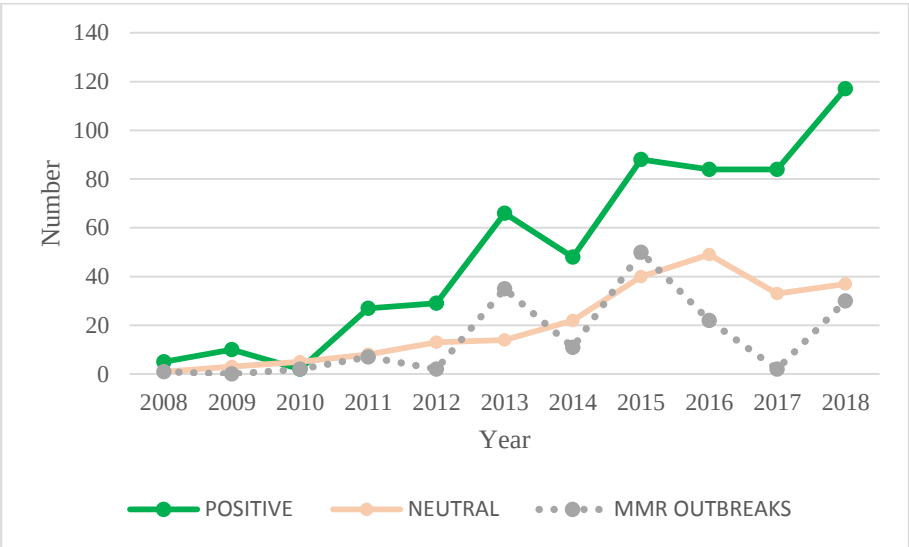


Figure 30. Positive tone coverage of children’s vaccines and MMR outbreaks (n)

Theme

A thematic analysis was used to determine the most frequent themes discussed in online news articles on children’s vaccination. Table 8 shows the breakdown of positive and negative themes and their frequency of appearance in children’s articles on vaccination between 2008-2018.

Table 8. Themes in positive and negative online news coverage of children’s vaccines

Positive articles (N=560)			Negative articles (N=40)		
<i>Theme</i>	n	%	<i>Theme</i>	n	%
Disease risk/vaccine benefit	484	86.4	Vaccine risk/uncertainty	21	52.5
Vaccine hesitancy	205	36.6	Complications	17	42.5
Case/outbreak	186	33.2	Conspiracy	4	10
Policy	147	26.3	Fairness/ Discrimination	2	5
Progress	81	14.5	Alternative knowledge/necessity	2	5
Safety/effectiveness	74	13.2			
Rights/responsibility	42	7.5			
Side effects	24	4.3			

Overall, disease risk/vaccine benefit is the most common topic theme appearing in positive online news articles on children’s vaccines (86,4%). When an article featured this issue it usually discussed the danger or population susceptibility to infectious diseases and/or emphasized the importance of vaccination. For example: *“Initial symptoms of meningococcal infection are usually non-specific and remind those of the common cold, making it difficult even for a health care specialist to diagnose this disease in the early stages. That is why one of the most effective means to prevent this cunning disease is vaccination (15MIN, October 10, 2017 “Žygis Stakėnas: Let’s make use of scientific progress and protect our children”)*.

The second most frequent theme in positive articles was vaccine hesitancy, appearing in 36,6% or slightly more than a third of all articles. These articles, like the May 31, 2013 article in 15MIN titled *“Doctors on the measles outbreak: we’re sorry that vaccines are reduced to the level of a massage”* usually addressed decreasing numbers of vaccinated children or the recent trend in parents’ ambivalence towards vaccines and discussed the ensuing consequences.

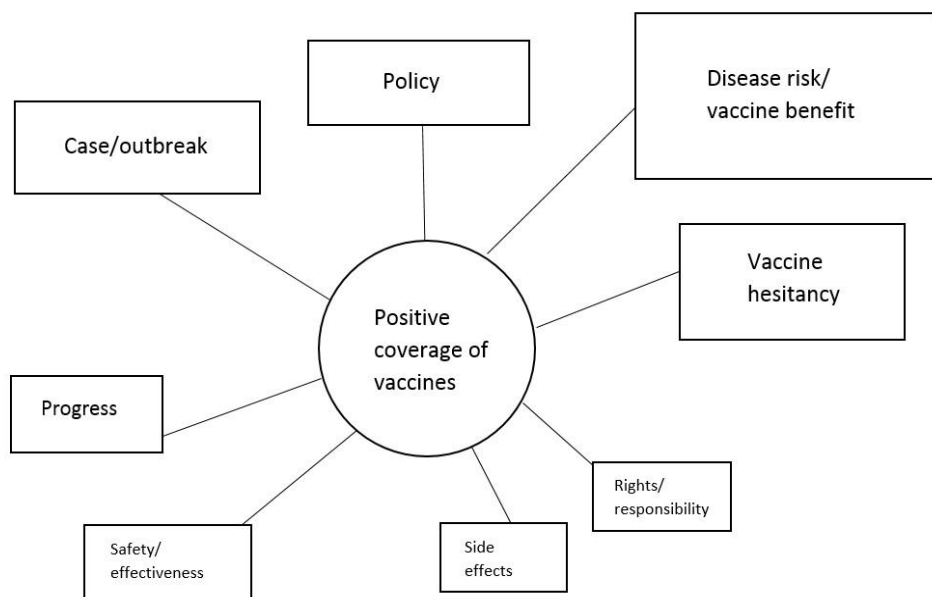


Figure 31. Themes in positive online news coverage of vaccines

Discussions of case/disease outbreaks appeared at relatively similar frequencies – 33,2% of positive news articles on children’s vaccines. Here, the stories would either discuss individual cases of infectious diseases or national/international disease outbreaks. For example, one story during the 2013 outbreak of measles in Lithuania reported: *“the outbreak source is currently in Vilnius, but specialists are threatened by the virus’ volatility: according to the Center for Communicable Diseases and AIDS, 27 cases of measles have been registered in Vilnius: 3 children and 24 adults are sick. Currently, huge outbreaks of measles are also recorded in Georgia and the UK. In Georgia around 3800 individuals are sick with measles. There are 2 registered deaths. Among the dead an 11 month old infant. Around 1500 cases of measles have been registered in the UK, one person died. The outbreak started with one family that refused to vaccinate their children <...>”* (DELFI; May 30, 2013 “A sudden outbreak of measles in Lithuania: is it time to introduce sanctions for refusal of vaccines?”).

Discussions of children’s vaccines in the context of policy and progress appeared in 26,3% and 14,5% of the articles respectively. In contrast to disease risk/vaccine benefit, vaccine hesitancy or disease cases/outbreaks

themes, discussions regarding vaccine safety/effectiveness (13,2%) or side-effects (4,3%) appeared relatively infrequently.

In comparison, negative articles about children's vaccines most frequently discussed vaccine risk or uncertainty related to vaccination (52,5%), as well as the alleged complications caused by vaccines (42,5%). Articles containing the vaccine risk/uncertainty theme emphasized the allegedly known dangers of vaccination, questioned vaccine safety, alleged presence of disagreement between doctors about vaccines and/or relayed general doubt about vaccine effectiveness. For example, an article in DELFI reported: *"Given the current environmental ecology, vaccines are an additional negative factor <...>The biggest distrust arises from not telling the truth. For example about mercury in vaccines – there were professors in Lithuania, claiming vaccines do not contain it and never did, that this is dumb gossip. But the World Health Organization admitted, that they did and still do to this day. The flu vaccine contains it. Another lie is that – it is "not dangerous". How can it not be dangerous if the chemical description of thimerosal states that it is a toxic substance, dangerous to water, fish, plankton. Our body is also composed of water. If something is toxic for water, it means it is also toxic for us"* ("Physician: viruses are not responsible for our diseases", May 17, 2014).

Stories about vaccine complications depicted, oftentimes in dramatic detail, individual experiences or hearsay events of unsubstantiated adverse effects after or due to vaccination: *"No one told my husband and I that there can be side-effects. We knew that the skin gets a little red and swells around the area where the injection was made. We never linked the diseases of our six kids with vaccination." Their 16, 12 and 10 year old children now have autism, 25 year old son has activity and attention deficit disorder, 14 year old has severe speech difficulties and 20 year old suffers from severe mood swings, writes the "Daily Mail". They also had chronic ear infections, bronchitis, asthma, eczema, psoriasis, urinary tract infections, auto immune diseases, had allergies and were sensitive to certain chemical substances"* (LRYTAS; March 31, 2015 "Mother calls the choice not to vaccinate children her best decision").

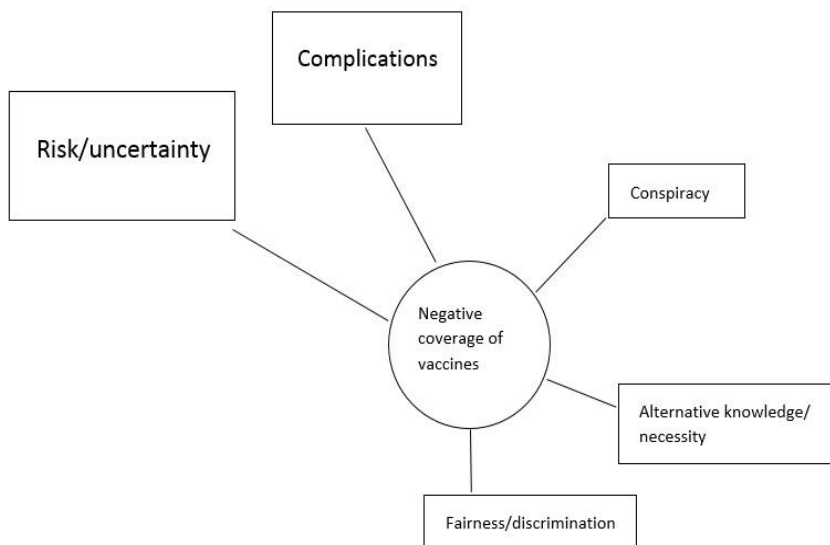


Figure 32. Themes in negative online news coverage of children’s vaccines

For example, in one such news story, a father argued “<...>*No, I never vaccinate. I have very bad memories about what happened when we vaccinated our son. We vaccinated him. Several minutes after the vaccine his face turned white, he fainted. He stayed in the ICU at Santariškės for a week. Afterwards his immune system was completely disbalanced <...>*” (DELFI; November 8, 2012 “An hour with Ruta: how do you medicate when you are sick..”).

Themes such as vaccine-related conspiracies (10%), including the “big pharma” myth, questions regarding the fairness and discrimination associated with vaccination (5%) or alternative theories to vaccination (5%) appeared in less than one-tenth of negative articles about children’s vaccines.

Analysis of themes also allows to understand and systemize in more detail the discourse surrounding specific vaccines across the analyzed news outlets. Data displayed in Table 9 shows that coverage of specific vaccines is powered by substantially different conversations. For example, aside from the focus on the risks of mumps, measles and/or rubella or the importance of vaccination, reporting on the MMR vaccine mainly revolved around the discussion of cases and/or disease outbreaks, which are mentioned in 80,3% of the stories. Another frequently reoccurring theme in news articles about MMR was

vaccine hesitancy (45,9%), with almost every second article elaborating on various aspects of public doubt over vaccination. Surprisingly, MMR vaccine safety/effectiveness and conversations regarding plausible vaccine side effects, which have been at the center of public disputes over vaccination, appeared only in 4,9% and 2,5% of stories respectively.

Table 9. Appearance of themes in positive tone coverage of specific children's vaccines (%)

	Risk/benefit	Hesitancy	Case/ outbreak	Policy	Progress	Safety/ effectiveness	Rights/ responsibility	Side effects
General (n=217)	77.0	56.7	2.8	24.0	26.7	24.4	16.1	7.8
MMR (n=122)	98.4	45.9	80.3	9.0	6.6	4.9	4.1	2.5
Meningococcal (n=92)	90.2	13.0	37.0	66.3	2.2	9.8	1.1	5.4
DTP (n=56)	91.1	23.2	71.4	8.9	0.0	5.4	0.0	0.0
Polio (n=14)	78.6	28.6	28.6	21.4	71.4	7.1	0.0	0.0
Pneumococcal (n=19)	100.0	0.0	10.5	84.2	0.0	15.8	0.0	0.0
Rotavirus (n=25)	100.0	4.0	32.0	40.0	4.0	4.0	4.0	4.0
Tuberculosis (n=42)	100.0	0.0	20.0	20.0	40.0	0.0	0.0	0.0

Policy (66,3%) is found to be the second most common theme in news articles about the type-b meningococcal vaccine, with news stories discussing importance and urgency of adding it to the national list of state subsidized vaccinations. Conversations about the safety/effectiveness (9,8%) and side effects (5,4%) of the vaccine appear in almost twice as many stories compared to MMR related articles and vaccine hesitancy is mentioned in 13,0% of the news articles.

Even though polio vaccine was supposed to become one of the three mandatory vaccines in Lithuania in 2014, articles about the polio vaccine primarily focus on the accomplishments of the international polio vaccination

efforts and discuss its future elimination (progress theme found in 71,4% of the articles). Themes such as vaccine hesitancy, policy issues or polio cases/outbreaks, which still occur in many parts of the globe, each appeared in less than one third of the articles.

Negative stories, which focused on vaccination complications (N=17) appeared most frequently in the ‘general’ news article category (n=10) and articles about the tuberculosis vaccination (n=4). Articles that focused on the risks/uncertainty of vaccines (N=18) also appeared primarily in the ‘general’ articles category (n=17), as did articles that discussed conspiracies surrounding vaccines (N=4, n=4).

Articles that were coded as having a mixed tone featured both positive and negative sentiments towards vaccines and their analysis showed that almost half of these articles featured direct juxtapositions of non-experts and experts. Disease risk/vaccine benefit (69,2%) and vaccine risk/uncertainty (59,0%) remained as the most frequent themes.

Table 10. Appearance of themes in mixed tone coverage of specific children’s vaccines (%)

Mixed tone articles (N=78)					
<i>Positive theme</i>	n	%	<i>Negative theme</i>	n	%
Disease risk/vaccine benefit	54	69,2	Vaccine risk/uncertainty	46	59,0
Safety/effectiveness	25	32,1	Alternatives knowledge/necessity	38	48,7
Progress	23	29,5	Complications	28	35,9
Vaccine hesitancy	22	28,2	Fairness/ Discrimination	21	26,9
Side effects	16	20,5	Conspiracy	21	26,9
Rights/responsibility	15	19,2			
Case/outbreak	14	17,9			
Policy	14	17,9			

There are several notable differences, when comparing the appearance of themes across positive, negative and mixed tone articles on children’s

vaccines. Unlike in positive coverage of vaccines, where conversations about vaccine safety/effectiveness and vaccine side effects appeared in 13% or less of the news coverage, in mixed tone articles on children's vaccines, the appearance of these themes was significantly more frequent, with safety/effectiveness theme appearing in 32,1% of the articles and side effects discussed in 20,5% of the articles. Another difference can be observed in the frequency of discussions surrounding disease cases/outbreaks. If disease cases/outbreaks was one of the primary themes in positive news coverage of children's vaccine (33,2%), then in mixed tone coverage of vaccines it appeared in almost twice as less articles (17,%). An inverse trend can be observed with the progress theme, which appeared only in 14,5% of positive news articles on vaccines and 29,5% of articles in mixed tone coverage of children's vaccination (Table 10).

Comparison of themes in negative coverage of vaccines and appearance of these themes in mixed coverage of vaccines shows a similar trend of difference. For example, almost half of mixed tone coverage of vaccines (48,7%) featured what was termed as the alternative knowledge/necessity theme, where news articles would mention or present elaborate discussions on alternative theories about vaccination, vaccination mechanisms, effects, immune system and/or question the necessity of vaccination. For example: *"Two shots are required for a newborn – for tuberculosis and hepatitis B. The latter is transferred through sex or blood. What chance is there, that a baby, which is constantly with the mother, is at risk for that? We also don't go with the child to dangerous places, where there's a chance to contract tuberculosis"<...>*" (DELFI, December 13, 2009, "Vaccines: weaken the immune system or save lives?"). In negative tone articles this theme appeared in 5% of the coverage. There were also significant differences in the appearance of the conspiracy theme and the fairness/discrimination theme. In negative coverage of vaccines these themes appeared in slightly less than 10% of the news articles compared to 26,9% of articles in mixed tone coverage. Conspiracy theme encompassed ideas about the commercial interests associated with vaccines, sinister purposes of the pharmaceutical industry, conflict of interest between scientists and business and/or corruption among medical practitioners. For example, a famous Lithuanian celebrity commenting on vaccines remarked - *"Some doctors told me they wouldn't vaccinate their kids. There is a lot of information about vaccines on the Internet, as well as claims form Russian scientists. That is why for me – it is a very sensitive topic. Of course, you cannot blow against the wind. It is a business and big money. I think that the representatives of the same pharmaceutical*

industry also invented the viruses. I received a letter from a mother, whose child died from a vaccine. That is covered up. Most of the people in Lithuania are marionettes, like a herd, with no opinions, they're controlled. <...>" (LRYTAS; February 2, 2016, "Anti-vaccine ranks include doctors"). Fairness/discrimination theme showed a significant spike in appearance between 5% in negative coverage of children's vaccines to 26,9% of the mixed tone coverage on children's vaccines. Fairness/discrimination/policy themed articles focused on the considerations of the prejudices, biases and injustice related to vaccination from the perspective of vaccine hesitant parents. For example, an article discussing the potential mandatory vaccine reform reported: *"Parent of 3.5 year old son from Vilnius <...> is certain, that such legislation would discriminate against unvaccinated kids and restrict their rights to education. "It would restrict the child's rights. Education in Lithuania is mandatory, while vaccinating a child is recommendational in nature, it is not mandatory. It is strange, that such a method is used to make an optional thing mandatory. Such legislation would be discriminatory and even degrading to the child<...>"* (LRYTAS; February 2, 2014, "V. Andriukaitis is determined to not accept unvaccinated children into daycare").

4.2 Overview of findings

Over the last ten years, the three most widely read online news sites in Lithuania published a total of 2093 articles related to vaccination. The current study found that a little over 40% (N=905) of this news coverage was related to children's vaccines. A 2017 analysis conducted by the European Medical Agency emphasized the benefits of monitoring media coverage on vaccines, in particular, its use for improving vaccine-related public communication activities (Bahri et al., 2017). Results of the present study show that overall, Lithuanian online media pays a substantial amount of attention to vaccines, confirming the importance of monitoring media content on vaccination in the local context.

There are significant differences in the proportion of the articles published by each news site, which likely reflects their scale. It was found that DELFI published almost half of all news articles on vaccines (49,1%), 15 MIN published roughly a third (35,2%) and LRYTAS - around 15,7% of the total volume of vaccine-related publications. Slight differences appear in the proportion of attention to children's vaccines within each news outlet: over half of all publications in LRYTAS focused on children's vaccines (60%),

whereas the proportion of such articles in DELFI and 15MIN was substantially lower (40%).

Although there is little data, which allows to understand how Lithuanians make use of online news source variety, given its readability statistics, it may be the case that DELFI dictates vaccine-related online news discourse in Lithuania. It can also be hypothesized that DELFI readers may have a higher awareness of vaccine-related issues compared to readers of the other online news sites. Moreover, given the popularity and scale of the latter online news platform, individuals who search for vaccine-related news online may encounter information presented by DELFI more often.

This study showed that taken as a whole online news media attention towards vaccines is increasing across all three of the analyzed news outlets. Although it may be argued that the upward trend reflects the changing landscape of news and the general shift of news organizations towards online platforms, peaks of online news volume seen in DELFI and 15 MIN as early as 2009 suggest otherwise. In fact, between 2008 and 2014 the volume of online news stories related to vaccines in DELFI showed slight fluctuation and the volume of articles published in 2009 was only surpassed in 2012, whereas the volume of articles published by 15MIN in 2009 was only surpassed in 2013. This shows that online news platforms perhaps had the capacity, but not the interest to publish more vaccine-related articles in the interim period or that vaccines were not a newsworthy topic.

Similarly, data showed a slight upward shift in media attention towards children's vaccines beginning in 2010, which since then has been growing. Interpretation of the news volume curve for children's vaccines from the perspective of the "issue attention cycle theory" (Downs, 1972), however, can also suggest that as a whole, for the past 10 years issues related to children's vaccines have been balancing between what Downs (1972) refers to as the "pre-problem stage", where societal issues are recognized by experts, but are still obscure among the general public, and beginning of „alarmed discovery/enthusiasm“, where dramatic events, such as a disease outbreak, can heighten public attention and catalyze action. It will be interesting to observe, therefore, the effects of the 2019 measles outbreak in Lithuania and how it affected media/public attention to vaccines. Since, according to Downs (1972), peaks of attention cannot be sustained for too long, stakeholders involved in public communication of vaccines, will have to find ways to keep the public interested in the vaccine hesitancy crisis and ensure that public attention does not wane.

A qualitative look at aggregated data suggests that peaks of coverage are sometimes associated with events related to vaccination, like epidemics, as in the case of the H1N1 influenza in 2009 or the introduction of new vaccine policies, as was the case with the HPV vaccine in 2015. This is consistent with previous research on media coverage of vaccines conducted in the UK (Harding, 1985) or Italy (Odone et al., 2018), for example, as well as with news-values theories overviewed in Chapter 1 and previous research analyzing media coverage of risk, science, health and technology (e.g. Hodgetts et al., 2007).

Event-driven reporting also manifests in media coverage of children's vaccines, particularly with reporting on specific vaccinations. Reporting on the MMR vaccine, for example, is highly inconsistent, waxing and waning along with the occurrence of MMR outbreaks. According to Singer et al. (1994; see also Shih et al., 2008), when covering risks, journalists frequently focus on events and their "immediate consequences" instead of "long-term considerations", which along with the *issue attention cycle theory* by Downs (1972), explains to some extent such cyclical patterns of reporting. In other words, as epidemics or other events end, so does the media attention given to the particular vaccination. Individual volume timelines, however, revealed that such patterns do not manifest for all vaccines alike. Media attention for the type b meningococcal vaccine, for example, showed a drastic spike in 2016, when it was included into the national immunization program, but then kept increasing. One possible explanation is that different vaccines and their related diseases, have different levels of newsworthiness among online media journalist, which accordingly influences their selection for news. This idea is particularly noticeable when considering the proportions of media attention given to specific vaccinations.

For example, analysis of the broader sample of articles revealed that the flu vaccine receives a major proportion of media attention related to vaccines (24,8%), which is more or less consistent with studies conducted in other countries (for example Powell et al., 2016 in US and Canada; Odone et al., 2018 in Italy). In comparison, other identified vaccines receive marginal proportions of coverage, usually at or below the 7 % level. To put it differently, media allocate roughly ten times more attention to the flu vaccine (N=520) compared to the vaccine for tuberculosis (N=43), which in Lithuania is a highly endemic and problematic disease. Likewise, despite high numbers of pertussis cases (N=472), which surpassed the number of measles cases (N=255) over the 2008-2018 period and despite actual disease related fatalities, DTP vaccine received 1.5 times less media attention. Even with the

polio vaccine being one of the vaccines included in the highly controversial 2014 bill on mandatory vaccination, in the last 10 years articles related to the polio vaccine appeared in the media less than 40 times. Beyond events such as outbreaks and policy issues, therefore, media attention criterion towards specific vaccines, remains ambiguous.

On the question of news article authorship, this study found that roughly 65% of all articles on vaccines were original publications, and 35% - written by a “third-parties”, e.g. articles that are republished, sponsored or distributed by Lithuanian news agencies. Articles on children’s vaccines followed the same patterns of authorship distribution. It is important to note that the number of original articles may be overrepresented, as it was noticed that journalists sometimes marked press releases as original publications. Analysis showed that original reporting in Lithuanian online news appeared most frequently in relation to the HPV, hepatitis, pneumococcal infection, chicken pox, rabies, tuberculosis and “other” vaccines, whereas third party content was slightly more common in the reporting on MMR, polio, rotavirus vaccinations.

On the one hand, as mentioned previously, it may be that some vaccines and/or their associated diseases are less newsworthy than others, drawing in little interest from journalists and partially substituted through third-party content. However, a possible explanation for the significant reliance on third-party content may also be found in the rise of information demand, which necessitates continuous production of new content. Since online news platforms may not have the capacity to meet this high demand, it may prompt them to rely on and deliver information from other sources. This highlights the importance of training journalists in information verification and evaluation skills, especially in relation to science, technology and health topics.

Which sources of information are featured in news can have decisive consequences on the presentation of views related to the topic. This question is particularly important with topics related to science, technology and health, which for most journalists are not in their immediate area of expertise. This study revealed that more than half of all articles on vaccines in the analyzed news sites contained at least one direct source per article and featured largely expert-driven conversations. Results showed that medical specialists, public health officials and government officials were the most common direct sources featured in news articles about vaccines. Source use in online news coverage of children’s vaccines did not deviate significantly from the larger sample. All in all, this suggests that experts make active use of opportunities to communicate about vaccination with the Lithuanian public via online news

websites. Surprisingly, in comparison to the mentioned experts, the visibility of scientists in online news discourse about vaccination is low, as they appear in less than 10% of the articles. Scientists, therefore, are experts who are the least engaged in discussions about vaccines in online news, pointing to the need for broader scientists' involvement.

Data showed that non-experts, mainly celebrities and parents, are also frequent sources of information. In addition, this study showed that appearance of non-experts in the news clusters in negative and mix-toned articles about vaccination. It was found that such articles about vaccines were also prone to the "balance bias" (Boykoff and Boykoff, 2004).

A positive finding to emerge from this study, however, is that children's vaccines in Lithuanian online news are usually presented in positive or neutral perspectives. In fact, it could be argued that the supermajority of articles in online news were leaning towards positive. In other words, they either present only vaccine supportive information or did not present any negative views related to vaccination. Negative and mixed tone articles exist, but make up a fraction of the total article volume (13%) and this is consistent with similar research studies analyzing media coverage of vaccination (Leask and Chapman in Australia (1998); Good-year Smith et al. (2007) New Zealand; Odone et al. (2018) in Italy; Powell et al., 2016 in US and Canada).

Graphical plotting of negative/mixed tone coverage of vaccines and outbreaks of measles revealed that such articles peak before measles outbreaks and subside once outbreaks take place. The appearance of positive coverage follows an inverse trend. Data also showed that the majority of negative leaning articles were clustered in what were categorized as *general articles about vaccination*, which may be a useful finding for guiding further research. In fact, negative leaning articles that focused on specific vaccines like MMR, made up very small proportions of the coverage.

As mentioned previously, analysis of sources by tone revealed that appearance of non-experts in the news may be a predictor of negative leaning articles on children's vaccination. Non-experts appeared in slightly more than 60% of all such articles. In contrast, non-experts appeared in less than 15% of positive or neutral news coverage of children's vaccination. In general, therefore, it seems that in the news, just as in the wider public sphere, anti-vaccine discourse is driven by non-expert voices. This also, however, suggests that pro-vaccine parents are less engaged or less frequently featured in positive leaning news stories and perhaps the wider debate on vaccination. This raises important considerations for news media content effects and vaccine-related public communication.

A qualitative analysis revealed differences in conversations about vaccines between positive and negative articles on vaccination. Negative articles about vaccination mainly discussed the risks of vaccines and/or alleged vaccine-related complications. The majority of these stories featured parents, presenting dramatic, personal opinions, accounts and experiences with vaccination and it was observed that these articles would be considerably shorter and likely – more readable, than positive leaning news articles about vaccines. Once again, most negative and mixed tone articles about children’s vaccines were “general articles”, that is mentioning more than one vaccine or no specific children’s vaccination. In comparison to other studies (for example Powell et al. 2016), it appears that negative leaning articles in Lithuanian online news are less concentrated towards specific vaccines and more towards vaccination in general.

In contrast, positive articles about vaccines mainly featured experts advocating for the benefit of vaccination, recommending vaccines, and/or included information about the risks associated with vaccine-preventable diseases. This is similar to findings in Leask and Chapman’s analysis of vaccines in the Australian press (2002). Contrary to the latter study, however, positive news articles on vaccines in the analyzed Lithuanian news websites, did not appear to be overly dramatic, and instead used a more rhetorically restrained, educational tone.

A closer look at positive articles across different types of vaccines showed that beyond the disease risk/vaccine benefit topic, most of the coverage concerning MMR vaccination was driven by discussions of measles cases and outbreaks. These articles were usually laden with statistical epidemiological data, descriptions of the disease course and potential complications, provided by the Center for Communicable Disease and Aids or other public health organizations. These articles, therefore, were fact-based and mainly used to distribute public health information. Majority of the articles on the type-b meningococcal infection and pneumococcal infection vaccines, on the other hand, revolved around policy discussions, whereas articles on the polio vaccine - around disease elimination progress achieved through vaccination.

The majority of general articles, which made up the biggest proportion of positive articles on children’s vaccines, revolved around discussions of vaccine hesitancy and the risks associated with decreasing rates of immunization. Conversations about vaccine safety/effectiveness or plausible vaccine side-effects, on the other hand, appeared in 13,1% and 3,9% of all positive articles respectively. Safety/effectiveness of the MMR vaccine was discussed in 5% of positive articles on MMR vaccination, 7,1% in articles on

polio vaccination, 8,5% of articles on meningococcal infection vaccination. Conversations about vaccine safety/effectiveness were more common in general articles about vaccination (23,3%), but discussions of side-effects were still essentially missing (7,5%).

Mixed tone articles about vaccines showed more varied thematic patterns, however, these results were not very encouraging, given the finding that more than half of these articles presented juxtapositions of expert and non-expert views, indicating the prevalence of “false-balancing” - a reporting bias equating evidence on both sides of the debate. Several research studies have shown the potential negative consequence of false-balancing on public attitudes towards climate change (Boykoff and Boykoff, 2004) and vaccination (Clarke, 2008). Further studies, therefore, should be undertaken to analyze this practice in Lithuanian journalism on science and health. Just as in positive news articles about children’s vaccines, here experts most frequently focused on disease risk and vaccine benefits. Mixed toned articles did, however, include more discussions of vaccine safety/effectiveness, the progress associated with vaccination, plausible side-effects and the rights/responsibilities related to vaccination. Negative comments on vaccines in these articles revolved around non-experts and their perceptions of vaccine risks and uncertainty, as well as presentations of alternative knowledge related to vaccines and the questioning of vaccine necessity.

5. DISCUSSION

Models in public health suggest that acceptance of vaccines is broadly conditioned upon the interaction of logistical, psychosocial and contextual factors (e.g. Dube et al., 2013; SAGE, 2014). According to experts, among these factors, *attitudes* towards vaccines, as well as vaccine-related *communication and information environments* play some of the key roles in this process. The potential role of these factors is also suggested across vast amounts of empirical social science research, studying public reactions to science, health and technological innovations. While the applicability of these models to the Lithuanian example has not been fully studied, emerging national research suggests that attitudes toward vaccination are also a strong predictor of vaccine behavioral intent among Lithuanians (Kupreviciene and Zagminas, 2014). Using key theories in media effects literature, the overreaching goal of this dissertation was to explore - in what ways the news media, as a key source of information, may shape public perceptions of vaccines in the national context. Two empirical studies were used to explore this question and this section attempts to relate results of the both studies in more detail.

The first empirical study of this dissertation confirmed the assumption that news media is a frequent source of vaccine-related information for the Lithuanian public. What followed was the necessity to analyze in more depth the potential ways in which media influences on vaccine perceptions may happen. Media content analysis conducted for this dissertation found a sizeable amount of articles on vaccines across the main Lithuanian online news platforms, with a substantial proportion of these articles focused on children's vaccines. Furthermore, time-plotting of vaccine-related news articles showed that media attention to vaccines is increasing across all analyzed news outlets. Together, these results point to the importance of online news media as an avenue for vaccine-related discourse in Lithuania and consequently its potential role in shaping public awareness of vaccine-related issues.

Additional layers of analysis, however, revealed that different vaccines attract a different level and pattern of media attention. Results showed that media allocate a disproportionate amount of attention to the flu vaccine in comparison to other vaccinations. Vaccines for diseases such as measles, mumps, rubella, diphtheria, pertussis, tetanus and the vaccine for tuberculosis, which is highly endemic in Lithuania, receive marginal proportions of the total coverage. Results also showed that with few exceptions, vaccine-related news

is cyclical and driven by events, such as outbreaks or vaccine-related policy debates, which is consistent with other similar studies as well as the broader literature on science and health issue newsworthiness (Harding, 1985; Guenther and Ruhrmann; 2013; Schäfer et al., 2014). Analysis of article authorship also showed a substantial reliance of online news outlets on third-party content, with certain critical children's vaccines, e.g. MMR, polio, rotavirus – receiving higher than average rates of third-party contributions.

While these results reveal interesting aspects of journalistic norms and practices, related to news selection, as well as science/health reporting discussed in the previous chapters, some of the issues emerging from these findings relate specifically to media effects, overviewed in the literature in Chapter 1 of this dissertation. Following assumptions of the agenda-setting theory, frequency of issue appearance in the news, can influence public awareness of those issues, as well as perceptions of issue importance. The prominence of some issues over others can then “shape the considerations” that people use when making further evaluations and judgements (McCombs and Shaw, 1972; Scheufele and Tewksbury, 2007). In the case of vaccines in Lithuanian online news, the effect could be two-fold.

First, it could be hypothesized that the disproportionate media attention towards certain vaccines could not only influence the awareness of those diseases/vaccines in general, but may also render some diseases more important than others in the public mind. For example, given the current results it is worth to consider the 2019 EU Special Barometer on “European’s attitudes towards vaccination”, which asked respondents to rank a list of diseases, which in their view, still cause deaths in the European Union. Among Lithuanians, flu was the most frequently mentioned disease (74% of the respondents), surpassing the EU average (58%) by slightly more than 15%, as well surpassing other diseases, such as meningitis (58%) and measles (44%). As vaccine hesitancy models show that awareness is one of the interacting factors in public acceptance of vaccines, marginal appearance of certain vaccines in the media may affect how Lithuanians come to know about such vaccines, especially those who rely on the news as a source of information on vaccines more often.

Secondly, skewed media attention towards certain vaccines also raises the question – to what extent could the coverage of one vaccine influence the perceptions of readers towards other vaccinations and with what implications? For example, several studies have shown (Chang et al. 2018, Andenberg et al., 2009) that controversy over the MMR vaccine resulted in subsequent decrease of immunization rates for other childhood vaccinations. This suggests that

perceptions of vaccines could be prone to the “spillover effect”, when ideas associated with one object spread over and influence a related one (Lee, 2018). For example, vaccination for flu has received considerable attention in the Lithuanian online press, but it has also generated a substantial level of controversy in Lithuania: 53,9% of Lithuanians do not believe that vaccines can protect from the flu, whereas almost a third (30.1%) have concerns about its safety (Caplinkas and Liausediene, 2018). The prominence of the flu vaccine in Lithuanian online news, points to the necessity for understanding whether and how media attention to this vaccine influences public perceptions of other vaccines in Lithuania. At the same time, scant attention to other vaccines, such as DTP, requires understanding why, despite occurrences of related disease cases and outbreaks, such vaccines lack journalistic interest factors. Future studies on this question are, therefore, recommended.

The first empirical study in this dissertation revealed that among Lithuanians, doctors are considered to be the most trustworthy source of information on vaccines. Analysis of Lithuanian online news media articles showed that doctors and public health officials are some of the most common direct sources featured in vaccine-related news. Despite doctors being considered as the most trustworthy source on vaccines, according to the new Wellcome Global Monitor survey conducted in 2018, the overall trust of Lithuanians’ in doctors and nurses is considerably low, measuring at 38% compared to 65 % in Northern, 45% in Southern and 68% of respondents in Western Europe. On the other hand, Lithuanians’ trust in scientists, measures at 33 %, exceeding Western European, Southern European and Eastern European countries. It is somewhat surprising, therefore, that scientists make up such a negligible proportion of information sources on vaccines, as well as raising intriguing questions regarding the effectiveness of doctors as information sources on public perceptions towards vaccination.

Similar questions arise when considering the appearance of non-experts, such as parents and celebrities in vaccine-related news. The current study found that non-experts appeared in roughly 20-35% of online news articles, both across the broader sample of articles and the sub-sample of articles about children’s vaccines. Moreover, it showed that non-experts appeared most frequently in negative and mixed tone articles on vaccination. Although this study confirms the common assumption that anti-vaccine discourse is driven by non-expert views, it also suggests that pro-vaccine parents are way less engaged or less frequently appear not only in online news about vaccines, but even perhaps the wider debate on vaccination. This highlights the importance of providing a platform in discourse on vaccines for vaccine supporting non-

experts, which in Lithuanian online news media coverage of vaccines is currently minimal. As vaccine hesitancy models reviewed in Chapter 1 have showed, peers and community are also important influences for vaccine acceptance and there exists empirical research which suggest that communication about vaccines given from the perspective of parents can lead to positive changes in vaccination attitudes (Horne et al., 2015). The failure to engage pro-vaccine parents in elevating vaccine supportive conversations in the news, therefore, remains obscure at both the journalistic and vaccine advocacy levels.

As reviewed in Chapter 1, previous work in media effects research has established that in addition to influencing public awareness of issues, media may also influence how those issues are understood. Of particular importance are the concepts of framing and attribute agenda-setting, which provide explanations for this effect and its occurrence. For example, different portrayal of issues could evoke different interpretations and meaning of those issues in people's minds (Scheufele, 2006). Similarly, making some attributes of issues more prominent than others, may also make them more easily recalled and used more often when forming perceptions and making judgements (McCombs, 2004). Article tone and theme were analyzed on a sub-sample of articles on children's vaccines for understanding how the issue of vaccination is portrayed in Lithuanian online news.

Consistent with similar literature in the field, this study found that Lithuanian online newsreaders are usually exposed to positive coverage of vaccines (e.g. Goodyear-Smith et al., 2007 or Odone et al., 2018). Overall, this is an encouraging finding, showing that the appearance of fake news or other types of purposeful misinformation across Lithuanian online news platforms is minimal and journalists likely engage in responsible reporting. It can also be hypothesized, however, that it is the regular appearance of experts as direct sources in the news, that contributes to this finding (Boykoff and Boykoff, 2004; Clarke, 2008).

Because vaccine events sometimes drive vaccine-related news coverage, retrospective analysis of article volume over time and measles outbreaks in Lithuania showed that positive coverage of vaccines peaks with disease outbreaks and falls when outbreaks subsides. As positive coverage wanes, gaps in discourse are filled with negative leaning articles, promoting critical views on vaccination. This suggests that Lithuanian online newsreaders may be most exposed to misinformation about vaccines between periods of vaccine-preventable disease outbreaks and when the overall media attention to related vaccines is low.

Roughly 13% of articles on children's vaccines in Lithuanian online news media were negative-leaning, i.e. negative in tone or presenting both sides of the argument. As discussed previously, several studies have shown a link between exposure to adverse media coverage about vaccines and vaccine related-attitudes and behavior (for example Tran et al., 2018; Lewis and Speers, 2003; Morimoto, 2015), pointing to the theoretical possibility of this effect in Lithuania. However, without understanding the threshold for inconsequential levels of anti-vaccine messages in the news - if such exists - it is currently not possible to make definitive conclusions regarding the magnitude of effect from this negative media coverage on Lithuanian public perceptions of vaccination. This is an important avenue for future research.

Moreover, despite the value of tracking vaccine-related attitudes for monitoring and prognostic purposes, the first empirical study found few representative empirical studies measuring public perceptions of vaccines in Lithuania and no longitudinal studies on the subject were found. Major gaps in public opinion research gave only several data points which could be cautiously compared to results of this media content analysis. For example, based on the available data, perceptions of vaccine importance in Lithuania likely fluctuated twice – once in 2011-2013 and once in October, 2018. Graphical plotting of news media article tone in 2011 showed a peak of positive-leaning news articles on vaccines and a slump in negative leaning articles. In 2011, several cases of measles were recorded in Lithuania (ULAC₁, 2019). In 2010, however, a slight peak of negative leaning articles in the news media was observed with a corresponding decrease of positive leaning articles. Lithuanian perceptions of vaccines were subsequently measured in the period between 2014-2016, however, all studies were small-scale and confined to particular regions in Lithuania. Nevertheless, results showed a generally gloomy view of public perceptions about vaccines, with supportive statements on vaccine effectiveness and safety observed only among 30%-60% of respondents. In 2014, negative online news media coverage of vaccines was once again at its peak, while positive leaning articles showed a visible slump from the 2013 period. In 2015, Lithuania experienced an outbreak of measles with 50 confirmed cases of the disease (ULAC₁, 2019). That same year, the volume for both of the tone-groups showed an inverse trend, e.g. a peak in positive leaning and a drop of negative leaning articles. Previous studies have shown that negative coverage of vaccines in the media have been linked to decrease of vaccine uptake (Begg, 1998; Mason and Donnelly, 2000; Morimoto, 2015; Suppli et al., 2018), which – it can be hypothesized – may also reflect in public perceptions towards vaccines. More

research is needed to explore the possible time-lag of negative media influence on public perceptions of vaccines.

As mentioned previously, negative sentiments towards vaccines also appeared in mixed tone articles on vaccination, presenting viewpoints on vaccines from both sides of the discussion. Several studies have shown that false-balanced messages on vaccines heighten vaccine-related uncertainty (Dixon and Clarke, 2012), can lead individuals to support anti-vaccine beliefs and reduce trust in vaccination even more so than entirely negative messages (Salvador et al., 2019). Moreover, even if false beliefs about vaccines in an article are immediately debunked, recent evidence suggests that such misinformation can fixate and continue to shape vaccine related attitudes (Thorson, 2016). Once again, while it is difficult to hypothesize about the magnitude of these effects with this study, the presence of such articles in Lithuanian online press points to a potential area for development in Lithuanian science and health journalism.

Finally, this analysis showed which aspects of vaccines are discussed most often, indicating the thematic frameworks within which vaccines may be perceived. Risks of diseases and benefits of vaccination was the most frequent theme to appear in vaccine-supportive, i.e. positive articles about vaccines. This theme was usually delivered via factual information on infectious disease(s) (e.g. disease symptoms) and/or information regarding relevant vaccination(s) (e.g. vaccination schedule). During the article analysis process it was observed that information about disease risks and vaccine benefits frequently appeared in verbatim across a noticeable proportion of articles. Other main themes in positive articles on vaccines were disease outbreaks, policy issues and vaccine hesitancy, which appeared in roughly one-third of the articles. Analysis of vaccine supporting articles also showed that different vaccines have different patterns of thematic associations. Besides the mentions of disease risk and vaccine benefits, which appeared across the majority of articles in the news, stories on the MMR and DTP vaccines mostly focused on outbreaks or cases of the diseases and vaccine hesitancy; articles on type-b meningococcal infection and rotavirus vaccines - on outbreaks or cases of the diseases and policy issues, whereas articles on polio and tuberculosis vaccine – on vaccine enabled progress. Negative articles on vaccines, on the other hand, primarily featured discussion of two main issues – the risks associated with vaccines or stories about vaccine caused complications.

There are several ways in which these findings may be significant for public perceptions of vaccines in Lithuania. Since certain themes may cue

individuals to interpret vaccines through a specific perceptual framework, it raises the question – how the considerably frequent mention of vaccine hesitancy could influence readers’ perception of vaccination, especially among those with little knowledge or new interest in vaccines (e.g. first-time parents). Some researchers suggest that frequent references to vaccine hesitancy or risks, could spread vaccine-related fears to other parents (Kahan, 2013; Hershey et al. 1994). This is particularly relevant for vaccines, such as MMR, which are largely covered against the backdrop of the *vaccine hesitancy* thematic framework. There is likewise evidence to suggest that politicization of vaccines, as in the case of type-b meningococcal vaccination, may result in decreased support for vaccination (Fowler and Gollust, 2015). Research into public responses to specific themes in the media among Lithuanians, therefore, should be conducted to inform evidence based public communication strategies.

Secondly, the first empirical study reported in this dissertation showed that in Lithuania, there is considerable discrepancy between what Lithuanians think about the importance of vaccines and what they think about vaccine effectiveness and safety. A look at public opinion dynamics over the past years showed that Lithuanians’ perceptions about the importance of vaccines are more or less positive; however their perceptions of vaccine effectiveness and safety are moderate, with roughly 3 out of 10 people having doubts about the safety and effectiveness of vaccination. The study has revealed, therefore, that public risk perception of vaccines is substantially high and this is observed for both - specific vaccines (children’s, flu) and vaccination in general. The media content analysis presented in the second empirical study showed that the appearance of misinformation about the effectiveness and safety of vaccines in Lithuanian online news exists, but is limited. The study also revealed, however, that positive discussions addressing concerns regarding vaccine safety, vaccine effectiveness and side-effects are essentially absent from news in the analyzed media. This may suggest that public discourse about vaccines and public perceptions of vaccination may be somewhat out of sync. More research, therefore, is needed to determine how this discrepancy between public concerns and public information influences Lithuanians’ views and understanding of vaccination. For example, some authors argue that communication, which is highly focused on promoting vaccines may “reassure public health professionals and have some positive impact, but it does not address negative emotions towards vaccines, which cause hesitancy” (Gesualdo et al., 2018). Furthermore, communication that is primarily based on factual information promoting vaccines may also be ineffective, to the

point of causing “backfire effects” and strengthening vaccine-related hesitancy (Nyhan et al., 2014). This type of communication is sharply different from negative news articles on vaccines that mostly feature personal, emotional charged stories. All in all, these findings highlight the need for more social science research, investigating effective themes for communication about vaccines, followed by evidence-based training for both – journalists and information sources at the forefront of vaccine-related discourse in Lithuania.

CONCLUSIONS

Over the last decades, rapid scientific and technological advances have triggered a variety of public reactions, spanning from unconditional approval and adulation to categorical rejection of science. Nevertheless, these innovations are leading major transformations in both - the social and the economic areas of human activities and large parts of these scientific and technological developments are related to public health. Advancements in immunization technologies in particular have resulted in significant improvement and control of infectious diseases, and are now being used to prevent certain types of cancer. Public support of immunization especially in industrial countries, however, is far from satisfactory.

While vaccine hesitancy presents a significant threat to individual and public health, along with issues such as climate change denial or the controversy over the safety of GMOs, it also serves as a case in point for a wider problem at the intersection of science and society: rising streams of misinformation, increasing science denial and rejection of scientific expertise - all of which begin to show tangible outcomes.

Throughout the past decades, public skepticism over vaccines has been linked to numerous outbreaks of deadly, but vaccine preventable diseases, such as measles, leading to socio-economic burden, jeopardized public health, but most importantly - preventable fatalities. In 2019, Lithuania faced one of the biggest outbreaks of measles in the past decades, which some have linked to public skepticism over vaccines. However, while the outbreak in Lithuania has been contained, the disease is still endemic in other parts of world, like the Democratic Republic of Congo, where in 2019-2020 measles infected more than 300,000 people and caused more than 6000 deaths (Ducomble and Gignoux, 2020). Continuous reappearance of measles outbreaks shows that such diseases can only be contained through optimal vaccination coverage rates, which necessitate widespread public cooperation.

Therefore, in the global struggle with public skepticism over vaccines, what determines public acceptance of vaccination, becomes a highly important question across all levels of stakeholders. Literature in public health and science communication studies points to attitudes and communication on vaccines, as some of the key factors which may shape vaccination behavior. As a result, it becomes imperative to understand how the public views vaccines and how the mass media, as one of the primary sources of information in modern societies, may influence the formation of public perceptions of vaccination. Seeking to contribute to research exploring

vaccine hesitancy in Lithuania, this dissertation examined public perceptions of vaccines over the last decade and analyzed coverage of vaccines in Lithuanian online news.

First, a systematic review of literature was used to systematize, compare and build a cumulative view of Lithuanians' perception of vaccination. Eleven empirical studies found in the literature retrieval process allowed to overview Lithuanian perceptions of vaccines for the period between 2003 and 2019. Overall, this study found that:

1) Lithuanians have high risk perceptions of vaccines, but attitudes are unsettled and prone to temporal fluctuations: a large majority of Lithuanians agree about the importance of vaccination, but have doubts about vaccine effectiveness and safety. This difference in perceptions towards vaccination among Lithuanians appears to be consistent over time. Lithuanian attitudes towards vaccines, however, exhibit high levels of volatility, which may indicate the presence of a meaningful proportion of the population which is undecided about vaccination and can be easily swayed in terms of vaccine-related opinion and vaccination intentions.

2) Longitudinal standardized public opinion monitoring may indicate oncoming outbreaks: although confident conclusions cannot be drawn, existing data indicates that outbreaks occur in times when public opinion of vaccines is low. Following outbreaks public perceptions of vaccines improve, but wane as an outbreak passes. In terms of practical solutions, a key public health strategy could be long-term vaccine promotion campaigns. This means that instead of ad-hoc public health interventions in times of disease epidemics, more special attention should be placed on cultivating positive attitudes towards vaccines in-between disease outbreaks.

Aside from surveys by international organizations, only a few nationally representative studies on public perceptions of vaccines were conducted within the last 15-year period, signaling an urgent need for more national research interest in the area. Moreover, results of small-scale studies conducted in regional areas of Lithuania, highlight the importance of following public perceptions of vaccines not only at the national, but also at the local levels. In line with other authors, it is suggested that local-level monitoring could allow to identify pockets of emerging vaccine hesitant communities, which could be targeted with vaccine promoting public health interventions and campaigns.

A second study was conducted to investigate the coverage and portrayal of vaccines in Lithuanian online news over the decade between 2008-2018, placing additional focus on children's vaccines, which have been at the center of recent public controversies over vaccination. This study found a total of 2093 articles on vaccines within the studied period with roughly half of these articles focused on children's vaccines. The investigation of online news media coverage showed that:

3) Online news media dedicate substantial attention to the flu vaccine, but attention towards children's vaccines is low to marginal: media, in general, is a common source of information for Lithuanians about vaccines and Lithuanian online news outlets generally give attention to vaccine-related issues, whether with original reporting on vaccines or through third-party content. However, in relation to the total volume of online news media coverage on vaccination, attention to specific children's vaccines like MMR, DTP and polio is considerably low. Furthermore, vaccines for children's diseases, such as diphtheria, measles, meningococcal infection and polio have a considerable proportion of third-party content. An implication of this is the possibility that as vaccine hesitant parents tend to question the need of vaccines for diseases they usually have not personally witnessed, e.g. mumps, measles, rubella, pertussis - low media attention to these vaccines may exacerbate this aspect of the vaccine hesitancy phenomenon.

4) Lithuanian online news media interest in children's vaccines is reactive and follows typical patterns of media/public interest in societal issues: from the perspective of theories that explain the patterns of societal attention to issues (e.g. Downs, 1972), despite decreasing numbers of vaccinated children and occurrence of vaccine-preventable disease outbreaks, over the past 10 years the issue of children's vaccination likely hovered in the "pre-problem stage" – recognized by experts, but not in full public view. It can be hypothesized that the major outbreak of measles in 2019 may have transitioned the issue onto the public agenda, however, further research is needed to confirm this. If this was the case, however, as the public will become aware of the complexities of vaccine acceptance/hesitancy issues as foreseen in societal attention to issues models, public health stakeholders will face the imminent challenge of up-keeping public interest in issues surrounding vaccines.

5) Some vaccines are more newsworthy than others: media coverage of specific prominent children's vaccines (MMR, meningococcal infection,

DTP) is usually driven by vaccine-related events, such as outbreaks and policy issues; however, coverage patterns for these vaccines differ. Coverage of the DTP vaccine and MMR vaccine, which has been at the forefront of public controversies over vaccination, is cyclical, waxing and waning along with measles outbreaks. In other words, coverage is not continuous and conversations begin only when something happens. In contrast, despite decreasing cases of meningococcal infection in Lithuania over the past years, attention to type-b meningococcal vaccination kept increasing. Taken together, these results suggest that some vaccines appear to be more newsworthy than others are. Indeed, despite considerable numbers of pertussis cases over the last 10 years, including several fatalities, media attention to the DTP vaccine compared to other children's vaccines, is surprisingly low.

6) Online news media presents mostly positively leaning, expert-driven perspectives on children's vaccines: news media in general has been commonly charged with escalating vaccine-related controversies. In terms of media coverage tone, this study does not support this assertion. It showed that aside from a few instances, mainstream online news platforms provide a positive or neutral perspective on children's vaccines. Negative sentiments towards vaccines are mostly expressed in articles that focus on more than one vaccine, e.g. several children's vaccines or no vaccine in particular. This has significant methodological implications for research: analyzing mass media coverage of articles that focus solely on specific vaccines may not capture important conversations about vaccination in media. Positive coverage of children's vaccines appears to be associated with MMR disease. Once outbreaks subside, positive coverage of children's vaccines decreases. On the contrary, negative and mixed-tone coverage of vaccines most usually decreases during moments of outbreaks and increases when outbreaks subside. This finding provides important insights into our understanding of how and when vaccine hesitancy attitudes may emerge.

7) In relation to the latter finding, this study showed that most of the articles on vaccines in general and children's vaccines in particular are well sourced, featuring experts, such as health care or public health professionals. Scientists, however, remain an untapped source of information on vaccines. Although no definitive conclusions can be drawn, it may be the case that the largely positive coverage of vaccines is a result of active pro vaccine agenda-building efforts of public health, medical and governmental experts. Little is known, however, about the ways in which the Lithuanian public reacts to expert opinions.

Previous studies have shown that lay audiences sometimes tend to reject factual based information, especially those with strong anti-vaccine beliefs, thus further research on the effectiveness of experts in the media would be warranted. In this study the appearance of non-experts in news articles about children's vaccines was a predictor of negative or mixed-tone articles, questioning the importance, safety and/or efficacy of vaccines. In mixed tone articles about vaccines, journalist showed the tendency of juxtaposing expert and non-expert views, with both elaborating on their side of the story.

8) Online news media reporting on vaccines is focused on the importance of children's vaccines, but rarely addresses other concerning questions: in terms of themes, positive articles about vaccines are monotonic, driven by few predictable frames. The primary theme in vaccine supportive articles is vaccine benefit/disease risk or in other words – importance of vaccines. It was observed that descriptions of disease risks and vaccination recommendations would consistently reappear in verbatim across different articles, and were rarely provided in narrative form. Other prominent themes were vaccine hesitancy, cases/outbreaks of diseases and policy issues. Positive news articles on children's vaccines rarely address what concerns parents about vaccination, i.e. safety and effectiveness. Although there are varying opinions on vaccine message effectiveness, it may be that conversations about vaccines in Lithuanian news are missing the point. Negative articles on vaccines, on the other hand, frequently questioned the safety of vaccines and featured emotional laden narratives on vaccine-related complications, e.g. corresponding to public risk perceptions of vaccines among the Lithuanian public.

Further experimental work needs to be done to establish how Lithuanian online newsreaders react to news articles on children's vaccines and how vaccine-related messaging found in online news articles influences newsreaders' attitudes towards vaccination. In particular, research could focus on exploring in more depth the effects of the positive online news coverage of children's vaccination, which dominates Lithuanian online news, but has received little research attention. In addition, research could examine which news article sources readers find to be the most compelling and how different articles themes influence vaccine perceptions. This could provide important evidence-based insights for public communication about vaccines in Lithuania.

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LIST OF PUBLICATIONS

Valinčiūtė, A., Schafer, M.S. (in press). Lithuanians' perceptions of vaccination and their sources of information: a literature review. *International Journal of Public Health*. DOI: 10.1007/s00038-020-01389-0

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APPENDICES

Appendix A shows the number of articles that a search for each news outlet retrieved according to the specified keywords, the total number of articles that were selected and the total number of articles left after the initial data cleaning process, i.e. elimination of duplicate articles.

SEARCH KEYWORD	DELFI		LYTAS		15MIN	
Singular noun forms	RETURNED	SELECTED	RETURNED	SELECTED	RETURNED	SELECTED
<i>Skiepas</i>	269	162	6	5	192	160
<i>Skiepo</i>	219	119	8	7	296	154
<i>Skiepai</i>	18	11	1	1	22	10
<i>Skiepa</i>	169	85	9	7	93	66
<i>Skiepu</i>	288	214	55	46	299	259
<i>Skiepe</i>	1	1	0	0	0	0
TOTAL	964	592	79	66	902	649
Plural noun forms						
<i>Skiepai</i>	315	278	81	66	298	273
<i>Skiepa</i>	304	224	55	44	305	282
<i>Skiepams</i>	213	89	5	4	297	196
<i>Skiepus</i>	298	154	36	32	296	229
<i>Skiepais</i>	298	170	7	7	153	128
<i>Skiepuose</i>	19	19	1	1	17	14
TOTAL	1447	934	185	154	1366	1122
Verbal noun forms						
<i>Skiepijimas</i>	288	148	10	8	168	138
<i>Skiepijimo</i>	299	159	18	15	299	197
<i>Skiepijimui</i>	82	39	1	1	47	42
<i>Skiepijimą</i>	299	202	14	14	174	160
<i>Skiepijimu</i>	35	7	0	0	289	264
<i>Skiepijime</i>	1	1	0	0	0	0
TOTAL	1004	556	43	38	977	801
Main verb forms						

<i>Skiepyti</i>	299	179	66	32	299	244
<i>Neskiepyti</i>	296	134	11	9	299	69
<i>Skiepija</i>	273	87	6	3	131	61
<i>Neskiepija</i>	44	24	0	0	11	5
<i>Skiepijo</i>	159	31	6	3	88	8
<i>Neskiepijo</i>	9	7	1	1	7	5
TOTAL	1080	462	90	48	835	392
Singular noun forms						
<i>Vakcina</i>	305	187	46	45	303	285
<i>Vakcos</i>	305	200	40	37	299	297
<i>Vakcinai</i>	122	66	1	1	41	40
<i>Vakciną</i>	315	144	15	15	259	250
<i>Vakcina</i>	-	-	-	-	-	-
<i>Vakcinoje</i>	42	37	1	1	21	21
TOTAL	1089	634	103	99	923	893
Plural noun forms						
<i>Vakcos</i>	312	197	-	-	-	-
<i>Vakcinų</i>	305	204	15	15	293	268
<i>Vakcinoms</i>	56	34	2	2	19	19
<i>Vakcinas</i>	299	195	15	14	134	132
<i>Vakcinomis</i>	212	155	8	6	85	84
<i>Vakcinose</i>	23	20	0	0	8	8
TOTAL	1207	805	40	37	539	511
Verbal noun forms						
<i>Vakcinacija</i>	288	127	9	7	225	114
<i>Vakcinacijos</i>	291	154	13	10	147	94
<i>Vakcinacijai</i>	289	143	13	10	161	100
<i>Vakcinaciją</i>	279	123	11	9	245	147
<i>Vakcinacija</i>	-	-	-	-	-	-
<i>Vakcinacijoje</i>	0	0	0	0	0	0
TOTAL	1147	547	46	36	778	455
Main verb forms						
<i>Vakcinuoti</i>	299	154	24	17	297	193
<i>Nevakcinuoti</i>	29	14	3	3	14	10
<i>Vakcinuoja</i>	15	6	1	0	5	3
<i>Nevakcinuoja</i>	1	0	0	0	0	0
<i>Vakcinavo</i>	3	1	0	0	2	0
<i>Nevakcinavo</i>	1	0	0	0	0	0
TOTAL	348	175	28	20	318	206
Singular noun forms						
<i>Imunizacija</i>	100	66	1	1	33	32
<i>Imunizacijos</i>	83	50	1	1	24	23

<i>Imunizacijai</i>	86	52	1	1	25	24
<i>Imunizacijq</i>	33	24	0	0	9	9
<i>Imunizacija</i>	-	-	-	-	-	-
<i>Imunizacijoje</i>	0	0	0	0	0	0
TOTAL	302	192	3	3	91	88
Main verb forms						
<i>Imunizuoti</i>	8	6	0	0	2	1
<i>Neimunizuoti</i>	0	0	0	0	0	0
<i>Imunizuoja</i>	4	2	0	0	1	1
<i>Neimunizuoja</i>	0	0	0	0	0	0
<i>Imunizavo</i>	0	0	0	0	0	0
<i>Neimunizavo</i>	0	0	0	0	0	0
TOTAL	12	8	0	0	3	2
SUM	8600	4905	617	501	6732	5119

Appendix B shows the keywords that each news outlet used to classify vaccine-related articles, the number of articles that a search with each keyword retrieved and the total number of articles that were selected.

15MIN TOPICS	TOTAL SELECTED ARTICLES
Vakcina	223
Skiepai	321
Skiepai nuo gripo	20
Skiepu kalendorius	5
Imunizac*	0
TOTAL	569
MINUS DUPLICATES ACROSS CATEGORIES	425

DELFI TOPICS	TOTAL SELECTED ARTICLES
Skiepai	292
Skiepai nuo gripo	55
Skiepu kalendorius	20
Skiepas	171
Skiepijimas	171
Skiepai nuo encefalito	1
Skiepijimasis	32
Skiepai nuo tymų	6
Skiepai Silgrad	2
Skiepijimo pažymėjimas	1
Kombinuota vakcina	10
Vakcinavimas	44
Vakcina nuo poliomielito	6
Vakcina nuo ŽPV	4
Vakcina Silgard	7
Vakcina nuo gripo	57
Vakcina	300
Vakcinacija	297
Vakcinacijos	235
Imunizacija	29
TOTAL	1740
MINUS DUPLICATES ACROSS CATEGORIES	1171

LRYTAS TOPICS	TOTAL ARTICLES	SELECTED
Vakcina	119	
Vakcinacija	18	
Skiepai	252	
Skiepijimas	11	
MMR vakcina	5	
Kombinuotos vakcinos	3	
Skiepų nauda	3	
Tarptautinis skiepų pasas	1	
Vaikų skiepijimas	15	
Keliautojų skiepai	3	
Skiepai nuo ŽPV	10	
Skiepai nuo nutukimo	1	
Skiepai nuo gripo	19	
Skiepais valdomos ligos	1	
Skiepijimas vaistinesė	1	
Sapnuoti skiepus	1	
TOTAL	463	
MINUS CATEGORIES	DUPLICATES ACROSS	335

Appendix C shows examples of articles that mentioned vaccines, but were considered off-topic. Example 1 shows an article in DELFI that mentions vaccines only in the title. Example 2 shows an article in 15MIN that mentions vaccines once in passing.

DELFI Naujienos Skaitmeniškos Lietuvoje Sportas Oras Kriminalai Užsienyje Vaidai Horoskopai Gyvenimas Mokslo Verslas Daugiau

PILIEČIS Temos: Piliėčių naujienos Vox Populi Iššiau namų Naudojimui saugos Ašio projektų

DELFI Piliėtis > Vox Populi

Aukštojo mokslo reforma. Ar skiepai prieš gripą gali iš komos prikelti ligonį? (8)

J. Šeštonas
2013 m. sausio 3 d. 09:28

f t in e p o

Einant aukštojo mokslo masiškumo linkme, universitetų vaidmuo tampa vis svarbesnis didesniai žmonių skaičiui. Universitetai susilaukia nuolatinio visuomenės dėmesio ir nuolat yra reformos būsenoje. Tai reiškia, kad iki tol buvusios reformos nedavė laukiamo rezultato, todėl išlieka pagrindas tolesnėms diskusijoms.



© DELFI (K.Čechovskis nuotr.)

Yra daugybė aspektų, kuriais galima vertinti aukštąjį mokslą. Čia apžvelgti tik studijų, mokslo ir verslo santykių klausimai. Pasaulio universitetai nėra vienodi tiek pagal savo prestižą, tiek pagal mokslo kryptis, pagal kurias jie specializuojasi. Mokslo kryptys nulemia studijų kryptį profilį.

Lietuvos universitetuose yra atotrūkis tarp universitetų profilio, studijų kryptų ir mokslinės veiklos. Kaip pavyzdį galima paminėti humanitarines studijas techninio profilio universitetuose arba studijų programas humanitarinio profilio universitetuose, kurios neturi sąsajų su universiteto moksline veikla.

SUSIJĘ STRAIPSNIAI

- Aukštasis mokslas Lietuvoje ir užsienyje: teigiamos ir neigiamos pusės (38)
- Apie „nemokamą“ mokslą Jungtinėje Karalystėje (45)

Dalis studijų programų pasiūlos remiasi ilgamete tradicija. Kartais studijuojami dalykai turi išlikusių penkiasdešimties metų senumo relikvų, kurie neatitinka šiuolaikinės realybės. Tačiau tarp jų yra ir naujų aukštojo mokslo studijų programų, kurios neatitinka šiuolaikinės realybės.

Norėdamas išsklaidyti abejones ministrų kabinetas ruošiasi išplatinti nurodymus verslui ir žmonėms, kaip elgtis, jeigu susitarimo dėl „Brexit“ pasiekti vis dėlto nepavyktų.

Tačiau dėl to Th.May vyriausybė ir kaltinama nereikalingu panikos kėlimu.

Nors premjerė tai neigia, ji pati anksčiau pareiškė, kad maisto atsargų kaupimas yra atsakingas veiksmas.

Įvairios įstaigos viena po kitos taip pat skelbia įspėjimus dėl ateities. Prie Lamanšo sąsiaurio įsikūrusio Doverio savivaldybė įvertino, kaip staigios skyrybos su Bendrija paveiktų daugiausia žmonių keltais Europoje perkeltantį uostą.



Bitai baiminasi savo ateities po išstojimo iš ES.

Kaip nurodo ataskaita, prie Doverio uosto galėtų susidaryti 65 kilometrų ilgio į Prancūziją norinčių persikelti sunkvežimių eilė.

„Piko dienomis uostas priima 10 tūkst. sunkvežimių – šeštadalį Jungtinės Karalystės prekybos judėjimo. Jeigu laukimo laikas tiek prailgtų, trumpai galiojančios prekės galėtų būti sugadintos“, – įspėjo Doverio savivaldybė.

Įspėjimus išplatino ir maisto pramonė. Britų sumuštinių ir maisto išsinešti asociacijos direktorius Jimas Winshipas pranešė, kad gali sutrikti pomidorų ir salotų lapų importas iš Europos: „Tad žymiajam šoninės, pomidorų ir salotų sumuštiniui gali kilti grėsmė.“

Sumuštinių trūkumas gal ir nėra didžiausia britams gresianti bėda, bet Prancūzijos farmacijos kompanijos „Sanofi“ padalinys Jungtinėje Karalystėje jau paskelbė apie planus kaupti didesnes vaistų ir vakcinų atsargas, jeigu po „Brexit“ sulėtėtų prekių importas.

Airijoje įsikūrusios oro linijos „Ryanair“ planuoja įtraukti įspėjimą, kad kitų metų vasarai bilietus nusipirkę klientai jais negalės pasinaudoti, jeigu „Brexit“ neleis vykdyti skrydžių tarp Jungtinės Karalystės ir ES.

Appendix D shows the records that were included in the literature review, analyzing public perceptions of vaccines in Lithuania.

YEAR OF STUDY	AUTHOR	SCOPE
2003-2004	Žagminas et al.	Vilnius
2011	Čaplinksas et al., Baltijos tyrimai	Nationally representative
2013	Kuprevičienė et al.	Nationally representative
2014	Šeškutė et al.	Post-partum mothers in Kaunas hospital
2014-2015	Lidžiūtė et al.	Parents of children in daycare centers in Klaipėda
2015	Kriščiūnienė et al.	Residents of Tauragė
2016	Nevulienė et al.	Online respondents
2018	Vaccine Confidence Proejct	Nationally representative
2018	Wellcome Global Monitor	Nationally representative
2019	EU Special barometer	Nationally representative
Unknown	Zalaitė et al.	Online respondents

Appendix E shows data counts for the media content analysis.
 Counts: year, vaccine, news sites

DELFI	TOTAL	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL
2008	21	4	7	2	1	0	1	0	1	3	0	0	1	0	0	0	1
2009	87	10	56	3	2	0	2	1	3	5	0	0	1	1	1	2	0
2010	71	6	46	6	0	0	4	2	1	1	0	0	2	0	0	1	2
2011	74	20	16	5	7	0	6	2	7	5	0	0	0	2	0	2	2
2012	88	20	18	4	4	2	1	9	10	2	1	3	3	3	2	6	0
2013	75	18	14	6	3	1	14	0	3	7	2	1	1	2	0	1	2
2014	79	42	6	3	1	1	8	0	4	3	1	3	0	1	1	0	5
2015	110	40	14	6	12	1	11	3	4	1	0	1	1	1	5	7	3
2016	136	33	22	12	18	17	4	6	3	2	3	1	1	1	4	0	9
2017	128	31	18	15	12	18	10	6	4	1	2	2	3	3	1	1	1
2018	154	31	46	10	7	20	14	3	5	3	2	1	0	6	2	2	2
TOTAL	1023*	255	263	72	67	60	75	32	45	33	11	12	13	20	16	22	27
*certain articles missing dates																	
15MIN	TOTAL	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL
2008	12	2	9	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	66	4	49	6	1	0	0	0	1	4	0	0	0	0	0	1	0
2010	46	1	36	3	1	0	1	1	0	0	0	0	0	1	0	1	1
2011	28	4	9	2	1	2	1	1	4	2	0	0	1	0	0	1	0
2012	50	18	15	2	1	0	0	8	4	0	0	0	1	0	0	0	1
2013	75	19	19	3	2	4	8	3	4	1	3	1	1	1	4	0	2
2014	64	18	9	6	0	2	3	2	4	1	0	2	1	0	1	1	14
2015	84	27	10	5	6	2	11	0	6	2	0	4	0	3	5	1	2
2016	110	35	12	22	11	13	3	2	6	2	0	0	0	1	1	0	2
2017	107	27	20	7	8	14	9	5	5	0	2	1	0	2	2	1	4
2018	95	18	13	8	9	15	8	1	3	1	1	2	0	2	3	3	8
TOTAL	737	173	201	65	40	52	44	23	37	13	6	10	4	10	16	9	34
LRYTAS	TOTAL	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL
2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	5	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2013	22	6	10	1	0	0	3	0	0	0	1	0	0	0	0	0	1
2014	30	17	3	1	0	1	1	0	1	0	1	0	1	1	0	0	3
2015	70	26	12	2	8	0	8	2	2	1	0	1	0	0	6	0	2
2016	73	29	10	4	7	8	2	1	2	0	3	0	2	0	2	0	3
2017	38	9	6	1	6	5	3	0	1	1	1	2	1	1	1	0	0
2018	90	19	12	6	7	13	9	0	6	4	0	2	0	3	2	3	4
TOTAL	328	108	54	16	29	27	26	3	12	6	6	5	4	5	11	3	13

Counts: author type ,vaccine, news site

ALL	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL	TOTAL
ORIGINAL	361	311	101	103	89	86	44	63	37	19	13	16	20	30	27	39	1359
NEWS AGENCY	69	117	5	17	27	25	4	21	4	1	9	2	8	10	4	27	350
SYNDICATED	98	85	29	14	7	33	10	11	11	3	4	3	6	3	3	8	328
SPONSORED	10	7	18	2	16	1	0	0	0	0	1	0	1	0	0	0	56
TOTAL	538	520	153	136	139	145	58	95	52	23	27	21	35	43	34	74	2093

DELFI	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL	TOTAL
ORIGINAL	162	142	48	48	44	47	23	28	23	8	5	10	9	12	18	14	641
NEWS AGENCY	33	57	2	8	12	7	3	9	1	0	4	0	5	2	1	9	153
SYNDICATED	61	65	22	10	4	21	6	9	9	3	3	3	6	2	3	4	231
SPONSORED	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
TOTAL	257	265	72	67	60	75	32	46	33	11	12	13	20	16	22	27	1028

15MIN	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL	TOTAL
ORIGINAL	117	126	40	33	22	22	18	27	8	5	5	3	8	9	7	18	468
NEWS AGENCY	24	54	3	4	11	11	1	8	3	1	4	1	2	6	2	12	147
SYNDICATED	25	19	6	2	3	10	4	2	2	0	1	0	0	1	0	4	79
SPONSORED	7	2	16	1	16	1	0	0	0	0	0	0	0	0	0	0	43
TOTAL	173	201	65	40	52	44	23	37	13	6	10	4	10	16	9	34	737

15MIN	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL	TOTAL
ORIGINAL	82	43	13	22	23	17	3	8	6	6	3	3	3	9	2	7	250
NEWS AGENCY	12	6	0	5	4	7	0	4	0	0	1	1	1	2	1	6	50
SYNDICATED	12	1	1	2	0	2	0	0	0	0	0	0	0	0	0	0	18
SPONSORED	2	4	2	0	0	0	0	0	0	0	1	0	1	0	0	0	10
TOTAL	108	54	16	29	27	26	3	12	6	6	5	4	5	11	3	13	328

Counts: year, children's vaccine, news sites

DELFI	TOTAL	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL
2008	5	3	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
2009	13	6	0	0	0	0	2	0	3	0	0	0	0	1	1	0	0
2010	7	3	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
2011	32	19	0	0	0	0	6	0	5	0	0	0	0	2	0	0	0
2012	36	13	0	0	0	2	1	1	10	0	0	3	0	3	2	0	0
2013	37	15	0	0	0	1	14	0	2	0	2	1	0	2	0	0	0
2014	50	32	0	0	0	1	8	0	4	0	1	2	0	1	1	0	0
2015	54	31	0	0	0	1	11	0	4	0	0	1	0	1	5	0	0
2016	60	27	0	0	0	17	4	0	3	0	3	1	0	1	4	0	0
2017	59	21	0	0	0	17	10	0	4	0	2	2	0	3	0	0	0
2018	75	24	1	0	0	20	14	0	5	0	2	1	0	6	2	0	0
TOTAL	428*	194	1	0	0	59	75	1	41	0	11	11	0	20	15	0	0

*certain articles missing dates

15 MIN	TOTAL	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL
2008	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	3	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2010	4	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0
2011	6	2	0	0	0	2	1	0	1	0	0	0	0	0	0	0	0
2012	15	11	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
2013	37	14	0	0	0	4	8	0	2	0	3	1	0	1	4	0	0
2014	26	16	0	0	0	2	3	0	2	0	0	2	0	0	1	0	0
2015	50	22	0	0	0	2	11	0	4	0	0	3	0	3	5	0	0
2016	46	25	0	0	0	13	3	0	3	0	0	0	0	1	1	0	0
2017	47	15	0	0	0	13	9	0	3	0	2	1	0	2	2	0	0
2018	45	13	0	0	0	15	8	0	1	0	1	2	0	2	3	0	0
TOTAL	281	123	1	0	0	51	44	0	21	0	6	9	0	10	16	0	0

LYRTAS	TOTAL	GEN	FLU	TICK	HPV	MEN	MMR	HEP	DTP	OTHER	PNEUM	POLIO	POX	ROTO	TB	RABIES	TROPICAL
2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	10	6	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0
2014	21	16	0	0	0	1	1	0	1	0	1	0	0	1	0	0	0
2015	44	25	0	0	0	0	8	2	2	0	0	1	0	0	6	0	0
2016	46	28	0	0	0	8	2	1	1	0	3	0	1	0	2	0	0
2017	22	8	0	0	0	5	3	0	1	0	1	2	0	1	1	0	0
2018	49	16	0	0	0	12	9	0	5	0	0	2	0	3	2	0	0
TOTAL	193	100	0	0	0	26	26	3	10	0	6	5	1	5	11	0	0

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