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Investigating an Issue–Attention–Action Cycle: A Case Study on the Chronology of Media Attention, Public Attention, and Actual Vaccination Behavior during the 2019 Measles Outbreak in Austria

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The present study investigated the chronology of media attention, public attention, and actual vaccinations during a recent measles outbreak in Austria. The analysis indicated that initial news coverage about the measles outbreak (the first wave of media attention) sparked public attention and led to additional heavy news coverage about measles (the second wave of media attention). The observed patterns of public and media attention reflect typical issue–attention cycles, as revealed by previous research. As a supplement to previous studies, the present study links media and public attention with a consecutive increase in the number of vaccinations, thereby supporting the notion of an issue–attention–action cycle. Additional curve-fitting analyses showed that the day-by-day variations in media and public attention resembled sharp, short-term "spotlight effects," whereas consequences on vaccination behavior represented a broader, long-term "echo effect." Above and beyond the theoretical contributions, we discuss practical implications: Surveilling the development of media and public attention in the immediate aftermath of a measles outbreak may be a cost-effective strategy to predict future patient load, thereby helping to effectively allocate resources for vaccination programs. A thorough understanding of the issue–attention–action cycle contributes to this aim.

Measles is a highly contagious disease and is responsible for about 110 000 deaths globally, according to estimates provided by the World Health Organization (World Health Organization. (WHO), 2018). The European Center for Disease Prevention and Control (European Centre for Disease Prevention and Control. (ECDC), 2019) documented that 35 deaths had been reported in European Union (EU) countries in 2018. This is the case despite a safe, effective, and inexpensive vaccine being available. Given that routine measles vaccinations for children are an effective strategy to reduce measles deaths, the World Health Organization. (WHO) (2019) recommends immunization for all susceptible children and adults for whom a measles vaccination is not contraindicated (see Bundesministerium für Arbeit, Soziales, Gesundheit und Konsumentenschutz, 2019a, for official recommendations in Austria). Despite the protection the vaccine affords, measles outbreaks continue to occur (e.g., Leslie, Delamater, & Yang, 2018). Importantly, infected individuals are responsible for measles outbreaks such as a recent outbreak in Graz, Austria in January 2019: An infected fifteen-year old boy was identified at the regional hospital in Graz, Styria. He presumably infected a number of children in the hospital. Health professionals and authorities reacted and the news media heavily reported about this event. Importantly, Austria has one of the lowest vaccination coverages among European countries—only France, Malta, Greece, Rumania and Austria had coverage rates of the second dose of measle-containing vaccine below 84% in 2017 (European Centre for Disease Prevention and Control. (ECDC), 2019).

The news media can be deemed a key factor for vaccination acceptance or hesitancy (Mavragani & Ochoa, 2018), including as a result of news coverage during a measles outbreak (Cataldi, Dempsey, & O'Leary, 2016). It is assumed that news reports can influence health beliefs about the safety of vaccines (European Centre for Disease Prevention and Control. (ECDC), 2010) by, for example, suggesting that there is an alleged link between the measles, mumps, and rubella (MMR) vaccination and autism, or that the vaccination itself leads to measles and is therefore dangerous—both incorrect beliefs. However, Gust et al. (2005) found U.S. parents' vaccination beliefs reflected a continuum, from complete acceptance to

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expressing hesitancy (but still complying with recommendations) to completely refusing vaccines for their children.

In addition to perpetuating negative beliefs and myths about vaccines, the news media can also raise the visibility of issues and as such, place them on the public agenda (McCombs & Shaw, 1972), including through coverage of measles cases and outbreaks. This typically happens through news coverage, especially that emanating from news media outlets that serve as an orientation point for other news and social media outlets (e.g., newspapers are often used as story source by broadcast news outlets). This results in so-called issue-attention cycles (Downs, 1972; Waldherr, 2014). The media outlets that serve as an orientation point often report on issues that are experienced differently by different groups and for which only a limited number of people experience directly. Thereby, the issue–attention cycle is only maintained for a limited amount of time since some audiences may feel threatened or bored by the issue in the news media, which then shifts their focus to new issues. For example, in the vaccination domain, social media activities (e.g., tweets about vaccination myths) usually *follow* traditional news media coverage (Tomeny, Vargo, & El-Toukhy, 2017).

Moreover, although outside of the health domain, Waldherr (2014) stressed factors that increased the news media's attention on an issue over time: 1) a higher news value for an event (e.g., a perceived public health threat due to a local measles outbreak); 2) the more journalists report a topic, the more the related topic value increases; 3) journalists observe each other and adjust their reporting focus onto their colleagues (i.e., intermedia agenda setting; Vliegenthart & Walgrave, 2008: Some newspapers may report on a measles outbreak and other newspapers will follow); and 4) news media outlet and journalists' attention on a topic can increase with each day that they report on a certain topic, assuming there are new developments of information. It is often the case that public attention is limited and therefore "issue fatigue" sets in after a few days. Moreover, 5) journalists differ in their adoption speed for issues on the rise; and 6) they prefer topics that are closer to them (Waldherr, 2014).

These processes explain how a local issue (e.g., a local measles outbreak) becomes a breakthrough topic (e.g., a national measles threat with vaccinations as a solution) that goes through a "boom" phase of nationwide news coverage and public interest, before the issue–attention cycle slows down through issue fatigue since public issue attention is depleted after a limited period of time (Geiß, 2011). However, the process might not necessarily be that linear; it might in fact interact with other issues, and public attention might be less relevant for the process than how the problem is constructed in the news media (see Hilgartner & Bosk, 1988).

While there is already supporting evidence for issue–attention cycles (Waldherr, 2014), their real-life consequences on individuals' behavior (e.g., from patients) remain under-researched. To bridge this gap, we will use the concept of issue–attention cycles to investigate how these cycles may foster actual measles vaccinations after a considerable amount of news media coverage. We conceptualize the chronological interplay between public and media attention on a health topic and actual behaviors as a response (vaccination) as *issue–attention–action cycles*. As a supplement to previous research, we thus include the public's behavior in our theorizing. In the present case study, we investigated the issue–attention–action cycle during a 2019 measles outbreak in Austria.

Previous Research on the Health-Relevant Consequences of Issue–Attention Cycles

There is already evidence that issue–attention cycles in the news media can create a presence that is strong enough to have a health-relevant effect on public attention and beyond. This evidence is scattered in different health domains and does not have an integrating conceptual framework such as the issue–attention–action cycle perspective. For example, actor Charlie Sheen's public disclosure of his HIV-positive status corresponded with significant levels of public attention on HIV and HIV prevention (indicated by search volume data from the search engine Google), known as the "Charlie Sheen effect" (Ayers, Althouse, Dredze, Leas, & Noar, 2016a; Ayers et al., 2016b). Importantly, this health-related "key event" (Brosius & Eps, 1995) motivated record sales of rapid in-home HIV self-tests—actions that could be predicted by public attention as indicated by online search volumes (Allem et al., 2017). Similarly, Angelina Jolie's announcement of a prophylactic mastectomy in reaction to her BReast CAncer 1 (BRCA1) gene mutation was widely covered by the news. In a research review on the "Angelina Jolie effect," Troiano, Nante, and Cozzolino (2017) found that Jolie's announcement led to an increase in genetic tests.

Media effects on public attention have also been revealed for the mental health domain. Fond, Gaman, Brunel, Haffen, and Llorca (2015) revealed that after news coverage on Catherine Zeta-Jones' treatment for bipolar disorder, online information-seeking for bipolar disorder via the search engine Google increased substantially, termed the "Zeta-Jones effect." Interestingly, Fond et al. (2015) noted that "searches for psychiatric conditions seem to be influenced by media events more than by real events in the general population" (p. 913). In this way, the news media act as an intermediary between the actual key event and the public—without heavy coverage, large parts of the public will not be aware of the actual event. Taken together, key events such as celebrities' announcements can captivate the attention of the news and subsequently increase public attention on health issues with possible important behavioral effects. As noted by Cacciatore, Nowak, and Evans (2018), while it seems intuitive that highly visible vaccine-preventable disease outbreaks should facilitate vaccination, there is a lack of empirical evidence.

The Present Study

The present paper reports on a case study investigating the interplay between media attention on measles, public attention on measles, and the number of vaccinations during the course of a recent measles outbreak in Austria in January 2019. Similar to Angelina Jolie's announcement, we conceptualized the measles outbreak as the key event. An infected fifteen-year old boy was identified at the regional hospital in Graz, Styria, and presumably infected a number of children in the hospital. Of interest, there was a high degree of uncertainty due to the fact that nobody could know whether more cases would appear in the first days after the index case had been observed (Jasny,

Hanson, & Bloom, 1999). Health professionals and authorities reacted to this event and the news media started to report on it some days later (see below). The general idea was that the index case stimulated an issue–attention–action cycle creating a considerable amount of news coverage, which in turn is related to an increase in public attention being placed on measles, ultimately prompting more people, particularly parents of young children, to obtain a measles vaccination.

In fact, we hypothesized that the index case and speculations about the transmission of the virus stimulated initial news coverage on this key event. As time progresses, more cases of infections will be revealed and made public, thereby eliciting additional news coverage, and, in turn, more public attention. We asked whether increased media and public attention about the local measles outbreak ultimately led to an increase in actual vaccinations. The primary contribution of the present case study is the investigation of the chronology of media attention, public awareness, and actual vaccinations (i.e., an issue–attention–action cycle).

Method

We used a time-series analysis to investigate media attention on measles, public attention on measles, and the number of vaccinations over time. We now describe the three data sources.

Media Attention on Measles

We assessed media attention on the measles outbreak using the largest news archive of Austrian newspapers, television, radio, and online media (Austrian Press Agency, 2019). The archive includes all daily newspapers from Austria, transcripts of the most important television and radio programs (both public broadcasting services and commercial broadcasters), as well as the most relevant Austrian online media outlets. We searched the archive for documents including the term "Masern" (measles). For each day of the observation period (January 1, 2019–February 20, 2019), we counted how many news items (e.g., newspaper articles, televised news programs) appeared on that day.

Public Attention on Measles

We used online information-seeking as an indicator for public interest. We investigated how often individuals used the term "Masern" (measles) for information-seeking via the search engine Google (Google Trends data). Google Trends data reflect the frequency of the search term entered into Google on each day of the observation period. Google Trends provides normalized data. The day on which users most frequently searched for measles is defined as the peak search volume within the observation period (= 100). A query share value of, for example, 60, represents 60% of the highest observed search proportion during the observation period. Although Google Trends data have limitations (Lazer, Kennedy, King, & Vespignani, 2014), there are already studies that used search volume data as a proxy for public attention (e.g., Arendt & Scherr, 2017; Fond et al., 2015).[1]

Vaccinations

The "Wissenschaftliche Akademie für Vorsorgemedizin" (personal communication), an institution cooperating with the Styrian government, provided (not yet publicly available) data for vaccinations in Styria, the Austrian province where the index case was discovered. These data describe the number of vaccinations per day in public institutions in Styria. The observation period for the case study was guided by the availability of vaccination data: For each day of the observation period (January 1, 2019–February 20, 2019), we counted how many individuals were vaccinated against measles. From the $N = 51$ days of the observation period, data on the number of vaccinations were available for $N = 35$ days. To compare these numbers with the previous year when there was no local measles outbreak, we also obtained data for the same time period for 2018 (January 1, 2018–February 20, 2018).

Statistical Analysis

The time-series analysis was employed to capture the day-by-day interplay between media attention, public attention, and vaccinations, and nonlinear regression techniques were used to address the shape of the developments among the three outcomes. GraphPad PRISM was used to fit a lognormal distribution function (see GraphPad, 2019) to each outcome. A lognormal model is characterized by a sharp, nonlinear increase that heads toward the peak value, after which a nonlinear decrease determines the shape of the function (see Arendt, 2015; 2017, for the methodology and application of nonlinear modeling in communication research). We used the geometric mean, including its 95% confidence intervals, as an indicator with which to assess the shape of the distribution functions. When fitting a lognormal distribution, the geometric mean most accurately describes the center of the distribution (see Kirkwood, 1979), and this information can be used in the present study to assess the duration of the key event's effect on public attention, media attention, and vaccinations. For the curve-fitting procedure, we restricted the observation period insofar that $x = 0$ represents the last day before the sharp increase in public interest (i.e., January 28, 2019, see the results section for details). We calculated confidence bands (95%) for the three lognormal distribution functions.

[1]We used Google search volumes as an *indicator* for public attention. Thus, we were less interested in the search per se, for example, whether search results generally provided positive of negative measles-related websites. In addition, we did not theorize a causal effect of the actual search (or the exposure to the provided websites) on vaccinations. We only use search volume data as an indicator for public attention (see Arendt & Scherr, 2017). Nevertheless, we repeatedly checked search results during the observation period. All search results on Google's first page provided positive links (e.g., websites of a measles health campaign, wikipedia, Austrian Government, vaccination center, netdoktor [similar to webMD in the US]). There were no anti-vaccination websites. Taken together, googling for measles in Austria provided search results that were generally supportive of vaccination.

Results

There was a strong correlation between media attention and public interest, $r(49) = .93$, $p < .001$. As visualized in Figure 1, the first news report on the index case appeared on January 19, 10 days after the index case had been identified (January 9). This *initial* news coverage almost exclusively occurred in two local newspapers with high circulation rates in Styria (i.e., the Styrian versions of *Kleine Zeitung* and *Kronen Zeitung*). This local news coverage about the measles outbreak elicited a first, albeit weak increase in media attention (see Figure 1). Several days later (with more convincing knowledge on the measles outbreak being available), longer articles on the measles outbreak appeared in these local newspapers on January 29, including the headline "Alarm um Masern" (Alarm over Measles) appearing on the front page of *Kleine Zeitung*. On the same day, the measles outbreak was also covered in the public broadcaster's evening news program (*ORF – Zeit im Bild*), the most important televised news program in Austria. On January 30, the measles outbreak was heavily covered in many national newspapers as well and in the background-oriented night-version of the public broadcaster's news program (*ORF – ZIB 2*).

Google searches increased sharply on January 29—presumably in response to the televised evening news program and local news coverage—, followed by a sharp increase in nationwide heavy media attention one day later on January 30. Both public interest and media attention ultimately peaked on January 31, a Thursday. Interestingly, public interest seemed to be stimulated by initial news coverage and preceded the follow-up heavy news coverage (see Figure 1).

When comparing the observation period of 2018 and 2019, there was a substantial increase in the number of vaccinations: $N = 160$ vaccinations against measles were documented between January 1 and February 20 in the preceding year of 2018 when there was no measles outbreak. This value increased substantially for the same time period in 2019 ($N = 913$). What is of utmost importance is that the number of vaccinations substantially increased *after* the heavy news coverage and *after* a peak in public attention. Of interest, one day after the peaks in media attention and public attention, there was an initial peak in the number of vaccinations on February 1, a Friday. It is reasonable to assume that the substantial increase in the number of vaccinations had been caused by the news coverage: This increase in the number of vaccinations did not appear immediately after the identification of the index case (January 11), but only after news coverage had stimulated public interest.

Interestingly, as can be seen in Figure 1, the distribution function of daily measles vaccinations was much broader compared to the distribution of published news (media attention) and Google searches for measles (public interest). To formally test this, we used nonlinear regression techniques. We fitted lognormal distribution models to all three time series. As can be seen in Figure 2, the shapes of the distribution functions differed. Using the geometric mean as an indicator for the width-related shape of the distribution, we found that the geometric mean of vaccination, $M_{geom} = 19.13$, 95% CI [9.27, >23], was substantially larger relative to the geometric mean of media attention, $M_{geom} = 3.69$, 95% CI [3.32, 4.27], and public attention, $M_{geom} = 5.29$, 95% CI [4.62, 6.22]—indicated by a non-overlap of the confidence intervals. Thus, the increases in media attention and public interest can be deemed as a somewhat more short-term "spotlight effect." Conversely, this spotlight effect translated into a much broader "echo effect" on the public's vaccination behavior.[2]

Discussion

Measles is a highly contagious disease with severe health consequences. We provide a case study of a recent measles outbreak in Austria, investigating the interplay between media attention, public attention, and the number of vaccinations as a behavioral consequence. We show that initial news coverage about the measles outbreak (the first wave of media attention) created some public interest in measles and sparked additional heavy news coverage about measles (the second wave of media attention). These observed patterns for news coverage reflect the typical issue–attention cycle (Waldherr, 2014). Importantly, peaks in media attention and public interest were followed by a substantial increase in the number of vaccinations. Thus, the present case study additionally documents the actions taken, constituting an issue–attention–action cycle. Such behavioral effects in terms of the number of vaccinations are particularly important considering that as of February 20 (= the end of our observation period), $N = 52$ measles cases had been documented in Austria for the year 2019 (Bundesministerium Arbeit, Soziales, Gesundheit und Konsumentenschutz, 2019b).

The behavioral consequences, here captured as the number of vaccinations, likely depend on several factors. We offer post hoc theorizing on two important aspects in this regard for future research: First, the size and shape of the distribution function of both media and public attention may be predictive of the size of subsequent behavioral effects in terms of the number of vaccinations. The (nonsymmetrical) distribution function had a sharp increase—the "boom" phase, as described by Waldherr (2014)—with a slower decay-related tail—the "fatigue" phase in Waldherr (2014). Interestingly, the sharp increase in public attention—stimulated by the initial news coverage in the first wave of media attention—preceded the sharp increase in heavy news coverage in the second wave of media attention. As a future research hypothesis, we suggest that increases in the number of vaccinations are weaker, the flatter, the narrower, and the shorter the decay tail of the distribution function is (of public and/or media attention).

Second, the content of news coverage may also be an important (limiting) factor for behavioral consequences. Although a systematic content-analytic assessment of the news coverage of the recent Austrian measles outbreak is not yet available, the overall tone of the news coverage appeared to be very positive from the perspective of public health, it provided background

[2]We conducted additional analysis to test the robustness of our findings: We used search engine volume data from Styria and re-ran analyses with Styrian data (instead of Austrian data). This analysis provided similar results. For example, the geometric mean of Styria, $M_{geom} = 5.75$, 95% CI [4.59, 7.90], was similar to the geometric mean of Austria, $M_{geom} = 5.29$, 95% CI [4.62, 6.22]. This additional analysis can be obtained upon request.

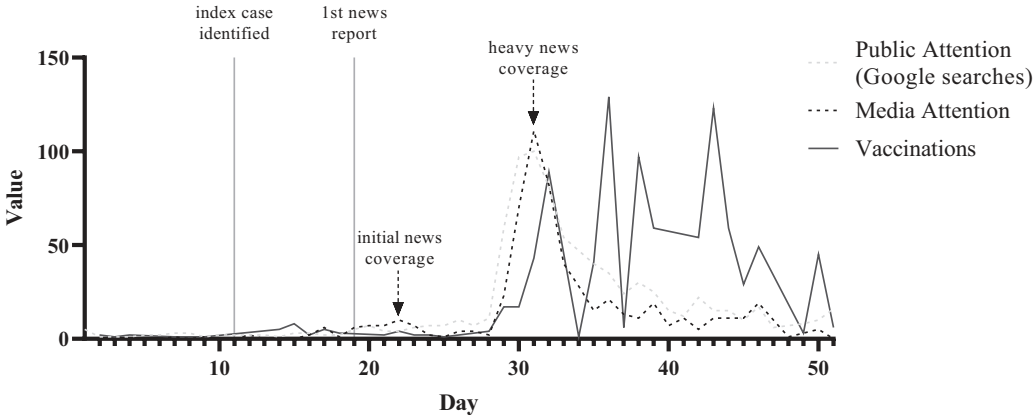

Fig. 1. Media attention, public attention (Google searches), and the number of vaccinations during the measles outbreak in Austria in 2019. The observation period is $N = 51$ days (Day 1 = January 1 to Day 51 = February 20). The figure provides untransformed raw data. For vaccinations, there were no data on some days (see the methods section); the graph connects adjacent points.

information in a responsible way, and was clearly pro-vaccines (including several direct appeals to get vaccinated). The coverage possibly influenced the public's *perceived severity* of measles and the public's *perceived susceptibility*. In fact, one health professional from the "Wissenschaftliche Akademie für Vorsorgemedizin," the source for our vaccination data, believed that "anxiety" was the primary motivating factor for more people coming forward to be vaccinated (personal communication). Importantly, the news coverage also reported on an effective solution (i.e., via vaccines; *response efficacy*) and provided references to contact information (e.g., where to get vaccinated for free; *self-efficacy*). These four concepts have been shown to determine individuals' responses to threatening health information, as theorized in the extended parallel process model (Witte, 1992). Thus, the news coverage during the recent Austrian measles outbreak may have influenced the public's beliefs that the threat was severe, unvaccinated individuals were at risk, the measles vaccine was effective, vaccination was easy, and that there were few barriers to vaccination.

Of note, increased perceived severity and perceived susceptibility should *not* lead to more vaccinations when efficacy (response efficacy and self-efficacy) is low (Witte, 1992). However, efficacy was probably not low during the Austrian outbreak, because public health officials promoted access and availability of the vaccine. This is important for health professionals and vaccination experts: If the news media contact them for interviews, it is wise to take this opportunity and target these four concepts (perceived severity, perceived susceptibility, response efficacy, and self-efficacy), with a special focus on efficacy, thus supporting the public in vaccination-related informed decision-making. Future research could study a number of different measles outbreaks and test whether differences in the content of the news coverage (e.g., by content-analyzing these four concepts) can explain differences in the size of the elicited behavioral effects.

Third, it is important to note that while Shih, Wijaya, and Brossard (2008) identified different issue–attention cycles for the West Nile virus, mad cow disease, and the avian flu, this event-based news coverage developed over the course of years and still yielded the typical shape of an issue–attention cycle. We found a similarly shaped cycle for the by far more short-term Austrian measles outbreak on a day-to-day basis in January/February 2019, resembling the case of the West Nile virus in Shih et al.'s (2008) study: News attention skyrocketed in the beginning, whereas mad cow disease and the avian flu represent public health threats that developed more slowly over time in the news media. It is up to future research to investigate more closely how much the strength of behavioral effects depends on the shape of the issue cycle that different types of diseases may evoke.

Practical Implications

As a supplement to the contribution to our theoretical understanding of the interplay between news coverage, public interest, and vaccinations, the findings of the present case study also have practical implications. For vaccination professionals, it is important to know (1) whether or not, and if yes, (2) when additional individuals will seek out health professionals to get vaccinated.

Regarding the first point (*whether or not*), it is important to note that while some measles outbreaks are heavily covered by the news media, others are not. We outlined some of the mechanisms that shape the amount of news coverage (Waldherr, 2014). As a future research hypothesis, we assume that a measles outbreak will lead to additional vaccinations only if media attention and/or public interest pass a certain attention threshold. In the present case study, we found that a spike in news coverage and public interest preceded an increase in vaccinations within one (media attention) or two (public attention) days. If there is a measles outbreak, health professionals can monitor publicly available data: Both the amount of news coverage and the search engine volume can easily be monitored. If a substantial peak appears, it is additional evidence that the number of people who want to get vaccinated will increase.

Regarding the second point (*when*), in terms of resource allocation for both personnel (e.g., available workforce:

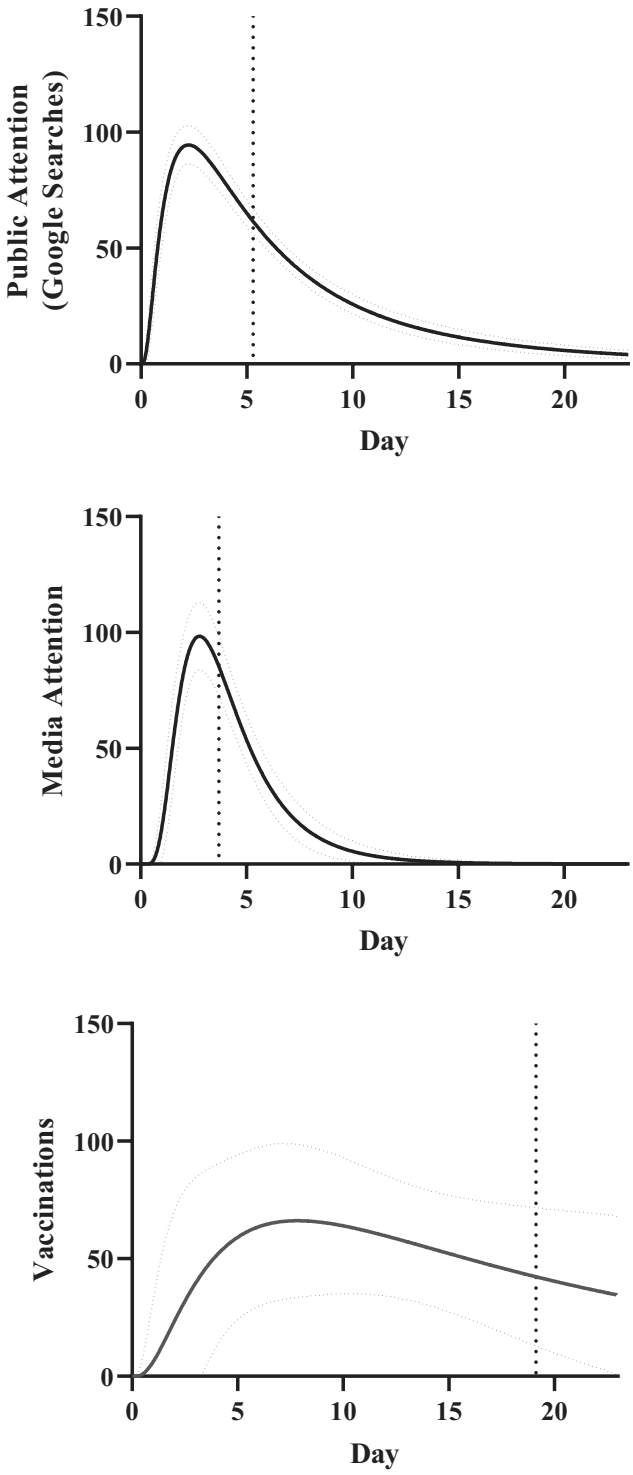

Fig. 2. Fitted lognormal distribution functions of a measles outbreak's effect on media attention, public attention (Google searches), and vaccinations. The vertical dashed lines represent the geometric mean. The dotted curves indicate the confidence band (95%) of the fitted lognormal distribution function.*Note*. The observation period in this Figure is N = 23 days (Day 0 = January 28 [i.e., the last day before the sharp increase in public attention] to Day 23 = February 20). Goodness of fit: Media attention (R^2 = .94, df = 21), public attention (R^2 = .95, df = 21), vaccinations (R^2 = .22, df = 16). Full models can be obtained upon request.

number of physicians; in Austria, only physicians vaccinate) and materials (e.g., availability of vaccines), it is important to know when additional individuals will come forward to get vaccinated. The first peak in the number of additional vaccinations may even occur on the very next day following a peak in media attention or two days after a sharp increase in public interest, as in the present case study. This increased vaccination activity will likely continue for the next few days/weeks. The length of time this increase in the number of vaccinations will last likely depends on several factors, including but not limited to the severity of the measles outbreak itself (e.g., new developments) and the content of news coverage (see above). Although more research is clearly needed, the present case study provides preliminary evidence for the usefulness of a systematic surveillance of media and public attention in a time of crisis (measles outbreak).

Of interest, the sharp increase in public interest occurred one day before the sharp increase in media attention. Thus, Google Trends data may be especially helpful in supporting resource allocation, because it provides a more rapid real-time assessment and allows for at least some time to adjust. This is important because many adjustment processes (e.g., increasing the number of physicians, ordering more vaccines) need at least some time. The earlier that vaccination experts and professionals know there will be an increase in the necessary resources, the better.

Note that there is already research on the use of search engine volumes (with Google Trends data) to predict health outcomes such as flu outbreaks. These studies typically investigate the covariation between search volume data and health outcomes, or search volume data's predictive power *over an extended time interval*, producing mixed results (see e.g., Butler, 2013; Lazer et al., 2014). Conversely to these kinds of studies, the approach emphasized by the present study focuses on a specific "key event" (measles outbreak) and aims to use search engine data as a proxy for public interest within a *short time interval around a key event* (i.e., a few days and weeks after a measles outbreak). We know from studies outside the measles/vaccine domain, for example, from suicide research, that there is a difference between (often failed) long-term attempts at using search volume data for forecasting (Tran et al., 2017) and (successful) proven spotlight effects elicited by key events such as the suicide of a celebrity (Arendt & Scherr, 2017). We therefore assume that search engine data patterns are threshold phenomena: If public interest is stimulated by a key event of sufficient magnitude (e.g., a severe measles outbreak), the search volume will increase substantially, and within this considerably shorter time frame, online search volumes could possibly be a useful predictor of behavioral consequences tightly linked to the key event. This is quite different to long-term covariation patterns (see Tran et al., 2017). We argue that a long-term covariation between the search volume data and a health outcome (vaccinations) is neither a necessary nor sufficient precondition for the detection of short-term effects on search volume by key events.

Limitations

The study has a number of limitations. First, a case study is restricted in terms of generalizability. Although we are not able to generalize our findings to other outbreaks, our study has been guided by theoretical assumptions about the shape of typical issue–attention(–action) cycles, for which the present paper provides a case study in the area of a measles outbreak. We also provide post hoc theorizing on possible avenues for future research. Second, we used search engine data as a proxy for public attention. Although previous research using Google Trends data as a proxy for public attention has shown that search volume is responsive for important key events (Arendt & Scherr, 2017), it has its limitations: Google Trends data are not the output of an instrument designed solely to produce valid and reliable data for the purpose of scientific analysis (e.g., Is the measurement stable and comparable over time and are measurement errors systematic?; see Lazer et al., 2014). Third, we only assessed the quantity of news coverage on measles. We did not provide a systematic analysis of the content of that news coverage. Although we thoroughly followed the news coverage using an interpretative approach and close reading of the material, future studies could combine media attention, public interest, and vaccination data with content-analytic data of the news coverage in a more systematic manner. Fourth, we only had vaccination data for a limited number of days. Although these data clearly show an increase in the number of vaccinations, the low number of data points produced a weaker goodness of fit in curve fitting for the vaccination data relative to the curve fitting for the media and public attention data. Fifth, causal claims should be interpreted with caution. Although we observed an increase in the number of vaccinations after the strong increase in media and public attention, our research design cannot prove causal effects. Public health officials, school officials, and private healthcare providers may as well have reached out to parents or caregivers of unvaccinated children. Furthermore, we could not assess whether the increase in vaccinations was caused by parents who closely followed news coverage—the level of familiarity with the measles outbreak does seem to matter (Cacciatore, Nowak, & Evans, 2016). Our macro-level data can also not answer individual-level phenomena, but could be seen as a valuable starting point for future studies. Importantly, the increase in vaccinations occurred immediately after the peak in media and public attention (i.e., not immediately after the identification of the index case), increasing the confidence into the causal media effects hypothesis. Nevertheless, important new developments (e.g., new infections) are essential and presumably contributed to increases in media and public attention. Sixth, news coverage consists of several potentially important elements (e.g., factual information, journalists' opinions and assessments, expert interviews and information on places where vaccinations are available). We can only theorize on the "net effect" in this macro-level observational study. Future (experimental) studies are invited to assess which specific content elements elicit the strongest helpful effects. Seventh, local

vaccination coverage may moderate a (local) measles outbreak's influence on the number of vaccinations. If vacciantion coverage is very high, the effect may be smaller given that relatively few unvaccinated individuals exist to create demand. Conversely, if vaccination coverage is low, a measles outbreak and associated media and public attention may elicit stronger effects. This is the case in many countries, including Austria: For example, in 2–5 year olds, the coverage of the second dose is only 82% and even in 6–9 years olds, the coverage is only 89% (and thus below the desired 95%).

Conclusion

The present study provides evidence for issue–attention–action cycles in the health domain. Although more research is still needed to tie all the loose ends together, the present case study provides preliminary evidence that news coverage can increase public attention by "spotlighting" a key event that "echoes" via an increase in actual vaccinations. Given that the vaccination coverage for measles is too low in many countries (including Austria), increases in vaccinations represent a beneficial news media effect on public health.

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