UNIVERSITÀ di VERONA

Department of ECONOMICS

Working Paper Series
Department of Economics
University of Verona

Media coverage and vaccination take-up: Evidence from a case study on influenza vaccination

Ylenia Brilli, Claudio Lucifora, Marco Tonello, Antonio Russo

WP Number: 17 October 2019

ISSN: 2036-2919 (paper), 2036-4679 (online)

Media coverage and vaccination take-up: Evidence from a case study on influenza vaccination*

Ylenia Brilli° Claudio Lucifora* Antonio Russo± Marco Tonello♦

Abstract

We study the role of media coverage concerning alleged side-effects of influenza vaccination on individuals' decisions to vaccinate. We exploit the diffusion of news linking 13 suspected deaths to the vaccine, during the 2014 vaccination campaign in Italy. By comparing the daily vaccination counts in the 2013 and 2014 campaigns, we show that media coverage decreases flu vaccination by about 3% (93 fewer vaccinations per day). However, the effect is short-lived, as it fades out after 10 days from the news outbreak.

JEL: I12, J18, D91, L82

Keywords: vaccination, influenza, media, vaccine hesitancy

° Università degli Studi di Verona, CHEGU (University of Gothenburg), CHILD-Collegio Carlo Alberto. (ylenia.brilli@univr.it). **Corresponding author**.

* Università Cattolica del Sacro Cuore, IZA.

± Agency for Health Protection of Milan, Epidemiologic Unit.

♦Bank of Italy, Territorial Economic Research Division, Firenze.

* The views expressed are those of the authors and do not reflect those of the institutions they belong to. Usual disclaimers apply.

1. Introduction

The diffusion of news by the media about the potential side-effects of vaccinations has contributed in many countries to alter public attitudes towards vaccinations, often influencing individuals' immunization choices and reducing vaccine take-up (WHO, 2019). Several economic studies have focused on the MMR (measles-mumps-rubella) vaccine-autism controversy, showing how media coverage has affected the take-up of pediatric vaccinations (see Andeberg et al. 2011 for the UK, Chang 2018 for the US, Carrieri et al. 2019 for Italy).

In this paper, we depart from the previous literature by focusing on influenza vaccination decisions by adults.[1] In particular, we study the role of media coverage concerning 13 suspected deaths, occurred during the 2014 flu vaccination campaign in Italy, which were first linked to the flu vaccine take-up. After the news outbreak, the Italian National Institute of Health (NIH) ruled to withdraw the vaccines from the market, and, only after testing the vaccines' safety, publicly declared that the suspected deaths were unconnected with the vaccinations.

We use data on daily flu vaccinations in a large metropolitan area in Italy during the influenza vaccination campaigns 2013 and 2014, the latter being the campaign in which the news related to the side-effects of vaccines were diffused. The panel dimension of the data allows us to control for day-of-campaign fixed effects, and thus exploit the within-day variation in news reporting and vaccination behavior. Since we observe daily flu vaccinations, we estimate the immediate effect of the case-related news, as well as test for any persistency.

We find that one additional news item about the alleged fatal side-effects of the vaccine in the media decreased the daily vaccination count by about 3%, corresponding to 93 fewer vaccinations per day with respect to the average number of vaccinations in the campaign not affected by the case. Importantly, we also document that the effect is short-lived, as it fades out after 10 days from the news outbreak.

The paper proceeds as follows: sections 2 and 3 describe background and data; sections 4 and 5 discuss the empirical strategy and present the results; conclusions follow.

2. Background

Seasonal influenza is an acute and highly contagious infectious disease, which, every year, causes substantial morbidity and mortality, particularly in elderly individuals and those with poor health conditions. Vaccination is the safest and most recommended strategy to reduce the epidemics, and, for this reason, it is strongly recommended (WHO, 2017).

[1] Differently from the pediatric vaccinations considered in previous studies, vaccination against the flu is effective only for a few months after the shot, and thus the decision to get it must be taken every year.

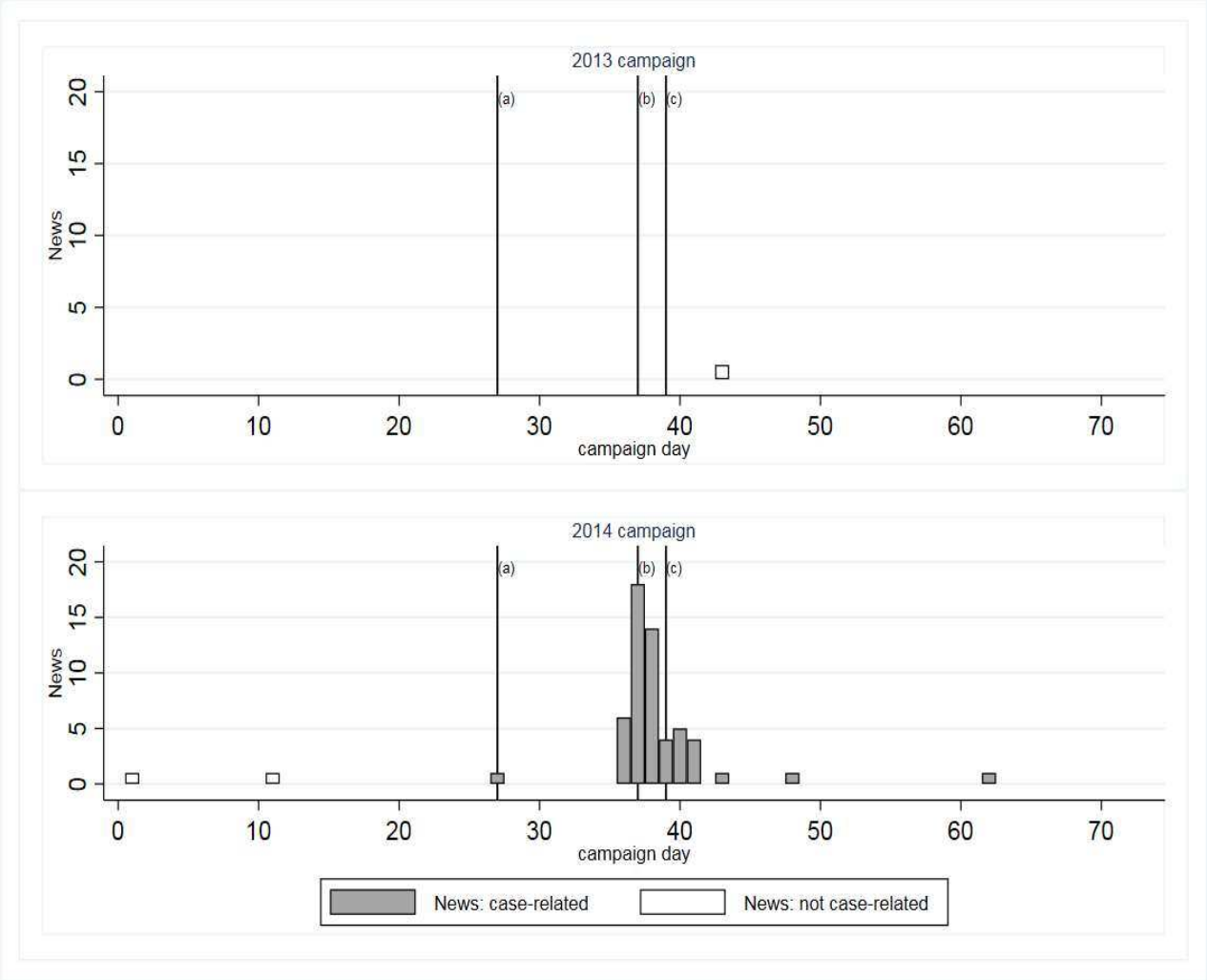
In Italy, vaccination against seasonal influenza is regulated by the *National Plan for Preventive Vaccination* (NPPV), established by the Italian Ministry of Health. The flu vaccination campaign starts in late October and finishes by the beginning of January, while the circulation of the influenza virus occurs between November and April. Because the influenza virus constantly evolves, every Spring the Ministry of Health states what types of vaccine should be used in the next vaccination campaign, according to the recommendations provided by the WHO.[2] By following these recommendations, every Italian Regional Government buys several slots of the vaccines through public auctions procedures.[3] According to the NPPV, flu vaccination is freely provided to categories of individuals who are at risk of complications in case of infection, namely (i) individuals aged 65 or more, (ii) individuals affected by a chronic disease, (iii) individuals institutionalized in nursing homes, (iv) women in $2^{nd}/3^{rd}$ trimester of pregnancy.

During the 2014 vaccination campaign 13 cases of deaths occurred, which were initially connected with two specific slots of the flu vaccines used in that campaign.[4] On November 18 2014 the first case was reported in the news, while on November 27 other three cases were reported and, on a precautionary basis, the NIH withdrew from the market the vaccine slots. Although other cases of deaths were reported in the news, on November 29 the first tests were concluded and the NIH assured that the vaccine was safe and that the deaths were not correlated with it. These findings were also confirmed in later tests.

Figure 1 shows the number of news items related to flu vaccination reported in the 2013 and 2014 campaigns. We observe a peak in the 2014 campaign, which was not present in 2013.[5]

[2] There are two main types of influenza virus known as A and B. Influenza A and one or two strains of influenza B viruses (depending on the vaccine) are included in each year's influenza vaccine.
[3] This implies that the vaccines used in a specific campaign may differ within and across regions depending not only on the type, but also on the producer.
[4] The vaccine connected with the cases were distributed by *Novartis Vaccines and Diagnostics* (slots n.142701 and n.143301). These slots were not used in the Lombardy region, to which our data refers.
[5] The number of news items can be different from zero in the 2013 campaign, as media also report practical information on the flu campaign.

Figure 1. Distribution of news items in the two campaigns.



Notes. The graph shows the number of case-related (grey bars) and not case-related (white bars) news items on the influenza vaccine reported in the newspapers in the 2013 (upper panel) and 2014 (lower panel) campaigns; the vertical lines (a), (b) and (c) indicate, respectively, November 18, 27 and 29 in each campaign (see section 2). **Sources:** Newspapers *Il Corriere della Sera* and *La Repubblica*.

3. Data

We use administrative data provided by the Agency for Health Protection (*ATS*) of the metropolitan area of Milan.[6] The data provides information on all flu vaccinations taken within the NPPV by all residents aged 50 and more, during the 2013 and 2014 vaccination campaigns I. We define the number of vaccinations against the flu (i.e., the vaccination count, *VC*) in each day (*t*) from the end of October to the beginning of January of the two campaigns I.[7]

[6] ATS is in charge of governing the healthcare sector in the area. The Milan metropolitan area is located in the Lombardy region. It includes approximately 3.2 million inhabitants (the second largest metropolitan area in Italy, after Rome).

[7] The data refers to all vaccination provided for free to the categories listed in section 2 and the categories of workers in the education, health and military sectors, who are also eligible for free vaccination for preventive reasons. This implies that the decision of the individual to get vaccinated is not affected by the cost of the shot.

We also collect all the news items containing the keyword "flu vaccination" (and its derivations, such as: flu vaccine, influenza vaccine, anti-influenza vaccine) appeared on the two more diffused Italian newspapers (*Il Corriere della Sera* and *La Repubblica*). We create the $News_{tc}$ variable as the 2 days moving average of the number of news items appeared on the newspapers the day of the vaccination and the day before. This measure is intended to proxy for the media reporting on this issue, not only by newspapers but also by other media (TV, radio).

Finally, we gather day-level information concerning plausible determinants of the vaccination decision, such as bad weather conditions or public transportation strikes, which, especially for the elderly, might impede or make more difficult to reach the General Practioner's facilities to get the vaccine. Table 1 presents descriptive statistics.

Table 1. Descriptive statistics.

	Overall sample		*2013 campaign*		*2014 campaign*	
	mean	sd	mean	Sd	mean	sd
Vaccination count	3090.336	4156.14	3099.411	4253.08	3081.26	4086.325
News	0.397	1.885	0.014	0.082	0.781	2.617
News: case-related	0.377	1.886	0	0	0.753	2.622
Wind	0.014	0.117	0.027	0.164	0	0
Storm	0.034	0.182	0.027	0.164	0.041	0.2
Snow	0.014	0.117	0.014	0.117	0.014	0.117
Strike	0.027	0.164	0.014	0.117	0.041	0.2
N	146		73		73	

Notes. *Wind, Storm* and *Snow* are equal to 1 if, respectively, strong wind (>50 km/h), a storm or snow were recorded in the day; *Strike* is equal to 1 for any strike programmed by the main Local Public Transportation firm. **Sources:** ATS-Milan for vaccinations; *Il Corriere della Sera* and *La Repubblica* for the news; *IlMeteo.it* for the weather; *www.atm.it* for strikes.

4. Empirical strategy

We estimate a panel fixed-effects model in which the two campaigns correspond to the time dimension I, and the campaign days (t) repeated in each year constitute the observation units ($t=1$ corresponds to the first day of campaign in both years, and so on):

$$VC_{tc} = \alpha_0 + \beta News_{tc} + X'_{tc}\alpha_2 + \varphi_t + \varepsilon_{tc} \quad (1)$$

X'_{tc} is a vector of day-specific characteristics (weather and strikes), φ_t are campaign day fixed effects. Identification of the parameter of interest (β) is achieved by leveraging on the fact that the differences in the news items reported on the newspapers in the same day, across the two campaigns, can be considered as-good-as random. Because the 2013 campaign was unaffected by relevant suspected side-events, this corresponds to difference-out the vaccination counts of the treated campaign (2014) with those of an untreated campaign (2013). Therefore, we can interpret β as the effect on vaccination take-up of the news related to adverse implications of flu

vaccination reported in 2014 but not in 2013. Given the count-data nature of the dependent variable, we estimate Poisson fixed-effects regressions.[8]

5. Results

2.1 *Baseline results*

Table 2 reports the baseline results, where we control for day of campaign fixed effects and progressively add month, week and day of the week fixed effects and weather conditions/strikes. The estimate in Column (3), our preferred specification, implies that one additional news item related to the alleged fatal side-effects of flu vaccination determines a decrease of about 3% in the daily vaccination count; this corresponds to about 93 fewer vaccinations per day with respect to the average daily vaccination count in the campaign not affected by the case. Considering that in the seven days following the withdrawal of the suspected slots of the vaccine, there were on average 6.5 news items per day, and that in the same days in the 2013 campaign the average vaccination count was 3970, the overall effect of the news would have been able to reduce vaccinations up to almost one fifth (i.e., between 120 and 780 fewer vaccinations per day). Importantly, since the slots which were withdrawn from the market by the NIH were not used in the region to which our data refers, the effect cannot be attributed to changes in the supply of vaccine slots. Plausibly, the reduction in vaccination take-up is due to a change in the individuals' perception of the risk of flu vaccination induced by the media reporting of the cases, which leads to an increase in their hesitancy to get vaccinated.

Given that we are interested in estimating whether the news coverage of side-events caused the decrease, in the last column of Table 2 we use as explanatory variable only the news items related to the cases of suspected deaths. The estimated coefficient does not change substantially from the previous ones, thus confirming that the effect is solely driven by the media reporting of those cases.

The effects do not change substantially also if we use alternative metrics for the definition of the news variable, or if we control for calendar day fixed effects instead of campaign day fixed effects (see Table 3).

[8] We test for the presence of overdispersion in the data by following Cameron and Trivedi (2005, pag.670-671). The test does not reject the null of equidispersion at the 95% confidence level (p-value=0.096). In addition, all the regressions use heteroskedasticity-robust standard errors, clustered at the campaign day level.

Table 2. Baseline estimates.

	Dep. variable: VC			
News	-0.073***	-0.025***	-0.030***	
	(0.026)	(0.005)	(0.006)	
News: case-related only				-0.033***
				(0.006)
N	146	146	146	146
Campaign day FE	X	X	X	X
Month, week and day of the week FE		X	X	X
Weather conditions and strikes			X	X

Notes. Poisson fixed-effects (FE) regressions with SEs heteroskedasticity-robust and clustered at the campaign day level. Significance levels: * p<0.1, ** p<0.05, *** p<0.01. **Sources:** see Table 1.

Table 3. Robustness checks.

	Dep. variable: VC			
Panel A				
News	-0.024***	-0.015***	-0.045***	-0.035**
	(0.006)	(0.003)	(0.010)	(0.014)
Panel B				
News: case-related	-0.025***	-0.017***	-0.050***	-0.036**
	(0.006)	(0.003)	(0.010)	(0.015)
N	146	146	146	142
Specifications:				
News in day *t=0*	X			
News in day *t-1*		X		
News: 3-days moving average			X	
Calendar day FE				X

Notes. See notes for Table 2. Significance levels: * p<0.1, ** p<0.05, *** p<0.01. **Sources:** see Table 1.

5.2 Persistency

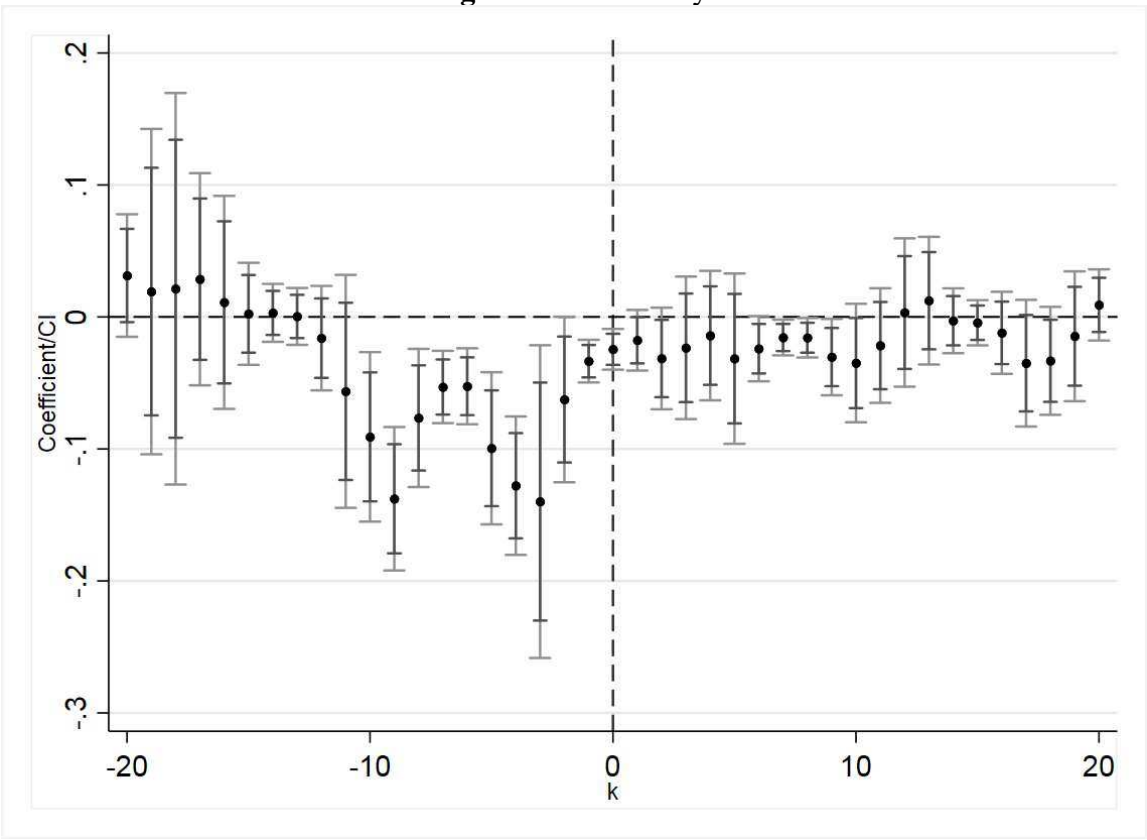
In this section, we study whether the media reporting on the side-effects, that were later proved to be unfounded, changed permanently or only temporarily the individuals' vaccination behavior. We thus test for the presence of persistent effects of media reporting on vaccination decisions by estimating the effects of news reported k days before ($News_{(t-k)c}$), on the daily vaccination count:

$$VC_{tc} = \alpha_0 + \beta News_{(t-k)c} + X'_{tc}\alpha_2 + \varphi_t + \varepsilon_{tc} \quad (2)$$

The results (Figure 2) show no evidence of persistent effects: lagged news variables are statistically significant only up to 10 days after the news outbreak. The media coverage thus leads to an immediate reaction and fall in vaccinations, which, however does not last long. Given that 10 days almost correspond to the period needed for the NIH to complete the lab tests and declare the vaccine as safe, we argue that the media effect vanished shortly after the National Institute of Health restored public confidence in flu immunization.

The estimates reported in Figure 2 also reassure us about the validity of our identification strategy, by showing that the leads of the news variable ($News_{(t+k)c}$) have no effects.

Figure 2. Persistency.



Notes. The black dots depict the point estimates, the dark (light) grey lines the 99% (95%) confidence intervals, of Poisson fixed-effects (FE) regressions based on equation (2); negative (positive) values of *k* indicate news appeared *k* days before (after) the day of vaccination. SEs are heteroskedasticity-robust and clustered at the campaign day level. **Sources:** see Table 1.

6. Conclusions

This paper exploits a case study in which media reported the news of deaths potentially associated to side-effects of flu vaccine, and shows that an additional news item induces a reduction of about 93 vaccinations per day. This effect is not persistent, as the vaccination behavior reverted to normality after about 10 days from the news outbreak, when the NIH declared that the vaccines were safe. Our results suggest that Health Authorities should act as quickly as possible in restoring public confidence.

References

Anderberg, D., Chevalier, A., Wadsworth, J., 2011. Anatomy of a health scare: Education, income and the MMR controversy in the UK. *Journal of Health Economics*, 30(3): 515-530.

Brilli Y. Lucifora C., Russo A., Tonello M. (2019), Vaccination take-up and health: evidence from a flu vaccination program for the elderly, UCSC Department of Economics and Finance WP 82/2019.

Cameron C. and P.K. Trivedi (2005), *Microeconometrics. Methods and Applications*. Cambridge University Press.

Carrieri, V., L. Madio, F. Principe (2019), Vaccine hesitancy and (fake) news: Quasi-experimental evidence from Italy. *Health Economics*, 2019, 1-6.

Chang, L., 2018. Information, education, and health behaviors: Evidence from the MMR vaccine autism controversy. *Health Economics*, 27:1043-1062.

WHO, 2017. Seasonal Influenza. Factsheet, World Health Organization.

WHO, 2019. Ten threats to global health in 2019. World Health Organization.