

SOCIAL MARKETING THROUGH VACCINATION CAMPAIGNS - A META ANALYSIS BASED EVIDENCE

Meghișan-Toma Georgeta-Mădălina^{1,2} and Toma Dorin³

¹⁾The Bucharest University of Economic Studies, Faculty of Business Administration in foreign languages, Bucharest, Romania; ²⁾Romanian Academy, National Institute of Economic Research "Costin C. Kiritescu", Bucharest, Romania; ³⁾Clinical Hospital "Prof. Dr. Th. Burghiele", Bucharest, Romania

E-mail: madalina_meghisan@yahoo.com; E-mail: dorintoma017@gmail.com

Abstract

The research methodology used is the meta-analysis, in order to make a synthesis of the studies on vaccination and prevention, so as to establish a global answer linked to the research field. For the studies' research phase, we analyzed the studies in the field of vaccination and prevention under the shape of review articles and research articles on Science Direct database. In the selection and inclusion phase, the main purpose is to eliminate the studies found that have no connection to the meta-analysis research problem and to retain only the studies closely linked to the selection criteria defined within the first step.

Keywords

Vaccination campaigns; meta-analysis; health care prevention; immunization.

JEL Classification

I12; C00; H00

Introduction

Due to the fact that immunization saves lives, the article focuses on vaccination campaigns, as a way towards health prevention. The World Health Organization (WHO, 2019) revealed the fact that in 2017 "*the number of children immunized (116.2 million) was the highest ever reported*". Since the year 2010 "*113 countries have introduced new vaccines, and more than 20 million additional children have been vaccinated*". (<https://www.who.int/campaigns/world-immunization-week/world-immunization-week-2019/key-messages>, accessed 21.04.2019)

In this study, the interventions regarding vaccination campaigns and prevention have been analyzed. Thus, we have reviewed the most recent approaches in the field of immunization through vaccination as a way towards prevention.

The research methodology used is the meta-analysis, in order to make a synthesis of the studies on vaccination and prevention, so as to establish a global answer linked to the research field. For the studies' research phase, we analyzed the studies in the field of vaccination and prevention under the shape of review articles and research articles on Science Direct database. In the selection and inclusion phase, the main purpose is to eliminate the studies found that have no connection to the meta-analysis research problem

and to retain only the studies closely linked to the selection criteria defined within the first step. Data extraction and analysis imply the access to complete information in order to include the article in meta-analysis.

Literature review

Immunization has always been “*the most effective public health measure to prevent disease*” (Ozisik et al., 2016), targeting “*a large number of healthy individuals*” (<http://venice.cineca.org>, accessed 30.03.2019).

Some authors argue that visual communications “*dominates every area of our lives*” (Barry, 1997) and visual messages “*are often inextricably linked with verbal ones*” (Kitch, 1997).

There were several adult vaccination campaigns during the years with the “*aim to raise awareness for adult vaccination and to understand the dynamics of the vaccination practices and the possible barriers against achieving targeted vaccination rates*” (Ozisik et al., 2016) There are also projections that indicate that the population over 60 years of age “*will be growing 3,5 times as rapidly as the total population*” (Ozisik et al., 2016) by 2025-2030. The ageing of population is an important issue, because of the increase in hospital admissions and the costs associated with the treatment. However, the childhood vaccines are not enough to assure the lifelong immunization, because childhood vaccines “*decrease with age and this phenomenon is called immunosenescence*” (Lang et al., 2011)

Research methodology

Meta-analysis is a method consisting of the following stages: “*studies’ research, selection, data extraction and analysis*” (Meghisan and Burger-Helmchen, 2017)

In the current study the research problem consists in determining the connection between the vaccination campaigns and prevention, using as bibliographic research the Science Direct database. In the first research phase, there were found a number of 9120 studies: review article (1266); research article (4183); encyclopedia (235); book chapters (905); conference abstracts (321); book reviews (43); case reports (5); conference infos (132); correspondence (157); discussion (672); editorials (191); mini reviews (66); news (234); patent reports (4); practice guidelines (13); product reviews (1); short communications (260); other (432).

In the selection and inclusion phase, there were found 2230 review articles and research articles published within the period 1995-2019 in the following main publications: “*Vaccine*” (1267 studies); “*The Lancet*” (253 studies); “*Social Science & Medicine*” (197 studies); “*Public Health*” (141 studies); “*Preventive Veterinary Medicine*” (108 studies); “*The Lancet Infectious Diseases*” (86 studies); “*American Journal of Preventive Medicine*” (80 studies); “*International Journal of Infectious Diseases*” (69 studies); “*American Journal of Infection Control*” (59 studies); “*Health Policy*” (56 studies) etc.

Of the full-text studies considered, a number of 17 met the established criteria: influenza vaccination campaigns (7 cases); measles and rubella vaccination campaigns (8 cases); HPV vaccination campaigns (2 studies).

Results

Influenza vaccination campaigns. Influenza is defined as a “*contagious viral respiratory infection*” (<https://ecdc.europa.eu/sites/portal/files/documents/seasonal-influenza-antiviral-use-2018.pdf>, accessed 04.04.2019). The main tool to protect people at higher risk (children and population aged 65 and over) is vaccination, more than ever now, when we “*are confronted with the aging population phenomenon*” (Cristea et al., 2016).

For most of the European Union countries, the vaccination against influenza of population aged 65 and over registered a decreasing trend in 2016 compared to 2008. The countries with the most significant decrease are: Romania (from 48,70% in 2008 to 7,80% in 2016);

Croatia (from 46,00% in 2008 to 21,00% in 2016); Slovakia (from 35,50% in 2008 to 13,30% in 2016); Hungary (from 37,80% in 2008 to 19,88% in 2016); Sweden (from 65,80% in 2008 to 49,10% in 2016). (Fig. no. 1)

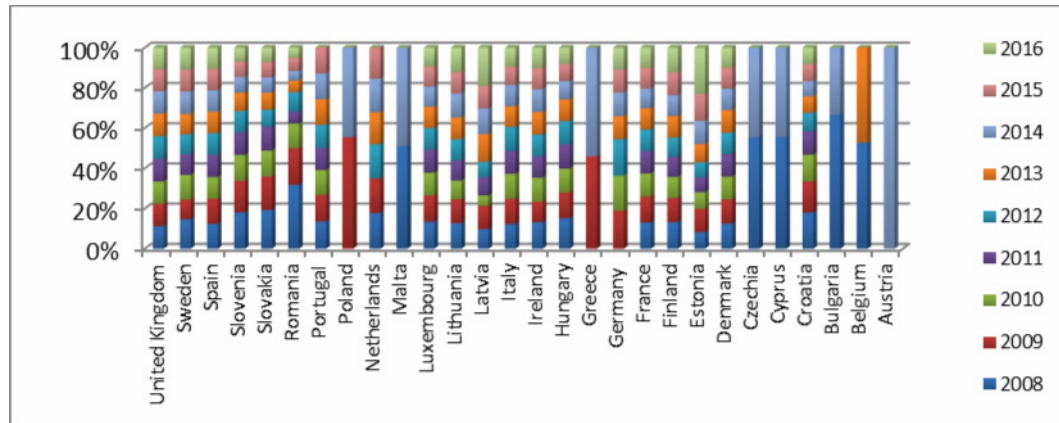


Fig. no. 1 Vaccination against influenza of population aged 65 and over (2008-2016)

Source: EUROSTAT, 2019

https://ec.europa.eu/eurostat/web/health/data/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_HBRnpDQkOkPD&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_count=1, accessed 12.04.2019

One of the main explanations for the low rates of vaccination is vaccines miss-trust. A “review of flu vaccination recommendations in the European Union and five Member States (Austria, Germany, Malta, Ireland and United Kingdom)” (Wiebke Ohlrogge and Suggs, 2018) underlined that all the states had a recommendation for flu vaccination as a primary protection tool, by 7 websites and 42 communication materials, stressing the benefits of vaccination. However, the approaches are different regarding the type of information emphasized.

Llupia et al. (2013) conducted a study on the importance of influenza vaccination coverage among health care workers from Hospital Clinic of Barcelona, as a goal towards preventive medicine in Spain. The data sources came from: self-administrated survey based on a Likert scale in order to assess the attitude towards the promotion of influenza vaccination and the risks of influenza. However, the results underlined “the impact on the strategic objectives, but not an increase in coverage” (Llupia et al., 2013).

Kim and Yoo (2015) examined the potential effectiveness of a television campaign to increase vaccination against influenza among elderly people in U.S.A. They developed “a decision-analytical model to evaluate a hypothetical nationwide TV campaign to promote seasonal influenza vaccination among the US medicare elderly” (Kim and Yoo, 2015). According to the results, the nationwide TV campaign for seasonal influenza vaccination increased the number of vaccinated elderly people and the authors underlined that this type of TV campaign was concluded to be cost-effective.

Borgey et al. (2019) conducted a study on an influenza vaccination campaign of elderly people from nursing home in Basse-Normandie region, France. The campaign on influenza vaccination was “offered to staff, combining different teaching aids in a multimodal approach” (Borgey et al., 2019) After the campaign, the staff was asked to fill in a questionnaire regarding their perception on influenza vaccination. Initial vaccination rates were 27,6% in the intervention group and 24,2% in the control group, with new rates to 33,7% and 22,9%, respectively, after the campaign. The authors revealed the overall positive effect of promotional campaigns in increasing the rate of influenza vaccination.

Wu et al. (2014) conducted a study on the impact of mass vaccination campaign against influenza in Taiwan on “34359 medically attended patients who displayed an influenza-like illness and had a rapid influenza diagnostic test”. According to the results of the regression model employed, the prediction was of five-fold or more influenza positive cases if “the mass influenza vaccination program had not been implemented” (Wu et al., 2014), with emphasize on prioritizing school-aged children, more than older adults.

However, not all the vaccination campaigns had success. An example is the vaccination campaign against A (H1N1) influenza in pregnant women in France. Blondel et al. (2012) conducted a research on 13453 women who gave birth in March 2010, who were interviewed in hospital before discharge. The “vaccine coverage was 29,3%” and the main reason for not being vaccinated was “that women did not want this immunization (91%)”. (Blondel et al., 2012) However, the vaccination was favorable in women “who were older, employed, born in France” (Blondel et al., 2012). One of the main justifications for the vaccination campaign failure was that the “initiative for vaccination was left mainly to women” (Blondel et al., 2012).

Measles and rubella vaccination campaigns. Several studies underlined the “beneficial non-specific effects of measles vaccine” (Byberg et al., 2017). For most of the European Union countries, the total confirmed measles cases registered a decreasing trend in 2019 compared to 2018. The most significant decrease was for the following countries: France (from 1913 cases in 2018 to 313 cases in 2019); Italy (from 2686 cases in 2018 to 332 cases in 2019); Greece (from 2193 cases in 2018 to 3 cases in 2019); Romania (from 1471 cases in 2018 to 336 cases in 2019); United Kingdom (from 953 cases in 2018 to 106 cases in 2019). (Fig. no. 2)

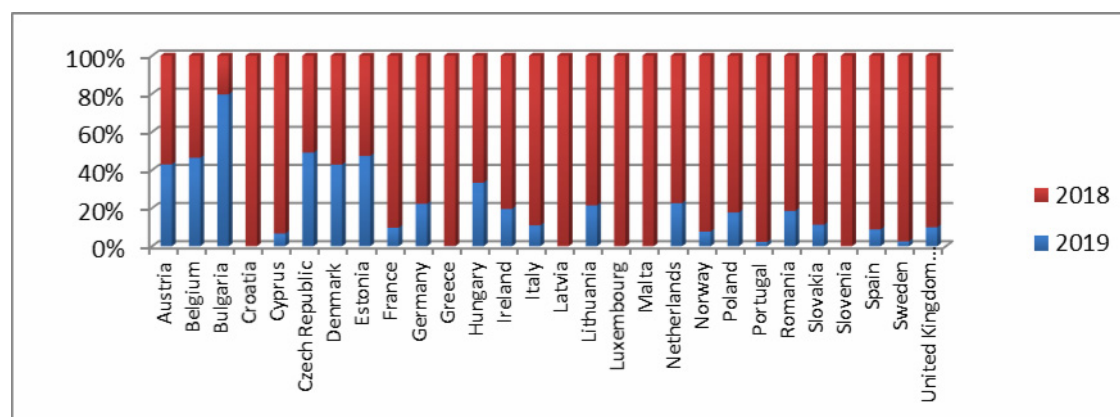


Fig. no. 2 Total confirmed measles cases (2018-2019)

Source: World Health Organization, 2019,

https://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measles_monthlydata/en/, accessed 01.04.2019

For the EU countries, the total confirmed rubella cases registered a decreasing trend in 2019 compared to 2018. The most significant decrease was for the following countries: Poland (from 450 cases in 2018 to 69 cases in 2019); Germany (from 58 cases in 2018 to 6 cases in 2019); Italy (from 21cases in 2018 to 4 cases in 2019); Spain (from 13 cases in 2018 to 3 cases in 2019); Austria (from 6 cases in 2018 to 1 case in 2019). (https://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measles_monthlydata/en/, accessed 01.04.2019)

In Eastern and Southern Europe, measles epidemic started in 2009 with thousands of cases, some of which resulted in the death of the persons (Ozisik et al, 2016), due to “measles outbreak in a vaccine-rejecting community” (Menach et al., 2014). Menach et al. (2014)

counted the number of measles-mumps-rubella (MMR) doses administered in 2011 and made a comparison to the 2008-2010 data, based on: an accelerated children vaccination campaign earlier than scheduled (1st dose at 6-11 months and the 2nd dose at 18-19 months) and “*catch-up of those aged over 18 months who had no MMR immunizations or were late for second MMR*”. The results underlined the fact that “*local practice administered 257 MMR doses in 2011, a 114% increase on average for 2008-2010*” (Menach et al., 2014).

Zang et al. (2017) made a research for the period 200-2014, on identifying risk factors for measles epidemic and evaluating the impact of measles-containing vaccines in China. The main goal of this analysis was to provide “*evidence-based recommendations for measles elimination strategies*” (Zang et al., 2017). According to the results of the study, there was a decrease in measles cases due to a series of strategies implemented by China and the cases of measles mostly occurred in individuals that were not vaccinated. The results also underline other studies’ results, emphasizing that: “*hospital exposure to measles virus 1-2 weeks before onset of measles rash and fever is the main cause of measles outbreaks*” (Zheng et al., 2015; Wang et al., 2014); patients, “*with recent recent history of hospital exposure, in contact with people infected with measles or that travel to other cities, were at risk for contracting measles*” (Zhang et al., 2014). Other studies conducted in Guangdong Province of China revealed that after the vaccination campaign against measles (May-December 2009) of 98,09% of children and 97,32% of migrant children, the number of measles cases “*was reduced by 93,04% compared with the same period of 2008. The antibody positive rate in children aged less than 15 years reached above 95%*” (Peng et al., 2011). A case-control study conducted in China by Hao et al. (2015) during 2012-2013 had the purpose to identify risk factors for measles infection in children aged between 8 months-14 years old. According to the results based on the “*multivariable analysis, lack of measles vaccination [...], hospital exposure and migration among countries were significant risk factors. The calculated vaccine efficiency was 91,9-96,1% for a single dose and 96,6-99,5% for 2 doses*” (Hao et al., 2015).

Byberg et al. (2017) compared mortality rate of the children one year after December 2012 measles vaccination campaign in Bissau city. The results of the studies revealed that a number of “*5633 children aged 9-59 months (85%) received campaign measles vaccination and 1006 (15%) did not. During the subsequent year 16 children died*”. (Byberg et al., 2017) The conclusion of this research underlines the importance of measles vaccination campaign as a possible effective way of improving child survival. Other studies conducted by Nigatu et al. (2008) evaluated the measles vaccine campaign from December 1999 on 745 children aged 9 months to 19 years in Asela, southern Ethiopia, by analyzing the measles antibody status by microimmune measles IgG enzyme immunoassay, based on the premises that “*measles vaccine campaigns are increasingly integrated into national or sub-national measles control programs*” (Nigatu et al., 2008). The results of this study underlined the fact that the campaign vaccination “*elevated immunity in the target ages by between 30% and 50% according to age group, or an average of around 40%*. (Nigatu et al., 2008) Goodson et al. (2009) assessed “*the impact of measles outbreak response vaccination campaign*” in Tanzania. The results underlined that the ratio of measles incidence rates “*in age groups targeted and not targeted by outbreak response vaccination (ORV) campaign decreased from 5,8 prior to ORV to 1,8 (p<0,0001)*” (Nigatu et al., 2008) In another study there was emphasized the importance of measles-rubella or measles-mumps-rubella vaccine within the childhood national immunization campaigns and programs. The main purpose of this study was to evaluate the rubella vaccine immunization for susceptible population (immunoglobulin IgG). The results of this research revealed that “*98% of susceptible group (723 out of 738) acquired immunity against rubella after vaccination and 2% of them (15 out of 738) did not acquire vaccine-induced immunity to*

rubella” (Hamkar et al., 2006) and thus, it was considered that mass vaccination from December 2003 from Iran had a proper immune coverage among vaccinated persons.

HPV vaccination campaigns. The European Union countries with the highest incidence estimation of cervical cancer cases attributable to HPV at the level of the year 2018 are: Latvia (25%); Estonia (22,5%); Bulgaria (20,30%); Romania (19,50%); Lithuania (18,90%). (Fig. no. 3) However, cervical cancer attributable to HPV is the second type of cancer after breast cancer that affects women aged between 15-44 years old. (https://ec.europa.eu/health/vaccination/hpv_ro, accessed 31.03.2019)

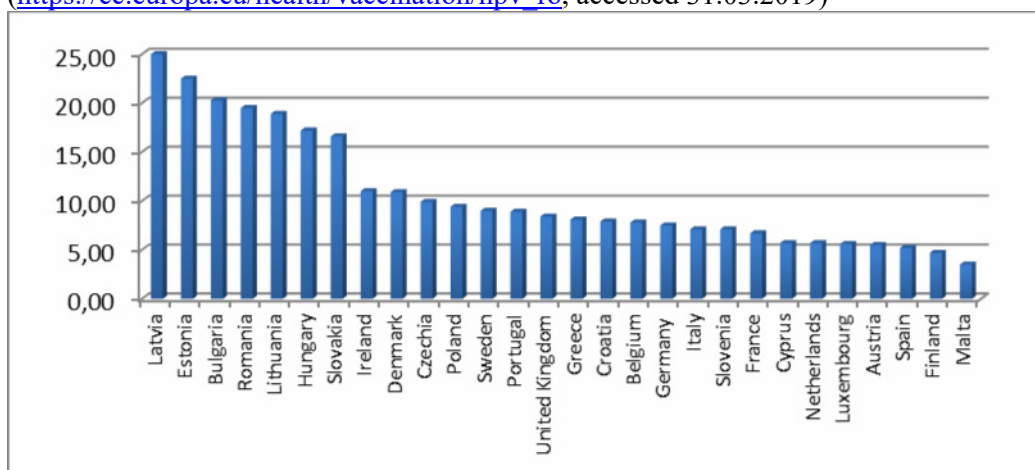


Fig. no. 3 Age-standardized incidence rate of cervical cancer cases attributable to HPV by country in European Union countries (estimates for 2018)

Source: <https://www.hpvcentre.net/statistics/reports/XEX.pdf?t=1556005480638>, accessed 01.04.2019

According to the Centers of Disease Control and Prevention, the proper age for vaccination is between 11-12 years old, but the HPV vaccinations “*can still be given to women and men through age 26*” (<https://www.cdc.gov>, accessed 23.03.2019).

Chadenier et al. (2011) performed a study that investigated “*the compliance to the first vaccination campaign*” (Chadenier et al., 2011), in the province of Milan between December 2008- December 2009. According to the results of the research, the “*knowledge about HPV among mothers went from 63% to 76% after vaccination*” (Chadenier et al., 2011). However, after the first round, 55,3% of the girls born in 1997 got vaccinated; 54% of them received the second dose, while 49,9% of them received the third.

Avery and Park (2018) analyzed the impact of visual flyers with pictures of HPV virus, with the text: “*Human Papillomavirus (HPV) is the most common STD in the United States [...] There is a vaccination to prevent it. Talk to your doctor and get vaccinated today*”. Visual attention was measured in seconds “*within the three areas of interest (AOIs) created by the researchers: one of the picture, one for the text above the picture, and one for the text below the picture*” (Avery and Park, 2018). According to the results “*fear appeals on behavioral intent to HPV vaccination*” (Avery and Park, 2018).

Conclusions

Using social marketing to create vaccination campaigns, we could see that most of the times the success of a campaign goes beyond its message and materials in its influence on the perceptions and attitudes of the target. From the four categories of marketing mix elements, Promotion is the most used element for a vaccination campaign. However, social marketing techniques employed in designing immunization campaigns are closely connected to the cost economy generated by preventive actions in health field. In conclusion, a summary of

the main areas of vaccination campaigns and prevention was provided. The importance of this article comes from its utility for vaccination advocates and policy makers, together with researchers, as well, for further analysis.

References

- Barry, A.M.S., 1997. *Visual intelligence: Perception, image, and manipulation in visual communication*. Albany, NY: New York Press.
- Blondel, B., Mahjoub, N., Drewniak, N., Launay, O and Goffinet, F., 2012. Failure of vaccination campaign against A(H1N1) influenza in pregnant women in France: Results from a national survey. *Vaccine*, 30, pp. 5661-5665.
- Borgey, F., Henry, L., Lebeltel, J., Lescure, P., Le Coutour, X., Vabret, A., Verdon, R., Thibon, P., 2019. Effectiveness of an intervention campaign on influenza vaccination of professionals in nursing homes: A cluster-randomized controlled trial. *Vaccine*, 37, pp. 1260-1265.
- Byberg, S., Thysen, S.M., Rodrigues, A., Martins, C., Cabral, C., Careme, M, Aaby, P., Benn, C.S. and Fisker, A.B., 2017. A general measles vaccination campaign in urban Guinea-Bissau: Comparing child mortality among participants and non-participants. Centers of Disease Control and Prevention, 2019. [online] Available at: <<https://www.cdc.gov>> [Accessed 23 March 2019].
- Chadenier, G.M.C., Colzani, E., Faccini, M., Borriello, C.R. and Bonazzi, C., 2011. Assessment of the first HPV vaccination campaign in two northern Italian health districts. *Vaccine*, 29, pp. 4405-4408.
- Cristea, M., Marcu, N. and Cercelaru O.V., 2016. Longer life with worsening pension system? Aging population impact on the pension system in two countries: Romania and Croatia. *Economic and Social Development: Book of Proceedings*, pp.28
- European Centre for Disease Prevention and Control, 2019. [online] Available at: <<https://ecdc.europa.eu/sites/portal/files/documents/seasonal-influenza-antiviral-use-2018.pdf>> [Accessed 4 April 2019].
- Eurostat, 2019. [online] Available at: <[Error! Hyperlink reference not valid.](#)> [Accessed 1 April 2019].
- Eurostat, 2019. [online] Available at: <https://ec.europa.eu/health/vaccination/hpv_ro> [Accessed 31 March 2019].
- Eurostat, 2019. Available at: <https://ec.europa.eu/eurostat/web/health/data/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_HBRnpDQkOkPD&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_count=1> [Accessed 12 April 2019].
- Goodson, J.L., Wiesen, E., Perry, R.T., Mach, O., Kitambi, M., Kibona, M., Luman, E.T and Cairns, K.L., 2009. Impact of measles outbreak response vaccination campaign in Dar es Salaam, Tanzania. *Vaccine*, 27, pp. 5870-5874.
- Hamkar, R., Jalilvand, S., Mokhtari-Azad, T., Nouri Jelyani, K. and Nategh, R., 2006. Evaluation of immunity against rubella in Iranian after mass campaign for measles-rubella vaccination on December 2003. *American Journal of Infection Control*, 34 (9), pp. 588-592.
- Hao, L., Ma, C., Wannemuehler, K.A., Su, Q., An, Z., Cairns, L., Quick, L., Rodewald, L., Liu, Y., He, H., Xu, Q., Ma, Y., Yu, W., Zhang, N., Li, L., Wang, N., Luo, H., Wang, H. and Grerory, C.J., 2016. Risk factors for measles in children aged 8 months-14 years in China after nationwide measles campaign: A multi-site case-control study, 2012-2013. *Vaccine*, 34, pp. 6545-6552.
- Johnson Avery, E. and Sejin, P., 2018. HPV vaccination campaign fear visuals: An eye-tracking study exploring effects of visual attention and type on message informative

- value, recall, and behavioral interventions. *Public Relations Review*, 44, pp. 321-330.
- Kim, M. and Yoo, B.-K., 2015. Cost-Effectiveness Analysis of a Television Campaign to Promote Seasonal Influenza Vaccination Among Elderly, *Value in Health*, 18, pp. 622-630.
- Kitch, C., 1997. Visual intelligence: Perception, image, and manipulation in visual communication (book review). *Journalism & Mass Communication Quarterly*, 74(4), pp. 908-910.
- Lang, P.O., et al., 2011. Immunosenescence: Implications for vaccination programmes in adults. *Maturitas*, 68(4), pp. 322-330.
- Le Menach, A., Boxall, N., Amirthalingam, G., Maddock, L., Balasegaram, S. and Mindlin, M., 2014. *Vaccine*, 32, pp. 1147-1152.
- Llupia, A., Mena, G., Olivé, V., Quesada, S., Aldea, M., Sequera V.G., Rios, J., Garcia-Basteiro, A.L., Varela, P., Bayas, J.M. and Trilla, A., 2013. Evaluating influenza vaccination campaigns beyond coverage: A before-after study among health care workers. *American Journal of Infection Control*, 41, pp. 674-688.
- Meghisan, G.M. and Burger-Helmchen, T., 2017. Meta-analysis in marketing research. *Innovative Marketing*, 13 (1).
- Nigatu, W., Samuel, D., Cohen, B., Cumberland, P., Lemma, E., Brown, D. and Nokes, J., 2008. Evaluation of a measles vaccine campaign in Ethiopia using oral-fluid antibody surveys. *Vaccine*, 26, pp. 4769-4774.
- Nowak, G.J., Shen, A.K. and Schwartz J.L., 2017. Using campaigns to improve perceptions of the value of adult vaccination in the United States: Health communication considerations and insights. *Vaccine*, 35, pp. 5543-5550.
- Ohlrogge, A.W and Suggs, L.S., 2018. Flu vaccination communication in Europe: What does the government communicate and how? *Vaccine*, 36, pp. 6512-6519.
- Ozisik, L., Durusu Tanriover, M., Rigby, S. and Unal, S., 2016. ADVICE for a healthier life: Adult Vaccination Campaign in Europe. *European Journal of Internal Medicine*, 33, pp. 14-20.
- Peng, Z.Q., Chen, W.S., He, Q., Peng, G.W., Wu, C.G., Xu, N., Zhao, Z.J., Shu, J., Tan, Q., Zheng, H.Z., Lin, L.F., Deng, H.H., Lin, J.Y. and Zhang, Y.H., 2012. Evaluation of the mass measles vaccination campaign in Guangdong Province, China. *International Journal of Infectious Diseases*, 16, pp. e99-e103.
- Vaccine European New Integrated Collaboration Effort, 2019. Available at: <http://venice.cineca.org> [Accessed 30 March 2019].
- Wang, F.J., Sun, X.J., Wang, F.L., Jiang, L.F., Xu, E.P., Guo, J.F., 2014. An outbreak of adult measles by nosocomial transmission in a high vaccination coverage community. *Int J Infect Dis*, 26, pp. 67-70.
- World Health Organization, 2019. Available at: https://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measles_monthlydata/en/ [Accessed 1 April 2019].
- WHO, 2019. Available at: <https://www.who.int/campaigns/world-immunization-week/world-immunization-week-2019/key-messages> [Accessed 21 April 2019].
- Wu, U.I., Wang, J.-T., Chang, S.-C., Chuang, Y.-C., Lin, W.-R., Lu, M.-C., Lu, P.-L., Hu, F.-C., Chuang, J.-H. and Chen, Y.-C., 2014. Impacts of mass vaccination campaign against pandemic H1N1 2009 influenza in Taiwan: a time-series regression analysis. *International Journal of Infectious Disease*, 23, pp. 82-89.
- Zhang, N., Zhang, X., Fu, H., An, J., Chen, N., et al., 2014. Study on the risk factors of measles among the 8-month-olds and children ≥ 15 years of age in Gansu province. *Chin J Epidemiol*, 35, pp. 1095-1108.
- Zhang, R.-Q., Li, H.-B., Li, F.-Y., Han L.-X. and Xiong, Y.-M., 2017. Epidemiological characteristics of measles from 2000 to 2014: Results of a measles catch-up vaccination

campaign in Xianyang, China. *Journal of Infection and Public Health*, 10, pp. 624-629.

Zheng, X., Zhang, N., Zhang, X., Hao, L., Su, Q. and Wang, H., 2015. Investigation of a measles outbreak in China to Identify gaps in vaccination coverage, routes of transmission, and interventions. *PLoS One*, 10.