


RESEARCH PAPER

 OPEN ACCESS



## Investigating knowledge, attitudes, and practices regarding vaccinations of community pharmacists in Italy

Giorgia Della Polla , Francesco Napolitano, Concetta Paola Pelullo, Caterina De Simone, Chiara Lambiase, and Italo Francesco Angelillo

Department of Experimental Medicine, University of Campania “Luigi Vanvitelli”, Naples 80138, Italy

### ABSTRACT

The purposes of this cross-sectional study were to determine the level of knowledge, attitudes, and behaviors related to vaccinations among community pharmacists in Italy and to understand the characteristics associated with the different outcomes of interest. The data were collected between September 2018 and April 2019 using semi-structured telephone interviews among a nationally representative sample of community pharmacists. Out of 550 pharmacists who were contacted, a total of 389 responded yielding a response rate of 70.7%. Only 23.9% indicated correctly all ten mandatory vaccinations for newborn. Participants with a lower number of years since degree, employee compared to owners, those who often/always collected information about public's immunization, and who have received information from educational activities were more likely to know all ten mandatory vaccinations for newborn. Almost all (91.7%) believed that they could play a prominent role in the educational interventions on vaccinations and 75.3% that they should be more engaged in these interventions. Only 23.7% had recommended HPV vaccine to 11–12 years-old adolescents. Pharmacists who have obtained information from educational activities, who knew all ten mandatory vaccinations for newborn, and who believed that they should be more engaged in vaccination interventions were more likely to recommend the vaccine. The HPV vaccine was less likely recommended by those who have obtained information from scientific journals, mass-media and internet, and educational activities compared to those who have not received any information, who worked a higher number of hours per week, who often/always collected data on immunization, and employee pharmacists compared to owners. The findings may be useful to design interventions that can overcome the knowledge gaps of community pharmacists and to improve vaccine recommendations.

### ARTICLE HISTORY

Received 26 November 2019

Revised 29 December 2019

Accepted 17 January 2020

### KEYWORDS

Attitudes; behaviors; community pharmacists; Italy; knowledge; vaccinations

## Introduction

Despite the availability of evidence that the vaccinations are one of the most effective public health interventions for the prevention of morbidity and mortality from vaccine-preventable diseases worldwide, there still remains suboptimal rates of immunizations in several countries,<sup>1</sup> mainly due to lack of appropriate information, false beliefs, concerns about side effects, and vaccine hesitancy among the population.<sup>2,3</sup>

To fully address these issues, health-care professionals, mainly primary care physicians, family pediatricians, and general practitioners, should work together in multidisciplinary teams in vaccination programs to disseminate evidence-based information about the effectiveness and safety of vaccinations and about the risks of vaccine-preventable diseases. Therefore, there is a need to improve the vaccination coverage and to adequately inform the population. In Italy, vaccines against diphtheria, hepatitis B, poliomyelitis, tetanus, *Haemophilus influenzae* type b, measles, mumps, pertussis, rubella, and varicella are mandatory for children up to 6 years and provided free of charge by public vaccination centers and primary care physicians. The last National Vaccine Prevention Plan stressed the need that the immunization

programs involve collaborative and integrated approaches with multidisciplinary actions of health-care teams.<sup>4</sup> Community pharmacists, although they are currently not allowed to administer vaccines in Italy, unlike various other countries,<sup>5</sup> are in the best position because they are one of the most frequently seen health-care professionals and interact directly with patients or customers within the community. Therefore, they are well placed to work closely with health-care professionals in designing, implementing, and disseminating information on vaccinations, given that they are an important advisor for such patients, to achieve the goal of improving the vaccination coverage. Indeed, the coverage is lower than the target set by the Italian National Immunization Plan. For example, the coverage rate for up to 24-month-old children against mumps, measles, and rubella was 93.2% and for varicella was 74.2%; only 53.1% of those over 64 years were vaccinated in the season 2018/2019 against influenza, and 49.9% of females and 15.5% of males for the 2005 birth cohort have completed the 3-dose series against human papillomavirus (HPV).<sup>4</sup>

In recent years, while previous studies have documented the level of knowledge, perceptions, and behaviors related to

vaccinations of different health-care professionals,<sup>6–11</sup> however, there is limited information regarding community pharmacists<sup>12–14</sup> although in several countries they have been utilized in these activities.<sup>15–18</sup> To the best of our knowledge, no published studies have been conducted in Italy. The need to examine this issue in more depth became apparent, and in view of this, the purposes of the present cross-sectional study were to determine the level of knowledge, attitudes, and behaviors related to vaccinations among community pharmacists in Italy as well to understand the characteristics associated with the different outcomes of interest.

## Materials and methods

### Setting and sampling

The data of the survey were collected between September 2018 and April 2019 among a nationally representative sample of community pharmacists practicing in Italy. A sample of 550 was drawn with a two-stage random cluster sampling strategy from the national list of community pharmacies and from each pharmacy one pharmacist was recruited for interview.

The minimum calculated sample size was 246, which was determined assuming that 80% had a positive attitude regarding their prominent role in the educational interventions on vaccinations, a confidence interval of 95%, and an error rate of 5%. Considering a non-response rate of 30%, a target sample of 352 pharmacists was finally determined.

### Procedure

This study was part of a larger assessment and the detailed description of the procedure has already been previously reported in detail elsewhere and shortly described below.<sup>19</sup> The research team contacted all selected community pharmacists via telephone, and one pharmacist from each selected pharmacy was invited to respond to the questionnaire. Data were collected by a semi-structured telephone interview performed by five members of the research team with experience in conducting interviews. Prior to answering the questions, detailed information was given on the objectives and methodology of the study, that participation was voluntary, and that the survey could be answered without responding to all questions. Confidentiality was ensured because the questionnaires were anonymous and no identifiable participant data were collected. The pharmacists were verbal consented after learning about the study and its objectives. No financial inducements of gifts were offered to participants.

### Survey instrument

A two-page questionnaire was used to collect the data, and questions were grouped into five key themes. First section comprised items relating to participants' socio-demographic and professional characteristics, including gender, age, marital status, year of graduation, number of years in practice, number of hours worked per week, and employment type. Second section asked 12 items related to pharmacists' knowledge about the vaccinations during childhood with three answer

options "Yes", "No", and "Do not know". Third section included three questions measuring the attitudes toward their role in public educational interventions on vaccinations. Two responses were collected on a numerical 10-point Likert-type scale with higher values corresponding to a stronger attitude, and one on a 5-point Likert-type scale ranging from "Strongly disagree" to "Strongly agree". In the fourth section, respondents were asked four questions on the behaviors regarding vaccinations. Responses were on a 5-point Likert-type scale ranging from "Never" to "Always" or through multiple-choice alternatives. Fifth section enquired about respondents' regarding valued sources of information about vaccinations and further educational needs.

A pilot study aimed to test content and validity of the questionnaire on a random sample of 20 pharmacists, excluded from the main study, was done after obtaining ethical approval for the study protocol and questionnaire from the Ethics Committee of the Teaching Hospital of the University of Campania "Luigi Vanvitelli" and prior data collection.

### Statistical analysis

All statistical analyses were performed using Stata statistical software version 15.<sup>20</sup> Primarily, descriptive data analyses were undertaken to summarize all information. Secondly, univariate analysis was employed, using chi-square and Student's t-test, to determine whether a relationship exists between the independent variables and the outcomes of interest. Variables with a  $p$  value  $\leq 0.25$  were included in the multivariate linear and logistic regression models. Finally, multivariate stepwise procedure was used to estimate the independent association between potential predictors and the following outcomes of interest: 1) pharmacists who knew all ten mandatory vaccinations for newborn (Model 1); 2) pharmacists who believed that they could play a prominent role in the educational interventions on vaccinations (Model 2); 3) pharmacists who recommended the HPV vaccine to 11–12 years-old adolescents (Model 3). The following independent variables were included in all Models: age (continuous), gender (male = 0; female = 1), number of years since degree (continuous), number of years in practice (continuous), number of hours worked per week (continuous), role in the pharmacy (owner = 1; employee = 2; director = 3), source of information on vaccinations (none = 1; scientific journals = 2; educational activities = 3; mass-media and internet = 4), and often or always collect data on immunization (no = 0; yes = 1). Moreover, the following variables were also included: knowledge of all ten mandatory vaccinations for newborn (no = 0; yes = 1) in Models 2 and 3, believe that they could play a prominent role in the educational interventions on vaccinations (continuous) and believe that they should be more engaged in the educational interventions on vaccinations (continuous) in Model 3. The significance level was set at 0.2 for entering and at 0.4 for removing the variables in the stepwise logistic and linear regression models. Odds ratios (ORs) and their 95% confidence intervals (CIs) were estimated in each logistic regression models. Standardized regression coefficients ( $\beta$ ) were presented for the linear regression

model. All analyses used two-tailed tests and *p* value less than or equal to 0.05 was considered to be statistically significant.

## Results

Out of 550 community pharmacists who were contacted, a total of 389 responded to the survey yielding a response rate of 70.7%. The socio-demographic and professional characteristics of study participants are summarized in [Table 1](#). The mean age was 48.8 years (range 26–79), more than half were female and married, most were the pharmacy owners, the average number of years in practice was 18, and the mean number of hours worked per week was 41.9.

## Knowledge

With regard to the knowledge items addressing specific vaccinations for newborn, importantly, less than one-quarter (23.9%) of respondents indicated correctly all ten mandatory vaccinations. To determine which possible independent explanatory variables were important for determining this knowledge of all ten mandatory vaccinations for newborn, a model of multivariate-adjusted logistic regression analysis was undertaken. Employee pharmacists compared to owners (OR = 3.39), those who often or always collected data on immunization (OR = 3.14), and those who had received information from educational activities (OR = 2.61) than those who did not receive information were more likely to know all ten mandatory vaccinations for newborn. Moreover, those with a higher number of years since degree (OR = 0.92) were less likely to have this knowledge (Model 1 in [Table 2](#)).

## Attitudes

With regard to attitudes, almost all pharmacists (91.7%) believed that they could play a prominent role in the educational interventions on vaccinations and three-quarters (75.3%) that they should be more engaged in these interventions, with a mean value, respectively, of 6.7 and 6.4 on a scale of 1 to 10. The multivariate linear regression analysis examined the influence of the predictor variables on the attitudes that pharmacists could play a prominent role in the

educational interventions on vaccinations. The model identified seven variables that showed some degree of association with this attitude. The three-predictor variables were gender, collecting data on immunization, and sources of information. Indeed, male pharmacists, those who often or always collected data on immunization, and those who have received information from mass-media and internet compared to those who did not receive information were more likely to believe that they could play a prominent role in educational interventions on vaccinations (Model 2 in [Table 2](#)).

## Behaviors

A total of 11.9% of the respondents received often or always request of information about vaccinations, mainly regarding efficacy (46.9%), side effects (43.1%), and costs (29.1%). Only 12.9% often or always collected data on immunization and 33.3% reported that they never did it. The main reasons for not collecting this data were that this was not a pharmacists' task (59.2%) and the lack of time (50.4%).

When asked whether they recommended the HPV vaccine for the adolescents of 11–12 years old, only 23.7% of the community pharmacists answered favorably. After adjustment, multivariate logistic regression analysis showed that this recommendation was influenced by several factors. Indeed, pharmacists who knew all ten mandatory vaccinations for newborn (OR = 4.13), those who often or always collected data on immunization (OR = 2.85) and those who believed that they should be more engaged in these interventions (OR = 1.28) were more likely to have this behavior. Instead, those who have obtained information from scientific journals (OR = 0.15), mass-media and internet (OR = 0.36), and educational activities (OR = 0.08) compared to those who have not received any information, those who worked a higher number of hours per week (OR = 0.96), and those who were employees compared to owners (OR = 0.42) were less likely to make this recommendation (Model 3 in [Table 2](#)).

## Sources of information

Finally, when community pharmacists were asked about the most helpful source to acquire information about vaccinations in their professional practice, only 59% of the respondents had acquired information from various sources. The most commonly indicated sources used by the sample to prepare themselves for responding to this topic were scientific journals (69.6%), followed by mass-media and internet (41.3%), and educational activities (27.4%). Almost all (94.8%) affirmed that they were interested in receiving further information about vaccinations.

## Discussion

This nationwide study adds to current literature toward vaccinations by exploring the extremely important topic of the knowledge, attitudes, and actual practices among an appropriate and accurate representation of community pharmacists in Italy and it provides important insights. Community

**Table 1.** Socio-demographic and professional characteristics of the study population.

	N	%
Age, years	48.8 ± 10.5 (26–79)*	
Gender		
Male	165	43
Female	219	57
Marital status		
Married	218	56.7
Other	166	43.3
Number of years since degree	22.3 ± 10.7 (1–54)*	
Number of years in practice	18 ± 10.9 (1–45)*	
Number of hours worked per week	41.9 ± 8.8 (1–72)*	
Role in the pharmacy		
Owner	221	57.1
Employee	112	28.9
Director	54	14

Number for each item may not add up to total number of study population due to missing value.

\*Mean ± Standard deviation (Range).

**Table 2.** Multivariate logistic and linear regression analysis to characterize factors associated with the different outcomes of interest.

Variable	OR	SE	95% CI	p
<b>Model 1. Pharmacists who knew all ten mandatory vaccinations for newborn</b>				
Log likelihood = -177.54, $\chi^2 = 60.51$ (9 df), $p < .0001$				
Role in the pharmacy				
Owner	1*			
Employee	3.39	1.11	1.77–6.46	<0.001
Director	1.68	0.67	0.76–3.68	0.196
Often or always collect data on immunization	3.14	1.21	1.48–6.68	0.003
Number of years since degree	0.92	0.28	0.87–0.98	0.012
Sources of information				
None	1*			
Educational activities	2.61	1.22	1.04–6.53	0.04
Scientific journals	0.58	0.19	0.30–1.12	0.109
Mass-media and internet	0.59	0.22	0.28–1.23	0.165
Age	1.05	0.03	0.98–1.11	0.106
Number of hours worked per week	0.98	0.01	0.95–1.01	0.344
	COEFF.	SE	t	p
<b>Model 2. Pharmacists who believed that they could play a prominent role in educational interventions on vaccinations</b>				
F = 6.74, $R^2 = 11.2\%$ , adjusted $R^2 = 9.5\%$ , $p < .0001$				
Often or always collect data on immunization	1.26	0.26	4.68	<0.001
Gender	0.47	0.17	2.7	0.007
Sources of information				
None	1*			
Mass-media and internet	0.55	2.11	2.61	0.01
Role in the pharmacy				
Owner	1*			
Employee	0.38	0.21	1.78	0.075
Number of years in practice	-0.01	0.01	-0.95	0.341
Age	0.02	0.02	0.9	0.369
Number of years since degree	-0.01	0.02	-0.86	0.388
	OR	SE	95% CI	p
<b>Model 3. Pharmacists who recommended the HPV vaccine to 11–12 years-old adolescents</b>				
Log likelihood = -143.25, $\chi^2 = 107.01$ (11 df), $p < .0001$				
Knowledge of all ten mandatory vaccinations for newborn	4.13	1.51	2.01–8.49	<0.001
Sources of information				
None	1*			
Scientific journals	0.15	0.05	0.07–0.32	<0.001
Educational activities	0.08	0.05	0.01–0.3	<0.001
Mass-media and internet	0.36	0.13	0.16–0.76	0.008
Believe that they should be more engaged in educational interventions on vaccinations	1.28	0.12	1.06–0.54	0.009
Often or always collect data on immunization	2.85	1.25	1.20–6.73	0.017
Role in the pharmacy				
Owner	1*			
Employee	0.42	0.17	0.18–0.93	0.035
Director	2.15	0.94	0.90–5.08	0.081
Number of hours worked per week	0.96	0.01	0.92–0.99	0.038
Gender	1.70	0.55	0.89–3.2	0.104
Having received often or always request of information about vaccinations	2.12	1.03	0.82–5.49	0.12

\*Reference category.

pharmacists may have a responsibility to take a prominent role in infectious diseases control programs in health-care systems.

The perfect knowledge can help community pharmacists about vaccinations and according to the national recommendations they have the task of providing education to the public and, therefore, of improving the immunization coverage. However, this study indicates that respondents lack the necessary knowledge and of particular concern is the finding that only one-fourth knew all ten mandatory vaccinations for newborn. Similar lack of knowledge, although in other health-care workers, has been already observed. Indeed, only 13.2% of those in critical care units knew all the vaccines that are recommended for them.<sup>21</sup> These gaps in knowledge may need to be narrowed and underscore a crucial need for strategies to educate community pharmacists about the vaccinations and to offer information in particular regarding those mandatory for newborn, perhaps through continuing medical education,

supplementary professional information, and additional patient educational materials. It should be noted that nearly all of the respondents recognized the need for further education in this field.

It is notable that this study demonstrated positive overall attitudes toward vaccinations. Most respondents rated the importance of their role in the educational interventions on vaccinations highly and, likewise, pharmacists also believed that they should be more engaged in these interventions. This is consistent with the statement from the already mentioned National Vaccine Prevention Plan which stressed the importance that pharmacists should work with other health-care professionals in implementing collaborative and integrated approaches toward vaccinations.<sup>4</sup> Two previous studies conducted in the US showed that 88.5% of licensed pharmacists agreed that they have an important role to play in vaccinating the public against tetanus, diphtheria, and pertussis,<sup>22</sup> 89.3% that vaccines for adults were one of the top priorities in

overall patient management and 96.3% considered vaccinations of adults within their scope of practice.<sup>23</sup> Regarding the practice of community pharmacists, despite the already mentioned Plan recommends routinely vaccinating all adolescents with HPV vaccine beginning at ages 11 to 12, only one out of four stated that they are recommending it. This result is similar to a survey conducted in US with 30% of community pharmacists actually recommended the vaccine to both girl and boy patients,<sup>24</sup> whereas slightly higher values of 38.7%<sup>25</sup> and 38.9%<sup>26</sup> have been observed among pharmacists in the US. However, the results of the present study were lower than those reported in previous investigations with values of 80% of pharmacists often or always recommended vaccines to the public and 51.6% recommended the HPV vaccination in Canada<sup>27</sup> and of two-thirds who offered vaccinations to children and adolescents aged <18 years in the US.<sup>28</sup> Reaching optimal vaccination coverage is essential considering the outbreaks of associated cancer cases in several countries due to suboptimal vaccination coverage among adolescents and adults.<sup>29</sup> Therefore, pharmacists may need to be more proactive about recommending the vaccine to all age-eligible individuals particularly adolescents with communication emphasizing the importance of the vaccine.

Respondents were also asked about the sources that they had used to acquire information about vaccinations. Only slightly more than half of pharmacists indicated that they are currently utilizing the educational resources and more than two-thirds of them preferred using scientific journals as a resource about vaccinations. This study highlighted the important role of educational activities as one of the main sources in providing vaccinations-related information. Indeed, if this become reliable source of information, this would have significant impact in the improvement of the pharmacists' knowledge of mandatory vaccinations for infants. This high impact of searching for information about the vaccines on the level of knowledge is in accordance with evidence from earlier studies in which acquiring information was a successful intervention to raise the level of knowledge related to health issues.<sup>10,11,30,31</sup> However, it should be noted that 41.3% had received information from internet and mass-media. Internet is not always the most credible source of health information, although it may be perceived as credible one, particularly the sites with negative information about vaccines, contain incomplete information and lack scientific support.<sup>32,33</sup> Encouragingly, it is noteworthy to underline that pharmacists using this source were more likely to believe that they could play a prominent role in educational interventions on vaccinations and to mention that the majority recognized the importance of vaccinations and that they were interested in receiving further information. There is overwhelming evidence corroborating the clear need for policy makers to plan targeted information interventions on this subject area for pharmacists in order to improve their adequate knowledge and to guarantee practices.

A main objective of the present investigation was the identification of those determining factors regarding the knowledge, attitudes, and behaviors of pharmacists and understanding such factors can help to target strategies to promote the implementation of procedures to increase

vaccination rates. The final multivariate regression models fit the data reasonably well and several variables emerged as the key drivers of knowledge, attitudes, and behaviors that warrant further investigation. Professional and personal characteristics that influenced the outcomes of interest included gender, years of working experience, role in the pharmacy, attitude and knowledge about vaccinations, and sources of information. In general, the current findings revealed that greater knowledge of all mandatory vaccinations for infants were noted among pharmacists with lower years of experience compared to those with more experience. This finding is confirmed by a previous study, although about the knowledge of influenza vaccination among health-care professionals, that has documented the role of a shorter work experience as significant predictor of better vaccination knowledge.<sup>34</sup> This might be due to that they have more opportunities to learn and to receive adequate education and training in this area through their university pharmacy curricula. Male pharmacists tended to believe regarding their prominent role in educational interventions on vaccinations. In addition, pharmacists who believed that they should be more engaged in these interventions were more willing to recommend an HPV vaccine to 11–12 years-old adolescents. The vital role that the vaccine plays in reducing morbidity and mortality should be at the forefront of interactions between the population and community pharmacists who are trusted sources of information<sup>35,36</sup> as part of immunization programs. Such activities will grow the position of community pharmacists as a key stakeholder in improving the health of patients.

Cautions should be taken into account while interpreting the findings of the current study in the context of certain potential identified limitations. First, the nature of the cross-sectional study method employed highlights the fact that, while the study showed the association between the independent variables and the dependent variables, one could not establish the directionality of the relationships. Second, in general, in studies employing on respondents' self-report through telephone-administered questionnaire of their practice, the information requested could not be checked through other methods, and, therefore, pharmacists may have reported socially desirable behaviors or their responses with an overestimation of their actual practice, such as how frequently they were engaging in recommended immunization practices. The anonymity precludes identification of pharmacists who responded and this may have minimized socially desirable responses. Third, response bias could have influenced the results because non-respondents may have declined to be interviewed because they do not support the vaccines. Despite limitations, results from this large, random, national sample of community pharmacists in Italy highlight the current status toward vaccinations activities.

In conclusion, due the fact that community pharmacists may have a role in reducing the burden of infectious diseases with multiple opportunities to improve awareness and understanding of vaccinations of the public through effective communication and education, this survey underlined the need to tailor and to implement interventions in order to overcome the knowledge gaps of community pharmacists and to improve the immunization coverage.

## Acknowledgments

The authors would like to express thanks to all the community pharmacists who participated in the study. The costs of the open access publication were supported by the “Programma Valere 2020” of the University of Campania “Luigi Vanvitelli” (Naples, Italy).

## Disclaimer

Preliminary results were presented at the Annual Congress of the Italian Public Health Association, October 16–19, 2019, Perugia, Italy.

## Disclosure of potential conflicts of interest

No potential conflict of interest was reported by the authors.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## ORCID

Giorgia Della Polla  <http://orcid.org/0000-0002-3182-4905>

## References

- World Health Organization. Immunization. 2018. [accessed 2019 Nov 7]. <https://www.who.int/topics/immunization/en/>.
- Dubé E, Vivion M, MacDonald NE. Vaccine hesitancy, vaccine refusal and the anti-vaccine movement: influence, impact and implications. *Expert Rev Vaccines*. 2015;14(1):99–117. doi:10.1586/14760584.2015.964212.
- Napolitano F, D’Alessandro A, Angelillo IF. Investigating Italian parents’ vaccine hesitancy: a cross-sectional survey. *Hum Vaccin Immunother*. 2018;14(7):1558–65. doi:10.1080/21645515.2018.1463943.
- Ministero della Salute. Piano Nazionale Prevenzione Vaccinale 2017–2019. [accessed 2019 Nov 7]. [http://www.salute.gov.it/imgs/C\\_17\\_pubblicazioni\\_2571\\_allegato.pdf](http://www.salute.gov.it/imgs/C_17_pubblicazioni_2571_allegato.pdf).
- International Pharmaceutical Federation (FIP). An overview of current pharmacy impact on immunisation - Aglobal report, 2016. Hague (The Netherlands): International Pharmaceutical Federation; 2016. [accessed 2019 Dec 27]. [https://www.fip.org/files/fip/publications/FIP\\_report\\_on\\_Immunisation.pdf](https://www.fip.org/files/fip/publications/FIP_report_on_Immunisation.pdf).
- Alshammari TM, Yusuff KB, Aziz MM, Subaie GM. Healthcare professionals’ knowledge, attitude and acceptance of influenza vaccination in Saudi Arabia: a multicenter cross-sectional study. *BMC Health Serv Res*. 2019;19(1):229. doi:10.1186/s12913-019-4054-9.
- Chhabra D, Mishra S, Gawande K, Sharma A, Kishore S, Bhadoria AS. Knowledge, attitude, and practice study on hepatitis B among medical and nursing undergraduate students of an apex healthcare institute at Uttarakhand foothills: a descriptive analysis. *J Family Med Prim Care*. 2019;8(7):2354–60. doi:10.4103/jfmpc.jfmpc\_331\_19.
- Chotta NAS, Mgongo M, Uriyo JG, Msuya SE, Stray-Pedersen B, Stray-Pedersen A. Awareness and factors associated with health care worker’s knowledge on rubella infection: a study after the introduction of rubella vaccine in Tanzania. *Int J Environ Res Public Health*. 2019;16:10. doi:10.3390/ijerph16101676.
- Picchio CA, Carrasco MG, Sagué-Vilavella M, Rius C. Knowledge, attitudes and beliefs about vaccination in primary healthcare workers involved in the administration of systematic childhood vaccines, Barcelona, 2016/17. *Euro Surveill*. 2019;24:6. doi:10.2807/1560-7917.ES.2019.24.6.1800117.
- Napolitano F, Navaro M, Vezzosi L, Santagati G, Angelillo IF. Primary care pediatricians’ attitudes and practice towards HPV vaccination: a nationwide survey in Italy. *PLoS One*. 2018;13(3):e0194920. doi:10.1371/journal.pone.0194920.
- Anastasi D, Di Giuseppe G, Marinelli P, Angelillo IF. Paediatricians knowledge, attitudes, and practices regarding immunizations for infants in Italy. *BMC Public Health*. 2009;9:463. doi:10.1186/1471-2458-9-463.
- Edwards N, Gorman Corsten E, Kiberd M, Bowles S, Isenor J, Slayter K, McNeil S. Pharmacists as immunizers: a survey of community pharmacists’ willingness to administer adult immunizations. *Int J Clin Pharm*. 2015;37(2):292–5. doi:10.1007/s11096-015-0073-8.
- Valiquette JR, Bédard P. Community pharmacists’ knowledge, beliefs and attitudes towards immunization in Quebec. *Can J Public Health*. 2015;106(3):e89–94. doi:10.17269/CJPH.106.4880.
- Gerges S, Peter E, Bowles SK, Diamond S, Bucci LM, Resnick A, Taddio A. Pharmacists as vaccinators: an analysis of their experiences and perceptions of their new role. *Hum Vaccin Immunother*. 2018;14(2):471–7. doi:10.1080/21645515.2017.1403695.
- American Pharmacists Association. Guidelines for pharmacy-based immunization advocacy; 1997. [accessed 2019 Nov 7]. <http://www.pharmacist.com/guidelines-pharmacy-based-immunization-advocacy>.
- Hogue MD, Grabenstein JD, Foster S, Rothholz MC. Pharmacist-administered immunizations: a decade of professional advancement. *J Am Pharm Assoc*. 2006;46:168–82. Erratum in *J Am Pharm Assoc*. 2006;46:308. doi:10.1331/154434506776180621.
- Burson RC, Bутtenheim AM, Armstrong A, Feemster KA. Community pharmacies as sites of adult vaccination: a systematic review. *Hum Vaccines Immunother*. 2016;12:3146–59. doi:10.1080/21645515.2016.1215393.
- Isenor JE, Edwards NT, Alia TA, Slayter KL, MacDougall DM, McNeil SA, Bowles SK. Impact of pharmacists as immunizers on vaccination rates: a systematic review and meta-analysis. *Vaccine*. 2016;34(11):5708–23. doi:10.1016/j.vaccine.2016.08.085.
- Napolitano F, Della Polla G, De Simone C, Lambiase C, Pelullo CP, Angelillo IF. Knowledge, attitudes, and practices of community pharmacists in the approach to antibiotic use: a nationwide survey in Italy. *Antibiotics*. 2019;8(4):E177. doi:10.3390/antibiotics8040177.
- Stata Corp. Stata Statistical Software: Release 15 College Station (TX): StataCorp LLC.
- Napolitano F, Bianco A, D’Alessandro A, Papadopoli R, Angelillo IF. Healthcare workers’ knowledge, beliefs, and coverage regarding vaccinations in critical care units in Italy. *Vaccine*. 2019;37(46):6900–6. doi:10.1016/j.vaccine.2019.09.053.
- Echtenkamp CA, Lampkin SJ, Hassan AK. Pharmacists’ attitudes and practices regarding tetanus, diphtheria and pertussis (Tdap) vaccination in pregnancy and surrounding newborns. *Pharmacy (Basel)*. 2018;25:6.
- Srivastav A, Black CL, Lutz CS, Fiebelkorn AP, Ball SW, Devlin R, Pabst LJ, Williams WW, Kim DK. U.S. clinicians’ and pharmacists’ reported barriers to implementation of the standards for adult immunization practice. *Vaccine*. 2018;36(45):6772–81. doi:10.1016/j.vaccine.2018.09.024.
- Tolentino V, Unni E, Montuoro J, Bezzant-Ogborn D, Kepka D. Utah pharmacists’ knowledge, attitudes, and barriers regarding human papillomavirus vaccine recommendation. *J Am Pharm Assoc*. 2018;58(4S):S16–23. doi:10.1016/j.japh.2018.04.014.
- Lutz CS, Carr W, Cohn A, Rodriguez L. Understanding barriers and predictors of maternal immunization: identifying gaps through an exploratory literature review. *Vaccine*. 2018;36(49):7445–55. doi:10.1016/j.vaccine.2018.10.046.
- Westrick SC, Hohmann LA, Hastings TJ. Pharmacy technicians-A critical element to facilitate implementation of pharmacist-provided services. *J Am Pharm Assoc*. 2018;58(2):133–4. doi:10.1016/j.japh.2018.02.008.
- MacDougall D, Halperin BA, Isenor J, MacKinnon-Cameron D, Li L, McNeil SA, Langley JM, Halperin SA. Routine immunization

- of adults by pharmacists: attitudes and beliefs of the Canadian public and health care providers. *Hum Vaccin Immunother.* 2016;12:623–31. doi:10.1080/21645515.2015.1093714.
28. Westrick SC, Patterson BJ, Kader MS, Rashid S, Buck PO, Rothholz MC. National survey of pharmacy-based immunization services. *Vaccine.* 2018;36(37):5657–64. doi:10.1016/j.vaccine.2018.07.027.
  29. Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine.* 2016;34(52):6700–6. doi:10.1016/j.vaccine.2016.10.042.
  30. Parmeggiani C, Abbate R, Marinelli P, Angelillo IF. Healthcare workers and health care-associated infections: knowledge, attitudes, and behavior in emergency departments in Italy. *BMC Infect Dis.* 2010;10:35. doi:10.1186/1471-2334-10-35.
  31. Napolitano F, Della Polla G, Angelillo IF. Knowledge, attitudes, and behaviors of parents towards recommended adult vaccinations: an explanatory survey in the geographic area of Naples, Italy. *Int J Environ Res Public Health.* 2019;16(12):E2070. doi:10.3390/ijerph16122070.
  32. Modanloo S, Stacey D, Dunn S, Choueiry J, Harrison D. Parent resources for early childhood vaccination: an online environmental scan. *Vaccine.* 2019;37(51):7493–500. doi:10.1016/j.vaccine.2019.09.075.
  33. Vrdelja M, Kraigher A, Vercic D, Kropivnik S. The growing vaccine hesitancy: exploring the influence of the internet. *Eur J Public Health.* 2018;28(5):934–9. doi:10.1093/eurpub/cky114.
  34. Khan TM, Khan AU, Ali I, Wu DB. Knowledge, attitude and awareness among healthcare professionals about influenza vaccination in Peshawar, Pakistan. *Vaccine.* 2016;34(11):1393–8. doi:10.1016/j.vaccine.2016.01.045.
  35. Kennedy A, Basket M, Sheedy K. Vaccine attitudes, concerns, and information sources reported by parents of young children: results from the 2009 health styles survey. *Pediatrics.* 2011;127(Suppl 1):S92–9. doi:10.1542/peds.2010-1722N.
  36. Shah PD, Calo WA, Marciniak MW, Gilkey MB, Brewer NT. Support for pharmacist-provided HPV vaccination: National surveys of U.S. physicians and parents. *Cancer Epidemiol Biomarkers Prev.* 2018;27(8):970–8. doi:10.1158/1055-9965.EPI-18-0380.