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Variation in adult vaccination policies across Europe: An overview from VENICE network on vaccine recommendations, funding and coverage

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ABSTRACT

Background: In 2010–2011, in the framework of the VENICE project, we surveyed European Union (EU) and Economic Area (EEA) countries to fill the gap of information regarding vaccination policies in adults. This project was carried out in collaboration with the United States National Vaccine Program Office, who conducted a similar survey in all developed countries.
Methods: VENICE representatives of all 29 EU/EEA-countries received an online questionnaire including vaccination schedule, recommendations, funding and coverage in adults for 17 vaccine-preventable diseases.
Results: The response rate was 100%. The definition of age threshold for adulthood for the purpose of vaccination ranged from 15 to 19 years (median = 18 years). EU/EEA-countries recommend between 4 and 16 vaccines for adults (median = 11 vaccines). Tetanus and diphtheria vaccines are recommended to all adults in 22 and 21 countries respectively. The other vaccines are mostly recommended to specific risk groups; recommendations for seasonal influenza and hepatitis B exist in all surveyed countries. Six countries have a comprehensive summary document or schedule describing all vaccines which are recommended for adults. None of the surveyed countries was able to provide coverage estimates for all the recommended adult vaccines.
Conclusions: Vaccination policies for adults are not consistent across Europe, including the meaning of "recommended vaccine" which is not comparable among countries. Coverage data for adults should be collected routinely like for children vaccination.

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1. Introduction

Vaccine-preventable diseases (VPD) have long had the attribute of being "childhood diseases", although affecting people of all ages. Although WHO estimates that two million child deaths were prevented through vaccination in 2003 [1], deaths from VPDs in adults remain a significant public health problem. Estimation from the United States shows that currently approximately 200 children die each year of VPDs, while 70,000 adults die of VPDs [2]. Healthcare and life expectancy have advanced in such a way that European countries are now facing an increasing ageing of its population. In all industrialized countries, the number of people older than 65 years is growing exponentially, and adults at retirement may now expect to live for another 2–5 decades [3].

Many reasons can affect the decision to recommend certain vaccinations for adults: VPD epidemiology, definition of elimination goals, a more severe clinical picture in adults, cost-effectiveness of vaccination, vaccine efficacy and long-term immunogenicity, country's resources. In the context of childhood-oriented vaccination policies, the epidemiology and implications of VPDs change [3]. For high communicable diseases, such as measles, rubella and pertussis, if childhood vaccination coverage is sub-optimal or is not uniform among geographical areas, the pathogen continues to circulate among population. Many adults are unprotected against the most common VPDs, because not all adults may have been adequately immunised in childhood, or acquired immunity (through vaccination or infection) can diminish with increasing age [4]. Moreover, the exposure to pathogens becomes less frequent and the opportunity of natural boosting decreases. Therefore the average age of infection can increase. This is especially concerning with regards to VPDs which are associated with an age-related increase in severity leading to hospitalisation, complications or death [5], such as measles [6] or pertussis [7–10]. Rubella virus, if the infection occurs during the early stages of pregnancy, can cause multiple birth defects and may result in foetal loss or still births; given that rubella, as measles, is now increasingly affecting adolescents or adults, vaccination of susceptible childbearing age women is fundamental to reduce the incidence of congenital rubella syndrome below 1 case per 100.000 live births by 2015, as established for the WHO European region [11].

Moreover, for certain VPDs, unprotected adults can represent an important source of infection for unimmunised or incompletely immunised infants; it was demonstrated for pertussis, whose natural and vaccine-induced immunity is not lifelong. A pertussis booster in adulthood could have the scope both to reduce the overall disease burden, and to protect newborns and infants in the first year of life, who are unvaccinated or partially vaccinated [7–9].

Instead, some vaccinations need to be tailored to meet individual variations in risk resulting from age (such as influenza vaccine in elderly), occupation (hepatitis B in health care workers), underlying illness (such as pneumococcal vaccination), lifestyle and foreign travel.

Several European networks have been collecting surveillance data on VPDs affecting different age groups during past decade, such as the Surveillance Community Network for Vaccine Preventable Infectious Diseases (EUVAC.NET), the European Union Invasive Bacterial Infections Surveillance Network (EU-IBIS) or the European Influenza Surveillance Network (EISN). Despite these efforts to standardize the methods of estimating of VPD burden in Europe, there is no comprehensive information available to policy makers on a European scale on the current status of vaccination programmes for adults.

Vaccination coverage in adults is often not known and the limited data indicate sub-optimal coverage uptake in target groups, even in high-risk individuals [12].

As part of the overall objective of VENICE (http://venice.cineca.org), a project funded by the European Centre for Disease Prevention and Control (ECDC) to improve understanding of vaccination programmes in Europe, a need was recognized to fill this gap of information. In June 2010 a survey was launched to gain an overview of vaccination strategies in adults in the 27 European Union (EU) member states (MSs) plus Norway and Iceland, including country specific vaccination policies and recommendations, funding strategies and availability of coverage data.

2. Methods

The survey was a collaborative study between the VENICE Project, the U.S. National Vaccine Program Office (NVPO), within the U.S. Department of Health and Human Services, and EU and European Economic Area (EEA) MSs. A common survey was launched by the VENICE project to the VENICE MSs[1] (27 EU countries plus Norway and Iceland) and by NVPO to other extra-EU developed countries. In this paper results from EU/EEA-countries are reported. The National Italian Public Health Institute (Istituto Superiore di Sanità) coordinated the survey among the VENICE countries.

An electronic standardized questionnaire was developed together with colleagues from NVPO, using the online software SurveyMonkey (http://it.surveymonkey.com/) and was used for the cross-sectional survey. The questionnaire consisted of 120 questions and covered general aspects of adult vaccination strategies. For 14 vaccine antigens (Bacillus Calmette-Guérin [BCG], diphtheria, hepatitis A, herpes zoster, measles, meningococcal, mumps, pertussis, pneumococcal, poliomyelitis, rabies, rubella, tetanus, and varicella), questions on specific immunisation recommendation for adults, funding mechanisms and availability of coverage estimates in adults were asked. We also asked whether there were recommendations for any other vaccines not included among the 14 vaccines. Questions were closed, with optional space for input of free text. The questionnaire was piloted by the VENICE consortium members and the NVPO, and amended as necessary. Data on seasonal influenza, hepatitis B, tick-borne encephalitis (TBE) and human papilloma virus (HPV) vaccination were already available from recent VENICE surveys [13–16]; data from these surveys have been added to the dataset and analysed for this report.

In the period June–August 2010, each VENICE gatekeeper (previously identified in each VENICE MS) received a personal link to the online-questionnaire and was asked to complete it; a detailed report summarizing the results was sent to participating countries asking for data validation.

The main indicators analysed included: (a) availability of a schedule or summary document specific for adults; (b) number of recommended vaccines for adults, by country; (c) for each vaccine: (i) type of recommendation (universal or selective); (ii) funding mechanism for vaccine; (iii) availability of coverage estimates. Recommendations for travellers have been excluded from this analysis, because they reflect mainly the importance of a VPD within the country of travel destination and furthermore because the national strategies, if any, could vary according to the reason for travel, the risk of disease and the destination.

A recommended vaccine was defined as inclusion in an official document or in national immunization schedule.

[1] AT Austria, BE Belgium, BG Bulgaria, CY Cyprus, CZ Czech Republic, DK, Denmark, EE Estonia, FI Finland, FR France, DE Germany, GR Greece, HU Hungary, IS Iceland, IE Ireland, IT Italy, LV Latvia, LT Lithuania, LU Luxembourg, MT Malta, NL The Netherlands, NO Norway, PL Poland, PT Portugal, RO Romania, SK Slovakia, SI Slovenia, ES Spain, SE Sweden, UK United Kingdom.

Table 1
Availability of adult vaccination schedule summary document of recommendations.

Comprehensive schedule	Schedule for ≥1 vaccine	No specific schedule for adults
AT, ES, FR, DE, IS, UK (n = 6)	BG, CY, CZ, DK, EE, FI, GR, HU, LV, LU, MT, NL, NO, PT, RO, SK, SI (n = 17)	BE, IE, IT, LT, PL, SE (n = 6)

The references to the comprehensive schedules are:
AT: http://www.bmg.gv.at/cms/site/attachments/1/4/0/CH0780/CMS1038913010412/impfplan_2010_korr_maerz.pdf
ES: http://www.msc.es/ciudadanos/proteccionSalud/vacunaciones/docs/recoVacunasAdultos.pdf (2004); update 2009: http://www.msc.es/ciudadanos/proteccionSalud/vacunaciones/docs/TetanosDifteria_2009.pdf.
FR: http://www.invs.sante.fr/beh/2010/14_15/beh_14_15.pdf.
DE: http://www.rki.de/cln_178/nn_1493664/DE/Content/Infekt/EpidBull/Archiv/2009/30_09,templateId=raw,property=publicationFile.pdf/30_09.pdf.
IS: http://landlaeknir.is/pages/858.
UK: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_079917

3. Results

The response rate was 100% (29/29 countries). Data was validated by 23/29 (79%) countries (BE, BG, CY, CZ, DE, DK, EE, ES, FR, GR, IE, IT, LV, MT, NL, NO, PL, PT, RO, SK, SI, SE, UK).

The definition of adulthood for the purpose of vaccination policies was collected. In most countries (23) the age threshold is 18 years. In two countries (LT, ES) it is 15 years, in two other countries (PL, SI) 19 years. NL has no definition with a strict age boundary for this purpose; SE did not answer this question.

Six countries have a comprehensive summary document or schedule describing all vaccines which are recommended for adults (including risk groups and timing of vaccination, if applicable); 17 countries have a schedule specifying recommendations for at least one vaccine for adults, which in all countries includes seasonal influenza vaccine, the second most frequently included vaccine was tetanus vaccine. In six countries there is no specific schedule or document available for any adult vaccination recommendation, but the recommendations are included in disease specific documents (Table 1).

EU/EEA-countries recommend between four vaccines (HU, IS, LT) and 16 vaccines (DE, UK) for adults (Table 2), with a median number of 11 vaccines. Fig. 1 and Table 2 show how many countries have vaccine recommendations for adults by VPD, and by which mechanisms vaccines are recommended: a general recommendation means a recommendation for all adults; a specific

Table 2
Summary overview of recommended vaccines for adults by country and vaccine, 2011.

Country	Seas. flu	Hep B	Tet.	Dipht.	Pneumoc.	Rabies	Hep A	Rubella	Meningoc.	TBE	Varicella	Measles	Polio	Pert	BCG	Hib	Mumps	HPV	Herpes Z	Total	Rg	Rsp
Austria									-			-			-	-	-	-		13	6	7
Belgium						-			-	-			-		-	-	-		(Rsp)	12	3	9
Bulgaria										-	-		-	-	-				-	12	2	10
Cyprus								-		-	-	-	-	-	-	-	-	-	-	8	2	6
Czech				-		-		-			-	-	-	-	-	-	-	-	-	7	2	5
Denmark						-			-		-			-	-	-	-	-	-	10	2	8
Estonia														-	-			-	-	16	5	11
Finland							-	-		Rg_s		-	-	-	-	-	-	-	-	9	3	6
France										-						-	-		-	15	3	12
Germany															Contra		-	-	-	15	4	11
Greece						-				-	-			-	-	-	-	-	-	10	2	8
Hungary			-	-	-		-	-	-		-	-	-	-	Contra	-	-	-	-	4	0	4
Ireland			-	-						-			-	-				-	-	12	0	12
Island			-	-		-	-		-	-	-	-	-	-	-	-	-	-	-	4	0	4
Italy					-		-		-				-	-		-	-	Rsp_s	-	11	2	9
Latvia					-		-	-	-		-	-	-	-	-	-	-	-	-	6	3	3
Lithuania					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	2
Luxemburg								-		-		-			-	-	-		-	12	4	8
Malta					-	-	-	-	-	-	-	-		-		-	-	-	-	6	0	6
Netherlands				-		-		-	-	-		-	-	-	-	-	-	-	-	6	0	6
Norway											-	-	-			-	-	-	-	12	3	9
Poland					-	-	-	-	-			-	-		-	-	-	-	-	7	3	4
Portugal							-			-	-	-		-	-		-	-	-	10	2	8
Romania					-		-	-	-	-	-	-	-	-	-	-	-		-	6	2	4
Slovakia								-			-	-	-	-		-	-	-	-	10	2	8
Slovenia													-		-	-		-	-	14	3	11
Spain										-					-		-	-	-	14	2	12
Sweden			-	-		-	-		-	Rg_s	-	-	-	-	-	-	-	-	-	5	1	4
UK			-											-		-		-	(Rsp)	15	0	15
Total	**29**	**29**	**24**	**23**	**22**	**19**	**18**	**17**	**16**	**15**	**14**	**12**	**11**	**9**	**7**	**6**	**5**	**5**	**1**			
Rg	2	1	22	21	0	0	0	0	0	8	1	0	3	5	0	0	0	0	0			
Rsp	27	28	2	2	22	19	18	17	16	7	13	12	8	4	7	6	5	5	1			

	General recommendation for all adults (Rg)
Rg_s	General recommendation for all adults in some parts of the country
	Recommendation for specific groups of adults (e.g. age groups, occupational risk groups, persons with underlying conditions etc.) (Rsp)
Rsp_S	Recommendation for specific groups of adults in some parts of the country
(Rsp)	Recommendation for specific groups of adults (see above), but recommendation not yet implemented
	Recommendation for specific groups of adults + General recommendation in some parts of the country
Contra	Contraindication for use in adults
-	No specific recommendation for adults

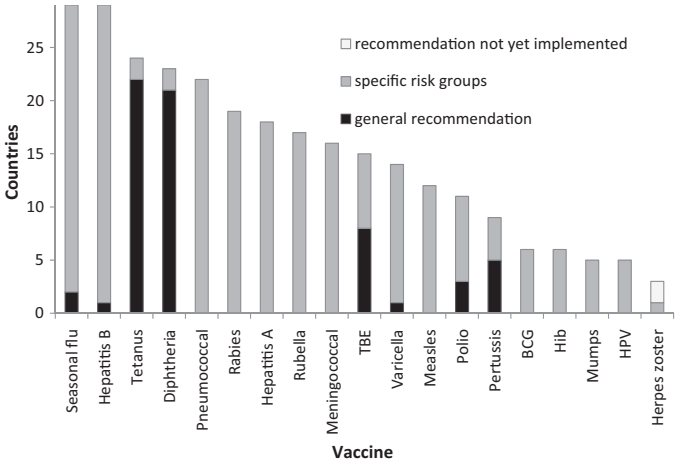

Fig. 1. Number of countries by recommended adult vaccine and type of recommendation, 2011.

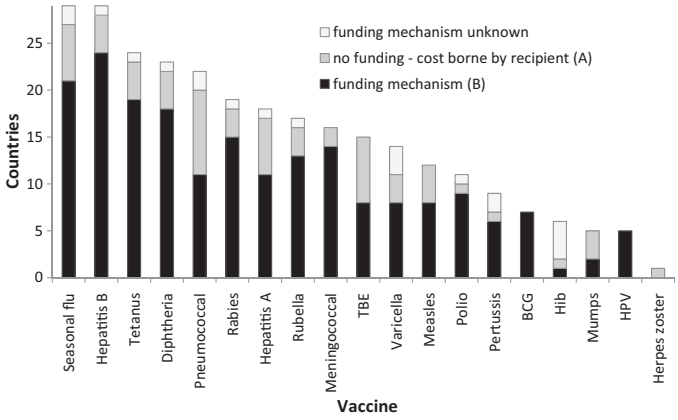

Fig. 2. Number of countries by funding of recommended vaccines, 2011.

recommendation means that a vaccine is recommended only for certain groups (specific age groups, occupational risk groups, persons with underlying conditions, etc.). For more details about the nature of the recommendations please refer to the comprehensive VENICE survey report: http://venice.cineca.org/reports.html.

Out of 29 countries, 22 (76%) and 21 (72%) states recommend to all adults tetanus and diphtheria vaccines respectively, which are generally recommended every 10 years; two other countries recommend these vaccines only to specific risk groups. In 16 countries the tetanus-diphtheria (Td) combined vaccine is the most frequently used vaccine in the context of tetanus recommendations for adults. Seasonal influenza and hepatitis B vaccinations are recommended in all surveyed countries for specific groups, except AT and EE which recommend seasonal influenza vaccination for all adults (without public funding), and EE which recommends hepatitis B vaccine for all adults (without funding). Vaccine for TBE is recommended in 15/28 countries (54%) in Europe, eight of which recommend vaccination for all adults where TBE is endemic. Eleven countries recommend polio vaccine for adults, three of which recommend it as a booster for all adults (AT, FR, LU). Regarding pertussis vaccination, five countries recommend it to all adults every 10 years, and four countries for specific groups. Fourteen countries recommend varicella vaccination for specific groups, except BE recommending it for all adults. All the other vaccinations are recommended only to specific age or risk groups. Rubella vaccine is recommended for susceptible women in 17/29 countries (59%). Two countries have a specific recommendation against the use of BCG vaccine in adults.

Fig. 2 shows how many countries have funding mechanisms to support vaccination recommendations for adults. No funding means that the cost of vaccination is entirely paid out-of-pocket by the recipient; having some funding mechanism for the cost of vaccination includes vaccinations which are publicly funded; funded by the official health insurance, or employer in case of some occupational risk groups; fully or partially funded. Approximately a third of official vaccination recommendations are not supported through funding. All countries recommending BCG (7/7 countries) vaccination for adults and planning HPV catch up campaigns in young adults (5/5) provide funding. Most countries recommending meningococcal (14/16), polio (9/11), rubella (13/17), rabies (15/19), and hepatitis B (24/29) vaccine also provide funding. Adult vaccines with the least financial support include pneumococcal (11/22) and TBE (8/15) vaccines.

None of the surveyed countries was able to provide coverage estimates for all the recommended adult vaccines (Fig. 3). Hepatitis B (23/29 countries) and seasonal influenza (20/29) coverage were the most commonly measured, for at least some of the recommended adult groups. Only 6/24 (25%) and 5/23 (22%) monitor uptake for tetanus and diphtheria respectively. The most recent available adult coverage estimates for tetanus, diphtheria and pneumococcal vaccines, as found in this survey, are shown in Table 3. Administrative data provided from the once off meningococcal catch up programme in IE showed a coverage of

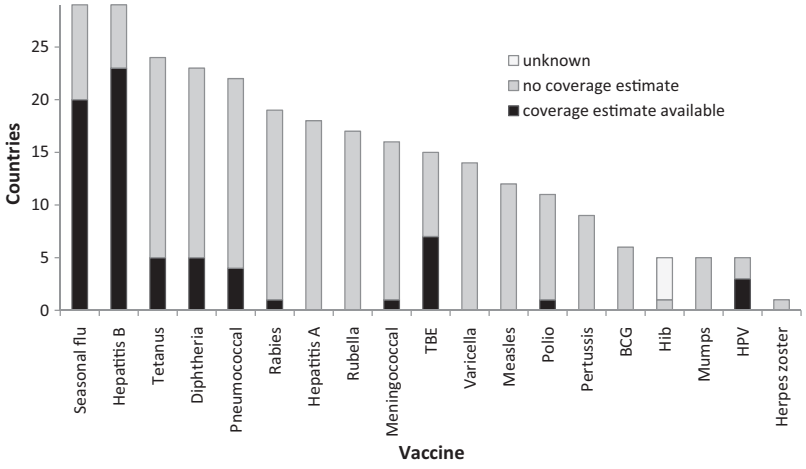

Fig. 3. Availability of coverage estimates for recommended adult vaccines among 29 European countries, 2011.

Table 3
Most recent available adult coverage estimates for tetanus, diphtheria, pneumococcal disease polio vaccine and meningococcal disease among 29 European countries, 2010.

Vaccine	Country	Coverage (%)	Target group	Year
Tetanus	BE	61	All adults	2008
	BG	74	Adults at 25–35–45–55–65 and 75+ years	2009
	DE	73	All adults	2009
	FR	71	All adults	2002
	LV	62	Adults >25 years	2009
	PT	61	Adults at 65 years	2010
Diphtheria	BE	61	All adults	2008
	BG	74	Adults at 25–35–45–55–65 and 75+ years	2009
	FR	34	All adults	2002[A]
	LV	62	Adults >25 years	2009
	PT	61	Adults at 65 years	2010
Pneumococcal	BE	13	Adults >60 years	2008
dis-	IE	10	All adults	2006
ease	LV	<1	All adults	2009
Polio	FR	40	–	2002
Meningococcal disease	IE	30	Adults 18–22 years	2002

[A] Before recommendation of adult diphtheria booster.

meningococcal vaccine in 18–22 year old adults at 30% [17]. Details on how these estimates were obtained can be found in the comprehensive report. No country could provide coverage estimates for vaccines for hepatitis A, rubella, varicella, measles, pertussis, BCG, mumps or polio. The influenza, hepatitis B, HPV and TBE coverage estimates are published elsewhere [13–16].

4. Discussion

The results of this survey show that vaccination policies for adults vary across Europe. EU/EEA-countries recommend between four to 16 vaccines for adults, reflecting the different approaches countries take towards vaccination in adults. The aim of this publication is to give an overview of adult vaccination recommendations in Europe, filling this gap of information. We covered only general aspects of vaccination and did not go into deeper details, as vaccine type, definition of risk groups, rationale or decision-making process for the introduction of each vaccine in national immunization programmes. In order to achieve a good response rate, we could not extend more the questionnaire, consisting of 120 questions yet. Therefore these aspects deserve separate and thorough discussions, as we did for certain vaccinations elsewhere [13–16].

All countries have recommendations for adults or adult target groups to be vaccinated with seasonal influenza and hepatitis B vaccine, followed by 23/29 countries with recommendations for prophylactic tetanus and diphtheria vaccination. These findings somewhat reflect the public health priorities placed on preventing these infections in Europe. Except for tetanus and diphtheria which are mainly recommended to all adults, in most countries all the other adult vaccines are recommended for specific age or risk groups only. For example, hepatitis B, rabies and influenza vaccines are recommended only for certain groups in the majority of surveyed countries, which may be consistent with indications and cost-benefit studies for these vaccines [18,19].

Hepatitis B vaccination is recommended to all adults only in EE and influenza vaccine only in EE and AT; it should be mentioned both EE and AT do not offer free-of-charge these vaccines to adult population. It represents a critical point because recommendations which are not supported through public funding mechanisms may impact the uptake of the vaccine. As reported later in the discussion, the definition of recommendation which we have used did not take in consideration the funding mechanism, representing a limitation of the study.

For other vaccines (e.g. pertussis, meningococcal, measles) the picture is much more varied, which gives rise to concerns that decisions are not always based on evidence of disease control costs and benefits. Two countries have specific recommendations against the use of BCG vaccine in adults; it reflects the worldwide hot debate regarding the use of BCG vaccine, due to concerns on its safety and efficacy [20].

Elaboration of evidence-based guidelines and short/long term cost-effectiveness studies could be useful to harmonize vaccination strategies among countries. A common policy is neither feasible nor advantageous for all vaccinations, because the integration of a new vaccination in the national immunization programme depends on several factors (disease epidemiology and burden, cost-benefit, resources and health system organization, vaccine efficacy, safety and immunogenicity). A common policy would be important for those immunisation programs whose impact is expected beyond political borders, for example for high communicable VPDs, like measles, rubella and polio, that are targeted by elimination and eradication plans and can easily spread beyond the country borders. Outbreaks from viruses imported from other countries have been frequently described [21]. Considering the movement of the population inside Europe, more efforts for a general evaluation of the needs for vaccination for adults are required [22].

In cases as TBE vaccination, whose recommendation mainly depends on VPD local epidemiology, sharing data and information among states is necessary to appropriately immunize travellers to endemic areas [15].

In most countries adult vaccination recommendations exist, however only six countries have a document summarizing the vaccination strategies in adults. It shows that, while childhood vaccination is a pillar of public health and prevention, vaccination for adults is not systematically addressed. Interestingly, the six countries which have a comprehensive adult summary document are also among the countries which recommend the most vaccines (>14 vaccines). Lack of well defined adult vaccination recommendations in a significant proportion of European countries may also complicate efficient application of the countries' recommendations by vaccinators and population compliance to vaccinations.

Another important finding of this survey was the poor availability of vaccine coverage data in adults; none of the surveyed countries routinely computed vaccine coverage for recommended vaccines in adults, except for influenza in 20/29 countries, hepatitis B vaccine (23/29) and Td-vaccine (6/29). Vaccination coverage assessment is one of the key parameters, together with disease

incidence, for monitoring successes and failure of immunization programs and to evaluate the progress towards the achievement of goals for controlling and/or eliminating VPDs [23]. In fact, the main strategic goal of specific vaccination strategies is usually set as a specific coverage level to be reached in the target population, i.e. 75% coverage for influenza vaccination in elderly [24]. Some difficulties to collect this information routinely are well known (old cohorts, movements of population, different services in charge of vaccination comparing with vaccination in childhood, absence of specific vaccine schedule, less attention to the problem, use of the vaccine in private sector and not reimbursed by insurances). The development of computerized immunization registries, linked to population registries, could facilitate vaccination coverage data collection in adults [25]. Alternative methods could be taken into consideration like telephone surveys or serological studies to obtain an estimate of the susceptible population, above all in decentralized (private) vaccination systems where immunization registries do not exist [23].

VENICE has recently produced a consensus document for the feasibility of routine collection of coverage data in all age groups (http://venice.cineca.org/deliverables.html) at the European level. A pilot data collection has been successfully tested in eight EU MSs and will be shortly extended to all VENICE MSs: this experience could provide an indication on how to collect routinely the available data on vaccine coverage for adults.

Most adult vaccinations are recommended to specific risk groups; the assessment of vaccination coverage in risk group is critical, because it is difficult to measure the denominator; disease or occupational registries are usually not available. A recent survey conducted by the VENICE network showed that only 4/25 countries collect coverage data for clinical risk groups (all for influenza vaccination), 5 countries have influenza vaccination data for health care workers (HCWs); in addition to influenza, only FR have coverage data for hepatitis B, MMR, varicella, pertussis, diphtheria, tetanus and polio vaccines for HCWs and GR collect vaccination coverage data for hepatitis B, MMR, varicella and pertussis among migrants [26].

Regarding possible limitations of this study, several aspects must be mentioned which make the strategies difficult to compare between countries. The definition of "adult" varied across countries, with ages defining the beginning of adulthood ranging from 15 to 19 years. Also, recommendation of vaccination, defined as inclusion in an official document or in national immunization schedule, did not automatically imply funding in part of the countries. Furthermore the source of this recommendation could be authoritative, initiated by a scientific society, but not necessarily representative of the government position. Resources to support vaccination are critical, and recommendations which are not supported through public funding mechanisms may impact the uptake of the vaccine and lead to geographic areas with a high proportion of susceptibles [27,28]. However, the decision whether to fund or not fund a vaccination programme is an autonomous decision of each country, and the determinants for prioritization of public health interventions were not investigated in the present study.

We have described the variable policies recommending adult vaccinations, funding mechanisms and monitoring of coverage across Europe. The adoption of a policy document for VPDs in all age groups and an appropriate schedule could encourage an efficient application of immunization recommendations by vaccinators and improve acceptance from population. The results of this survey could be a starting point to discuss the need of evidence-based guidelines for Europe for certain vaccinations, which would serve as a reference document for national policy makers to formulate sound national vaccination strategies for all age groups. As with any public health intervention, vaccination recommendations for adults should be accompanied by a monitoring strategy.

Conflict of interest

None declared.

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