



Prices of paediatric vaccines in European vaccination programmes

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ABSTRACT

Objective: To compare the vaccine prices per vaccinated child under 18 and vaccine funding and procurement systems in the national vaccination programmes (NVPs) in Europe.

Methods: The on-line survey targeted to NVP managers collected data referred to the information available on 31 December 2016. The prices of vaccines were categorised into three groups. The price per child 1) fully vaccinated comprised all vaccines and doses offered in the NVP; 2) vaccinated with standard vaccines comprised the vaccines included in the NVP in all countries; 3) vaccinated with recent vaccines comprised the pneumococcal conjugate, human papillomavirus and rotavirus vaccines.

Results: In the 23 out of 32 countries that answered the survey, 17 funded the vaccines by taxes and six by social insurance. 18 countries procured the vaccines through public tenders or negotiations. Five countries purchased the vaccines by healthcare providers and reimbursed from the health insurance system.

In the countries with vaccine procurement through public tenders the price per child vaccinated with standard vaccines ranged from €59 to €117 when using pentavalent and from €98 to €220 when using hexavalent vaccines. The mean price per child vaccinated with recent vaccines was €130 for the countries that offered pneumococcal conjugate and human papillomavirus vaccines and €142 for the countries that in addition included rotavirus vaccine.

In the countries that purchased the vaccines by healthcare providers and reimbursed from the health insurance system the price per child vaccinated with standard vaccines ranged from €136 to €427.

Conclusions: The vaccine prices differ notably in Europe. Prices were lower in countries where vaccines in the NVP were tax-funded and nationally or regionally procured. Improved procurement systems could lead to substantial savings or possibilities to introduce more vaccines into the NVP.

Introduction

Vaccinations are one of the most effective ways to prevent diseases and improve health. Many childhood vaccinations have been shown to be cost-effective or even cost saving public health interventions [1]. Even so, when new cost-effective vaccinations are being added to the national vaccination programme, the health expenditures for vaccines are growing as well.

The prices are varying across European countries as well as the vaccines that are included in the vaccination programmes, the vaccine

products, the procurement and funding systems [2]. The vaccination costs of one healthy infant (0–24 months) varied from €303 (France) to €1039 (Germany) in a study that compared the costs in seven Western European countries in 2014 or 2015 [3]. The costs, that included both the vaccine price and the administration costs, reflect the differences in vaccine prices, included vaccinations and funding systems in the national vaccination programmes.

In European countries vaccines are funded by taxes or either social or private statutory health insurance [4]. In addition, private health insurances may serve as alternative or supplement in the social health

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insurance systems [5]. The procurement system of the vaccines is often through public tenders or negotiations on a national or regional level or through direct negotiations using European reference or local pharmacy pricing [4,6]. When responding to tenders, manufacturers consider many conditions such as volume of the contract, timing, payment terms, cost of production, income level of the customer country and competitive circumstances that reflects on a set price [7].

The vaccination schedules and number of doses differ across the European countries [8]. However, either pentavalent (DTaP-IPV-Hib) or hexavalent (DTaP-IPV-Hib-HepB) combination vaccine is included in the vaccination programme in all European countries. Both combination vaccines protect against diphtheria, tetanus and pertussis (DTaP) as well as poliomyelitis (IPV) and *Haemophilus influenzae* type b (Hib). In addition, the hexavalent vaccine protects against Hepatitis B (HepB). Another routine childhood vaccination in European vaccination programmes is vaccine protecting against measles, mumps and rubella (MMR). The most recent introductions to the programmes were vaccines against diseases related to human papillomavirus (HPV), rotavirus, pneumococcus, and meningococcal serogroup C (MenC). WHO recommended pneumococcal conjugate vaccine (PCV) to be included in national programmes in 2007 [9] as well as rotavirus and HPV vaccines (for adolescent girls) in 2009 [10] and Men C vaccine in 2011 [11].

The vaccine prices range greatly, especially in high- and middle-income countries, indicating high price differentiation [12]. The price of PCV, for example, ranged from USD25.51 to 100.94 in high-income countries in 2016 [13]. Although the price of PCV, rotavirus and HPV vaccine has been decreasing over time, they are still the most expensive ones. Furthermore, the next generation vaccines covering more sero- or genotypes can be expected to raise the costs of vaccination programmes even further. The implementation of new and expensive vaccines raises the overall cost of a vaccination programme.

It is difficult to directly compare the prices of vaccine products due to confidentiality issues related to the national legislation of procurement systems and agreements between manufacturers, governments and in some countries health insurance bodies. When a direct comparison of prices is not available, it is hard to perceive market's specifications and decide if the prices are within reason and affordable for all countries [2]. There is a lack of studies on price comparisons between Europe countries, especially variation of prices for the same vaccines. Comparing these variations could improve price transparency and understanding why countries pay differently, increase negotiating power of governments, and seek the possibility to assimilate and reduce prices. The aim of this study was to compare vaccine prices without violating confidentiality agreements to better understand the differences between vaccine prices across European countries.

Methods and data

An on-line survey was conducted for collecting the information on the vaccine prices, funding, and procurement systems in national vaccination programmes in European countries. Programme managers of 28 European Union (EU) countries, three European Economic Area (EEA) countries and Switzerland were invited to respond to an on-line survey using Webropol Survey Tool.

The invitation to the online survey was sent in April 2017 and the completed questionnaires were collected in May–July 2017. The non-respondents were sent e-mail reminders in 2 weeks from the initial e-mail. If there were any clarifications to be made, respondents were contacted by e-mail or phone. We compared the responding and non-responding countries by funding and procurement systems and income status.

The survey referred to the information available on 31 December 2016 and was limited to the most common vaccines that are offered free of charge for children under 18 years of age with the exception of seasonal influenza vaccines. We used information from the European Centre for Disease Prevention and Control (ECDC) Vaccine scheduler [8]

and the public health organisations' official websites in each country to define the vaccines that we expected to be included in the national vaccination programmes in Europe. The respondents were also allowed to give open text comments in all multiple-choice questions.

The respondents were asked to indicate whether the vaccines were funded by taxes, social or private insurance or both in their countries. Furthermore, they were asked to provide information on the vaccine procurement system.

The respondents were asked to provide the price per fully vaccinated child according to the current national vaccination programme as well as the price per child vaccinated with standard vaccines and recent vaccines subgroups separately. The categorisation allowed the countries to participate in the survey without revealing the price of an individual vaccine. The reported vaccines were not verified to correspond to the real vaccination programmes. Therefore, the reported vaccines and subgroups do not necessarily reflect the vaccination programme but the combination of vaccines the country provided the price for.

The price per fully vaccinated child was determined to comprise all vaccines and doses including boosters used to fully vaccinate one healthy child under 18 years of age. If HPV vaccines were included in the vaccination programme, it was asked to indicate the price per girl. The standard vaccines subgroup was determined to comprise the vaccines that were expected to be included in the national vaccination programme across all European countries (Table 1). Initially, we established four alternative standard vaccine subgroups in order to take into account the number of doses of either pentavalent (DTaP-IPV-Hib) or hexavalent (DTaP-IPV-Hib-HepB) combination vaccine the country used. In addition, the MMR and the DTaP-IPV vaccines were included in the standard vaccine subgroups. The recent vaccines subgroup referred to pneumococcal conjugate (PCV), HPV and rotavirus vaccines (Table 1). All possible combinations of these vaccinations comprised the initial four alternative recent vaccines subgroups. According to the open text comments, we defined two additional subgroups for both standard and recent vaccines subgroups (S5, S6, R5 and R6 in Table 1).

The number of prevented diseases by the vaccination programme for each country was extrapolated from the combination of vaccines that comprised the given price per fully vaccinated child, and therefore, it did not necessarily reflect the vaccination programme exactly. Furthermore, the prices per child vaccinated with standard and recent vaccines did not necessarily sum up to the price per fully vaccinated child, because the price per fully vaccinated child may have included less-used vaccines (e. g. Meningococcal B or varicella vaccines) that were not included in either subgroup. Open text comments enabled us to take into account less commonly used schedules and vaccines to distinguish the countries with fully comparable prices.

The countries provided the prices in euros or local currency. The local currencies were converted to euros using InforEuro monthly accounting rate for the euro by European Commission for December 2016 [14]. The respondents were asked to provide the prices without value-added tax (VAT).

We calculated the mean and median price per fully vaccinated child and per child vaccinated with standard and recent vaccines subgroups. The prices per child were rounded to the nearest euro. The price per child, funding and procurement systems and diseases prevented were compared between countries. In order to study the association between vaccine prices and national income and volume, the Spearman correlation coefficient rho (ρ) was calculated between price per child vaccinated with standard vaccines and real gross domestic product (GDP) per capita and number of live births for countries with vaccine procurement through public tenders or negotiations [15].

Results

Out of 32 contacted countries, 23 (72 %) responded to the survey. Of the respondent countries (Table 2) 19 were EU members and four (Iceland, Liechtenstein, Norway and Switzerland) EEA members. The nine

Table 1

Vaccines and diseases prevented by the standard and recent vaccines subgroups in the Survey (data as of 31 Dec 2016). The subgroups do not necessarily reflect the vaccination programme but the combination of vaccines the country provided the price for.

Vaccination against	Vaccine	Number of doses	Combinations in standard vaccines subgroup					
			S1	S2	S3	S4	S5	S6
Standard vaccines subgroup								
Diphtheria, tetanus, pertussis, poliomyelitis, Haemophilus influenzae type b	Pentavalent combination vaccine, DTaP-IPV-Hib	2						x
		3	x					
		4		x				
		2						x
Diphtheria, tetanus, pertussis, poliomyelitis, Haemophilus influenzae type b, Hepatitis B	Hexavalent combination vaccine, DTaP-IPV-Hib-HepB	2						x
		3			x		x	
		4				x		
		1					x	x
Hepatitis B infections	Hepatitis B (HepB) vaccine	1					x	x
Measles, mumps, rubella	MMR vaccine	2	x	x	x	x	x	x
Diphtheria, tetanus, pertussis, poliomyelitis	DTaP-IPV vaccine	1	x	x	x	x		
Diphtheria, tetanus, pertussis	Dtap vaccine	1						x
Recent vaccines subgroup			Combinations in recent vaccines subgroup					
			R1	R2	R3	R4	R5	R6
Pneumococcal infections	Pneumococcal conjugate vaccine (PCV)	3	x	x	x	x	x	x
HPV related cancers	Human papillomavirus (HPV) vaccine	2	x	x	x			x
Rotavirus gastroenteritis	Rotavirus vaccine	2/3*	x		x	x		
Meningococcal serogroup C infections	Meningococcal C (MenC) vaccine	1			x			x
		2					x	

S1: Denmark, Finland, Iceland; S2: Estonia, Hungary, Lithuania, Liechtenstein; S3: Italy, Ireland, Norway, Romania, Slovakia, Sweden; S4: Belgium, Croatia, Germany, Latvia, Netherlands, Switzerland; S5: Bulgaria; S6: Spain.

R1: Finland, Ireland, Latvia, Norway; R2: Denmark, Hungary, Iceland, Lithuania, Netherlands, Spain, Sweden; R3: Germany; R4: N/A; R5: Switzerland; R6: Belgium, Italy.

* Number of doses depends on the product used.

non-respondent countries (Austria, Cyprus, Czech Republic, Greece, Luxembourg, Malta, Portugal, Slovenia and United Kingdom) were all EU members when the data collection was carried out in 2017.

Funding and procurement system

Out of the 23 respondent countries, 17 funded the vaccines by taxes and six by social insurance in their national vaccination programmes (Table 2). In the countries with tax-funded vaccines, 15 countries procured the vaccines on the national level and two on the regional level using open EU-tender procedure. In the six countries that funded the vaccines by social insurance systems, only Croatia procured the vaccines by national tenders. In the remaining five countries, the vaccines were procured by healthcare providers and reimbursed from the health insurance system. Only Germany reimbursed the vaccines by contract prices. In the other countries the vaccines were reimbursed by retail prices. In France, vaccines in the vaccination programme were funded both by statutory (65 %) and voluntary private (35 %) health insurances. In Germany, Liechtenstein, Slovakia and Switzerland the vaccines were funded by either public or private statutory health insurances.

Price per fully vaccinated child

The mean price per fully vaccinated child in the respondent countries was €339, ranging from €111 in Poland to €1018 in Germany (Fig. 1). The 0.25, 0.5 (median) and 0.75 quantiles for price per child were €215, €263 and €400, respectively. The included vaccinations prevented from 9 diseases in Bulgaria to 14 diseases in Germany, Ireland and Latvia. The more vaccines were included the higher was the price per fully vaccinated child with some exceptions. The median price per fully vaccinated child was €488, €269, €217 and €232 for countries that included

vaccinations against 14, 12, 11 and 10 diseases, respectively. The three countries with highest price per fully vaccinated child (Germany, Liechtenstein and Switzerland) procured the vaccines by healthcare providers and reimbursed from the health insurance system. All countries offered vaccinations against diphtheria, tetanus, poliomyelitis, pertussis, Haemophilus influenzae B, measles, mumps and rubella. In addition, in the 23 countries that responded to the survey, the price per fully vaccinated child vaccines included vaccines against pneumococcal (16 countries), human papillomavirus (17 countries) and hepatitis B (20 countries) infections.

All prices were reported in euros without value-added taxes (VAT) except Belgium that included the VAT. In addition, Belgium included transportation and delivery costs and Latvia included transportation costs.

Price per child vaccinated with standard vaccines

In total, 21 countries provided the price per child vaccinated with standard vaccines. Of these, 19 countries reported the price for two doses of MMR vaccine and one dose of DTaP-IPV vaccine in addition to the three or four doses of either pentavalent (DTaP-IPV-Hib) or hexavalent (DTaP-IPV-Hib-HepB) combination vaccine (Table 1). In the countries with vaccine procurement through public tenders or negotiations on national or regional level, the mean price per child vaccinated with standard vaccines was higher in the 9 countries that used the hexavalent combination vaccine (€141) than in the six countries that used the pentavalent combination vaccine (€87) (Fig. 2). The mean price per child vaccinated with standard vaccines was only slightly higher in the countries that used four doses (€90) instead of three doses (€84) of pentavalent combination vaccine. In the countries using the hexavalent combination vaccine, the mean price per child vaccinated with standard

Table 2

Overview of funding and procurement systems of national vaccination programmes in 23 European countries in 2016.

A. Vaccine procurement through public tenders or negotiations on national or regional level		
Country	Funding system	National/regional procurement
Belgium (BE)	Tax-funded ¹	Regional
Bulgaria (BG)	Tax-funded	National
Croatia (HR)	Social insurance ²	National
Denmark (DK)	Tax-funded	National
Estonia (EE)	Tax-funded	National
Finland (FI)	Tax-funded	National
Hungary (HU)	Tax-funded	National
Iceland (IS)	Tax-funded	National
Ireland (IE)	Tax-funded	National
Italy (IT)	Tax-funded ³	Regional ⁴
Latvia (LV)	Tax-funded	National
Lithuania (LT)	Tax-funded	National
Netherlands (NL)	Tax-funded	National
Norway (NO)	Tax-funded	National
Poland (PL)	Tax-funded	National
Romania (RO)	Tax-funded	National
Spain (ES)	Tax-funded ¹	National ⁵
Sweden (SE)	Tax-funded	National ⁵
B. Vaccine procurement by healthcare providers and reimbursement by insurance at pharmacy or contract prices		
Country	Funding system	Reimbursed at pharmacy/contract prices
France (FR)	Social and private insurance ⁶	Pharmacy
Germany (DE)	Social and private insurance	Contract
Liechtenstein (LI)	Statutory private insurance	Pharmacy
Slovakia (SK)	Social insurance	Pharmacy
Switzerland (CH)	Social insurance	Pharmacy

¹ Vaccines were funded from National Health Insurance fund.

² Vaccines were funded from regional government budgets.

³ Vaccines funded from National Health Fund divided among 21 regions.

⁴ Regional vaccine procurement was done considering the regional needs.

⁵ A voluntary national procurement mechanism that most regions (counties) joined.

⁶ Vaccines were funded 65% by statutory social insurances and 35% by voluntary private insurances.

vaccines were nearly the same in the countries that used four (€139) and three (€143) doses of the hexavalent combination vaccine.

According to the open text comments, we defined two additional subgroups to include the use of single-antigen Hepatitis B vaccine in Bulgaria and Spain and Dtap vaccine in Spain (Table 1). The price per child vaccinated with standard vaccines was €130 in Bulgaria and €129 in Spain. Poland and France did not report the price with standard vaccines. In Germany and Switzerland, the vaccines were funded by social insurance and both countries reported the price for the four dose hexavalent combination vaccination schedule, but in Germany the vaccines were reimbursed at contract prices while in Switzerland they were reimbursed at pharmacy retail prices. The price per child vaccinated with standard vaccines was €295 in Germany and €427 in Switzerland. The corresponding price was €333 in Liechtenstein using 4 doses of pentavalent combination vaccine and €136 in Slovakia using 3 doses of hexavalent combination vaccine. Both countries reimbursed the vaccines at the retail prices.

In the 17 countries with vaccine procurement through public tenders or negotiations on national or regional level, the Spearman's correlation coefficient (ρ) indicated no correlation between the price per child vaccinated with standard vaccines with real GDP per capita ($\rho = 0.03$) and a weak correlation with number of live births ($\rho = 0.33$).

Price per child vaccinated with recent vaccines

Except for Croatia, France and Romania, the respondent countries (20 out of 23) reported the price for either PCV, HPV or rotavirus vaccines. Belgium, Italy, Switzerland, and Germany also included the price for MenC vaccines (Table 1, Fig. 4). In order to overcome the confidentiality requirements of an individual vaccine price, the price per child vaccinated with recent vaccines was not reported for Bulgaria, Estonia, Liechtenstein, Poland and Slovakia who reported to have only one of the recent vaccines included in the vaccination programme in 2016. Out of 15 countries that reported the price per child vaccinated with recent vaccines, 14 included the price of PCV or HPV vaccine, 5 countries included rotavirus vaccine and 4 countries included MenC vaccine.

The mean price per child vaccinated with PCV and HPV vaccines was €130, ranging from €98 (Netherlands) to €177 (Spain) (Fig. 4). The mean price per child vaccinated with PCV, HPV and rotavirus vaccines was €142, ranging from €120 (Ireland) to €156 (Latvia). The price per child vaccinated with PCV, HPV and MenC vaccines was €126 in Belgium and €212 in Italy. In both countries vaccines were tax-funded and regionally procured, but Belgium used ten-valent PCV and Italy used 13-valent PCV in the vaccination programme. The price per child vaccinated with PCV and MenC vaccine was €332 in Switzerland where they were recommended as additional vaccinations and funded by compulsory health insurance. In Germany, the price per child vaccinated with PCV, HPV, MenC and rotavirus vaccines was €649.

Discussion

In this survey we have comprehensively collected data of vaccine prices in European vaccination programmes. Our findings show that vaccine prices range greatly in Europe. Most of the countries participating in the survey procured the tax-funded vaccines through public tenders. Out of 32 contacted European countries, responses were received from 23 countries, with response rate of 72 %. This study presents data from December 31, 2016.

The standard vaccines subgroup provided the best cross-country comparison in the vaccine prices. In the countries that procured the tax-funded vaccines through public tenders, the mean price per child was higher in the countries that used the hexavalent combination vaccine (€141) than in the countries that used the pentavalent vaccine (€87). In the recent vaccines subgroup in the countries with vaccine procurement through public tenders, the difference in the mean price per child was slightly higher in the four countries that in addition to PCV and HPV vaccine included rotavirus vaccine (€142) compared to seven countries that included only PCV and HPV vaccine (€130).

With the exception of Slovakia, both in the standard and recent vaccines subgroups the vaccine prices per child were lower in the countries that procured the vaccines through public tenders or negotiations than in the countries where the vaccines were purchased by healthcare providers and reimbursed from the health insurance system. Slovakia has regulated pharmaceutical prices by external reference pricing since 2008 and the pharmaceutical prices are overall among the lowest in the EU [16,17].

Higher prices are known to be paid by higher income countries and in some vaccines higher volumes have been shown to be associated with lower prices per dose [12]. Our study suggests no correlation between the prices in the standard vaccines subgroup and real GDP per capita and a weak correlation with number of live births in the countries with vaccine procurement through public tenders. The countries that purchased the vaccines by healthcare providers were excluded from the analysis, since the number of purchased vaccines was unknown. The analysis included 15 high-income and two upper middle-income countries [18].

The data did not allow us to study further the complex vaccine pricing mechanisms nor global vaccine demand and supply dynamics.

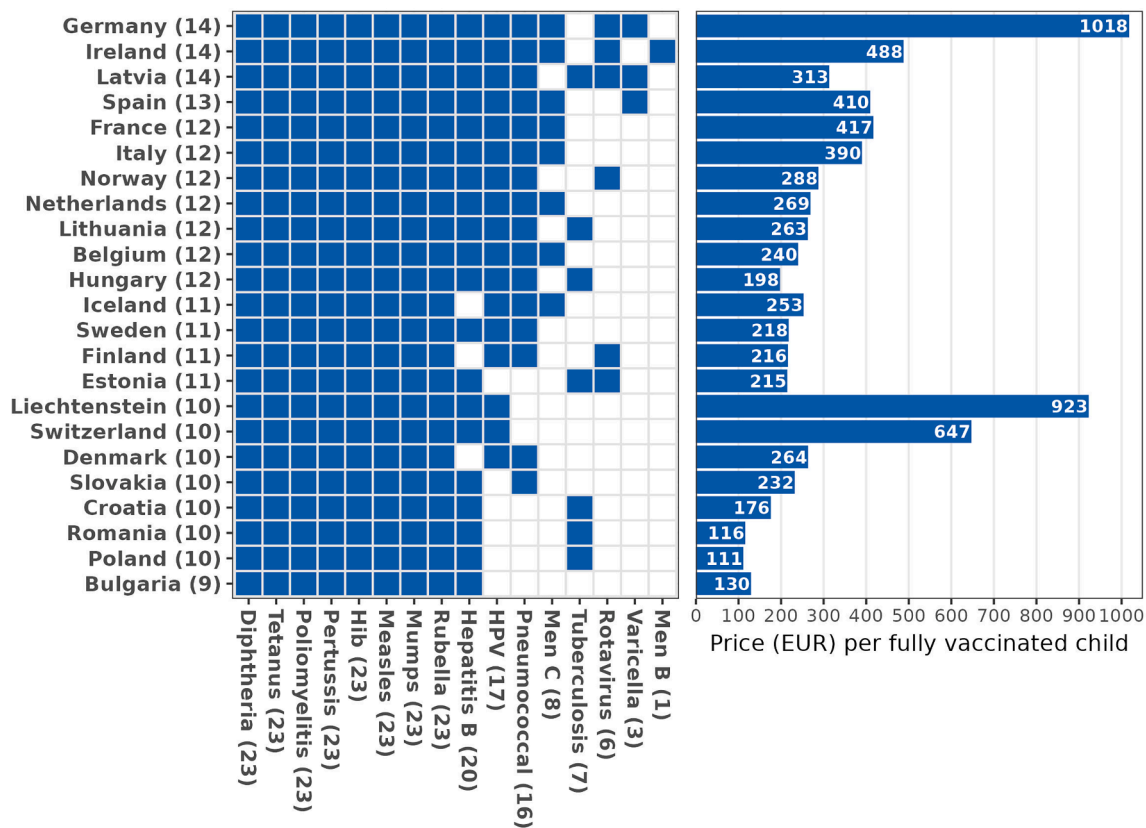


Fig. 1. Price (€) per fully vaccinated child and diseases prevented in 23 European countries in 2016 (the numbers of prevented diseases by country and by disease within the brackets). The prices and diseases prevented do not necessarily reflect the real vaccination programme but the combination of vaccines the country provided the price for. Abbreviations: Men C (Meningococcal C), Men B (Meningococcal B), HPV (Human papillomavirus), Hib (Haemophilus influenzae type b).

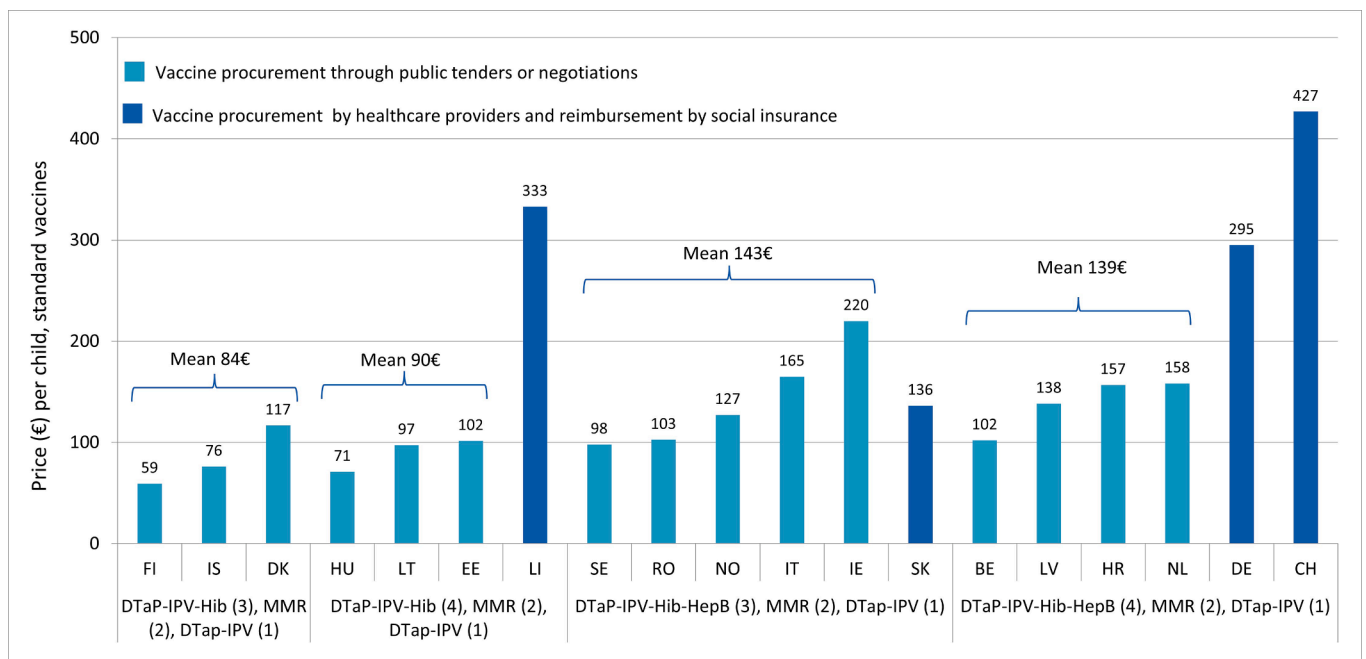


Fig. 2. Price (€) per child and mean price (€) per child vaccinated with standard vaccines in national vaccination programmes in 19 European countries in 2016. The prices do not necessarily reflect the true vaccination programmes but the combination of vaccines the country provided the price for. Country abbreviations: Belgium (BE), Croatia (HR), Denmark (DK), Estonia (EE), Finland (FI), Germany (DE), Hungary (HU), Iceland (IS), Ireland (IE), Italy (IT), Latvia (LV), Liechtenstein (LI), Lithuania (LT), Netherlands (NL), Norway (NO), Romania (RO), Slovakia (SK), Sweden (SE), Switzerland (CH).

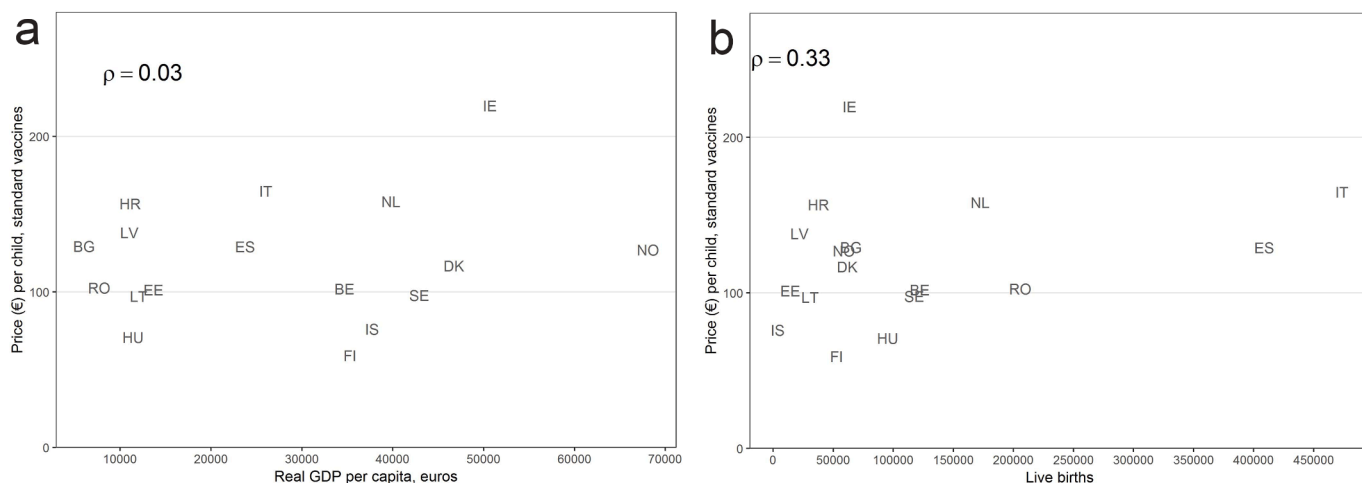


Fig. 3. Country-based scatter plot for price (€) per child vaccinated with standard vaccines and a) the real GDP per capita; b) the live births in 17 European countries with vaccine procurement through public tenders or negotiations on national or regional level in 2016 (ρ = the Spearman’s correlation coefficient between the two variables). The prices do not necessarily reflect the true vaccination programme but the combination of vaccines the country provided the price for. Country abbreviations: Belgium (BE), Bulgaria (BG), Croatia (HR), Denmark (DK), Estonia (EE), Finland (FI), Hungary (HU), Iceland (IS), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Netherlands (NL), Norway (NO), Romania (RO), Spain (ES), Sweden (SE).



Fig. 4. Price (€) per child and mean price (€) per child vaccinated with recent vaccines in national vaccination programmes in 15 European countries in 2016. The prices do not necessarily reflect the true vaccination programme but the combination of vaccines the country provided the price for. Rotavirus: number of doses depends on the product used. Country abbreviations: Belgium (BE), Denmark (DK), Finland (FI), Germany (DE), Hungary (HU), Iceland (IS), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Netherlands (NL), Norway (NO), Spain (ES), Sweden (SE), Switzerland (CH).

Chalkidou and colleagues [19] mention several factors, such as price elasticity of the market, purchaser’s buying power, payment timeliness, long-term customer value, and transaction costs that have an effect on pharmaceutical prices. Furthermore, they consider a greater volume to create market power and decrease transaction costs relative to a manufacturer’s revenue. It is most probably advantageous to procure vaccines, also, at the national level instead of smaller purchasers, for example regional governments or health care providers in private sector or individual hospitals. In addition, the prices of Belgium and Latvia were not fully comparable with other countries. The prices of Belgium included transportation and delivery costs, and the VAT and Latvia included transportation costs. Even then the prices of Belgium were

among the lowest and the prices of Latvia were close to the mean price. The high response rate of 72 % might be due to the study design that allowed the countries to participate in the survey without revealing the price of an individual vaccine. Due to the confidential information on a singular vaccine price, the between-country comparisons in the vaccine prices were only possible in small groups. Comparing the prices by a priori established subgroups resulted in loss of information. The diversity in vaccination schedules, information not provided in the questionnaire and the open text comments in the survey expanded the alternative combinations of vaccines and reduced the number of countries with respective subgroups. In addition, we could not indicate the exact vaccine that constituted the price differences of the respective

subgroups between the countries.

The respondent countries were likely to be comparable to the non-respondents in terms of funding and procurement systems and income status since the survey was conducted among EU and EEA countries and Switzerland. Firstly, the respondents and non-respondents did not differ by the funding and procurement system. This is apparent since most of the EU member states procure the vaccines in the national vaccination programme through public tenders [4]. In addition, the income status was rather similar. All nine non-respondents were high-income countries and of the 23 respondent countries 20 were high-income and three upper middle-income countries in 2016 [18].

The present study adds to the knowledge about the vaccine prices in European high-income countries. To improve vaccine market transparency and understand global vaccine market dynamics, World Health Organization (WHO) launched the Market Information for Access to Vaccines (MI4A) initiative [20] including vaccine purchase database [21] that contains information on vaccine prices, volumes, manufacturers and procurement modalities. The number of countries fully reporting their price data has increased from 51 in 2016 [13] to 158 in 2019 [22]. The countries that have not shared the price information were mainly high-income countries. The reason for not sharing the price information was mostly not reported but a third reported the confidentiality issues as a reason [13].

This study enhances the vaccine market transparency in Europe. Further work is required to improve not only the transparency but also comparability of vaccine prices. Nevertheless, the new vaccines, needs of aging population and health emergencies such as covid-19 epidemic are growing the pressure on vaccine budgets and public health spending. It is evident that there is a great potential for countries to share good practices and to collaborate in purchasing vaccines to the national vaccination programmes.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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