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Tracking parental attitudes on vaccination across European countries: The Vaccine Safety, Attitudes, Training and Communication Project (VACSATC)

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ABSTRACT

The paper presents the first results from the European project VACSATC which aimed to track parental attitudes on vaccinations across several European countries. We compared five cross-sectional surveys of parents with children less than 3 years of age in England, Norway, Poland, Spain and Sweden carried out during 2008–2009. Data were collected from 6611 respondents. Two countries used face-to face interviews, one used telephone interviews, and two other countries used mail-in questionnaires. In all countries health professionals were indicated as the most important and trusted source of information on vaccination. The study results also show that parental attitudes on vaccinations in the childhood vaccination programs are generally positive. However, there were differences in attitudes on vaccination between the five countries, possibly reflecting different methods of sampling the respondents, context-specific differences (e.g. level of activity of governmental agencies), but also individual-level parental variation in demographic and socioeconomic status variables.

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1. Introduction

Carrying out surveys to track parental attitudes on the vaccination of their children is important in order to identify barriers which may lead to suboptimal vaccination coverage. A survey supplements surveillance data and vaccination coverage assessments, and allows early detection of the reasons why some parents do not vaccinate their children. Attitudinal studies have been performed in several countries [1–4]. Several studies have also addressed factors driving the decision to be vaccinated [5–8].

Few countries run routine attitudinal surveys, and no common methodology has been agreed between governmental health agencies. The recent situation concerning A(H1N1) vaccinations against swine flu revealed public apathy or outright opposition towards vaccination in some countries [9]. The important public health prevention tool of vaccination can become ineffective if not widely accepted. To address health education to the public, we first need to understand what people already know about vaccines and the vaccine-preventable diseases, and what more they want to know and their opinion of the health services offered. Information has to be tailored to the public level of knowledge about diseases and the benefits and possible adverse events following vaccination. Furthermore, the form and language used in information materials to the public may need to be tailored to particular ethnic minorities or 'hard to reach' groups.

Within the framework of the project Vaccine Safety – Attitudes, Training, Communication (VACSATC) funded by a grant from the Directorate General for Health and Consumer Affairs (DG SANCO) [10], a group of vaccination experts representing mostly public health institutions in 14 countries, has agreed on a common thematic approach to monitor attitudes on vaccinations. In each country a survey was performed during the years 2007–2009, using

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Table 1
Survey methodology used in five studied countries.

Characteristic	England	Norway	Poland	Spain	Sweden
Period of study	10–11/2008	8–12/2009	6–7/2008	5–7/2008	4–5/2009
Interview collection	CAPI face-to-face	Mail-in	Telephone	Face-to-face	Mail-in
Sampling frame	Parents of children aged 0–2	Parents of children aged 0–2	Parents of children aged 0–2	Parents of children aged 0–3	Parents of children aged 0–2
Sampling method	Random location sampling of households	Stratified random sampling	1. Selection of households with children <2 years 2. Random digit dialling	Random location sampling of households in selected areas; systematic sampling of patients	Stratified random sampling
Method of selecting the parent/legal guardian in the household	Screening interview on doorstep	If married, interview addressed to the father; if cohabitants or single, it was addressed to the mother	Parent answering the phone	Interview addressed directly to the mother	The oldest parent in the household (questionnaire addressed to 50% men, 50% women)
Type of database	Enumeration districts	Population register	Consumer database	Hospitals and health centres; and sampled communities	Population register
Coverage	National	National	National	National	National

a list of at least 10 questions based on the core themes agreed between the partners. The list was adapted from the Department of Health attitudinal surveys that have been performed annually in England since 1991 [3,11]. In 5 countries the surveys were performed during 2008–2009 in large samples of parents with children aged 0–3 years. Results from the Polish survey have been published in Polish [4]. Detailed results from the other VACSATC surveys are expected to be published in their local language as well as in English.

The objective of this paper was to summarize the surveys performed in England, Norway, Poland, Spain and Sweden, in order to assess the possibility to develop a standard tool that could be applied in diverse geographical and cultural settings. We used the comparison of the survey results to discuss the methodological challenges, and assess selected indicators of vaccination perceptions.

2. Materials and methods

The data used in the analysis come from surveys of caregivers or parents to 0–3-year-old children in England, Norway, Poland, Spain and Sweden. Methods of sample selection in the five surveys are summarized in Table 1.

In England the survey was performed during October–November 2008 through a subcontracted social research company TNS-BMRB. A random location sampling technique assured representativeness of the sample compared to the age, socioeconomic status and geography of the overall population. The data were also weighted using these characteristics. A total of 1005 interviews were collected across 154 enumeration districts in England. The respondents were identified using a screening interview conducted on the doorstep. All interviews were carried out face-to-face in the respondent's home by fully trained interviewers. Interviews were conducted using multi-media Computer-Assisted Personal Interviewing (CAPI).

The Norwegian survey took place during August–December 2009. A stratified random sample from the Norwegian population register was drawn by a subcontracted social research company called EDB Business Partner Norge AS. Quotas on age, sex and geography were used in order to secure sample representativeness. The data were not weighted. The distribution of the questionnaires and their collection was performed by a subcontracted social research company "Sentio Research AS". The questionnaires were sent by mail to the parents, accompanied by an information letter. The parents returned the questionnaires free of charge by post or completed a web-based version. One out of five used the web-based version. One postal reminder and one reminder by phone were made to those who did not reply within the due date.

The Polish survey was conducted during June–July 2008 by a subcontracted social research company "ARC Rynek i Opinia". A two-stage sampling method was used. First, a list of 3000 households with children aged 0–2 years was quota-selected from a consumer database which covers 95% of all Polish mothers after childbirth. The sample was weighted in terms of age, education, and parenthood status (having one or more children) to match the profile of the overall target group. Second, random digit dialling was used in order to reach the quota-selected parents. The computer-assisted telephone interview (CATI) method was used.

The Spanish survey was conducted during May–July 2008. The survey was performed in 12 provinces belonging to 7 autonomous communities. Survey subjects were sampled in two ways. First, a random stratified sample of communities was drawn. Then, households were randomly selected from the sampled communities. Second, survey participants were also randomly selected among patients at hospitals and health centres. Face-to-face interviews were performed by trained nurses with experience in the field of vaccination as well as graduates of the Master of Sciences of Nursing program (University of Alicante).

The Swedish survey was performed during April–May 2009. A stratified random sample of parents of 2-year-old children (quotas on geographical residence and sex) was drawn from the population register. Statistics Sweden was responsible for drawing the sample, for distributing the questionnaire and for compiling data. The questionnaires were distributed by mail to the oldest parent in the household. Two reminder letters were sent, the first after one week, and the second after one month.

The questionnaires used in all surveys were based on the Department of Health England's attitudinal survey. The questionnaires consisted of different types of questions: open questions, questions with answers in the Likert scale, and yes/no questions. The VACSATC Partners agreed on 10 "core" questions (see Box 1). Because questions 2 and 8 are very similar, only the results from question 2 are presented in this paper.

Answers to the questions including information on basic sociodemographics of the parents are presented in country-specific bi-variate cross-tables (in absolute numbers, per cent and ranked

Box 1: List of agreed questions for VACSATC attitudinal surveys.

1. SOURCE: What are your main sources of information about vaccination?
2. EXPERIENCE: Overall how satisfied were you with your (last) vaccination appointment?
3. REFUSAL: Have you ever chosen not to give your child a vaccine that you have been offered?
4. DOUBTS: Have you ever had any doubts about having your child vaccinated?
5. SAFETY: Have you ever had worries about the safety of a vaccination?
6. FUTURE: Would you have your child vaccinated with vaccines offered to you in the future?
7. TRUST: Who do you trust the most to give health advice and information about vaccination?
8. SATISFACTION: Are you satisfied with the way in which vaccination is provided?
9. HEALTH IMPORTANCE: How important are vaccinations in protecting the whole community against diseases?
10. UNDERSTANDING: How serious are vaccine-preventable diseases to your child?

order). Because of diverse sampling, and measurement methods, no pooled results analysis, nor computation of confidence intervals were presented in the results.

3. Results

A total of 6611 interviews were collected in the five countries from May 2008 until December 2009. The basic demographic information of the interviewed parents is presented in Table 2. Sweden and Norway differ from the other countries in the proportion of parents >35 years of age, fathers responding to the survey, parents with university education and parents with 2 or more children. The response rate ranged from around 40% in Norway and Sweden to 77% in Poland and 98% in Spain. The response rate could not be calculated in the English survey because the number of eligible mothers in each enumeration district was unknown.

We compared which sources that were indicated as the most used to obtain information on vaccines and vaccinations, and which sources that was indicated as the most trusted in particular countries (Table 3). Across all the countries there was a consensus that health professionals (physicians or nurses) were both the most used and the most trusted source of information. The government or the national public health institutes were also important sources of information and sources of trust in Norway, Sweden and England. In Spain and Poland the media and family/friends seemed to play the role as the second most highly used and trusted source of information.

Table 4 presents comparison of parent's opinions about the role of vaccination and vaccine safety in the five countries. Most people across all countries recognized immunization as a good thing, and a great majority was satisfied with the way in which vaccination was provided (73–91%). They also recognized the benefits of herd immunity (88–97%). The vaccination intentions were also very positive (81–97% would immunize their child in the future). However, a significant minority had doubts about immunization. The English parents were the most doubtful (28%), Polish and the Norwegian respondents expressed less doubt (about 20%), while parents in Sweden and Spain reported the least doubt (17% and 12% respectively). The vaccines reported to cause worries among the doubters and the reasons for the parent's doubts on permitting their children to be vaccinated were investigated in more detail (results not shown). Among the doubters, the English parents had the highest proportion reporting the combined vaccine against measles, mumps and rubella (MMR) as the reason for their concern (88%). In comparison 66% of the Swedish doubters, 57% of the Norwegian doubters and only 7% of the Polish doubters reported worries about the MMR vaccine (the type of vaccine that created doubt among the doubters were not surveyed in Spain). The Polish doubters were more concerned about the vaccines against pneumococci (55%) than the MMR vaccine (7%). A third of the English doubters also reported a specific concern about the combined pentavalent vaccine containing DTaP/IPV/Hib.

The most prevalent reasons for concern expressed among the doubters were fear of adverse events following vaccination (Spain 12%; England; 14%; Sweden 40%; Norway 76%), the alleged link between autism and MMR vaccination (England 22%; Sweden 30%), vaccine safety and its long-term effects (England 40%; Norway 40%). In Norway the doubters were also concerned because they thought that there were some disagreement between experts on the safety of vaccines (31%), while in Spain 24% of the doubters declared that their doubt was due to poor information about vaccination in gen-

Table 2
Demographic features of the studied parent population by country (*n* and %).

Characteristic	England	Norway	Poland	Spain	Sweden
Number of interviews	1005	1529	1045	913	2119
Response rate	NA	1529/3939 (38.8)	1045/1353 (77.2)[a]	913/935 (97.6)	2119/4998 (42.4)
Gender					
Females	895 (89.1)	1040 (68.0)	960 (91.9)	913 (100.0)	1236 (58.3)
Males	110 (10.9)	489 (32.0)	85 (8.1)	0 (0.0)	883 (41.7)
Age group (years)					
15–24	197 (19.6)	106 (7.0)	183 (17.5)	24 (2.6)	15 (0.7)
25–34	524 (52.1)	969 (64.0)	672 (64.3)	560 (61.4)	518 (24.4)
35+	282 (28.1)	439 (29.0)	190 (18.2)	329 (36.0)	1486 (70.1)
Level of education					
Primary	NA	43 (3.0)	50 (4.8)	149 (16.3)	120 (5.7)
Secondary	NA	402 (28.0)	703 (67.3)	391 (42.8)	838 (39.5)
Tertiary	NA	905 (63.0)	292 (27.9)	373 (40.9)	1136 (53.6)
Number of children in family					
1	328 (32.6)	657 (43.0)	477 (45.6)	485 (53.1)	534 (25.3)
2	NA	581 (38.0)	406 (38.8)	361 (39.5)	1048 (49.7)
2+	BA	291 (19.0)	162 (15.5)	67 (7.3)	526 (25.0)

[a] Of 3000 persons selected, only 1353 could be reached. The denominator for the response rate was number of persons agreeing for the interview + number of persons refusing.

Table 3
Ranked list of most used and most trusted sources of information on vaccines by country.

Rank	England		Norway		Poland		Spain		Sweden	
	Used source (%)	Trusted source (%)	Used source (%)	Trusted source (%)	Used source (%)	Trusted source (%)	Used source (%)	Trusted source (%)	Used source (%)	Trusted source (%)
1	NA	Health professionals 92	Public Health nurse 49	Public Health doctor 67	Primary care physician 79	Primary care physician 82	Primary care physician 85	Primary care physician 87	Primary care nurse 82	Primary care nurse 87
2	NA	Public Health service 88	Vaccination leaflet 36	Hospital staff 66	Media 30	Primary care nurse 13	Primary care nurse 46	Primary care nurse 46	Vaccination leaflet 59	Vaccination leaflet 78
3	NA	Government 59	Public Health doctor 19	Public Health nurse 65	Primary care nurse 21	Media 8	Family and friends 17	Hospital staff 15	Family and friends 36	Primary care physician 78
4	NA	Pharmacist 58	National Public Health Institute 11	Vaccination leaflet 57	Internet 17	Internet 4	Media 16	Public Health service 6	Internet 31	National Public Health Institute 68
5	NA	Media 19	Primary care physician 11	Primary care physician 54	Family and friends 6	Family and friends 3	Vaccination leaflet 15	Family and friends 5	Primary care physician 27	Public Health service 49

eral. The reasons for having doubts about vaccination were not investigated in Poland.

We compared the perception of seriousness of the diseases preventable by vaccination. Table 5 displays the ranked order of ten diseases or syndromes in terms of seriousness perceived by the parents in each country. Meningitis, poliomyelitis and tetanus were diseases that a high proportion of all parents considered to be the most serious or very serious. Tuberculosis was also ranked high by all parents except English parents. The parents generally ranked measles, mumps, rubella and diphtheria at the bottom. The question on seriousness of vaccine-preventable diseases was not included in the Spanish survey.

In two countries the parents were asked whether they had ever bought vaccines recommended for their children (results not shown). In Poland and Spain 38% and 63% of the parents respectively had bought vaccines not offered through the childhood vaccination program for their children. Among the Spanish vaccine buyers 79% had bought a vaccine against pneumococci and 21% had bought a rotavirus vaccine.

We have investigated whether parents had any concerns about the safety of vaccination. The proportion of parents expressing concerns about the safety of the MMR vaccine (as opposed to the proportion of MMR concern among those who expressed general doubt about vaccines) was 20.0% in England, 9.6% in Norway, 5.8% in Sweden, 2.6% in Poland, and 1.5% in Spain. The corresponding official estimates of MMR vaccine uptake among 3-year-old children (31 December 2008) was 85% in England, 93% in Norway, 96% in Sweden, 98% in Poland, and 95% in Spain.

4. Discussion

Few studies have previously addressed the role of attitudes in vaccine uptake at a European level [6,12,13]. The general aim of the VACSATC collaboration was to fill this gap in the literature on attitudes on childhood vaccinations. The more specific aim of the VACSATC collaboration was twofold. The first aim was to develop a comprehensive common questionnaire on parental attitudes on vaccinations to be used by all members of the consortium. The second aim was to agree on a common mode of data collection. Achievement of the two aims would make comparison of the survey results across the various countries possible. However, after lengthy discussions in the working group, it became apparent that the first aim was difficult to achieve. Because of resource constraints (human and financial) and because some questions would not be relevant in all countries (e.g. private purchase of vaccines), a standardized multi-country survey with a large number of questions could not be achieved. Instead the consortium agreed that a minimum of ten core questions would provide a good baseline for understanding immunization attitudes in Europe. There were also barriers in achieving a common sampling methodology. Some of the differences in sampling methodology will be addressed below.

In all countries health professionals were indicated as the most important and trusted source of information on vaccination. This is in correspondence with previous research [2,14]. The study results also show that parental attitudes about vaccinations in the childhood vaccination programs are generally positive across the five European countries. More than nine out of ten of the parents in Sweden, Norway, Poland and Spain agreed that they would immunize their child in the future and that immunization was important in protecting the whole community. On one hand, more than one in five of the parents in England, Poland, and Sweden claimed that they ever have had doubts about vaccinating their children. At the same time these three countries had a very low proportion of parents refusing vaccination offered to their children (<6%). Spain, on the other hand, had the lowest proportion of parents expressing

Table 4
Opinions of parents on the role of vaccination and vaccine safety by country.

The parents...	England	Norway	*Poland*	*Spain*	*Sweden*
	n (%)	*n* (%)	*n*(%)	*n*(%)	*n*(%)
have ever chosen not to give their child a vaccine that they have been offered	55 (5.5)	NA	17(1.6)	134(14.7)	78(3.7)
have ever had any doubts about having his/her child vaccinated	277 (27.6)	309 (20.2)	222(21.2)	109(11.9)	349(16.5)
have ever worried about the safety of a vaccination	NA	63 (4.1)	152(14.5)	200(20.9)	172(8.1)
would vaccinate his/her child(ren) in the future	813 (80.9)	1482 (96.9)	980(93.8)	889(97.4)	2073(97.8)
are satisfied with the way in which vaccination is provided	871 (86.7)	1243 (81.3)	763(73.0)	829(90.8)	1855(87.5)
believe that childhood vaccination is important in protecting the whole community against diseases	NA	1453 (97.0)	944(90.0)	824(90.3)	1867(88.1)

doubt about vaccinating their child (12%), yet at the same time had the highest proportion of parents refusing vaccination offered to their children (15%). England had the highest proportion of parents who expressed doubts about vaccinating their children (close to a third), and the lowest proportion of parents who would vaccinate their child in the future (eight out of ten), compared to the other countries. Meningitis, poliomyelitis and tetanus were diseases that a high proportion of all parents considered to be the most serious or very serious. The parents generally ranked measles, mumps, rubella and diphtheria at the bottom. The ranking of the perceived seriousness of the vaccine-preventable diseases in our study corresponds with previous research with data from England, The Netherlands and Germany [2,3,11,15].

The European differences in parental attitudes reported in our study may stem from different methods of sampling of the respondents, the time when the interviews were conducted as well as contextual (country-specific epidemiological, socioeconomic context, etc.; role of governmental agencies, mandatory vs. voluntary vaccination) and individual-level parental socio-demographic variables.

There are at least three ways in which various sampling may hamper cross-country comparisons. First, research has shown that the mode of data collection affects reporting of self-assessed health items substantially. More specifically, extreme response categories were more often used among telephone respondents than mail-respondents, and that the non-response bias was greater for questionnaire surveys than for telephone surveys [16]. The differences in attitudes towards vaccination observed between Norway and Sweden on one hand (mail surveys), and Poland (telephone survey) on the other hand, may thus be due to different modes of data collection. The much lower response rate in the Swedish and Norwegian surveys (approximately 40%) compared to the Polish survey (77%) would therefore lead us to expect that the non-response bias is larger in the two Scandinavian surveys than in the Polish (and the Spanish) survey. In order to appropriately document non-response bias and sample representativeness future cross-country comparisons of parental attitudes on vaccinations should collect detailed information on the non-responders.

Second, the way in which gender of the parent was selected varies substantially between the five surveys. Three countries selected the mothers (England, Spain and Poland), one country selected the oldest parent in the household (Sweden), while one country made the marital/cohabitation status of the respondents the gender-selecting factor (Norway). The Swedish method would select relatively more men since the questionnaire was addressed to 50% men and 50% women (compared to the gender selection methods used in the other countries). The literature on parental attitudes towards childhood vaccination has focused on mothers [3,11,17,18]. Hence we do not know whether there are gender-based differences in parental attitudes on this topic. The Norwegian and Swedish surveys provide an opportunity to look into this very interesting research question in future research papers.

The third way in which differences in methods may hamper comparison in this paper is the use of quotas and weights. All countries used quotas in selecting the respondents (on age, sex, geography or socioeconomic status), but only Poland, England and Sweden have used weights in order to make their samples as representative of the actual population as possible.

The time when the surveys were conducted could also play a role in observed differences. The earliest surveys were performed during the summer of 2008 (Spain and Poland). Their results could be influenced by the ongoing discussion on the HPV vaccines

Table 5
Ranked list of vaccine-preventable diseases which are most often indicated as serious or very serious by country.

Rank	England (%)	Norway (%)	Poland (%)	Sweden (%)
1	Meningitis (93)	Meningitis (86)	Hepatitis (46)	Tuberculosis (89)
2	Septicaemia (84)	Pneumococcal disease (86)	Tuberculosis (46)	Meningitis (88)
3	Pneumonia (68)	Tuberculosis (70)	Poliomyelitis (32)	Poliomyelitis (87)
4	Poliomyelitis (67)	Poliomyelitis (66)	Tetanus (32)	Tetanus (85)
5	Diphtheria (49)	Hepatitis (62)	Meningitis (31)	Hepatitis (84)
6	Tetanus (46)	Tetanus (44)	Septicaemia (31)	Diphtheria (75)
7	Rubella (41)	Diphtheria (33)	Pertussis (29)	Pertussis (58)
8	Hib (34)	Pertussis (29)	Mumps (24)	Measles (55)
9	Measles (29)	Mumps (15)	Measles (24)	Mumps (49)
10	Mumps (27)	Measles (15)	Diphtheria (22)	Rubella (48)

implementation. Results from the Norwegian survey which was conducted as late as December 2009 could potentially be influenced by the discussions on the effect and safety of the pandemic flu vaccine.

There are at least four examples in which differences in context may explain the variation between the surveyed countries. First, governmental agencies may play an important role not only in training health professionals, but also in informing the general public about the benefits of vaccination. In countries such as England, Sweden and Norway, for example, central governmental sources of information play a major role in informing the public on vaccination, and are trusted by parents. This may reflect a high level of public health services activity in those countries which do provide adequate, reliable information on vaccination. In other countries such as Poland and Spain, governmental agencies do not play an important role in conveying information on vaccinations. In Spain, for example, the procurement of vaccines is decentralized to the 17 autonomous communities, and this in turn makes provision of clear and univocal messages about immunization difficult. In Poland and Spain, the media in the form of printed magazines, radio or TV is highlighted as an important source of information.

Second, different attitudes may also result from different perceptions of the severity of vaccine-preventable diseases that are context-specific. Although the questions were asked in the same way in all countries, the different knowledge on the most serious vaccine-preventable diseases may reflect the different activity of public health agencies in informing the public on infectious diseases. For example, poliomyelitis was indicated as a very severe disease, although it was eradicated in the surveyed countries 25 years ago. This may reflect public health messages having effectively reached the general public – messages on the necessity of continuing vaccination against polio due to the risk of importation.

Third, certain questions that were relevant for some countries were not useful in other cultural and societal settings. For example, in England, Sweden and Norway, the question of private purchase of vaccines is not relevant because all childhood vaccines are provided to parents at no charge as part of the corresponding national childhood immunization programmes.

Fourth, our results showed that there was a negative association between parental distrust in the MMR vaccine and corresponding MMR vaccine compliance in the five countries studied. The attention in the media on the alleged association between the MMR vaccine and autism in the 1990s played an important role in explaining the low vaccine uptake for the MMR vaccine. Nowhere was this debate more vivid and long running than in England [3,11]. This is probably the reason why the English parents have the highest distrust of the MMR vaccine (20%) and the lowest MMR uptake (85%) of the five countries, even a decade after the loudest debate had subsided, and even after the link between the MMR vaccine and autism has been disproved. Finally, the relatively high distrust and low vaccine coverage for the MMR vaccine in England is also reflected in the attitude of the parents who rank mumps, measles and rubella as less serious than other vaccine-preventable diseases (Table 5).

The different attitudes to childhood vaccination may also be due to differences in the respondent's age, sex, number of children, level of education, and other socioeconomical factors (which in part may reflect differences in the mode of data selection). Sweden and Norway, for example, clearly differ from the other countries in the proportion of parents aged over 35, number of fathers responding to the survey, parents holding a university education and parents with more than two children. In previous research young US mothers (California and Colorado) are shown to be more likely to delay MMR immunization [18,19] and young mothers also demonstrate a lower degree of compliance with the MMR, polio, DTP and Hib vaccines than older mothers [18,19]. Recent studies in the Netherlands and Flanders, Belgium [1,15] could not confirm the effect of age demonstrated in the US studies [18,19]. Research findings on the effect of education on attitudes and compliance towards vaccines have also been mixed. On one hand, highly educated mothers in the Netherlands have been shown to have negative attitudes towards future vaccinations [1]. On the other hand, two US studies (Colorado and Texas) found that better educated parents are less concerned about the safety of vaccines and have consequently higher immunization coverage among their children [7,18]. In Flanders, Belgium, full-time working mothers more frequently had their children completely vaccinated with DTaP-containing vaccines, compared to non-working mothers [15]; this is consistent with findings in the UK [20]. Finally, the reported effects of family size on vaccine intentions, delays and compliance have also been mixed. One English study showed that families with a greater number of children had a stronger intention to vaccinate with dTaP/IPV [17] whereas two US studies showed that the likelihood of delaying MMR immunization was greater in larger families [18,21] and that there was poorer uptake of the MMR, polio, DTP and Hib vaccines among larger families than among smaller families [19]. In Sweden and Norway all vaccines within the national childhood immunization programmes are provided to parents at no charge. The family policies are also generous in the two Scandinavian countries. For these two reasons it would be expected that effects of age, family size and education in Sweden and Norway would be more like that reported for England and the Netherlands than that shown for the US. Therefore, estimations of the independent associations between the socio-demographic profile of the respondents and their attitudes towards vaccination would necessitate multivariate analysis of the single countries in question or analysis of pooled data.

Some potentially significant findings of the present study relate to the comparison of sources of information which are most commonly used, and that are considered to be most trusted by parents. To successfully deliver public health messages to the general public, it is necessary to understand how people get their information on vaccines and vaccination. In all countries the most important source of information was health professionals. In order to assure appropriate information to the general public, we first need to ensure that the nurses and doctors delivering the vaccination programmes are provided with reliable and comprehensive information on all elements of the programmes. In this context, the national immunization programmes should consider the importance of specific immunization training for future health professionals, e.g. medical and nurse students. Approaches to this subject were considered by Work Package 4 of the VACSATC project [22].

The VACSATC collaboration clearly shows that the work towards standardized questionnaire surveys and mode of data collection should continue to be developed. Routine surveys should be adopted across more EU countries, allowing appropriate monitoring of public perceptions of vaccines and vaccination practices. The crucial issue which needs to be pointed out is the necessity to repeat the attitudinal surveys in countries to monitor public perception on the idea of vaccination, or as in the case of MMR in the 1990s, the recent discussions related to HPV vaccines in many EU countries, and the new influenza A(H1N1) pandemic in 2009. In this way, worrying signals may be detected and addressed in a timely manner by public health services. A single cross-sectional attitudinal survey provides a 'snapshot' and is not useful in tracking changes in attitudes which may lead to a drop in vaccine coverage. Conclusions on causality are also impossible to draw in studies not using an analytical design. Therefore we recommend implementing attitudinal vaccine surveys, routinely applied every 1–5 years in each country. Moreover, further development of attitudes tracking methodology is needed both within and across countries.

Applying new simple indicators would be of great value in order to improve monitoring of public perceptions and beliefs. New tools in the objective measurement of vaccination beliefs have recently been proposed. A British group has developed a potentially useful indicator – the Immunization Beliefs and Intentions Measure (IBIM) – which is used to predict parents' intentions to immunize preschoolers [17]. Recently, another group of researchers in North Carolina has developed a simple scale to measure the factors that drive parents' decision to vaccinate their children with HPV vaccine (Immunization Attitudes and Beliefs Scale) [23].

5. Conclusions

The 2009 A(H1N1) influenza pandemic clearly showed that even when equipped with an excellent prevention tool, public health authorities cannot use vaccines efficiently without public acceptance. This in turn requires good communication channels to disseminate the reasons for mass vaccination, explanations that vaccination is safe and carefully monitored, and convincing information that the disease poses a threat to individuals and to the society. To communicate efficiently, public health authority's first need to understand what the target groups know about vaccines and what more people want to learn about vaccines. The European public is increasingly challenging the safety of vaccination in general or at times, certain vaccines in specific, as exemplified by the MMR debate in the UK and similar scares (but for different vaccines) in other European countries. It therefore becomes increasingly important for national public health authorities to ensure that their communication with the public is based on a proper understanding of the needs of their individual populations.

Our effort to address parental attitudes towards vaccinations is to our knowledge the first attempt to use a standardized approach to compare attitudes towards vaccination in European countries. We here conclude that the present survey methodology could not be applied in a uniform way across European countries (common study protocol and a standardized survey methodology). One of the most important consequences of this work was the move towards a shared understanding of the importance of polling public opinion. It needs to be considered as one of the important tools for routine surveillance of vaccine-preventable diseases in European countries. The work to standardize attitudinal surveys should be continued, both to enable comparability of clearly defined indicators, and to identify changes in parental perceptions and beliefs that may lead to non-compliance with the recommended childhood vaccines. Of significance to other European partners is the experience gained through this collaboration, and sharing good practice. Now at least fourteen countries have experience in carrying out surveys and many will continue and expand upon this initial work. All the partners of this project have also gained valuable context-specific information that can be used to improve the public understanding of vaccination. The results presented within this project also offer valuable knowledge which can be used when preparing information strategies about childhood vaccination. This should increase public knowledge of and trust towards vaccines and thereby maintain acceptable vaccine coverage rates.

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