



SPECIAL REPORT

Implementing the ECDC Action Plan for Measles and Rubella

ECDC SPECIAL REPORT

Implementing the ECDC Action Plan for Measles and Rubella



This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Andrea Würz and overseen by Lucia Pastore Celentano and Niklas Danielsson, with additional input from the following members of the ECDC Vaccine-Preventable Disease Programme: Sabrina Bacci, Paloma Carrillo-Santistevé, Tarik Derrough, Irina Dinca, Emma Huitric, Romit Jain, Pierluigi Lopalco, Ùlla-Karin Nurm, Isadora Quick, Marybelle Stryk, Edit Szegedi, and Svetla Tsołova.

Suggested citation: European Centre for Disease Prevention and Control. Implementing the ECDC Action Plan for Measles and Rubella. Stockholm: ECDC; 2014.

Stockholm, April 2014

ISBN 978-92-9193-570-3

doi 10.2900/23739

Catalogue number TQ-01-14-459-EN-N

© European Centre for Disease Prevention and Control, 2014

Reproduction is authorised, provided the source is acknowledged

Contents

| | |
|---|----|
| Abbreviations | iv |
| 1 Foreword | 1 |
| 2 Introduction | 2 |
| ECDC's role in supporting the measles and rubella elimination goal | 2 |
| 3 ECDC strategy for measles and rubella elimination | 5 |
| 1. Thorough analysis of the problem..... | 5 |
| 2. Data for action..... | 5 |
| 3. Strengthening of public health capacities..... | 5 |
| 4. Evidence-based communication..... | 5 |
| 5. Regional and international collaboration | 5 |
| 4 ECDC Action Plan for Measles and Rubella – activities..... | 6 |
| 4.1 Analysis of the problem – assessing reasons for less-than-optimal vaccine coverage | 6 |
| 4.1.1 Innovative approaches to promote vaccine uptake | 6 |
| 4.1.2 Understanding barriers to reach underserved populations | 6 |
| 4.2 Data for action..... | 9 |
| 4.2.1 Surveillance data | 9 |
| 4.2.2 Rapid risk assessments | 10 |
| 4.2.3 Improving vaccination coverage data | 10 |
| 4.2.4 Immunisation schedules and vaccine products | 10 |
| 4.3 Strengthening public health capacities..... | 10 |
| 4.3.1 'Let's talk about protection' and pilot interventions | 11 |
| 4.3.2 Practical tools to support countries in evaluations and assessments | 11 |
| 4.3.3 Targeted country support..... | 11 |
| 4.3.4. Strengthening capacities through training | 11 |
| 4.3.5 Eurovaccine conference | 12 |
| 4.4 Evidence-based communication | 12 |
| 4.4.1 Audiovisual materials for advocacy purposes..... | 12 |
| 4.4.2 Communicating the evidence: measles and rubella – misconceptions and facts | 12 |
| 4.4.3 Vaccination website | 12 |
| 4.4.4 External communication..... | 13 |
| 4.4.5 ECDC publications | 13 |
| 4.5 Regional and international collaboration | 13 |
| 4.5.1 Support to WHO in the verification process..... | 14 |
| 4.5.2 Support to the European Commission and Member States in implementing the Council conclusions on childhood immunisation..... | 14 |
| 4.5.3 Collaboration on the TIP approach | 14 |
| 4.5.4 Workshops for sharing best practices | 14 |
| 5 Conclusions | 15 |
| References | 16 |

Figures

| | |
|--|----|
| Figure 1. Number of measles cases by country, January 2013–December 2013, EU/EEA countries with two doses of measles vaccine coverage (2011–2012 WHO*) | 3 |
| Figure 2. Measles notification rate (cases per million) by country, January 2013–December 2013, EU/EEA countries (N=10 271)..... | 4 |
| Figure 3. Main strategic areas covered in the 'ECDC strategy for measles and rubella elimination 2012–2015' | 5 |
| Figure 4. Online measles atlas..... | 10 |

Abbreviations

| | |
|---------|---|
| CPME | Standing Committee of European Doctors |
| EC | European Commission |
| ECDC | European Centre for Disease Prevention and Control |
| EIW | European Immunisation Week |
| EMA | European Medicines Agency |
| EMMO | European Measles Monitoring newsletter |
| EPIS | Epidemic Intelligence Information System |
| ESCAIDE | European Scientific Conference on Applied Infectious Disease Epidemiology |
| EWRS | Early Warning and Response System |
| MMR | Measles, mumps and rubella vaccine |
| TESSy | The European Surveillance System |
| TIP | Tailoring immunisation programmes |
| VENICE | Vaccine European New Integrated Collaboration Effort |
| VPD | Vaccine-preventable diseases |
| WHO | World Health Organization |

1 Foreword

At the turn of the 21st century, the countries of the World Health Organization's (WHO) European Region set themselves the goal of eliminating measles in Europe by 2010. That deadline came and went without measles being eliminated. Indeed, in 2011 Europe had one of its largest measles epidemics for many years, with tens of thousands of children, adolescents and adults becoming sick with this vaccine preventable disease. When ECDC analysed the epidemiology of the 2011 outbreaks together with the EU Member States, it became clear that measles in Europe is very much an EU problem. The countries most affected by outbreaks in 2011 were France, Italy, Spain, Romania, Germany and the United Kingdom.

The ECDC Action Plan for Measles and the initiatives flowing from it, which also address rubella elimination, are the result of discussions that took place in the Centre's Advisory Forum in 2011. The Forum brings together state epidemiologists and other senior scientists from EU Member States. When we examined together the question 'Why are we seeing large measles outbreaks in the EU?' it was impossible to escape the conclusion: 'Because measles vaccine uptake in many Member States has been too low for too long'.

This then raised the question: what are ECDC and its EU and Member State partners going to do about it? My answer, as Director of ECDC, was to make measles the Centre's theme of the year for 2012 and initiate the process that led to our Action Plan for Measles and Rubella.

In this report you can read an account of the actions taken and the activities developed to support the measles and rubella elimination goals for Europe. ECDC and its partners have generated valuable information on the barriers to measles and rubella elimination that public health professionals across the EU face. We have also gained useful insights into how we can work together to overcome those barriers. Our challenge now is to make sure that our information and insights lead to effective public health action, so that every country and every community in the EU is protected against measles and rubella.

Dr Marc Sprenger

Director

2 Introduction

Measles and rubella are highly infectious diseases, but can be prevented with vaccination. In recent years, Europe has experienced a resurgence of measles and rubella, and several countries have experienced large outbreaks. The reasons behind this resurgence are multiple and complex, but the root cause of the continued measles and rubella transmission in the EU is the sub-optimal uptake of the measles-mumps-rubella (MMR) vaccine, leading to an accumulation of susceptible individuals. ECDC estimates that 4.9 million children born between 1998 and 2008 missed the first dose of measles vaccine. The number of children who did not receive a second dose is even higher [1]. While the WHO Region of the Americas reached a high enough vaccination coverage to break the cycle of transmission in all countries on the continent around the year 2000 – and has maintained measles elimination – this important step was never achieved in Europe. In order to stop the spread of the disease, sustained vaccination coverage above 95% with two doses of MMR vaccine is required in all EU Member States, and once this has been achieved, all imported outbreaks have to be rapidly controlled.

In September 2010, the countries of the WHO European Region unanimously adopted a resolution at the World Health Organisation's (WHO) Regional Committee for Europe meeting to renew their commitment and accelerate actions to eliminate measles and rubella from the WHO European Region by 2015 [2]. The elimination of measles by 2015, understood as the interruption of indigenous measles transmission, is part of the WHO strategic plan for measles and congenital rubella infection in the WHO European Region. The WHO target for immunisation coverage is to achieve and sustain high vaccination coverage (above 95%) in the population, with administration of both doses of the MMR vaccine, in order to achieve elimination.

But this target is looking progressively more challenging. The 2012 statistics show that 13 EU/EEA Member States were below the vaccination coverage target, and seven countries were not reporting MMR uptake [3]. Factors that negatively impact on the chances of reaching the recommended vaccination goals [4,5] include: perceptions by the general population and healthcare workers that measles is a mild disease; a decline in public confidence in vaccines; the existence of pockets of undervaccinated populations (e.g. those who have taken an active decision not to vaccinate and those that the national immunisation programmes have failed to reach); strained public health budgets, and various health system factors. Because measles spreads so easily, MMR vaccination uptake must be very high (i.e. above 95%) in order to interrupt transmission of the virus. The law of diminishing returns implies that marginal improvements in vaccination coverage will be increasingly difficult to achieve as the target of 95% coverage gets closer.

ECDC's role in supporting the measles and rubella elimination goal

ECDC's mission is to prevent, identify, evaluate and communicate threats to human health from communicable diseases [6]. Since its establishment in 2005, ECDC has been closely following measles and rubella in the EU, in the context of the European Commission (EC) Decision on infectious diseases to be covered by epidemiological surveillance at the EU level [7]. The Centre provides support to Member States so they can reach the goal of measles and rubella elimination and increase MMR vaccination coverage.

ECDC developed a 'Strategy for measles and rubella elimination 2012–2015' to support Member States in their efforts to achieve the WHO measles and rubella elimination goal and to guide the Centre's annual work plans. Five key areas of intervention were identified: a thorough analysis of the problem, data for action, strengthening of public health capacities, evidence-based communication, and regional and international collaboration. For each area, specific activities were identified and an ECDC 'Action Plan for Measles' was developed. This plan was launched in 2012 and includes more than 20 different activities and specific deliverables, including reports, guidance documents, meetings, and advocacy tools. This report describes the specific activities and achievements with regard to the implementation of the Action Plan for Measles and Rubella up to the first quarter of 2014.

Why urgent action is needed

- Europe is at risk of not achieving the measles elimination goal by 2015.
- In 2013, only one third of the EU/EEA countries (11 of 30) met the elimination target of less than one case per million population.
- In 2013, 10 271 cases of measles were reported in the EU/EEA [31].
- 38 847 cases of rubella were reported by EU/EEA countries in 2013. Data available for 2012 show that 60 congenital rubella cases were reported in the EU/EEA [32].
- Measles and rubella continue to circulate in many EU countries because:
 - the required vaccination coverage of 95% has not been reached (two doses in all population groups and in all geographical areas);
 - some birth cohorts may have skipped rubella vaccinations [8].
- The EU has become a net exporter of measles to measles-free countries, for example in the Americas: 50% of the cases reported in the United States between January and August 2013 were imported from the WHO European Region [9].

What are the groups of un- and undervaccinated children?

Un- and undervaccinated children in the EU belong to the following groups [4,5]:

- Children of parents who hesitate to have their children vaccinated out of fear of complications.
- Children whose parents oppose vaccinations on philosophical or religious grounds.
- Children in marginalised and underserved population groups.
- Children whose parents erroneously believe that measles is a harmless disease.
- Children whose doctors and nurses have not made an effort to ensure that parents vaccinate their children.
- Children whose parents forgot to get them vaccinated or whose parents did not have the time to do so.

Figure 1. Number of measles cases by country, January 2013–December 2013, EU/EEA countries with two doses of measles vaccine coverage (2011–2012 WHO*) (N=10 271)

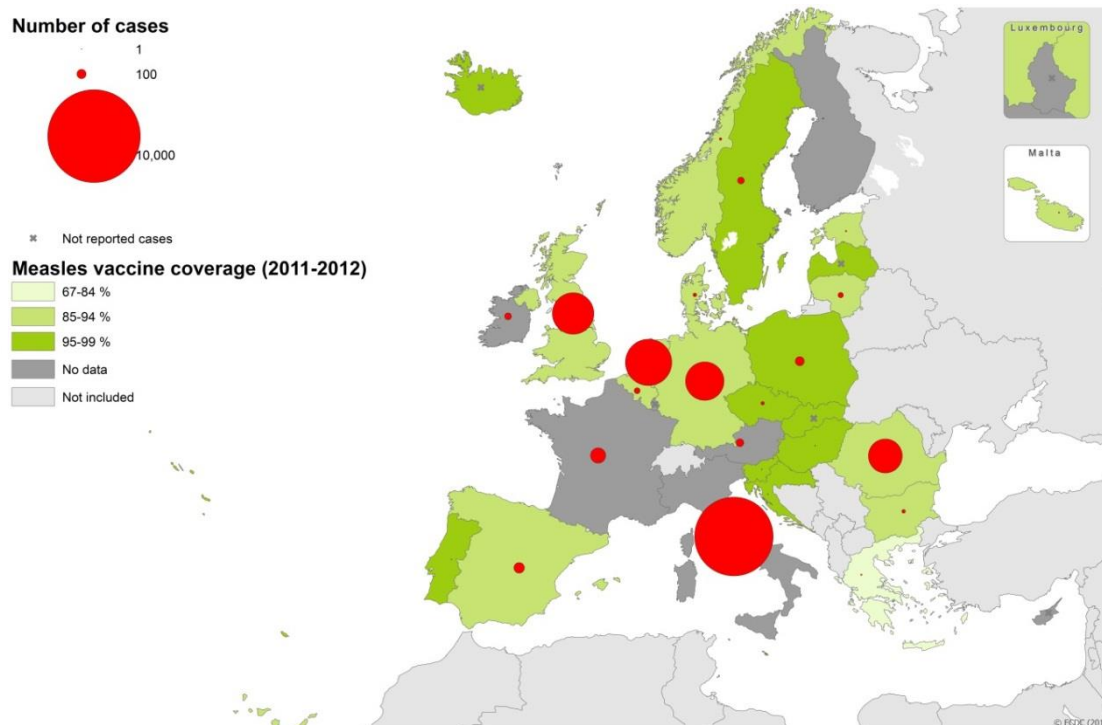
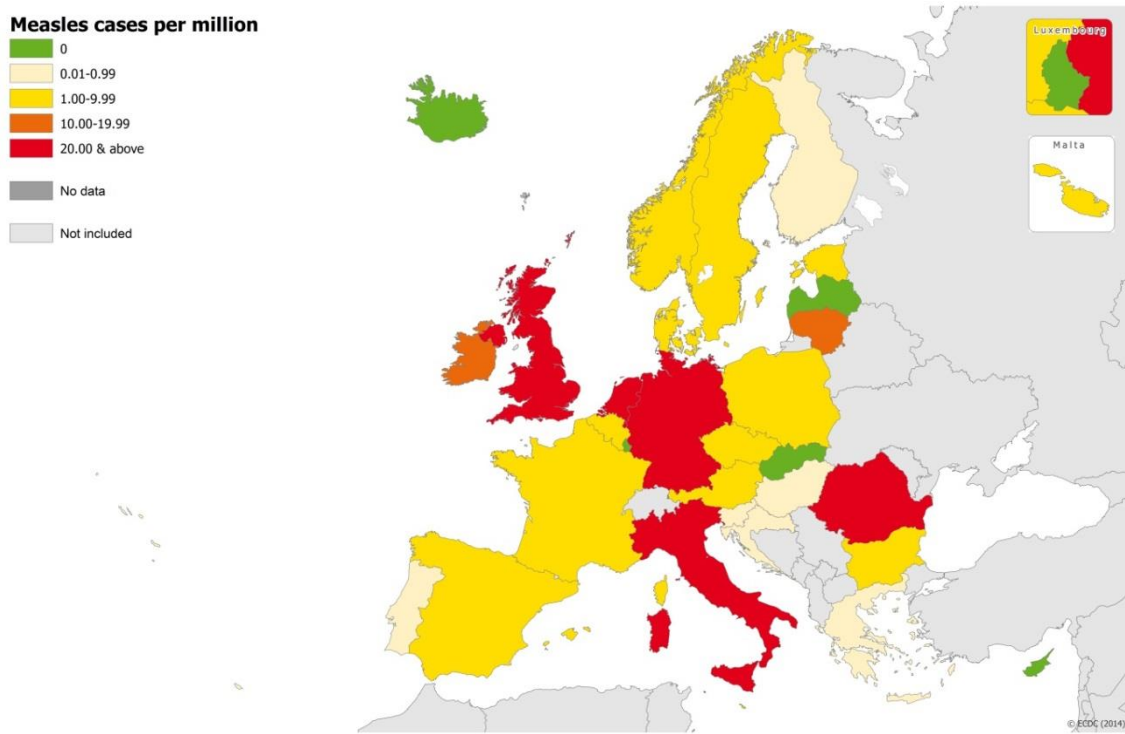


Figure 2. Measles notification rate (cases per million) by country, January 2013–December 2013, EU/EEA countries (N=10 271)



* Coverage figures (%) are official national figures reported via the annual WHO/UNICEF Joint Reporting Form.

3 ECDC strategy for measles and rubella elimination

The 'Strategy for measles and rubella elimination 2012–2015' identifies five key areas of interventions, each with its specific activities and outputs. The main objectives for each key area are described below.

1. Thorough analysis of the problem

Objective: To list all conceivable explanations for a less-than-optimal vaccine coverage, followed by a prioritisation of these explanations according to impact and addressability.

2. Data for action

Objective: To provide Member States, the EC, WHO, UNICEF and other stakeholders with timely, processed and easy accessible analytical data on which they can base their actions for achieving measles and rubella elimination.

3. Strengthening of public health capacities

Objectives: To support EU and EU candidate/potential candidate countries in planning and implementing activities aimed at achieving measles and rubella elimination by 2015 and beyond; to provide expert advice for EU-wide initiatives and projects.

4. Evidence-based communication

Objectives: To enhance behaviour-change communication for MMR uptake at the national and EU level; to raise awareness among policymakers and other key audiences about the threat to public health from continued measles transmission; to advocate for increased resources to achieve measles and rubella elimination in the EU.

5. Regional and international collaboration

Objective: To strengthen collaboration among the key stakeholders for measles and rubella elimination in Europe.

This report outlines various activities based on the five strategic areas described above, along with the tools, publications and capacity building activities developed from 2012 to the first quarter of 2014, and earlier ECDC activities that have contributed to ECDC's efforts.

Figure 3. Main strategic areas covered in the 'ECDC strategy for measles and rubella elimination 2012–2015'



4 ECDC Action Plan for measles and rubella – activities

4.1 Analysis of the problem – assessing reasons for less-than-optimal vaccine coverage

4.1.1 Innovative approaches to promote vaccine uptake

To provide Member States with options for addressing low vaccination coverage in the general population, a meeting was convened among public health experts and 'free thinkers' from other professions, e.g. public relations, social and commercial marketing, campaigning, etc. Participants focused on innovative proposals to overcome barriers to measles vaccination. The meeting was organised in the context of the 2012 European Immunisation Week.

Free thinkers meeting

Place/date: Stockholm, 25 April 2012

Participants: 20 representatives from public health institutions and other professions.

Outcomes: Comprehensive list of innovative approaches to address obstacles to high MMR vaccine coverage and to increase immunisation uptake. Recommended measures could be tailored to individual national contexts.

The list was discussed in several follow-up meetings which focused on reaching underserved population groups (see below) in order to produce a list of top ten interventions for increasing immunisation uptake.

4.1.2 Understanding barriers to reach underserved¹ populations

Multidisciplinary meetings

Two meetings were organised in Vienna and Dublin to discuss vaccination of so-called 'hard-to-reach populations' (including Roma, Travellers, religious and anthroposophic groups) and to exchange experiences among representatives of national public health institutes, ministries of health, healthcare professionals and organisations representing specific population groups (NGOs). Participants discussed the various barriers that make it difficult to reach underserved populations, exchanged experiences and proposed solutions. One of the most promising approaches focused on the active participation of underserved populations in vaccination measures.

¹ In this document the terms *underserved*, *vulnerable* and *hard-to-reach* are used interchangeably, although there are differences in meaning. Nevertheless, for the purpose of this report, i.e. to express that there are population groups that are insufficiently or not at all vaccinated, all three terms can be used synonymously.

The low level of vaccination can be explained as health-related (certain population groups are not reached efficiently by the health system) or from a beneficiary perspective (people have various barriers towards vaccination, e.g. geographical, financial or philosophical). Currently, the most frequently used term at ECDC is 'underserved population groups'.

Meetings to analyse barriers in reaching hard-to-reach populations and proposed solutions

Meeting: 'Communicable disease prevention among Roma'

Place/date: Vienna, 27–29 November 2011

Participants: 72 participants from Bulgaria, the Czech Republic, Greece, Hungary, Romania, Slovakia, and Spain (the seven countries with the highest percentage or absolute number of Roma), EU agencies, WHO Regional Office for Europe, and NGOs working to improve Roma health and toward inclusion.

Outcomes: A discussion paper that reviews the disproportionate burden of communicable diseases among Roma, describes the key obstacles to Roma inclusion, and identifies areas of possible intervention. Participants shared best practices and lessons learned, and proposed measures for the international, national and regional levels.

A meeting report was published by ECDC [10]. The report is available from:

<http://ecdc.europa.eu/en/publications/Publications/Communicable-disease-prevention-among-Roma-meeting-report.pdf>

Meeting: 'Inform, protect, immunise: Engaging underserved populations'

Place/date: Dublin, 4–6 September 2012

Participants: Around 70 participants, including representatives of public health organisations, vaccination experts, primary healthcare professionals, representatives of Roma/Travellers NGOs from 18 Member States, as well as representatives of the European Commission, the European Union Agency for Fundamental Rights, WHO, EuroHealthNet, the Council of Europe, and ECDC.

Outcomes: The meeting provided a platform for healthcare professionals, public health experts and civil society to share best practices and discuss practical solutions for current outbreaks, particularly in underserved populations. Participants were also asked to rank the suggested interventions developed during the 'free thinkers' meeting. This resulted in a list of 'top ten interventions' (see text box below).

Top ten interventions to increase vaccination coverage among vulnerable populations in the EU

(Developed in 2012 at the 'free thinkers' meeting, Stockholm, and the 'inform, protect, immunise' meeting, Dublin)

1. Invest in education for physicians and nurses to communicate more efficiently and emphatically.
2. Make remembering easier, e.g. introduce efficient alert systems to remind people of vaccination dates.
3. Include measles under the broader umbrella of child health and support the role of mothers as key opinion leaders on health issues in their families.
4. Address stigma and discrimination.
5. Cooperate with field workers.
6. Make vaccination more accessible, i.e. offer immunisation days/campaigns in various locations.
7. Motivate local authorities and non-governmental organisations to cooperate on community-based interventions, particularly those which target underserved groups.
8. Conduct epidemiological analyses of the risk groups for lower vaccination uptake.
9. Use mass media (e.g. insert measles-related messages in television soap operas); encourage wider collaboration between public health and the film and TV industry.
10. Monitor the web to understand concerns about vaccination and provide answers based on trusted web sources.

Studies on determinants of low MMR vaccine coverage

A VENICE report commissioned by ECDC and published in February 2013 [11] covers measles, mumps and rubella outbreaks over the last two decades, provides information on MMR vaccination coverage, and describes barriers to MMR vaccination among underserved populations in EU countries. Only few countries have data on vaccination coverage among underserved populations and can provide information on attitudes among sub-populations such as

anthroposophic, religious, migrant and ethnic groups. The report concludes that the barriers to vaccination are many and varied, yet they are often group-specific.

The report 'Review of outbreaks and barriers to MMR vaccination coverage among hard-to-reach populations in European countries' is available on ECDC's website: <http://ecdc.europa.eu/en/publications/Publications/MMR-vaccination-hard-to-reach-population-review-2013.pdf>

Barriers to vaccination in hard-to-reach populations

Barriers to MMR vaccination identified in the report on 'Review of outbreaks and barriers to MMR vaccination coverage among hard-to-reach populations in European countries' include:

- discrimination
- administrative and financial problems
- language or literacy difficulties
- lack of cultural knowledge
- lack of information on health and vaccination
- religious beliefs
- a fatalistic approach to life or a distorted risk perception in relation to vaccines and vaccine-preventable diseases among some individuals and groups.

A qualitative study on barriers to immunisation for Roma in six countries with large Roma populations (Bulgaria, the Czech Republic, Greece, Hungary, Romania and Slovakia) was commissioned by ECDC and developed by an NGO engaged in Roma issues, the Roma Center for Social Intervention and Studies (Romani CRISS). The study provided up-to-date information about the determinants of low vaccination in the Roma population and presented reliable solutions to guide public health experts and vaccination programme managers on how to provide better and more equitable access to vaccines.

The study indicates that the health system fails to properly interact with the Roma population, who, in turn, mistrust the system and feel discriminated by health service providers. It highlights the importance of comprehensive systematic efforts: improved access to primary care; training in Roma culture and social determinants of health for service providers; additional health mediators with official roles; awareness-raising campaigns on vaccination focused on, and adapted to, people with a low level of education. This report constitutes a background document.

The role of healthcare workers in supporting measles and rubella elimination efforts

There is substantial evidence that healthcare workers are the most trusted source of information on childhood vaccination. ECDC has explored the obstacles that keep healthcare workers from effectively promoting and delivering childhood vaccinations.

Review of evidence

A review of evidence was published in *Eurosurveillance*, exploring the knowledge, attitudes and practices of health professionals towards measles vaccination and on how health professionals have an impact on parental vaccination choices [4]. The review points out that it is essential to raise awareness and fill in knowledge gaps among healthcare workers by providing them with evidence-based information on vaccines and educating them to communicate effectively with patients and parents. It also acknowledges that health professionals who are trained and well-informed could influence the vaccination choices of parents who are reluctant to have their children vaccinated with MMR vaccine. The full article, published in June 2012, is available from:

<http://www.eurosurveillance.org/images/dynamic/EE/V17N26/art20206.pdf>

Potential barriers among doctors to promote MMR vaccination

A meeting with the CPME (Standing Committee of European Doctors) was organised in Brussels on 4 May 2012. Topics included strategies on how to get doctors to convince parents of the benefits of childhood vaccination and all aspects of reaching the measles elimination target.

Another example of initiatives to address the role of healthcare professionals in immunisation uptake was ECDC's participation in the conference 'Excellence in paediatrics', held in Doha, Qatar, in December 2013. Marc Sprenger, Director of ECDC, presented a lecture entitled 'Parents trust paediatricians' view on childhood vaccination: take your responsibility seriously'.

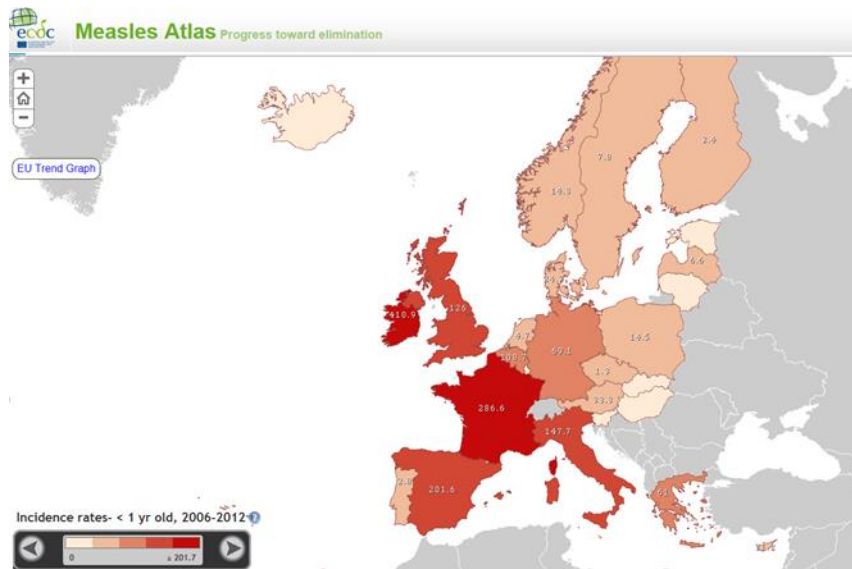
4.2 Data for action

ECDC provides EU/EEA Member States with timely and reliable information on measles and rubella epidemiology, as well as risk assessments, vaccination coverage data, immunisation schedules, and vaccine products.

4.2.1 Surveillance data

Timely and reliable information on measles epidemiology:

- **Annual Epidemiological Report:** Measles and rubella surveillance data at the EU level are collected via the ECDC-coordinated European Surveillance System (TESSy). EU/EEA Member States report data for both diseases to TESSy on a monthly basis [12]. These surveillance data are published in the ECDC Annual Epidemiological Report, which provides information on the epidemiology of communicable diseases in the EU/EEA and includes sections on enhanced measles and rubella surveillance.
- **Measles monitoring report:** Since July 2011 ECDC has been publishing a measles monitoring report; rubella monitoring was added later. This report is published on the ECDC website and provides timely public updates on the measles and rubella situation in Europe and disseminates information on good practice interventions carried out in Member States [13]. The report is based on the measles and rubella surveillance data received monthly at ECDC through TESSy. The measles monitoring report also includes information on outbreaks in the EU – detected through epidemic intelligence activities at ECDC. Measles and rubella reports are available from:
http://www.ecdc.europa.eu/en/healthtopics/measles/epidemiological_data/Pages/measles_surveillance_reports.aspx.
- **Weekly bulletins:** Through the weekly Communicable Disease Threat Report (CDTR), ECDC provides epidemiologists and health professionals with alerts and updates on outbreaks [14]. The CDTR is available at: http://www.ecdc.europa.eu/en/publications/surveillance_reports/Communicable-Disease-Threats-Report/Pages/default.aspx.
- **Daily exchange of information:** ECDC coordinates the Epidemic Intelligence Information System (EPIS) for vaccine-preventable diseases, an access-restricted platform for nominated experts on technical issues and outbreaks.
- **Measles atlas:** This atlas offers an easy-to-understand visual guide to assess progress towards achieving and sustaining measles elimination. The atlas can be accessed here:
<http://emmageocase.ecdc.europa.eu/atlas/measles/#?t=1&m=1&x=8.08&y=49.58&l=2>
- **Times series analysis on measles data:** An ongoing study aimed at investigating the burden of measles using data routinely collected by the surveillance network between 1998 and 2010.
- **Spatial analysis of measles outbreaks:** The aim of this ongoing project is to identify geographic patterns, explore hypotheses on risk factors, and analyse the distribution and spread of measles at the subnational level.
- **Mapping of measles surveillance systems:** This ongoing study aims at understanding the characteristics of the national surveillance systems in order to support harmonisation and reduce the complexity in surveillance across Europe. The goal is to strengthen disease surveillance systems and to improve public health, based on more reliable data. Information from the mapping study will also guide the interpretation of historical data.
- **Survey on surveillance systems for rubella and congenital rubella:** The survey describes national surveillance systems for rubella infection, and rubella infection during pregnancy [15]. The aim was to improve understanding and interpretation of surveillance data and ensure that measles and rubella surveillance in the EU meets the standards set by the WHO Regional Office for Europe with regard to measles and rubella elimination. The results of the survey were published in an ECDC technical report, available from: <http://ecdc.europa.eu/en/publications/Publications/survey-rubella-pregnancy-congenital-surveillance-systems-may-2013.pdf>

Figure 4. Online measles atlas

4.2.2 Rapid risk assessments

Rapid risk assessments related to measles outbreaks in and outside the EU assess the risk to Member States so they can implement the necessary prevention and control measures.

One example is a rapid risk assessment on a large Ukrainian measles outbreak prior to the EURO football cup in 2012 [16] (see http://www.ecdc.europa.eu/en/publications/Publications/20120314_RA_Measles_Ukraine.pdf).

A more recent rapid risk assessment assessed the risk for further transmission of measles after an outbreak had been detected on a cruise ship in the Mediterranean Sea in March 2014, and included mitigation options for the Member States [17] (see <http://www.ecdc.europa.eu/en/publications/Publications/rapid-risk-assessment-measles-cruise-ship-Mediterranean-5-March-2014.pdf>).

4.2.3 Improving vaccination coverage data

The ECDC funded VENICE project, which aims at improving knowledge on vaccinations programme performance across the EU, pilot-tested a standard survey for collecting enhanced vaccination coverage data in the EU in eight EU Member States (Denmark, Greece, Germany, Italy, Ireland, Poland, the United Kingdom) [18]. The pilot project has been extended to all EU Member States and has proven that it is possible to collect enhanced vaccination coverage data in the EU/EEA with standard and harmonised methodology, including data from the subnational level. In the future, this will allow EU Member States to better monitor MMR vaccination coverage at the national and sub-national levels and to establish a standard benchmark to improve implementation of the measles elimination programme.

The VENICE website is available from: <http://venice.cineca.org/index.html>

4.2.4 Immunisation schedules and vaccine products

Vaccine scheduler: An ECDC web platform was created to offer easily accessible and practical information on vaccination schedules in the EU [19]. This platform facilitates the comparison of schedules across countries according to age and disease. The platform is available from: <http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx>.

4.3 Strengthening public health capacities

ECDC has developed a variety of initiatives to strengthen public health capacities in Member States, many of them directed at the planning and implementing of activities towards measles and rubella elimination. Activities comprise tools and guidance, targeted technical support to countries, and training initiatives.

4.3.1 'Let's talk about protection' and pilot interventions

To support healthcare providers in their interactions with different population groups in order to enhance vaccination uptake, ECDC developed the guide 'Let's talk about protection' [20]. The guide provides peer-reviewed advice and evidence-based guidance on how to best communicate with parents and grandparents, underserved population groups, media and peers. It reframes the focus of discussions, highlighting the benefits of getting protected and protecting (preventing disease) rather than focusing on the negative/side effects of vaccination. It also gives a voice to various population groups on how best to communicate with them. A slide presentation complements the guide.

'Let's talk about protection' was adapted to the local situation in four EU countries: culturally-adapted, local-language versions of the guide were produced for Bulgaria, the Czech Republic, Hungary, and Romania. A pilot intervention to test the usability of the guide took place in Bulgaria. When the project finishes, it is expected that Member States will have access to a comprehensive toolkit which includes an English version of the materials, and methodologies for adaptation and evaluation. A training package will become available in the near future.

4.3.2 Practical tools to support countries in evaluations and assessments

In order to support Member States in evaluating their progress towards measles and rubella elimination, ECDC and WHO developed the MESSAGE web-based tool (Measles and Rubella Self-Assessment Generating Tool) [21]. MESSAGE allows public health experts identify gaps in programme planning, evaluate implementation processes, prepare for the WHO verification process, and renew commitment to elimination targets. The tool is available from: <http://venice.sissdev.cineca.it/register.php>.

ECDC has published a guidance document which assists EU Member States to assess the risk for transmission of infectious diseases in aircraft (RAGIDA project) [22]. The operational guidelines also address measles and rubella, provide an evidence base and offer an operational approach: http://www.ecdc.europa.eu/en/publications/Publications/1012_GUI_RAGIDA_2.pdf.

An update of the measles RAGIDA guidelines will be published in 2014.

4.3.3 Targeted country support

ECDC's technical support to national health authorities includes support in outbreak containment, the evaluation and revision of vaccination programmes, and, upon request, study design. One example is an ECDC/WHO mission to Bulgaria. Following a request from the Bulgarian Ministry of Health, a joint ECDC/WHO expert team travelled to Bulgaria in February 2010. The team assessed a measles outbreak and the risk of further spread to European countries, reviewed vaccination strategies, evaluated whether MMR vaccine supplies were sufficient to implement efficient control measures, and provided guidance on long-term vaccination strategies for vulnerable populations. A mission report was prepared and sent to the Bulgarian Ministry of Health.

Another example is a mission to Austria before the EURO 2008 football championship. The mission assessed the extent of an ongoing measles outbreak; the risks of further spread in Europe; and supported the Austrian health authorities in defining strategies for prevention, investigation and control, in particular with regard to the football championship [23]. The mission report on the measles outbreak in Austria is available on the ECDC website: http://ecdc.europa.eu/en/publications/Publications/0804_MIR_Measles_Outbreak_in_Austria.pdf

4.3.4. Strengthening capacities through training

Capacity building activities developed by ECDC include the development of training initiatives in the following areas:

Training-the-trainers in 'Epidemiological aspects of vaccine-preventable diseases': This project started in 2011. The training materials focussed on increasing the technical capacity for conducting surveillance, outbreak investigation and epidemiological studies on vaccine-preventable diseases in Europe. A training course was held in February 2012 in Florence. Thirty experts from 21 countries (18 EU Member States plus Norway, Croatia, and Serbia) were trained to use the reference ECDC training materials (slides and case studies), enabling them to start cascade training in their countries. As a follow-up, ECDC is currently developing core competency domains on vaccine-preventable diseases and immunisation for public health professionals.

Strengthening risk communication capacities in the countries: To support countries in addressing communication challenges in communicable disease prevention, ECDC has developed a training curriculum on 'Risk communication for the prevention and control of communicable diseases', which includes scenarios related to vaccine-preventable diseases, and measles in particular. This training course conveys new approaches for risk communication in public health and discusses the concepts and principles of risk communication in relation to practical examples and case scenarios. The concept was first tested and evaluated by ECDC experts in a two-day workshop. After adaptations, a series of regional training workshops on 'Risk communication for the prevention and

control of communicable diseases' were planned. The first one was held in Tallinn, Estonia, in October 2013. Participants included public health experts, healthcare practitioners and health communication experts from Estonia, Finland, Latvia and Lithuania, as well as observers from Sweden.

4.3.5 Eurovaccine conference

In 2013, ECDC hosted the fifth Eurovaccine conference, a biennial web-cast scientific conference for European experts in vaccine-preventable diseases. The format is interactive, so participants can ask questions at any time during the presentation.

Eurovaccine is the only European conference on vaccination issues that is publicly funded and industry independent.

Eurovaccine website: <http://www.ecdc.europa.eu/en/eurovaccine/Pages/default.aspx>

4.4 Evidence-based communication

Communication is a strategic key component to increase immunisation uptake, and ECDC activities in this area include awareness-raising initiatives and tools to enhance communication in order to increase MMR vaccine uptake, including communication guidance and reviews of evidence on effective communication.

4.4.1 Audiovisual materials for advocacy purposes

Audiovisual materials were developed to communicate the importance of reaching elimination targets and to highlight the seriousness of measles. The following videos are available on the ECDC website:

<http://ecdc.europa.eu/en/press/ecdctv/Pages/player.aspx>:

- **'95% vaccination coverage for a measles-free EU'**: Animation video (running time: two minutes) highlighting the importance of reaching the 95% vaccination coverage goal for a measles-free Europe. The main target audiences of this video are policymakers and representatives of national public health authorities. The text of the voice-over is available in 11 EU languages.
- **'Eliminating measles – personal stories'**: An ECDC-sponsored documentary (running time: eight minutes) was broadcast on Euronews, presenting the personal stories of parents of patients from France and Germany and highlighting the potentially severe consequences of measles infection [24]. The documentary addresses a broad audience and aims at increasing awareness about the importance of measles vaccination. It was broadcast to a potential audience of more than 20 million people in and outside Europe.

4.4.2 Communicating the evidence: measles and rubella – misconceptions and facts

A project on communicating the evidence aims to educate health professionals in the Member States about measles and rubella, with special emphasis on misconceptions about measles vaccination. The project will also inform about the risks and benefits of vaccination, the health consequences of rubella for women of childbearing age, and rubella infections during pregnancy.

Common misconceptions about measles and measles vaccination are presented and debunked with solid, scientific, evidence-based facts. Rubella and congenital rubella incidence is analysed and suggestions are made on which groups should be targeted for vaccination. The materials enable national health professionals to incorporate evidence-based risk communication in their activities and address various barriers to measles vaccination, while at the same time raising awareness about congenital rubella syndrome and the available preventive measures (immunisation, antenatal screenings, and post-partum vaccination).

4.4.3 Vaccination website

ECDC developed a concept for an ECDC subsite² on vaccination which will provide evidence-based information on immunisation. The concept is based on a review of best practices and innovations in communication on immunisation from different countries and organisations.

The subsite will act as a gateway to a comprehensive package of reliable and useful information on vaccination. It aims to support public health professionals and healthcare workers with tools for effective communication with the general public. The first components of the subsite will be launched in 2014.

² A subdirectory of a website that is a complete site.

4.4.4 External communication

ECDC provides timely, up-to-date information on its activities in the area of vaccine-preventable diseases through a variety of channels, including social media and the ECDC website, which features regular updates and special sections on the elimination targets as well as measles and rubella prevention.

ECDC also contributes to the annual European Immunisation Week (EIW) in April by sharing updates on current projects, actively engaging in the EIW web platform (e.g. in the discussion forums, blogs), and promoting EIW through the ECDC website and social media platforms.

4.4.5 ECDC publications

A number of ECDC reports have been published to summarise existing evidence and provide guidance on how to communicate effectively on vaccination issues.

‘Conducting health communication activities on MMR vaccination’: This guide provides strategies on how to effectively communicate on a broad range of issues that relate to MMR vaccination, with hands-on advice on how to develop a health communication programme, how to address some of the barriers to reaching elimination goals (from a communication perspective), and how to evaluate communication activities [5]. The report is available from:

http://ecdc.europa.eu/en/publications/Publications/1008_TED_conducting_health_communication_activities_on_MMR_vaccination.pdf

‘Communication on immunisation – building trust’: This publication highlights the importance of trust and credibility for public health organisations in order to communicate effectively on immunisation [25]. The report can be accessed here: <http://ecdc.europa.eu/en/publications/Publications/TER-Immunisation-and-trust.pdf>

Reviews of evidence: A number of evidence reviews (on effective communication, including issues related to immunisation) have been published by ECDC in the context of a grant agreement with a consortium of universities³. Publications include a systematic literature review on the evidence for effective promotional communications on immunisation schedules, a literature review on trust and reputation management, and a literature review on health information-seeking behaviour on the web [26-28]. These publications are available on ECDC’s website:

http://ecdc.europa.eu/en/healthtopics/health_communication/Pages/publications.aspx

ECDC and ECDC experts also publish in scientific journals which relate to improvements in the control of measles and rubella and discuss obstacles to vaccine uptake. Examples:

- **Commitment needed for the prevention of congenital rubella syndrome in Europe:** This article seeks to raise the profile of rubella prevention in the EU [8]. The 2011 outbreak in Romania had dramatic consequences, with high numbers of congenital rubella cases reported.
- **Article on an ongoing outbreak of rubella among young male adults in Poland:** Documents a large rubella outbreak in the EU [29]. The 2013 outbreak in Poland accounted for almost 40 000 cases. Mostly affected were male adolescents and young adults, whose cohorts were not, or incompletely, covered by rubella vaccination.

In addition, ECDC provides comprehensive information about measles and rubella on its website, including factsheets for health professionals and the general public:

<http://ecdc.europa.eu/en/healthtopics/measles/Pages/index.aspx> (measles information) and

<http://ecdc.europa.eu/en/healthtopics/rubella/Pages/index.aspx> (rubella information).

4.5 Regional and international collaboration

ECDC engages in a variety of activities organised by national and international partners. It supports WHO in the verification process for measles elimination and collaborates with Member States and the European Commission in implementing the ‘Council conclusions on childhood immunisation’. It also organises a scientific conference dedicated to immunisation issues.

³ Health Promotion Research Centre at the National University of Ireland Galway, as the lead coordinating centre, and the Institute for Social Marketing, University of Stirling, Scotland, and the University of Navarra Clinic, Pamplona, Spain. The overall aim of the ‘Translating Health Communication’ research project was to support the optimal use and development of health communication activities for the prevention and control of communicable diseases in the EU/EEA.

4.5.1 Support to WHO in the verification process

ECDC participates as an observer in the WHO Regional Office for Europe verification committee and supported the participation of EU Member States in meetings organised for this purpose in 2012. ECDC also participated in the sixty-third session of the WHO Regional Committee for Europe, held in Turkey in September 2013.

4.5.2 Support to the European Commission and Member States in implementing the Council conclusions on childhood immunisation

ECDC is involved in the activities initiated by the European Commission in the context of the 'Council conclusions on childhood immunisation' (adopted in 2011), which call for increased efforts to improve childhood vaccination in the EU [30].

ECDC participated in the Luxembourg conference on childhood immunisation, organised in 2012 by the Directorate-General for Health and Consumers.

Luxembourg conference on childhood immunisation

Place/date: Luxembourg, 16–17 October 2012

Participants: European Commission, European Parliament, Ministry of Health Luxembourg, ECDC, WHO Regional Office for Europe, the European Medicines Agency (EMA), and other public health organisations and NGOs.

Outcomes: Participants discussed recent initiatives to improve childhood immunisation in the EU, including the follow-up to the 'Council conclusions on childhood immunisation' adopted in June 2011, as well as priority areas for future EU-level action. Participants received a portfolio of deliverables which was produced in the context of the ECDC Action Plan for Measles and Rubella. Also presented at this meeting was ECDC's top ten list of interventions that could contribute to increase vaccination in the EU. More information on this meeting is available from: http://ec.europa.eu/health/vaccination/events/ev_20121016_en.htm

4.5.3 Collaboration on the TIP approach

ECDC experts participated in a series of jointly organised workshops with the Swedish Institute for Infectious Diseases and WHO Regional Office for Europe on implementing the WHO TIP (Tailoring Immunisation Programs) approach. The workshops also explored the low vaccination coverage in hard-to-reach communities in Sweden (e.g. anthroposophic groups, the Somali population, and undocumented migrants) during 2012–2013.

4.5.4 Workshops for sharing best practices

A workshop entitled 'Measles elimination – every step matters' was organised in 2013. This workshop was held on the occasion of the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE), with the aim to discuss different approaches to achieve measles and rubella elimination in Europe and abroad.

Workshop 'Measles and rubella elimination – every step matters'

Place/date: Stockholm, 5 November 2013

Participants: Representatives of national public health institutions, experts in vaccine-preventable diseases, and representatives of regional and international organisations in the area of public health.

Outcomes: Presentations included case studies on how to reach hard-to-reach populations in EU countries, the development of supplementary immunisation activities during outbreaks, and experiences in the United States with the control and elimination of measles and rubella/congenital rubella. Discussions highlighted the need for increased efforts to reach elimination goals.

The conference identified several areas of opportunity. The following suggestions were made: Reinforce the key role of health professionals in supporting immunisation programmes; understand the importance of schools as venues for catch-up campaigns; understand the power of peer pressure as a motivator for vaccinating; maintain a high level of surveillance; and ensure aggressive outbreak control measures.

5 Conclusions

As this report shows, valuable knowledge, data and tools are available to support the measles and rubella elimination goal. The ECDC strategy for measles and rubella elimination provides a comprehensive and consistent approach that covers five key areas for intervention, each with specific objectives: a thorough analysis of the problem, data for action, strengthening public health capacities, evidence-based communication, and regional and international collaboration.

In the context of this strategy, ECDC and its partners have developed more than 20 different activities and specific deliverables, including reports, guidance documents, meetings and advocacy tools, all of which support countries in their efforts to increase immunisation uptake.

However, a number of challenges still remain, and outbreaks of measles and rubella continue to occur in EU Member States, often among adults. Sustained action is needed in order to reach the elimination goal of 95% coverage in the population with two doses of MMR vaccine. As the statistics show, a total of 13 Member States were below the coverage goal in 2012, and seven countries did not even report coverage data [3]. This shows how important it is to review national immunisation programmes to ensure they actively offer MMR vaccination, especially for hesitant and underserved population groups. At the same time, all remaining barriers need to be addressed. In addition, the timeliness and completeness of surveillance data for the measles WHO verification process needs to be enhanced.

ECDC is committed to continue to provide evidence for public health action and valuable assessment tools for country support. The double failure of not responding adequately to the ongoing measles epidemic and not achieving measles and rubella elimination in the EU would result in a significant health risk for European citizens and threaten to undermine regional and global disease control efforts.

References

1. Carrillo-Santistevé P, Lopalco PL. Measles still spreads in Europe: Who is responsible for the failure to vaccinate? *Clin Microbiol Infect.* 2012 Oct;18 Suppl 5:50-6.
2. World Health Organization. Renewed commitment to measles and rubella elimination and prevention of congenital rubella syndrome in the Who European Region by 2015. Copenhagen: WHO; 2010. Available from: http://www.euro.who.int/_data/assets/pdf_file/0008/119546/RC60_edoc15.pdf.
3. World Health Organization. Measles-containing vaccine 2nd dose: Reported estimates of MCV2 coverage. [internet]. 2013 [cited 2014 Mar 3]. Available from: http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tscoveragemcv2.html.
4. Simone B, Carrillo-Santistevé P, Lopalco PL. Healthcare workers role in keeping MMR vaccination uptake high in Europe: A review of evidence. *Euro Surveill.* 2012 Jun 28;17(26).
5. European Centre for Disease Prevention and Control. Conducting health communication activities on MMR vaccination. Stockholm: ECDC; 2010. Available from: http://ecdc.europa.eu/en/publications/Publications/Forms/ECDC_DispForm.aspx?ID=558.
6. Regulation (EC) No 851/2004 of the European Parliament and of the Council of 21 April 2004 establishing a European Centre for Disease Prevention and Control.
7. 2000/96/EC: Commission Decision of 22 December 1999 on the communicable diseases to be progressively covered by the community network under Decision No 2119/98/EC of the European Parliament and of the Council.
8. Derrough T, Bacci S, Lopalco PL. Letter to the editor: Commitment needed for the prevention of congenital rubella syndrome in Europe. *Euro Surveill.* 2012 Mar 8;17(10).
9. Centers for Disease Control and Prevention (CDC). Measles – United States, January 1–August 24, 2013. *MMWR Morb Mortal Wkly Rep.* 2013 Sep 13;62(36):741-3.
10. European Centre for Disease Prevention and Control. Communicable disease prevention among Roma. Stockholm: ECDC; 2012. Available from: <http://ecdc.europa.eu/en/publications/Publications/Communicable-disease-prevention-among-Roma-meeting-report.pdf>
11. European Centre for Disease Prevention and Control. Review of outbreaks and barriers to MMR vaccination coverage among hard-to-reach populations in Europe. Stockholm: ECDC; 2013.
12. European Centre for Disease Prevention and Control. Annual epidemiological report 2013. Reporting on 2011 surveillance data and 2012 epidemic intelligence data. Stockholm: ECDC; 2013. Available from: <http://ecdc.europa.eu/en/publications/Publications/annual-epidemiological-report-2013.pdf>.
13. European Centre for Disease Prevention and Control. Measles and rubella monitoring reports 2011 to 2014. Available from: http://ecdc.europa.eu/en/healthtopics/measles/epidemiological_data/Pages/measles_surveillance_reports.aspx
14. European Centre for Disease Prevention and Control. Communicable disease threats reports. Available from: http://ecdc.europa.eu/en/publications/surveillance_reports/Communicable-Disease-Threats-Report/Pages/default.aspx
15. European Centre for Disease Prevention and Control. Survey on rubella, rubella in pregnancy and congenital rubella surveillance systems in EU/EEA countries. Stockholm: ECDC; 2013. Available from: <http://ecdc.europa.eu/en/publications/Publications/survey-rubella-pregnancy-congenital-surveillance-systems-may-2013.pdf>
16. European Centre for Disease Prevention and Control. Outbreak of measles in Ukraine and potential for spread in the EU. Stockholm: ECDC; 2012. Available from: http://www.ecdc.europa.eu/en/publications/Publications/20120314_RA_Measles_Ukraine.pdf
17. European Centre for Disease Prevention and Control. Rapid risk assessment: Measles on a cruise ship, Mediterranean sea. Stockholm: ECDC; 2014. Available from: <http://www.ecdc.europa.eu/en/publications/Publications/rapid-risk-assessment-measles-cruise-ship-Mediterranean-5-March-2014.pdf>
18. O’Flanagan DSC; Mereckiene J. Vaccination coverage assessment in EU/EEA, 2011. VENICE, Rome; 2012. Available from: http://venice.sissdev.cineca.it/Final_Vaccination_Coverage_Assesment_Survey_2011_1.pdf

19. European Centre for Disease Prevention and Control. Vaccination schedules. 2014 [internet]. [cited 2014 Mar 2]. Available from: <http://vaccine-schedule.ecdc.europa.eu/Pages/Scheduler.aspx>
20. European Centre for Disease Prevention and Control. Let's talk about protection – Enhancing vaccination uptake. Stockholm: ECDC; 2013. Available from: <http://ecdc.europa.eu/en/healthtopics/immunisation/comms-aid/Documents/Vaccine-comms-action-2013.pdf>
21. European Centre for Disease Prevention and Control. Measles and rubella self assessment generating tool – MESSAGE. 2011 [internet]. [cited 2014 Mar 2]. Available from: <http://venice.sissdev.cineca.it/register.php>
22. European Centre for Disease Prevention and Control. Risk assessment guidelines for diseases transmitted on aircraft. 2nd ed. Stockholm: ECDC; 2010. Available from: http://www.ecdc.europa.eu/en/publications/Publications/1012_GUI_RAGIDA_2.pdf
23. European Centre for Disease Prevention and Control. Measles outbreak in Austria – risk assessment in advance of the Euro 2008 football championship. Stockholm: ECDC; 2008. Available from: http://ecdc.europa.eu/en/publications/Publications/0804_MIR_Measles_Outbreak_in_Austria.pdf
24. Euronews. Science special: eliminating measles – personal stories. 2012 [video clip on the internet]. Available from:
 - Arabic <http://arabic.euronews.com/2012/03/26/eliminating-measles-personal-stories/>
 - English <http://www.euronews.com/2012/03/26/eliminating-measles-personal-stories/>
 - French <http://fr.euronews.com/2012/03/26/eliminer-la-rougeole-une-maladie-a-la-gravite-oubliee/>
 - German <http://de.euronews.com/2012/03/26/masern-der-kampf-gegen-die-vergessene-krankheit/>
 - Italian <http://it.euronews.com/2012/03/26/lotta-contro-il-morbillo-vaccinarsi-o-no/>
 - Persian <http://persian.euronews.com/2012/03/26/eliminating-measles-personal-stories/>
 - Portuguese <http://pt.euronews.com/2012/03/26/sarampo-volta-a-ensombrar-europa/>
 - Russian <http://ru.euronews.com/2012/03/26/eliminating-measles-personal-stories/>
 - Spanish <http://es.euronews.com/2012/03/26/el-sarampion-de-vuelta-en-europa/>
 - Turkish <http://tr.euronews.com/2012/03/26/avrupa-da-30000-kisi-kizamik-oldu/>
 - Ukrainian <http://ua.euronews.com/2012/03/26/eliminating-measles-personal-stories/>
25. European Centre for Disease Prevention and Control. Communication on immunisation – building trust. Stockholm: ECDC; 2012. Available from: <http://ecdc.europa.eu/en/publications/Publications/TER-Immunisation-and-trust.pdf>
26. Cairns G, MacDonald L, Angus K, Walker L, Cairns-Haylor T, Bowdler T. Systematic literature review of the evidence for effective national immunisation schedule promotional communications. Stockholm: ECDC; 2012. Available from: <http://ecdc.europa.eu/en/publications/Publications/Literature-review-national-immunisation-schedule-promotional-communications.pdf>
27. European Centre for Disease Prevention and Control. A literature review of trust and reputation management in communicable disease public health, Stockholm: ECDC; 2011. Available from: http://ecdc.europa.eu/en/publications/Publications/Trust_Reputation_Management_Report.pdf
28. Higgins O, Sixsmith J, Barry MM, Domegan C. A literature review on health information-seeking behaviour on the web: a health consumer and health professional perspective. Stockholm: ECDC; 2011. Available from: <http://ecdc.europa.eu/en/publications/Publications/Literature%20review%20on%20health%20information-seeking%20behaviour%20on%20the%20web.pdf>
29. Paradowska-Stankiewicz I, Czarkowski MP, Derrough T, Stefanoff P. Ongoing outbreak of rubella among young male adults in Poland: Increased risk of congenital rubella infections. Euro Surveill. 2013 May 23;18(21).
30. Council conclusions on childhood immunisation: successes and challenges of European childhood immunisation and the way forward. 3095th Employment, Social Policy, Health and Consumer Affairs – Council Meeting, Health Issues. Luxembourg, 6 June 2011.
31. European Centre for Disease Prevention and Control. Measles and rubella monitoring, February 2014 – Reporting on January–December 2013 surveillance data and epidemic intelligence data to the end of February 2014. Stockholm: ECDC; 2014. Available from: <http://www.ecdc.europa.eu/en/publications/Publications/measles-rubella-monitoring-february-2014.pdf>
32. World Health Organization. Rubella (crs) reported cases. [internet]. 2013 [cited 2014 Apr 2]. Available from: http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencecrs.html