



## MEETING REPORT

# First annual meeting of the invasive bacterial infections surveillance network in Europe

17–18 March 2009, Stockholm

## Executive summary

On 17–18 March 2009, 79 public health experts—including epidemiologists and laboratory experts from 25 European Union (EU) and European Economic Area/European Free Trade Association (EEA/EFTA) countries working on invasive bacterial diseases—met at the European Centre for Disease Prevention and Control (ECDC) in Stockholm to discuss the future surveillance of invasive meningococcal (MENI) and *Haemophilus influenzae* (HAEINF) diseases. For each disease, working groups provided their opinion on specific questions regarding surveillance objectives, variables to be collected in enhanced EU surveillance, frequency of reporting and production and timing of regular reports. In addition, the experts expressed their views on the use and feasibility of molecular typing methods for routine surveillance, and on ECDC's and Member States' (MS) roles in the detection of international and cross-border clusters and outbreaks. EU countries have been working together in these areas for several years and the experts at this meeting exchanged ideas on how to further enhance this collaboration.

This was the first meeting of newly nominated disease MENI and HAEINF epidemiology and laboratory surveillance expert contact points. The participants learned about the following: recent developments at the ECDC; the ECDC programme and goals for upcoming years; the development of the new invasive bacterial infection (IBI) metadata set in The European Surveillance System (TESSy); and the progress of laboratory surveillance activities in the EU. The experts presented the status of surveillance and disease trends of invasive bacterial infections in their countries, laboratory method developments and the susceptibility of pathogens to antibiotics. Representatives from the World Health Organization (WHO) and a representative from a vaccine manufacturer presented their activities in the field of invasive bacterial infection. The meeting provided a good opportunity to learn from the experiences of several countries regarding epidemiological and laboratory surveillance activities, prevention and detection of clusters and outbreaks, and how to develop and strengthen multidisciplinary collaboration between different partners.

The outcomes of these discussions have been summarised in session seven. ECDC is committed to ensuring that any issues requiring agreement at a higher level (e.g. by the national surveillance contact points) will be followed-up accordingly and any suggested improvements carefully considered.

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Stockholm, January 2010

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# 1 Scope and purpose

## Background

The first annual meeting of the invasive bacterial infection surveillance (IBIS) network after the transition of EU-IBIS to ECDC took place in Stockholm, 17–18 March 2009.

## Meeting objectives

The following goals of the meeting were outlined and emphasised:

- to reach a consensus about surveillance objectives for MENI and HAEINF with the national experts;
- to explore opportunities for the development of EU laboratory surveillance for IBI;
- to discuss the countries' experiences using TESSy;
- to discuss further improvement of the reporting system by highlighting its strengths and limitations;
- to explore opportunities for including new variables in the enhanced EU IBI Surveillance Network; and
- to discuss the possibility for further development of systematic reports, outputs, format and frequency of reporting.

## Expected outcomes

The meeting was composed of plenary sessions and working groups (see Annex 1), and included pursuing the following points:

- revising the disease specific surveillance objectives for MENI and HAEINF, if needed;
- agreeing upon the further development of IBI laboratory surveillance in the EU;
- receiving proposals from MS for improving the data reporting system and the modes of collaboration with ECDC, and for exploring how to build up and maintain the collaboration;
- agreeing upon the methodology for improving the reporting system;
- discussing the feasibility of including new variables to be collected at the EU level; and
- agreeing upon the methodology for the implementation of systematic reports, output formats and reporting frequency.

# 2 Main discussions

## 2.1 Epidemiology of IBI in the EU, an overview

During session one, an overview of invasive bacterial infections surveillance activities at ECDC was presented. The ECDC Vaccine Preventable Diseases Surveillance Unit (VPD-SUN) presented current and future surveillance activities, with a special focus on the epidemiology and trends of invasive diseases from *N. meningitidis* and *H. influenzae* in 2007 in EU and EEA/EFTA countries. A presentation on WHO perspectives regarding IBI surveillance was given by the WHO European Region representative who described IBI surveillance objectives, core activities and future steps in the WHO European Region, with a special focus on the introduction of *H. influenzae* type b (Hib) vaccine in Ukraine.

## 2.2 Laboratory surveillance of IBI in the EU

After the EU-IBIS transition, laboratory activities have been outsourced to Julius Maximilian University Wurzburg, Germany, and they coordinate activities using their own staff and sub-contractors.

During the meeting, several members of the consortium illustrated ongoing laboratory activities. Presentations were made about the following three aspects of laboratory surveillance:

- 1) the use and value of molecular typing methods in routine surveillance as well as in the research field;
- 2) the EU database that collects laboratory data on meningococcal strains on a voluntary basis from the national reference laboratories in real-time (the so-called EMERT project, coordinated by the European Monitoring Group for Meningococci (EMGM)); and
- 3) the need to harmonise phenotypic and molecular data for strain and antibiotic resistance surveillance of *N. meningitidis* strains.

The coordinator of the network illustrated the main activities of the ongoing outsourced tender, as well as the short-term deliverables for external quality assurance and training for the diagnosis of IBI at the national reference laboratory level. The session ended with a presentation on laboratory aspects of *H. Influenzae*.

## 2.3 Building up the IBI metadata set in TESSy

Experiences from 2007 data collection were presented focusing mainly on general data quality, data comparability—using different case definitions for 2007 data collection—and general problems related to the enhanced data set of variables applied. Possible steps for improving the quality of data collection were presented.

The process and principles of the EU-IBIS network transition was also presented, providing background information on the origin and history of the network and highlighting several aspects (data collection forms, coding of the variables, database structure, website structure, etc.) that have been considered during the transition phase.

## 2.4 Surveillance updates and country experiences

Several participants presented brief updates regarding developments in surveillance, laboratory methodologies, recent trends, outbreaks, as well as the integration of IBI-related laboratory and epidemiological data.

## 2.5 Working groups (four parallel sessions)

The participants were allocated to one of the four working groups according to their main expertise (laboratory expert or epidemiologist, meningococcal disease or *H. influenzae* expert).

The topics to be discussed were different for each group and included both pathogens. Each group dealt with at least two of the following topics: epidemiological and laboratory variables to be collected in the IBI-enhanced EU surveillance; VPD and IBI surveillance objectives; frequency of reporting; implementation of the new case definitions; how to best collect information on vaccination status and vaccine failure; the use of molecular typing in routine surveillance and cluster/outbreak detection; and the expected outputs in the medium-term for IBIS.

As a starting point, the groups got a number of background documents intended to clarify the context and stimulate discussion.

## 2.6 Vaccines and immunisation

During this session, the most recent updates were presented on the development of new meningococcal vaccines, in particular against serogroup B. The presenter gave a short overview on vaccine development going from the empirical approach to the application of reverse technology, presenting the most important factors—Factor H, binds, complements—affecting B vaccine development.

## 2.7 Summary key points of the working groups' discussions

- With regard to the surveillance objectives for IBI, a full consensus among the participants has not yet been reached. The majority of participants agreed that the main objectives should include monitoring disease incidence and strain distributions in Europe by age group, country and seasonality. Additionally, the following objectives were proposed but, because they were neither feasible at the time nor specific IBI objectives, they were not considered priorities for the near future:
  - 1) monitoring the Adverse Events Following Immunization (AEFI); and
  - 2) early detection of outbreaks and/or clusters in MS. However, the involvement of ECDC for the risk assessment of cross-border outbreaks has been positively received.
- Regarding vaccine effectiveness monitoring, the majority of experts think that this is a very complex matter that requires a large amount of information to be collected which, at this stage, is not feasible. However, some participants think that vaccine coverage, safety and effectiveness should be monitored at the EU level and complemented with information on vaccine failures and vaccination schedules. A written protocol should be provided by ECDC to support MS in the attempt to collect information in a standardised way.
- In addition, there was a suggestion to collect data on antimicrobial susceptibility profiles of reported cases for both diseases. In terms of reporting frequency, national experts stressed the importance of reporting validated and cleaned data once a year for both diseases. This reporting frequency has been considered appropriate to fulfil the surveillance objectives stated above. Furthermore, it was suggested that MS should send short reports on outbreaks occurring at the national level to ECDC.
- As a principal for improving surveillance activity, changes in metadata set—leaving out certain variables and adding others (vaccine effectiveness, vaccine failure)—were proposed. The participants agreed on collecting

all variables that could be accurately obtained from all or most MS and eliminating those variables that were likely to be uninformative and incomplete.

- In addition, a clear definition for certain epidemiological and laboratory variables were required (sterile site, epidemiological link, imported, human-to-human transmission, direct contact, vaccination status and antigen detection).
- The consensus of the group was that the 2008 EU case definition should be used and the revision of case definitions is required in order to avoid over- or underreporting.
- With regard to laboratory surveillance, it was agreed that the sub-typing variables used by TESSy should follow the European consensus. It was also agreed that a uniform typing scheme is a prerequisite and that real-time molecular typing data is only valuable for countries with a large number of isolates. It was further recommended that a modified nomenclature should be adopted according to the following formula: Serogroup/FetA type/Sequence type (clonal complex).
- For antibiotics, minimum inhibitory concentrations (MICs)<sup>\*</sup> of rifampicin, penicillin, ciprofloxacin, ceftriaxone/cefotaxime were proposed.
- Regular outputs were proposed, including the following: quarterly reports; newsletters on outbreaks, clusters and special strain circulations; basic descriptive analyses with graphs and maps; and additional tables summarising clinical and epidemiological data from MS.
- A contact list of the EU-IBIS members and their email addresses should be available. All members of the group should be able to access the TESSy data, look at live data and use these data for their presentations.
- A written protocol was requested to support efforts of the MS epidemiologists in their work on IBI surveillance.

## 2.8 Plans for future IBI activities

- The next meeting on IBI will be held in Manchester, UK, on 17–19 June 2009. All participating countries were asked to produce posters summarising national epidemiology of meningococcal and *H. influenzae* infections, highlighting any recent changes and trends regarding these two diseases.

## 3 Conclusions

A key aspect of this meeting was its success in bringing together a wide range of partners including epidemiological and laboratory experts from EU and EEA/EFTA countries and WHO, EU-IBI outsourced laboratory consortium members, as well as invited scientists to discuss the surveillance of IBI in the EU.

Overall, the participants felt the meeting was a success with many lessons learned and that it provided useful and concrete suggestions from the working group discussions that will enable improvements to IBI surveillance in the EU.

Further points to consider for upcoming meetings:

- Future meetings should be organised to include more country-specific presentations.
- Supplementary discussions on methods and obtaining a comprehensive understanding of the molecular epidemiology of meningococci are the prerequisites needed to achieve the surveillance objectives. The need to continue having disease-specific working groups was highlighted. Additional support and capacity building is needed for several EU countries.

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<sup>\*</sup> MIC is defined as the minimum concentration of antibiotic which will inhibit the growth of the isolated microorganism

# Annex 1: Meeting programme

## Tuesday 17 March, 2009

- 10:30** Bus from hotel to ECDC
- 11:00–12:00** Registration and sandwich lunch at ECDC
- 12:00–12:15** Welcome and opening of the meeting  
*Andrea Ammon (ECDC)*
- SESSION 1** **Epidemiology of IBI in the EU, an overview**  
*Chairman: Lucia Pastore Celentano (ECDC)*
- 12:20–12:40** Surveillance of IBI at the EU level: current activities and future plans  
*Andrew Amato (ECDC)*
- 12:40–13:00** Epidemiology and trends of invasive disease from *N. meningitidis* in the EU, 2007  
*Ida Czumbel (ECDC)*
- 13:00–13:20** Epidemiology and trends of invasive disease from *H. influenzae* in the EU, 2007  
*Anna Jansson (ECDC)*
- 13:20–13:40** Surveillance of IBI in the WHO European Region—the WHO perspective  
*David Mercer (WHO EURO)*
- 13:40–14:00** Discussion
- SESSION 2** **Laboratory surveillance of IBI in the EU**  
*Chairman: Per Olcén (National Reference Laboratory, Sweden)*
- 14:00–14:20** IBI Laboratory surveillance in the EU: an update from the consortium members on current and future activities  
*Matthias Frosch (University of Würzburg, Germany)*
- 14:20–14:40** Molecular typing of meningococci: state of the art  
*Martin Maiden (University of Oxford, UK)*
- 14:40–15:00** Real-time molecular epidemiology of meningococci  
*Arie van der Ende (National Reference Laboratory, the Netherlands)*
- 15:00–15:20** Antibiotic resistance—harmonisation of phenotypic and molecular data  
*Muhamed Keir-Taha (Institut Pasteur, France)*
- 15:20–15:40** Laboratory aspects of *Haemophilus influenzae*  
*Mary Slack (HPA, UK)*
- 15:40–16:00** *Coffee break*
- SESSION 3** **Building up the IBI metadata set in TESSy**  
*Chairman Edward van Straten (ECDC)*

- 16:00–16:20** The transfer of EU-IBIS: principles and process  
*Manosree Chandra (HPA, UK)*
- 16:20–16:40** Experiences from 2007 data collections and steps for future data collections  
*Lucia Pastore Celentano & Tina Purnat (ECDC)*
- 16:40–17:00** Discussion
- SESSION 4** **Surveillance updates and country experiences**  
*Chairman Anna Jansson (ECDC)*
- 17:00–17:10** EpiscanGIS: an online geographic surveillance system for meningococcal disease meningitidis  
*Ulrich Vogel (University of Würzburg, Germany)*
- 17:10–17:20** The in vitro susceptibility to five antibiotics of *N. meningitidis* strains isolated last year in Romania  
*Marina Pana (INCDMI Cantacuzino, Romania)*
- 17:20–17:30** Epidemiology of invasive *H. influenzae* in Ireland  
*Piaras O'Lorcain (HPSC Ireland)*
- 17:30–17:40** Epidemiology and surveillance of meningococcal disease in Ireland, 2008  
*Piaras O'Lorcain (HPSC Ireland)*
- SESSION 4:** **Surveillance updates and country experiences—continued...**  
*Chairman Anna Jansson (ECDC)*
- 17:40–17:50** Decreased incidence of meningococcal disease in Belgium  
*Francoise Carion (IPH, Belgium)*
- 17:50–18:00** Spanish Epi lab in meningococcal disease: keeping updated information  
*Rosa Cano and Julio A Vázquez (ISCIII, Spain)*
- 18:15** Bus from ECDC to the restaurant
- 19:00** Dinner hosted by ECDC
- 21:00** Bus from the restaurant to the hotel

## Wednesday 18 March, 2009

- 08:30** Bus from the hotel to ECDC
- SESSION 5** **Working groups (four parallel sessions)**
- 09:00–09:15** Summary of the previous day's work and division into groups  
*Lucia Pastore Celentano (ECDC)*
- 09:15–10:30** **Working group 1:** Epi variables in the metadata set for the surveillance of MENI and HAEMINF in EU: What is good? What has to be modified? What is missing? What is feasible to collect?

	<b>Working group 2:</b> Lab variables in the metadata set for the surveillance of MENI and HAEMINF in EU: What is good? What has to be modified? What is missing? What is feasible to collect?
	<b>Working group 3:</b> Frequency of reporting according to the IBIS objectives
	<b>Working group 4:</b> Implementation of the new case definitions for MENI and HAEMINF
<b>10:30–10:45</b>	<i>Coffee break</i>
<b>SESSION 5</b>	<b>Working groups (four parallel sessions) continued...</b>
<b>10:45–12:00</b>	<b>Working group 1:</b> How best to collect information on vaccination status and on vaccine failure
	<b>Working group 2:</b> How to best detect clusters and outbreaks?
	<b>Working group 3:</b> How best to organise real-time data collection for <i>N. meningitidis</i>
	<b>Working group 4:</b> Outputs expected from the IBIS (reports, publications, meetings, working groups, other activities). How to structure the content of the website
<b>12:00–13:15</b>	Lunch at SMI
<b>SESSION 6</b>	<b>Presentation of the results of the working groups</b>
	<i>Chairman Anna Jansson and Ida Czumbel, (ECDC)</i>
<b>13:30–14:00</b>	Summary report from working group 1
<b>14:00–14:30</b>	Summary report from working group 2
<b>14:30–15:00</b>	Summary report from working group 3
<b>15:00–15:30</b>	Summary report from working group 4
<b>15:30–16:00</b>	<i>Coffee Break</i>
<b>SESSION 7</b>	<b>Vaccine and immunisation</b>
	<i>Chairman Pierluigi Lopalco (ECDC)</i>
<b>16:00–16:15</b>	Latest developments and experiences with the new meningococcal vaccines
	<i>Rino Rappuoli (Novartis, Italy)</i>
<b>16:15–16:30</b>	Discussion
<b>SESSION 8</b>	<b>Plans for future IBI activities</b>
<b>16:30–17:00</b>	Wrap up and next steps
	<i>Lucia Pastore Celentano (ECDC)</i>

## Annex 2: Presentation of the results from the working groups

### Working group 1

#### Session 1: Epidemiological variables for the surveillance of MENI and HAEMINF in EU

The working group reconsidered the epidemiological variables available in the TESSy database. The discussion was mainly focused on *H. influenzae* variables. As a basic principal the group agreed that, in the future, the 2008 EU case definition should only be used for both diseases and only the value 'confirmed' for the variable 'laboratory result'.

The group suggested leaving out variables that do not provide useful information for *H. influenzae* (i.e., Clinical criteria, EpiLinked, AgeMonth, Clinical Presentation, Imported, and Probable Country of Infection) and proposed to focus mainly on the relevant ones.

As a general rule regarding which variable to report, the group suggested 'date of onset' as mandatory for reporting and 'date used for statistics' as one of the other three variables.

For the vaccine effectiveness assessment the date of birth, age of vaccination and the type of vaccine were proposed to be added.

#### Session 2: Vaccination status

The ability to completely capture vaccination related data is currently limited in most countries. Vaccination status should be analysed according to age (based on the country in question's schedule). Therefore, it would be useful to provide more detailed data on vaccine type, date of birth and age of vaccination. Various participants were reserved about both the analysis of vaccine effectiveness and pooling results for vaccination status from different countries because of the diversity of data quality and low data availability.

Participants agreed to collect information on vaccine failure when it becomes available and proposed having this variable instead of vaccination status. A definition of vaccine failure should be provided for the countries.

Some countries feel that the information quality of vaccination status will improve in the upcoming years. The participants agreed that good quality data is essential for meaningful analysis and proposed using a European survey within the VENICE network for collecting information on vaccination status variables available in MS.

The ECDC surveillance unit should liaise closely with other networks—VENICE, EUVAC-NET, WHO—who also collected surveillance data from the Member States. As the MS report their vaccination coverage to WHO, the group proposed using WHO coverage data in order to avoid double reporting.

### Working group 2

#### Session 1: Laboratory variables in the TESSy metadata set

The working group strongly endorsed the IBI surveillance objective of estimating the incidence of meningococcal disease in Europe by MS, age group and seasonality, and suggested that this should be treated as an overriding priority. To this end, the group recommended that the collected data should be of high quality with the objective of collecting extremely accurate key variables from as many MS as possible. Specific recommendations concerning these key variables were made. As a basic principal, the group members agreed on a collection of variables that could accurately be obtained from all or most of the MS along with removing the variables that were likely to be uninformative and incomplete.

A single data entry point model was recommended in order to avoid duplicate entries and promote harmonisation with reference to core variables (Classification, Clinical Criteria, Laboratory Result and EpiLinked). Regarding disease specific variables, only one field option was proposed to define 'Specimen' which has implications also for the field 'TestMethod'. The group felt that this information could be omitted.

Molecular typing of PorA VR1, PorA VR2 and FetA are sufficient for describing the epidemiology of IBI. It was further recommended that a modified nomenclature should be adopted according to the below formula: Serogroup/FetA type/Sequence type (clonal complex).

With regard to the information on antibiotics, the group recommended that MICs of Rifampicin, Penicillin, Ciprofloxacin and Ceftriaxone/Cefotaxime should be recorded.

Vaccine status was considered to be meaningless without information on vaccine, batch, immunisation protocols, etc; all of which are not collectable at the European level.

## Session 2: How to best organise *N. meningitidis* molecular surveillance

The group discussed real-time reporting of molecular data in terms of its importance, feasibility, frequency and timeliness. The importance of real-time molecular typing data collection at national reference level for countries with large number of bacterial isolates was highlighted. In countries with few isolates such activities have limited value and not cost effective. Real-time or near real-time surveillance with molecular data is feasible only for reference laboratory data. Real-time surveillance at daily and weekly levels is important for detecting outbreaks. It is conducted in many countries and can be efficiently achieved at the European level with the peer-to-peer EMERT system.

For monitoring changes in strain prevalence, including those occurring as a consequence of vaccine introductions, high quality surveillance data, collected annually or semi-annually, are appropriate.

## Working group 3:

### Session 1: VPD specific surveillance objectives, including IBI and the frequency of reporting

In terms of reporting frequency, the MS experts expressed their wish to submit data annually for pathogens, *N. meningitidis* and *H. influenzae*.

With regard to objectives, the participants agreed on the following:

- monitoring disease incidence in Europe by age group and seasonality;
- monitoring strain incidence and identifying emerging strains, strain replacement and new strains;
- monitoring antimicrobial susceptibility;
- monitoring vaccine coverage, effectiveness and safety complemented by vaccine failure and vaccination schedules; and
- designing an appropriate response and measuring the impact of intervention.

A uniform typing scheme and comprehensive understanding of the molecular epidemiology of meningococci are prerequisites to achieve these objectives.

A written protocol was requested to support the efforts of the Member States' epidemiologists in their work on IBD surveillance, with regard to vaccine effectiveness monitoring. The first and second working groups also discussed these objectives and concluded that the monitoring of vaccine effectiveness and vaccine coverage should not be prioritised at this moment.

### Session 2: How to best detect clusters and outbreaks?

During this session the discussion focused specifically on meningococcal disease and two main topics were addressed: the detection of cross-border outbreaks and real-time case-based data collection.

With regard to the detection of cross-border outbreaks, in principal, it was agreed that epidemiological surveillance and laboratory data should be used for detection of cross-border outbreaks, and this implies changes in the definition of some variables and in the data format used. Namely, the cluster ID assigned by ECDC should be used by the MS to track and follow cases. Fine-typing variables used by TESSy should follow the European consensus published recently<sup>†</sup>. EpiLinked definitions should include the 'travel' and 'supranational' groups, and 'Imported' should be rephrased to reflect a European context.

The utility of real-time data collection by TESSy was questioned by the participants. The feasibility of real-time data collection was excluded by annual submission of the collected data.

Participants from working groups 1 and 2, who also discussed the topic, had a similar view on it and were of the opinion that clusters and outbreak detection should be considered a national issue and the responsibility of the MS. It was suggested that MS should send a short report on their national outbreaks to ECDC.

<sup>†</sup> Jolley KA, Brehony C, Maiden MC. Molecular typing of meningococci: recommendations for target choice of nomenclature. FEMS Microbiol Rev. 2007 Jan; 31(1): 89–96.

## Working group 4:

### Session 1: Implementation of the new case definitions for MENI and HAEMINF

The following comments and proposals were made regarding the case definitions for MENI and HAEMINF:

- It was uncertain whether the 2008 case definition was for *H. influenzae*, *H. influenzae* type b or both.
- In the absence of possible and probable criteria, *H. influenzae* cases that are not laboratory confirmed will be lost.
- The countries with high levels of antibiotic use and suboptimal blood culture systems will have a large number of negative blood cultures.
- According to the 2008 invasive meningococcal disease case definition, all fever and septic arthritis cases should be reported into TESSy as possible meningococcal disease cases. Greater weight to some of these signs should be given.
- Since antigen detection for invasive meningococcal disease is not a sensitive test, adding Gram-stain and detection of antigen in other fluids, such as joint fluid, was suggested.
- In addition, clearly defining certain variables was required (sterile site, epidemiological link, vaccination status).

As the current report form in some MS does not follow the format required by ECDC and changing forms is a lengthy procedure, applying the case definition to all MS does not appear feasible.

### Session 2: Outputs expected from IBI surveillance network

Group suggestions were provided for regular outputs including quarterly reports, newsletters on outbreaks, clusters and special strain circulations, list of publications from data set, and basic descriptive analyses with graphs and maps. Additional tables summarising clinical and epidemiological data from MS and the results of review of different surveillance systems in place and vaccination schedules in MS. A contact list of the EU-IBI members and email addresses should be available.

In the future, all members of the group should be able to access the TESSy data, look at live data and use these data for their presentations.

## Annex 3: List of participants

Country	Name	Organisation
Austria	Sigrid Heuberger	National Reference Centre for Meningococci, Pneumococci and Haemophilus influenzae, Austrian Agency for Health and Food Safety
Austria	Robert Muchl	Vaccine European New Integrated Collaboration Effort (VENICE), Federal Ministry For Health Women Directorate General Public Health
Belgium	Francoise Carion	National Meningococcal Reference Laboratory, Scientific Institute of Public Health
Bulgaria	Teodora Georgieva	National Center of Infectious Parasitic Diseases (NCIPD)
Bulgaria	Dimitar Nashev	National Center of Infectious Parasitic Diseases (NCIPD)
Czech Republic	Pavla Krizova	National Institute of Public Health (CNIPH)
Czech Republic	Vera Lebedova	National Institute of Public Health (CNIPH)
Czech Republic	Jitka Kalmusova	National Institute of Public Health (CNIPH)
Denmark	Lotte Lambertsen	Department of Bacteriology, Mycology and Parasitology, Statens Serum Institute
Estonia	Inna Sarv	Central Laboratory of Communicable Diseases, Health Protection Inspectorate
Estonia	Natalia Kerbo	Department of Epidemiology, Health Protection Inspectorate
Estonia	Unna Jöks	Central Laboratory for Microbiology, Health Protection Inspectorate
Estonia	Irina Filippova	Department of Epidemiology, Health Protection Inspectorate
Finland	Anni Virolainen-Julkunen	Department of Microbiology, National Public Health Institute
Finland	Majja Toropainen	Department of Vaccines, National Public Health Institute
France	Muhamed Keir-Taha	Unite des Neisseria & Centre National de Reference des Meningocoque, Institut Pasteur
France	Agnès Lepoutre	Department des Maladies Infectieuses, Institut de Veille Sanitaire
France	Olivier Gaillot	Laboratoire de Bacteriologie, Hygiene Hospitaliere, Centre de Biologie et Pathologie
France	Isabelle Parent du Chatelet	Department des Maladies Infectieuses, Institut de Veille Sanitaire
Germany	Matthias Frosch	Institut für Hygiene und Mikrobiologie, Universität Würzburg
Germany	Wiebke Hellenbrand	Department of Infectious Disease Epidemiology, Robert Koch Institute

Germany	Anette Siedler	Department of Infectious Disease Epidemiology, Robert Koch Institute
Germany	Ulrich Vogel	Institut für Hygiene und Mikrobiologie, Universität Würzburg
Germany	Johannes Elias	Institut für Hygiene und Mikrobiologie, Universität Würzburg
Greece	Danai Pervanidou	Hellenic Centre for Disease Control and Prevention
Greece	Georgina Tzanakaki	National Meningococcal Reference Laboratory, National School of Public Health
Greece	Maria Theodoridou	Paediatric Clinic of the University of Athens, "Aghia Sofia" Children's Hospital
Greece	Anastasia Pangalis	Department of Clinical Microbiology, "Aghia Sofia" General Children's Hospital
Hungary	Ákos Toth	Department of Bacteriology, National Centre for Epidemiology
Hungary	Judit-Krisztina Horvath	Communicable Disease Epidemiology, National Centre for Epidemiology
Ireland	Piaras O'Lorcain	Health Protection Surveillance Centre, Surveillance Scientist
Ireland	Suzanne Cotter	Health Protection Surveillance Centre, Specialist in Public Health Medicine
Italy	Marina Cerquetti	Infectious, Parasitic and Immune-Mediated Diseases, Istituto Superiore di Sanita
Italy	Paola Mastrantonio	Infectious, Parasitic and Immune-Mediated Diseases, Istituto Superiore di Sanita
Italy	Rino Rappuoli	Novartis, Italy
Lithuania	Greta Amasenkovaite	Vaccine European New Integrated Collaboration Effort, Seasonal Influenza Vaccination Policy and Coverage contact
Lithuania	Dauksiene Snieguole	Department of Infectious Diseases, Dermatovenerology and Microbiology
Luxembourg	Jos Even	Laboratory of Molecular Pathology, Centre de Recherche Public Sante
Luxembourg	Joël Mossong	Microbiology Unit, Laboratoire National de Santé
Malta	Paul Caruana	Medical Microbiologist, Department of Pathology, St Luke's Hospital
Netherlands	Arie Van der Ende	Department of Medical Microbiology, Academic Medical Center
Netherlands	Sabine De Greeff	Surveillance and Epidemiology of Vaccine-preventable Diseases, National Institute of Public Health and Environment
Netherlands	Lodewijk Spanjaard	Department of Medical Microbiology, Reference Laboratory for Bacterial Meningitis
Norway	Dominique Caugant	Department of Bacteriology, National

		Institute of Public Health
Norway	Øistein Løvoll	Department of Infectious Disease Epidemiology, Folkhelseinstitutt
Poland	Pawel Stefanoff	Department of Epidemiology, National Institute of Public Health,
Poland	Justyna Rogalska	Department of Epidemiology, Unit of Surveillance of Vaccine-Preventable Diseases
Poland	Anna Skoczynska	National Reference Centre for Bacterial Meningitis, National Institute of Public Health
Poland	Alicja Kuch	Department of Epidemiology and Clinical Microbiology, National Medicines Institute
Portugal	Maria Joao Simões Pedro	Centro de Bacteriologia, Instituto Nacional de Saúde Dr Ricardo Jorge
Portugal	Laurinda Queiros	Public Health Doctor, Centro Regional de Saúde Pública de Norte
Portugal	Paula Lavado	Centro de Bacteriologia, Instituto Nacional de Saúde Dr Ricardo Jorge
Romania	Aurora Stanescu	Center of Communicable Diseases Prevention and Control, Institute of Public Health
Romania	Marina Pana	INCDMI, Cantacuzino Institute
Romania	Vasilica Ungureanu	National Reference Center for Streptococci, Cantacuzino Institute
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## Annex 4: Abbreviations

AEFI	Adverse events following immunization
DSN	Dedicated surveillance network
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EFTA	European Free Trade Association
EU	European Union
EU-IBIS	The European Union Invasive Bacterial Infections Surveillance
EMGM	European Monitoring Group for Meningococci
HAEINF	<i>Haemophilus influenzae</i> diseases
IBI	Invasive bacterial infections
MENI	Invasive meningococcal diseases
MIC	minimum inhibitory concentration
MS	Member States
TESSy	The European Surveillance System
VPD SUN	Vaccine Preventable Diseases Surveillance Unit
WHO	World Health Organization