EUPHEM

EUPHEM REPORT

# Summary of work activities

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European Public Health Microbiology Training Programme (EUPHEM), 2013 cohort

## Background

According to the European Centre for Disease Prevention and Control (ECDC) Advisory Group on Public Health Microbiology ('national microbiology focal points'), public health microbiology is a cross-cutting area that spans the fields of human, animal, food, water, and environmental microbiology, with a focus on human population health and disease. Its primary function is to improve health in collaboration with other public health disciplines, in particular epidemiology. Public health microbiology laboratories play a central role in detection, monitoring, outbreak response and the provision of scientific evidence to prevent and control infectious diseases.

European preparedness for responding to new infectious disease threats requires a sustainable infrastructure capable of detecting, diagnosing, and controlling infectious disease problems, including the design of control strategies for the prevention and treatment of infections. A broad range of expertise, particularly in the fields of epidemiology and public health microbiology, is necessary to fulfil these requirements. Public health microbiology is required to provide access to experts in all relevant communicable diseases at the regional, national and international level in order to mount rapid responses to emerging health threats, plan appropriate prevention strategies, assess existing prevention disciplines, develop microbiological guidelines, evaluate/produce new diagnostic tools, arbitrate on risks from microbes or their products and provide pertinent information to policy makers from a microbiological perspective.

According to Articles 5 and 9 of ECDC's founding regulation (EC No 851/2004) 'the Centre shall, encourage cooperation between expert and reference laboratories, foster the development of sufficient capacity within the community for the diagnosis, detection, identification and characterisation of infectious agents which may threaten public health' and 'as appropriate, support and coordinate training programmes in order to assist Member States and the Commission to have sufficient numbers of trained specialists, in particular in epidemiological surveillance and field investigations, and to have a capability to define health measures to control disease outbreaks'.

Moreover, Article 47 of the Lisbon Treaty states that 'Member States shall, within the framework of a joint programme, encourage the exchange of young workers.' Therefore, ECDC initiated the two-year EUPHEM training programme in 2008. EUPHEM is closely linked to the European Programme for Intervention Epidemiology Training (EPIET). Both EUPHEM and EPIET are considered 'specialist pathways' of the two-year ECDC fellowship programme for applied disease prevention and control.



Stockholm, September 2015

This report summarises the work activities undertaken by Didrik F. Vestrheim, cohort 2013 of the European Public Health Microbiology Training Programme (EUPHEM) at the Norwegian Institute of Public Health, Oslo, Norway.

All EUPHEM activities aim to address different aspects of public health microbiology and underline the various roles of public health laboratory scientists within public health systems. Didrik is a senior microbiologist who has worked with Streptococcal diseases, in particular penumococcai and antimicrobial resistance for many years before starting the EUPHEM programme.

# Methods

This report accompanies a portfolio that demonstrates the competencies acquired during the EUPHEM fellowship by working on various projects, activities and theoretical training modules.

Projects included epidemiological investigations (outbreaks and surveillance); applied public health research; applied public health microbiology and laboratory investigation; biorisk management; quality management; teaching and public health microbiology management; summarising and communicating scientific evidence and activities with a specific microbiological focus.

The outcomes include publications, presentations, posters, reports and teaching materials prepared by the fellow. The portfolio presents a summary of all work activities conducted by the fellow, unless prohibited due to confidentiality regulations.

# Results

The objectives of these core competency domains were achieved partly through project or activity work and partly through participation in the training modules. Results are presented in accordance with the EUPHEM core competencies, as set out in the EUPHEM scientific guide[1].

## 1. Epidemiological investigations

### 1.1. Outbreak investigations

Supervisors: Katrine Borgen, Line Vold

#### *A. Outbreak of* Salmonella *Coeln in Norway, 2013*

A nationwide outbreak of *Salmonella* Coeln, comprising 26 cases identified between 20 October 2013 and 4 January 2014, was investigated. A matched case–control study was performed, along with an environmental investigation and detailed trace-back of food purchases to identify the source of the outbreak. In the case–control study, cases were found to be more likely than controls to have consumed a ready-to-eat salad mix (matched odds ratio 20, 95% confidence interval 2.7-infinity). By trace-back of purchases one brand of ready-to-eat salad was indicated, but all environmental samples were negative for *Salmonella*. The outbreak underlines that pre-washed and bagged salads carry a risk of infection despite thorough cleaning procedures by the importer. To further reduce the risk of infection by consumption of ready-to-eat salads, product quality should be ensured by importers. Outbreaks linked to salads reinforce the importance of implementation of appropriate food safety management systems, including good practices in lettuce production.

Both an EPIET and EUPHEM fellow participated in the investigation team. Didrik Vestrheim participated in all stages of outbreak investigation, performed control interviews, analysed data and wrote the manuscript.

#### *B. Modules*

The EPIET/EUPHEM introductory course familiarised participants with the methods and logistical aspects of outbreak investigations. The module 'Computer tools in outbreak investigations' taught essential data management skills (entering, validating and cleaning data), dataset management and how to perform case–control studies, descriptive and cohort studies, including stratified analyses.

**Educational outcome:** Participation in outbreak team meetings and teleconferences, involvement in outbreak investigations (case definitions, active case-finding, data collection, data analysis), writing of report and scientific article.

[1] European Centre for Disease Prevention and Control. European public health training programme. Stockholm: ECDC; 2013. Available from: http://ecdc.europa.eu/en/publications/Publications/microbiology-public-health-training-programme.pdf

## 1.2. Surveillance

Supervisors: Hilde Kløvstad, Katrine Borgen, Ingeborg Aaberge

### *A. Evaluation of HIV surveillance in Norway*

AIDS has been notifiable to the Norwegian Surveillance System for Communicable diseases (MSIS) since 23 August 1983, and reporting of HIV infection since 2 May 1986. AIDS is notified by name, while HIV infection is notified anonymously. We performed an evaluation of the current system for HIV surveillance in Norway in the context of a changing epidemic and future needs for HIV surveillance, including the need for changes indicated in a national strategy 2013–2015 ('Revitalisering og konkretisering') and the proposed dataset requested by ECDC. We assessed the operational challenges of the system and identified the need for future changes, by examining the description of the surveillance data, conducting interviews with operating personnel, and sending questionnaires to clinicians and laboratories that participate in HIV surveillance. The aim of the evaluation was to guide future changes in the objectives for the surveillance system, and changes to the medical and epidemiological data included. The anonymous surveillance system was found to have a high completeness rate for key variables, but to be resource intensive. An evaluation report was distributed to key stakeholders in Norway.

### *B. Surveillance of invasive pneumococcal disease, 2013 and 2014*

Invasive pneumococcal disease (IPD) is notifiable to MSIS. A pneumococcal conjugate vaccine (PCV) was included in the childhood immunisation programme in 2006. Surveillance data are compiled and quality checked annually for reporting at national level and for transfer to The European Surveillance System (TESSy). The objectives of this activity were twofold: to describe the serotype-specific incidence of IPD and assess vaccine programme effectiveness; and to describe the prevalence of antimicrobial resistance among pneumococci isolated from cases of IPD.

The overall incidence of IPD was 12 cases per 100 000 population in 2013, and 11 cases per 100 000 population in 2014. In 2013, isolates were available for 595 (96%) of 620 notified cases of IPD, and non-susceptibility to penicillin was detected in 19 (3.2%) of the isolates. In 2014, isolates were available for 555 (98%) of 569 notified cases of IPD, and non-susceptibility to penicillin was detected in 29 (5.2%) of them. One case of PCV vaccine failure was observed in 2014.

Data from IPD surveillance reinforce that the PCV immunisation programme is highly effective, with a decline of IPD incidence in both immunised and non-immunised age groups. The prevalence of antimicrobial resistance among pneumococci is low. The surveillance data are used for recommendations in the use of pneumococcal vaccines, and for information in the process of procuring vaccines to the national childhood immunisation programme.

Being responsible for the national reference laboratory function for pneumococci at NIPH, Didrik Vestrheim participated in the surveillance by reporting results to MSIS, and, in collaboration with the Department of Infectious Disease Epidemiology, performed quality checks and compiled the datasets, and analysed, described and reported the results. The fellow also collaborated with the Department of Vaccines in the vaccine procurement process.

NIPH participated in an ECDC-funded project for active surveillance of IPD in children under 5 years old. A network, SpIDnet, was established and coordinated by EpiConcept. Surveillance data were regularly quality checked and reported to the network coordinator. Didrik Vestrheim participated in SpIDnet as the NIPH representative and project leader.

### *C. Establishing laboratory-based surveillance of severe flu in hospitalised patients*

The A(H1N1)pdm09 pandemic revealed a lack of information on the incidence and severity of influenza among hospitalised patients. Strengthening influenza surveillance and pandemic preparedness are among NIPH's strategic goals. An NIPH working group met in spring 2014 to discuss alternatives for the surveillance of influenza in hospitals. The group suggested that enhanced laboratory-based surveillance should be implemented, building on an existing voluntary laboratory notification system. In the long term, other solutions for surveillance will be further discussed, taking into consideration the limitations of existing data sources. A report describing the work of the group and the suggested surveillance system was finalised in June 2014. The enhanced laboratory surveillance was piloted during the 2014–2015 influenza season.

### *D. Modules*

The EPIET/EUPHEM introductory course familiarised participants with the development, evaluation and analysis of surveillance systems.

**Educational outcome:** Participation in disease-specific networks at the national and European levels; analysis of laboratory-based surveillance systems at hospital, country and European level; analysis of laboratory, drug resistance and national surveillance data; questionnaire design; writing scientific articles and the formulation of specific public health recommendations.

# 2. Applied public health microbiology research

Supervisors: Ingeborg Aaberge and Audun Aase

## A. Seroprevalence of *Borrelia* in Norway

The incidence of Lyme borreliosis in Norway ranged from 5.0 to 7.3 cases per 100 000 population per year in the period 2004–2013, with the highest annual incidence in coastal areas in the south of Norway. In previous studies, IgG antibodies have been detected in up to 18% of healthy adult blood donors in the southernmost part of Norway. A cross-sectional study was performed to estimate the prevalence of antibodies against *Borrelia burgdorferi sensu lato* in Norway, analysed by age-group and geography to provide a nationwide reference of positive predictive values for diagnostic testing. From a sample of 3 057 sera, we found an overall seroprevalence of 4.0% (95% CI: 2.4%–6.6%). By geography, age-standardised seroprevalence ranged from 1.8% (95% CI: 1.0%–3.0%) in northern Norway to 8.8% (95% CI: 5.4%–14.0%) in the southernmost county. The seroprevalence increased by age, with a 6.3% (95% CI: 3.6%–10.7%) seroprevalence in the ≥ 50 year age group, as compared with 1.8% (95% CI: 1.1%–2.9%) in children aged 2–4 years. The overall seroprevalence was lower than has previously been reported from Norway. The distribution varied by geography and increased by age. The results provided regional pre-test probabilities for positive test results.

The project was proposed by diagnostic laboratories participating at an expert meeting for harmonisation of *borrelia* laboratory reports, see section 5.A. Didrik Vestrheim participated in study preparation, data analyses and communication of the results.

## B. Carriage of *Streptococcus pneumoniae* among children in Norway, 2013

A carriage study of *S. pneumoniae* was performed among children attending daycare centres (DCC) in Oslo and surrounding municipalities. The study was a follow-up to carriage studies performed in 2006 and 2008, in order to monitor shifts in overall carriage prevalence and serotype-specific prevalence following introduction of the 7-valent pneumococcal conjugate vaccine (PCV7) in 2006 and subsequent switch to the 13-valent vaccine (PCV13) in 2011. Nasopharyngeal swabs were obtained in autumn 2013 from children attending DCC (874 swabs, 583 isolates). Serotyping, multilocus sequence typing and antimicrobial susceptibility testing were performed on all isolates. Results were compared with samples from 2006 (610 swabs, 538 isolates) and 2008 (600 swabs, 562 isolates). The carriage prevalence in 2013 was 62 per 100 (95% CI: 58–66), a significant decrease from 2006 and 2008. PCV13 serotypes accounted for 7% of isolates in 2013. Non-PCV13 prevalence increased from 2006 to 2008 (prevalence ratio: 1.73 (95% CI: 1.40–2.15)) but remained stable in 2013. In 2013, the serotype and genetic diversity had decreased slightly, and distinct serotype and genetic profiles clustered more within DCC than in the earlier samples. Serotype switch was uncommon. Carriage of PCV13 serotypes has decreased without a coinciding increase in non-PCV13 serotypes. The serotype and genetic shifts among non-PCV13 serotypes suggest that a new equilibrium has not yet been reached. As the few non-PCV13 serotypes that increased have generally a lower invasive capacity than vaccine serotypes, direct and indirect protection of PCV13 against invasive pneumococcal disease can be expected to continue.

This study was performed as a part of a Ph.D. project (Ph.D. fellow Anneke Steens). Didrik Vestrheim participated as supervisor to the Ph.D. fellow, contributing to protocol writing, applying for ethical clearance, recruiting study personnel, recruiting study participants, obtaining specimens, and participating in data analyses and writing the manuscript.

## C. Modules

While the EPIET/EUPHEM introductory course focused on the development and presentation of study protocols, the module 'Initial management in public health microbiology' focused on laboratory aspects, time management and collaboration as a team.

**Educational outcome:** Preparation of study protocols; organisation of a multicentre study; interpretation of typing results; data analysis; writing of scientific articles; supervision of research studies.

# 3. Applied public health microbiology and laboratory investigations

Supervisor: Ingeborg Aaberge

## A. Serotype distribution and antimicrobial susceptibility of *S. pneumoniae* isolated from cases of invasive pneumococcal disease, 2013 and 2014

Clinical isolates from cases of invasive pneumococcal disease (IPD) are referred to the national reference laboratory for pneumococci at NIPH for serotyping and antimicrobial susceptibility testing. They are analysed continuously in order to report data on serotype distribution and antimicrobial resistance to the diagnostic laboratories, MSIS and the Norwegian Surveillance system for Antimicrobial Resistance in microbes (NORM).

In 2013 and 2014, laboratory analyses were continuously supervised, which included trouble-shooting. Results were interpreted and reported to the primary laboratory, MSIS and NORM. On an annual basis, laboratory data was linked with MSIS, followed by a quality check of the surveillance data. The activities of the reference laboratory were reported to the Directorate of Health.

Overall, 681 isolates were analysed in 2013, of which 651 were from sterile sites. In 2014, 619 isolates were analysed, of which 575 were from sterile sites. In 2013, 43 different serotypes were identified, while 44 different serotypes were identified in 2014.

The number of isolates received at the national reference laboratory has declined following the introduction of PCV in the childhood immunisation programme. The data on serotype distribution and antimicrobial resistance in pneumococci is used to develop Norwegian recommendations for use of pneumococcal vaccines.

## B. Outbreak of wound botulism in people who inject drugs, Norway, October to November 2013

During an outbreak of wound botulism in 2013, a limited diagnostic capability was identified in Norway. A rapid test for botulinum toxin was available at NIPH. Identification of toxin in human specimens was attempted, although unsuccessful. Following analysis by mouse bioassay, performed by the Veterinary Institute, botulism was confirmed in four of six cases. Didrik Vestrheim performed laboratory analyses at NIPH, and contributed to the manuscript preparation.

## C. Training

A one-week training visit to Public Health England, Colindale, UK, was arranged for an introduction to whole genome sequencing (WGS) of food-borne bacteria and the use of WGS for outbreak detection and investigation. Practical aspects of specimen preparation and analysis, as well as interpretation of typing results were covered.

WGS has not been established as a routine service at NIPH. The capacity for WGS is, however, rapidly expanding at NIPH, and the knowledge and experience obtained from the stay at PHE will be valuable for implementation and use of WGS for outbreak investigation.

**Educational outcome:** Understand the limitations of laboratory methods; make scientific presentations at conferences and write scientific articles; application of laboratory methods to analyse and interpret resistance mechanisms.

# 4. Biorisk management

Supervisor: Ingeborg Aaberge

## A. EQuaTox project, capacity for detection of toxins with biological threat potential

A European project, managed by the Robert Koch Institute, was set up to improve the capacity and quality of identification of toxins with biological threat potential. Proficiency testing for the identification of three toxins was performed during 2012–2014: ricin, botulinum toxin, and staphylococcal enterotoxin B. Before participating in this project, NIPH did not have methods available for toxin detection. A rapid diagnostic test platform was selected, the method was established at the preparedness laboratory at NIPH, and experience gained on limitations of methods.

Didrik Vestrheim acted as the Norwegian contact point and project leader, obtained permits for import of the specimens, decided on the choice of test to implement, participated in laboratory analyses and result reporting.

## B. Preparedness on-call duty for biosafety level 3 (BSL3), NIPH, Norway

A Norwegian preparedness laboratory is located at NIPH, offering advice and laboratory services on a 24/7 basis by a team of technicians and clinical microbiologists. The team receives biannual training in the BSL3 laboratory. Specimens suspected to be highly pathogenic are received from diagnostic laboratories. Samples processed by the preparedness laboratory include suspected *Bacillus anthracis* (human isolates and environmental samples), *Brucella* spp., *Burkholderia pseudomallei*.

## C. Biorisk management module, ECDC, Sweden

This five-day module provided techniques for biorisk/biosafety assessment and mitigation, including WHO recommendations on biosafety management in laboratories. One day focused on international regulations for the transportation of dangerous goods, as determined by the International Civil Aviation Organization.

**Educational outcome:** Understand processes associated with BSL3/BSL4 laboratories; experience different personal protective equipment; understand the principles and practices of biorisk management; biorisk assessment and biorisk mitigation; understand the limitations of laboratory methods; participation in networks at the national and European levels.

# 5. Quality management

Supervisor: Ingeborg Aaberge

## A. Harmonisation of laboratory reports for Borrelia

Diagnostic laboratories in Norway mainly use ELISA methods for identification of *Borrelia* antibodies. Laboratory results aid clinicians in the diagnosis of Lyme borreliosis. However, test results are reported inconsistently between diagnostic laboratories, leaving room for confusion. By request from the Directorate of Health, an attempt was made to harmonise reporting practices by diagnostic laboratories. In collaboration with the national reference laboratory for *Borrelia* (Sørlandet Hospital Trust), a questionnaire regarding *Borrelia* diagnostics was distributed to all clinical microbiology laboratories in Norway, with an invitation to a harmonisation meeting. A questionnaire response was received from 16 of 23 laboratories, and 15 laboratories were represented at a discussion meeting held at NIPH on 17 June 2014. Following the meeting, a set of standard comments for reporting were developed and distributed. In addition, results from the questionnaire were incorporated in an ongoing evaluation of the surveillance system for Lyme borreliosis in Norway.

## B. Quality assurance and revision of accredited methods

At the national reference laboratory for pneumococci at NIPH, identification (including serotyping) and antimicrobial susceptibility testing (AST) is performed according to accredited methods. To conform with the requirements for accredited methods, external quality assessments are perfomed biannually for serotyping and AST. Standard operating procedures are revised, internal audits are perfomed, and quality controls are assessed regularly. The Norwegian accreditation authority perform annual audits at NIPH.

**Educational outcome:** quality assurance and quality control; questionnaire design.

# 6. Teaching and pedagogy

## A. Screening and vaccinology

Lectures on screening and vaccinology for students the Nordic School of Public Health (Nordiska skolen for folkhälsevetenskap), Göteborg Sweden.

## B. Outbreak investigation

Facilitation of case study at training course for municipal health officers in Norway. Norwegian Institute of Public Health, Oslo, Norway.

## C. Antibiotic awareness day 2014

Information stand with experiments for children to increase awareness on hand hygiene and antimicrobial resistance. Technical Museum, Oslo, Norway.

## D. Supervision

Supervision of EPIET fellow evaluating pertussis surveillance system in Norway.

Supervision of EUPHEM fellow comparing transport media used in pneumococcal carriage studies.

Supervision for Ph.D. fellow studying pneumococcal carriage in Norway, and impact of pneumococcal immunisation programme.

**Educational outcome**: Planning and organisation of lectures; guiding of case studies, defining learning objectives and teaching laboratory and microbiology topics to epidemiologists; supervision of projects.

# 7. Public health microbiology management

## A. 'Initial management in public health microbiology', ECDC, Stockholm, Sweden

This one-week module focused on understanding roles and responsibilities in public health management. Topics included the identification of different management styles, team roles and team evolution, the delegation of tasks and the provision of structured feedback.

## B. Public health microbiology management components as part of regular projects and duties

Public health microbiology management was an integral component of all projects and activities during the fellowship. This included laboratory management, ethical and integrity considerations, team building and coordination, research collaboration, time management, management of cultural differences in international contexts and working in a multidisciplinary team with microbiologists, physicians, laboratory technicians, epidemiologists, statisticians, government officials, public health officers and logisticians.

**Educational outcome:** Working in a multidisciplinary public health team; understanding team management; planning, scheduling and organising research projects.

# 8. Communication

## A. Publications

1. Vestrheim DF, Lange H, Nygård K, Borgen K, Wester AL, Kvarme ML, Vold L. Are ready-to-eat salads ready to eat? An outbreak of *Salmonella* Coeln linked to imported, mixed, pre-washed and bagged salad, Norway, November 2013. (Submitted).
2. Steens A, Caugant DA, Aaberge IS, Vestrheim DF. Decreased carriage and genetic shifts in the *Streptococcus pneumoniae* population after changing the 7-valent to the 13-valent pneumococcal vaccine in Norway. Pediatr Infect Dis J. 2015 May 26.
3. Vestrheim DF, Aaberge I, Herstad T, Aase A. Seroprevalence of Lyme borreliosis in Norway, 2011-2013. (In preparation).
4. MacDonald E, Arnesen TM, Brantsaeter AB, Gerlyng P, Grepp M, Hansen BÅ, Jonsrud K, Lundgren B, Mellegård H, Møller-Stray J, Rønning K, Vestrheim DF, Vold L. Outbreak of wound botulism in people who inject drugs, Norway, October to November 2013.Euro Surveill. 2013 Nov 7;18(45):20630.
5. MacDonald E, Vestrheim DF, White R, Konsmo K, Lange H, Aase A, Nygård K, Aaberge IS, Vold L. Are the current notification criteria for Lyme borreliosis in Norway suitable? Results of an evaluation of Lyme borreliosis surveillance in Norway, 1995-2013. (In preparation).

## B. Reports

1. Caugant D, Haugen IL, Konsmo K, Nordstrand K, Steinbakk M, Storsæter J, Vestrheim DF, Winje BA. Annual report 2014, Invasive bacterial infections (in Norwegian). Norwegian Institute of Public Health, 2015.
2. Blystad H, Caugant D, Haugen IL, Konsmo K, Steens A, Steinbakk M, Storsæter J, Vestrheim DF. Annual report 2013, Invasive bacterial infections (in Norwegian). Norwegian Institute of Public Health, 2014.
3. Noraas S, Jensen GHF, Aase A, Aaberge I, Vestrheim DF. *Borrelia* diagnostics, challenges and needs. (in Norwegian) Norwegian Institute of Public Health, 2014.
4. Vestrheim DF, Kløvstad H. Surveillance of HIV and AIDS in Norway, evaluation of an anonymous surveillance system. (In preparation).

## C. Teaching materials

Revision of case study on invasive pneumococcal disease surveillance and pneumococcal conjugate vaccine effectiveness for the 2015 EPIET/EUPHEM Vaccinology module.

## D. Conference presentations

1. Vestrheim DF, Lange H, Nygård K, Borgen K, Wester AL, Kvarme ML, Vold L. Are ready-to-eat salads ready to eat? An outbreak of *Salmonella* Coeln linked to imported, mixed, pre-washed and bagged salad, Norway, November 2013. ESCAIDE, Stockholm, Sweden, 2014.

## E. Selection of other presentations

1. Vestheim DF. Revised recommendations for use of pneumococcal vaccine in risk groups. Oslo University Hospital, Oslo, Norway.
2. Vestrheim DF. Laboratory methods for diagnosis of invasive pneumococcal disease, and related challenges. SpIDnet kick-off meeting, Prague, Czech Republic, 2013.
3. Vestrheim DF. Surveillance of IPD and evaluation of vaccination programme impact. International workshop for users of multiplex immune assays. Norwegian Institute of Public Health, Oslo, Norway.

# 9. International mission

Supervisor: Line Vold

## Assessment of IHR (2005) core capacities in Malawi

In Malawi, there is limited capacity to detect, assess, notify and report events as well respond promptly and effectively to public health risks and public health emergencies of international concern (PHEIC). An assessment was performed to (1) determine the current status of IHR core capacities for surveillance, response, coping with potential hazards and any other system required for implementing the IHR; and (2) obtain baseline information for measuring progress towards planning and monitoring IHR implementation. A descriptive cross-sectional assessment was performed in a collaboration between the Public Health Institute of Malawi (PHIM) and NIPH using the assessment tool developed by WHO, including interviews at central, district and peripheral levels of the public health system. The NIPH team consisted of Emily MacDonald, Line Vold and Didrik F. Vestrheim. In March 2015, the NIPH team visited Malawi to kick off the assessment with an initial stakeholder meeting, followed by adaption of the assessment tool, pilot interviews and field trips. After completion of interviews by the PHIM team, a follow-up visit was conducted in July 2015 to finalise the assessment report, identify major gaps and develop an action plan for implementation of IHR core capacities.

NIPH has a long-standing relationship with Malawi, and has committed to assist in the establishment of a national public health institute there. The IHR (2005) core capacities assessment was performed as part of an NIPH project, Global Health Preparedness, a project funded by the Norwegian Ministry of Foreign Affairs and falling under the umbrella of the Global Health Security Agenda.

**Educational outcome:** Challenges for implementation of IHR core capacities in middle- and low-income countries; performing IHR core capacities assessment using WHO tool.

# 10. EPIET/EUPHEM modules attended

- EPIET/EUPHEM introductory course, Spetses, Greece (three weeks)
- Computer tools in outbreak investigations, Robert Koch Institute, Berlin, Germany (one week)
- Rapid health assessment and sampling module, Athens, Greece (one week)
- Biorisk and quality management module, ECDC, Stockholm, Sweden (one week)
- Initial management in public health microbiology, ECDC, Stockholm, Sweden (one week)
- Vaccinology, Public Health England, London, UK (one week)
- Project review module, ECDC, Stockholm, Sweden (one week)
- Project review module, Lisbon, Portugal (one week)

# 11. Other courses

- Research project administration, Norwegian Institute of Public Health, Oslo, Norway (one day)
- Whole genome sequencing for food- and waterborne bacteria. Introduction to methodology and application in surveillance and outbreak investigation. Public Health England, Colindale, UK (one week)

# Discussion

## Coordinator's conclusions

Didrik was the first EUPHEM fellow in Norway in addition to being of the first cohort of MS-track EUPHEM. He was a senior scientist who worked for many years with vaccine-preventable diseases, in particular with pneumococcal infections. During the two years he has shown a great interest for other disease groups and acquired new competencies aligned with core competencies for PH microbiologists. With a keen intrest in public health and epidemiology Didrik succesfully created a multidiciplinary collaboration during the fellowship. He was very keen to learn about epidemiology and the public health importance of different diseases and showed a high affinity for collaboration with other disciplines especially with epidemiologists. With Didrik's participation in the EQuATox project, a contribution was made to improve the capacity and quality of identification of toxins with a potential biological threat. For MS-track fellows who are doing their fellowship in their own country such a projects offer a valuable European dimension to disease prevention and control strategy. Projects involved different professional groups, such as physicians, laboratory technicians, epidemiologists, statisticians, government officials, and public health officers, strengthening the fellow's ability to work in a multidisciplinary team. Didrik has already started to cascade his competencies to other professionals, in particular to current and former EPIET fellows. In addition he actively contributed to EPIET/EUPHEM module in vaccinology by designing and developing course material which was highly appreciated by the participants. All activities of the fellow were in line with the 'learning by doing' and 'on-the-job' training service approach of the EUPHEM programme and followed the core competency domains described for professionals in mid-career and above. The EUPHEM coordinator team concludes that the fellow has succeeded in performing all his tasks to a high standard and with a professional attitude. Didrik has developed into a true leader and a good public health manger as it is clear from this portfolio.

## Supervisor's conclusions (Ingeborg Aaberge, Katrine Borgen and Ulf Dahle on behalf of the supervision team)

Being the first EUPHEM fellow at NIPH, Didrik has, together with us, broken new grounds and strengthened the collaboration across departments within the Division of Infectious Disease Control. He was an experienced senior medical officer when he started the EUPHEM MS-track fellowship, and has during the two years deepened and broadened his understanding and knowledge within the public health microbiology field. He also gained a thorough understanding and experience in field epidemiology through outbreak investigations and surveillance activities. Didrik is an excellent team player and as well as completing his own training objectives, he has provided valuable microbiological support and supervision to EPIET fellows. Didrik's projects and activities have all been within the NIPH strategy and core activities. He has generated new information that will improve the infectious disease surveillance and control in Norway and beyond as described by the projects. The knowledge generated has been implemented as important scientific background for improved advice and targeted public health interventions. It is our clear conclusion that the EUPHEM program in general, and Didrik's efforts specifically, have been a 'breath of fresh air' to our departments and that the scientific environment at the division is enriched by these activities.

## Personal conclusions of fellow

The EUPHEM programme presents the unique opportunity to work in diverse projects across various departments, thus covering the entire field of public health microbiology in a two-year period. The fellowship successfully bridges the gap between microbiology and epidemiology by maintaining a close connection to the EPIET network. EUPHEM fellows benefit from the fact that they are not restricted to conducting laboratory-based research, but instead learn to conduct field studies with the help of a multidisciplinary team. Based on the various courses that are given during the two years in combination with considerate supervision and guidance, essential public health skills are strengthened and knowledge of public health microbiology is increased. The EUPHEM programme strongly contributes to the growing public health microbiology community, enabling the fellows to establish personal networks between European public health laboratories.

# Acknowledgements of fellow

I would like to thank my local EUPHEM supervisor, Ingeborg S. Aaberge, for her supervision and kind engagement in all my activities. My thanks also go to Katrine Borgen for supervising and encouraging me throughout my fellowship. I would also like to thank my project supervisors Line Vold, Hilde Kløvstad and Audun Aase. I would also like to thank current and former EPIETs Heidi Lange, Margot Einöder, Emily MacDonald and Anneke Steens for project collaboration, sharing of experience and contributing to a friendly working environment.

Additionally, I would like to thank the EUPHEM coordinators Aftab Jasir and Androulla Efstratiou for their continuous support and constructive feedback.