EPIET REPORT

Summary of work activities

Maria Louise Borg
European Programme for Intervention Epidemiology Training (EPIET), 2011 cohort

Background

Pre-fellowship short biography

Maria Louise Borg graduated from the University of Malta as a medical doctor of in 2005. In 2011, she completed a four-year specialist training in Public Health Medicine. As part of this training, she completed a Master's in Public Health in 2009.

EPIET assignment

On 19th September 2011, Maria Louise Borg was assigned to:
South West Regional Epidemiological Unit, Health Protection Agency, 1210 Lansdowne Court, Gloucester Business Park, Gloucester GL3 4AB, United Kingdom. In May 2012, the unit relocated to 2 Rivergate, Temple Quay, Bristol BS1 6EH, United Kingdom.

Fellowship projects

Surveillance project

Evaluation of the national *Shigella* surveillance in England [1,2]

Background: In September 2011, we investigated a nationwide outbreak of *Shigella flexneri* of serotype 3a among men who have sex with men (MSM). Between September and December 2011, we enhanced surveillance for *S. flexneri* nationally to follow up *S. flexneri* reports and ascertain risk factors, including MSM risk behaviour. Since retrospective analysis of laboratory data indicated that the outbreak had started in 2009, we evaluated both the routine and enhanced systems to assess their ability of outbreak detection and develop recommendations to strengthen outbreak identification and response.

Method: Using the national laboratory reporting database (LabBase) and the national reference laboratory database for gastro-intestinal pathogens (GastroDataWarehouse – GDW), we evaluated the timeliness of laboratory reporting

Stockholm, May 2014

and estimated the proportion of *S. flexneri* cases reported by each database (sensitivity). We estimated completeness of sexual behaviour information in enhanced reports submitted between September and December 2011.

Results: Between 2009 and 2011, the median duration between specimen collection and laboratory reporting to the Health Protection Agency was 13 days (range 2–477). Between May 2011 and May 2012, the sensitivity of LabBase and GDW was 89% and 92%, respectively. Information on sexual contact was provided for 27 (75%) of the confirmed UK-acquired adult male cases, and 19 of 21 who reported sexual intercourse a week prior to onset were MSM.

Conclusion: Laboratory reporting of *S. flexneri* was timely and sensitive. Enhanced surveillance proved successful at collecting information on sexual orientation. A review of the arrangements for analysis and dissemination of surveillance information is therefore recommended to ensure early detection and response in the future. We also recommend the inclusion of travel history and sexual health risk factors as part of routine surveillance arrangements.

Contribution/role: Principal investigator

Status: In progress

Outputs: Poster presentations at ESCAIDE 2012 and HPA Conference 2012. Final report in progress

Outbreaks

National outbreak of *S. flexneri* Serotype 3a in men who have sex with men, England and Wales, 2009–2012 [3, 4, 5]

A national outbreak of *Shigella flexneri* serotype 3a in MSM, United Kingdom, 2009–2011. Unique challenges in outbreak identification and management [4]

Aims: Cases of *S. flexneri* in the United Kingdom are usually related to travel; however, an increase in UK-acquired cases was identified in 2010/2011. Initial cases occurred mostly in men who have sex with men (MSM) and were of serotype 3a. A national outbreak investigation was launched to describe, monitor and manage the outbreak and identify associated risk factors.

Methods: Enhanced surveillance was conducted from September to November 2011. *Shigella* isolates were forwarded to the national reference laboratory for serotyping, PFGE analysis, and sensitivity testing. A questionnaire was completed for UK-acquired *S. flexneri* cases or cases associated with travel to countries with low risk for *Shigella* infection. In-depth interviews with confirmed MSM cases were held to identify risk factors for infection. Long-term trend data from national reference laboratories were also analysed to determine when the outbreak started and to provide context.

Results: Data analysis revealed a twofold increase in cases in 2009, mostly attributable to a rise in serotype 3a in male cases aged between 30 and 50 years. Enhanced surveillance detected 36 UK-acquired *S. flexneri* cases, 30% of which were confirmed in MSM. Almost half of the MSM cases were diagnosed with serotype 3a. In-depth interviews with MSM cases revealed a lack of awareness about *Shigella* and the risks associated with unprotected oral and oroanal sex. Moreover, all the interviewed MSM cases reported having a casual sexual partner in the week preceding illness.

Conclusions: *Shigella spp.* surveillance is being reviewed in order to identify reasons for the delay in identifying the outbreak, which appeared to begin in 2009. Despite considerable likelihood of under-ascertainment of MSM status, enhanced surveillance revealed a high incidence of *S. flexneri* in MSM. The outbreak will continue to be monitored through routine arrangements, and further work to investigate risk factors for transmission among MSM is planned.

What is sustaining the ongoing outbreak of Shigella flexneri in men who have sex with men? Enhanced surveillance data analysis, England and Wales, 2011–2012 [5]

Background: In September 2011, we investigated an increase in UK-acquired *Shigella flexneri* cases of serotype 3a occurring mostly in men who have sex with men (MSM). We launched i) a nationwide investigation to assess the magnitude of the outbreak, ii) enhanced surveillance for *S. flexneri* nationally to ascertain risk factor information, including MSM activity, and understand infection transmission dynamics.

Method: We analysed *S. flexneri* diagnoses reported by national laboratories between 2001 and 2011. We conducted in-depth interviews with initially identified MSM cases to identify potentially risky behaviours. We conducted telephone interviews with the remaining MSM cases using a standardised questionnaire, which was also available as a confidential online survey. We calculated proportions using the number of responses as denominator.

Results: In 2009, *S. flexneri* 3a diagnoses increased by 200%. Until 2009, the male:female ratio was 1:1; it subsequently changed to 3:1 to date. Between September 2011 and July 2012, national laboratories reported 350 *S. flexneri* cases with no/unknown recent travel. Of these, 41 (12%) were reported as MSM. We interviewed 21 (51%) MSM cases using in-depth interviews (n=9) or questionnaires (n=12). Seventeen (81%) reported sexual activity in the week preceding illness. Two (18%) of the cases that had anal sex, and 12 (86%) of the cases that had oral sex, did not use protection. Sexual partners of 13 (76%) cases for whom information was available were asymptomatic.

Conclusions: Our analysis suggests that the outbreak may have started in 2009 and that, among other factors, the role of asymptomatic sexual partners needs to be explored further. Studies to measure carriage of *S. flexneri* in the MSM population and ascertain the role of asymptomatic infection are underway. We issued advice to minimise transmission between MSM.

Contribution/role: Member of the national outbreak control team.

Status: Completed

Output: Regular epidemiological updates and internal report. Oral presentation at the Five Nations Conference, Belfast 2012 and ESCAIDE, Edinburgh 2012. Manuscript published in Eurosurveillance in March 2012.

Extensive transmission of tuberculosis in a school in the United Kingdom, 2011 [6, 7]

Background: In November 2011, the Health Protection Unit was notified of a 16 year old school student with active pulmonary *Mycobacterium tuberculosis* (TB) symptomatic since May 2011. In light of the delay in notification we screened school contacts to estimate risk of infection according to level of exposure and prevent transmission.

Methods: We initially screened school contacts reporting at least eight hours of cumulative weekly exposure to the case using an *interferon gamma release assay* (IGRA) blood test. We then extended screening to school contacts at lower risk (United Kingdom guidelines recommend this when transmission >10%). We estimated risk of infection in terms of cumulative weekly hours of exposure to the case and corresponding risk ratios.

Results: Initially, 113 contacts were screened. Of these, 17 (15%) were infected. Subsequently, among 79 screened contacts we found, three (4%) were positive. Contacts with >0–3.9, 4–7.9 and ≥8 hours exposure had a 1.80 (95% CI 0.38–8.54), 4.31 (95% CI 1.26–14.76) and 6.17 (95% CI 1.40–27.08) times higher risk of infection than contacts with no exposure. Positive contacts were referred to a respiratory physician and offered appropriate treatment.

Conclusions: The risk of TB infection increased with increasing duration of contact, with the risk being markedly higher for those with cumulative weekly contact in excess of four hours. The delay in diagnosis may explain the high risk of infection for contacts in this school setting and underlines the importance of early diagnosis. This outbreak also demonstrated the importance of taking into account such factors as the total duration of exposure to the index case, especially when children may be at risk.

Contribution/role: Member of the outbreak control team

Status: complete

Output: Internal report. Poster presentation at the Health Protection Conference, United Kingdom 2012. Oral presentation at ESCAIDE, Edinburgh 2012. Paper for submission to a peer reviewed journal in progress.

Outbreak of gastroenteritis in people attending a company party at a hotel in Gloucestershire, 2012

Background: On 20 June 2012, the HPA was notified of an outbreak of diarrhoea and vomiting in a company whose staff attended an afternoon party in a hotel in Gloucestershire on 14 June. Seventy of the 400 people who attended the party were reported to have symptoms. An outbreak control team was set up in order to investigate the outbreak and implement timely control measures.

Methods: We conducted a retrospective cohort study to find cases and identify the source of the outbreak. A link to an online survey was sent to all company employees (n=400), and questionnaires received until 26 June at noon were included in the study. We calculated attack rates and adjusted risk ratios (ARR), using multivariable analysis to identify potential risk factors.

Results: Seventy of the 186 respondents were identified as being cases (attack rate of 38%). After adjusting for other exposures, the only significant risk factors were consumption of chicken sandwich (RR: 5.9, 95% CI: 2.7–12.9) and tuna-and-mayo sandwich (RR: 5.7, 95% CI: 2.6–12.5), accounting for 70% of all the cases.

Conclusions: The source of the infection may have been a common ingredient in both the chicken and tuna sandwiches (such as mayonnaise). Alternatively, this could indicate potential cross-contamination during the preparation of the chicken and tuna sandwiches. In the absence of environmental and clinical findings, the epidemiological study proved crucial in identifying the possible source of infection.

Contribution/role: Principal investigator and member of the outbreak control team

Status: complete

Output: Internal report

***Cryptosporidium* outbreak linked to a holiday park in Dorset, 2012** [8]

Background: On 12 September 2012, four cases of cryptosporidiosis were confirmed in two groups of people who visited a park in Dorset between 25 August and 1 September. Unlike the four cases, group members unexposed to the indoor park pools did not develop symptoms. There were other possible sources, and further evidence was required to implement control measures such as pool closure and cleaning. We conducted a case-control study to test the hypothesis that the indoor pools were associated with *Cryptosporidium* infection.

Methods: We randomly selected individuals who visited the park between 25 August and 1 September and conducted telephone interviews. We defined a case as a person reporting three or more episodes of diarrhoea/day within 14 days of visiting the park. The remaining individuals were considered as controls. We calculated odds ratios (OR) and 95% confidence intervals (95% CI).

Results: We interviewed 30 cases and 60 controls. The mean age of cases and controls was 18 and 32 years, respectively (p-value<0.001). Twenty-seven (90%) cases and 37 (62%) controls swam in the indoor pools (OR 5.6; 95% CI 1.4–31). The mean daily duration of exposure to indoor pools among cases and controls was 90 and 54 minutes, respectively (p-value<0.001). Swimming in the round indoor pool was the only factor that remained significant in the final regression model (OR 13; 95% CI 4.1–46). Twenty-four (80%) cases reported using the round indoor pool.

Conclusions: The round indoor pool was the most likely source of infection, which would explain the majority of cases. *Cryptosporidium* was not identified in environmental samples, but inspections and water testing indicated suboptimal pool management. The pools were closed and disinfection measures were implemented. Higher numbers of users during the peak August season may have exacerbated the problem. It is important to increase frequency of disinfection of pools in accordance with the volume of users.

Contribution/role: Main investigator and member of the outbreak control team

Status: complete

Output: Internal report. Oral presentation at the South West Scientific Conference, Weston-super-Mare, United Kingdom, 2013.

Outbreak of *Pseudomonas* in a neonatal intensive care unit, South West England, 2012 [9]

Background: On 16 August 2012, *Pseudomonas* was confirmed in a neonate in a neonatal intensive care unit (NICU) in hospital A in South West England. By 26 August 2012, five more neonates tested positive, one of whom died of the infection. *Pseudomonas* was also identified in environmental samples taken from the NICU. Despite implementation of control measures, an additional seven neonates were colonised with *Pseudomonas*. Colonisations were also identified in two neighbouring NICUs in the region. We utilised descriptive epidemiological tools to understand infection transmission dynamics and inform control measures.

Methods: For each case, we collected information on date of birth, transfers between hospitals and within different areas in NICU. We matched clinical and environmental results based on their variable number tandem repeat (VNTR) profile. The data collated was mapped and presented in a timeline.

Results: Six (46%) of the cases had been transferred in hospital A from other hospitals prior to being tested positive for *Pseudomonas*. VNTR typing revealed three clusters of four, three, and two neonates sharing the same strain, and three neonates with unique strains. One case was identified with a strain isolated from an area she was never admitted in. Cases were also identified following installation of filters to water taps. Although the profile of one cluster was not identified in the hospital A environment, one of the neonates from that cluster was previously colonised while being an inpatient in hospital B. The same VNTR profile was found in colonised hospital B neonates.

Conclusion: Mapping of data revealed probable person-to-person transmission of infection, which was previously not suspected by the investigation team. The identification of cases after implementation of control measures suggests failure of these measures or presence of other contaminated sources. As results suggest possible transmission between NICUs, we recommend that advice on neonatal transfers between hospitals is incorporated into national guidelines.

Contribution/role: Main investigator and member of the outbreak control team

Status: complete

Output: Regular situational updates and internal report. Poster presentation at the South West Public Health Scientific Conference, United Kingdom, 2013.

Outbreak of *Clostridium perfringes* gastroenteritis following a buffet dinner at a restaurant in Bristol, December 2012

Background: On 17th December 2012, the Health Protection Agency was notified of an outbreak of gastroenteritis among individuals attending a buffet dinner at a restaurant in Bristol on 13 December 2012. In the previous month, the same venue was implicated in an outbreak of *Clostridium perfringens*. An outbreak control team (OCT) was set up in order to investigate the outbreak and implement timely control measures in the restaurant, which had recently expanded from a small family business to a popular catering establishment.

Methods: We conducted a retrospective cohort study among customers and staff who attended a buffet dinner to identify the source of the outbreak. We defined a case as individuals who developed diarrhoea or vomiting within three days following a buffet dinner at the restaurant on 13 December 2012. We followed up individuals who attended the buffet dinner and asked them to complete a questionnaire (by telephone interview) about symptoms and food eaten. The questionnaires were also available as a postal survey and a confidential online survey.

Results: Of the 68 people identified, 38 (56%) successfully completed the questionnaire. Of these, 19 (50%) met the case definition. *Clostridium perfringes* was isolated in three of the submitted stool specimens. Following multivariable analysis, consumption of chana dhal (RR=4; 95% CI 1.16–14.5) and goat curry (RR=4; 95% CI 0.688–23.5) were significantly associated with illness. Environmental investigation identified deficiencies in the food preparation and storage techniques, especially of the goat curry, which provided the ideal conditions for proliferation of *C. perfringes.*

Conclusion: Although *C. perfringes* was not detected in clinical and environmental samples, the deficiencies identified in the preparation and cooling of the food supported by the epidemiological findings suggest that *C. perfringes* may once again have been the causative organism for the outbreak. This outbreak highlights the importance of ensuring that food outlets experiencing a growth in business are aware of the need to upgrade their food preparation and storage practices to safeguard public health.

Contribution/role: Main investigator and member of the outbreak control team

Status: Complete

Output: Internal report

Research

The impact of smoke-free policies on the incidence of invasive meningococcal disease in Europe [10]

Background: Active and passive smoking has been associated with an increased risk of invasive meningococcal disease (IMD). Several European countries have recently adopted policies to make public places smoke-free. We aimed to determine whether the introduction of smoke-free policies (SFPs) in Europe led to a decrease in IMD incidence in children and young adults.

Methods: We conducted a retrospective ecological study, including IMD cases reported to ECDC between 1999 and 2011 and national SFPs implemented over the same period. As a measure of tobacco smoke exposure, we used a scale based on the implementation and enforcement of SFPs in countries over time. We assessed the impact of SFPs on IMD incidence in 0–14- and 15–24-year-olds by calculating incidence rate ratios (IRR) using a negative binomial mixed-effects model. We excluded IMD serogroup-C cases to eliminate the effect of MenC vaccination on IMD incidence and adjusted for influenza rates, population size and diagnostic tests.

Results: Preliminary data from 15 countries showed that IMD incidence decreased by 1.8% (IRR=0.98, 95% CI 0.98–0.99) and 0.8% (IRR=0.99; 95% CI 0.98–1.00) per unit increase in SFP score in 0–14-year-olds and 15–24-year-olds, respectively. In 0–14-year-olds, the incidence of IMD decreased significantly by 19.7% in Portugal, 8.8% in Germany, 5.3% in France, and 2.6% in Spain (per unit increase in SFP score).

Discussion: SFPs may contribute to a reduction in IMD incidence, particularly in children. The association between introduction of SFPs and IMD incidence differed among countries. It is difficult to draw conclusions on a causal link due to different underlying trends in IMD incidence. These findings may inform tobacco control measures and their enforcement, particularly in countries contemplating implementation of SFPs.

Contribution/role: Main investigator

Status: Finalising data analysis; currently writing project report

Output: Internal report being drafted and manuscript to be submitted in a peer-reviewed journal. Oral communication at ESCAIDE 2013.

Scientific communication

- One article published in Eurosurveillance in March 2012 as first author [3]
- One oral presentation at the Five Nations Health Protection Conference; Belfast; May 2012 [4]
- Two oral presentations at the European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE); Edinburgh; October 2012 [5, 7]
- One oral presentation at the South West Public Health Scientific Conference; Weston-super-Mare, United Kingdom; 7 February 2013 [8]
- One oral presentation at ESCAIDE; Stockholm; November 2013 [10]
- Two poster presentations at the Health Protection Conference 2012; Warwick, United Kingdom; September 2012 [1, 6]
- One poster presentation at ESCAIDE; Edinburgh; October 2012 [2]
- One poster presentation at the South West Public Health Scientific Conference; Weston-super-Mare, United Kingdom; February 2013 [9]
- Two manuscripts in progress (as first author) [11, 12]

Teaching experience

Moderation of one case study on toxic shock syndrome, December 2011 (one hour). This was part of the 'Field epidemiology applied to health protection' course organised by HPA at Bristol University. The target audience were healthcare professionals and public health trainees involved in outbreak management and health protection.

Contribution/role: Facilitator, moderator

Status: Completed

Moderation of workshop on interpretation of surveillance information and vaccination, November 2011 (one hour).The workshop was conducted as part of the communicable disease module at Bristol University and attended by Bristol university students, public health trainees and health protection staff.

Contribution/role: Facilitator, moderator

Status: Completed

Moderation of case study on *Legionella*, November 2012 (one hour).The workshop was conducted as part of the communicable disease module at Bristol University and attended by Bristol university students, public health trainees and health protection staff.

Contribution/role: Facilitator, moderator

Status: Completed

Lecture on vaccinology, May 2013 (one hour). Delivered to HPA colleagues at the South West Regional Epidemiology Unit.

Contribution/role: Teacher

Status: Completed

Output: PowerPoint presentation

Moderation of case study on vaccinology (measles in United Kingdom case study), May 2013 (1 hour). Delivered to HPA colleagues in the South West Regional Epidemiology Unit.

Contribution/role: Moderator, teacher

Status: Completed

Output: PowerPoint slides, materials for participants

Organisation and moderation of a regional one day update and training event entitled 'South West health protection update & training day 2012' for public health professionals in the South West Region, March 2012. The event was targeted at a wide range of health professionals, including consultants, specialists and practitioners working in health protection, public health and environmental health, as well as others involved in the management of outbreaks and public health incidents. The aim of Update Day was to explore issues of interest, discuss new policies and guidance, and enhance inter-agency work by promoting good practice and strengthening competence in health protection.

Maria's duties included identifying training needs, drafting the programme, identifying the teaching methodology and evaluating the one-day course. She also assisted in the development of two short outbreak investigation case studies and gave a talk on the cryptosporidium outbreak.

Contribution/role: Organiser, coordinator, presenter

Status: Completed

Output: PowerPoint slides, materials for participants, evaluation report

Supervisor's conclusions

During her two-year fellowship, Maria Borg was an integral part of the Health Protection Agency South West Regional Epidemiology team based in Bristol. Maria gained a wide experience through supporting many outbreak investigations, evaluating a surveillance system and conducting regular analysis and interpretation of surveillance information. Maria made an excellent contribution to the development of the evidence-base for public health through her research into the impact of smoke-free policies on the incidence of meningococcal disease in Europe. She also gained experience in the teaching and training of public health professionals. Maria's work was of a high standard and it resulted in excellent outcomes, including several publications in peer-reviewed scientific journals and presentations at national and international conferences.

It was a pleasure to work with Maria, and I am sure that she will continue to have a very successful career in epidemiology and public health.

Next steps

Maria will be working at the Maltese Ministry of Health as a resident specialist in public health. In view of her EPIET background, she has been assigned to the Infectious Disease Prevention and Control Unit (IDCU) within the Directorate for Health Promotion and Disease Prevention. Her duties will range from day-to-day outbreak management and control, communicable disease research as well as collaboration with other entities to develop national strategies pertaining to communicable disease prevention and control.

References

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3. Borg ML, Modi A, Tostmann A, Gobin M, Cartwright J, Quigley C, et al. Ongoing outbreak of *Shigella flexneri* serotype 3a in men who have sex with men in England and Wales, data from 2009–2011. Euro Surveill. 2012;17(13):pii=20137. Available from: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20137.
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5. Borg ML, Gobin M, Cartwright J, Quigley C, Crook P, Boxall N, et al. What is sustaining the ongoing outbreak of *Shigella flexneri* in men who have sex with men? Enhanced surveillance data analysis, England and Wales, 2011–2012. In: Abstracts of the 6th European Scientific Conference on Applied Infectious Disease Epidemiology (ESCAIDE); Edinburgh; October 2012. European Centre for Disease Prevention and Control; 2012.
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