出國報告（出國類別：研究）

參加歐洲疾病預防及控制中心(ECDC)為期兩年 EPIET 計畫

服務機關：奧地利健康暨食品安全署（Austrian Agency for Health and Food Safety, AGES）
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摘要

本人於 100-102 年參加歐洲疾病預防及控制中心(European Centre for Disease Prevention and Control, ECDC)舉辦之現場流行病學訓練項目(European Programme for Intervention Epidemiology Training, EPIET)。EPIET 於 2011 年約有 40 名學員，兩年期間約每季赴指定城市參加相關專業課程 。此外，職參與五場奧地利國內或歐洲國際研討會，其中共計三場進行口頭或壁報報告。

於 AGES 研習期間，本人執行奧地利國內百日咳、流行性感冒及李斯特菌有關之研究計畫、例行監測及監測系統評估，並協助食因性傳染病之疫病調查，以第一作者身分刊登一篇論文。另與 ECDC 合作調查歐盟會員國百日咳流行病學現況，預計建立 ECDC 技術報告及資料供所有會員國參考。

101 年 12 月份，職邀請 EPIET 首席協調員 Dr. Yvan Hutin 參訪本署，其對於本署參與 EPIET 之同仁表示肯定。102 年 5 月份，職協助 AGES 舉辦第二次台奧傳染病研討會，ECDC 疫情監測部門負責人 Dr. Pasi Penttinen 獲邀參與並肯定讚揚台奧雙邊合作的成果。

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目的

一、 參加 EPIET 20111 並取得結訓證書。

二、 協助台奧雙邊第二次國際研討會舉行。

三、 藉受訓期間，增進流病知識及現場疫調能力，並學習撰寫研究報告及論文。

四、 藉受訓期間，建立與歐盟公共衛生專家聯繫管道，以創造未來本署與歐盟會員國合作之可能。

過程

一、EPIET 課程

（一） 基礎流行病學

爲期三週，地點爲西班牙小島 Lazaretto，是第一次與同期學員共同研習的課程。該課程教授學員身爲一位現場流行病學家所需基本知能包括疫病調查，實際案例研究，基礎分析流行病學，監測系統建立與評估，研究計畫撰寫及公眾溝通。除了授課之外，在下午則爲流行病學調查案例討論，藉由實際討論歐盟會員國的疫情調查案例，以小組方式腦力激盪，學員間提出因應計畫及作爲，相當實用。另外，亦有模擬申請撰寫研究計畫。最後於課末評估授課品質，以供課程設計教師參考。該課程亦可認識多位頂尖歐盟國家公共衛生人才及專家，並向同期學員學習認識歐洲風土民情及文化。

（二） 疫病調查軟體應用

本課程爲期五天，主要目的爲學習使用疫病調查時常用之分析軟體包括MS-Excel, EpiData/Entry 和 Stata。學員在該課程後學會如何利用上列軟體進行疫調表單匯入，運用敘述性流行病學及分析性流行病學之知識以進行假說測試及資料分析。解讀軟體輸出結果並統合其他微生物學，食品安全或環境衛生相關調查結果，以協助及時疫情控制並進而預防類似疫病情境再度發生。最終撰寫疫調報告或發表論文以供同仁及相關人員參考。

（三） 多變項分析

本課程爲期五天，包括基礎運用廣義線性迴歸模型(Generalised linear model, GLM)來進行多變項分析。學員於課程後學會如何運用 Stata 選擇模型來解釋資料，理解各迴歸方法之優缺點，並正確解讀輸出結果。除分層分析(Stratified analysis)之外，流病常用 GLM 包括線性迴歸（linear regression），羅吉斯迴歸（logistic regression），布阿松迴歸（Poisson regression)，及生存分析(Survival analysis)亦於本課程提及。

（四） 時間序列分析

本課程授課五天，目的爲教授學員如何建立模型以妥善分析現有具時序性之監測資料。本課程之基礎模型建立採用簡單線性迴歸公式，解釋監測資料的長期趨勢，再以 sine, cosine 數學函數模擬時序資料的週期性變化，進而預測未來疫情趨勢以及界定疫情警戒閾值。適用於有季節性或週期性流行之傳染病分析如登革熱、腸病毒等。課程並簡介兩種常用在時序分析時的統計工具，即自相關函數(Autocorrelation)及頻譜分析(Spectral analysis)。進階時序分析包括如何修正模型以獲得理想殘差則建議需進一步與統計學家請教。

（五） 疫苗學

本課程主要介紹現今可運用疫苗預防之傳染病(Vaccine-preventable diseases, VPD)。其中包括 VPD 相關歷史介紹，VPD 監測，VPD 疫情案例分析，疑似疫苗不良反應監測，疫苗成本效益評估，疫苗學基本辭彙簡介及計算接種率等。該課程邀請數位曾評估疫苗臨床測試階段及控制 VPD 專家例如 Dr. David Heymann 及 Dr. Roger I. Glass 等授課及經驗分享，本人獲益良多。本次課程並以剛果共和國小兒麻痺疫情及英國麻疹疫情爲例進行案例討論，藉此了解小兒麻痺根除計畫大要及如何運用疫苗來控制疫情，並運用監測資料以評估疫苗接種計畫的影響。另外，以芬蘭孩童嗜睡症與流感疫苗關係來評估並解釋如何監測及解讀疑似疫苗造成的不良反應，及如何因應，需要進一步進行哪些流行病學調查及如何與民眾溝通及解釋。在疫苗臨床試驗階段，有哪些步驟需要執行及如何評估疫苗的效力等亦有在本課程中概述。

（六） 抽樣方法學

除了普查，流行病學家在調查時，善用抽樣方法，以推估母群體對於研究議題的特性。本課程簡介常見抽樣方法包括機率抽樣及非機率抽樣。機率抽樣中介紹簡單隨機抽樣，分層隨機抽樣，系統抽樣，集體抽樣，多階段抽樣。非機率抽樣中介紹便利樣本及滾式樣本。另外，利用兩案例研究（希臘西尼羅病毒疫情調查及希臘孩童疫苗接種率調查）理解實際如何選擇適當抽樣方法以獲得樣本，收集樣本資料，分析及解讀。理解目標族群特性及介入調查時可能有的限制，再進一步選擇合適的抽樣方法是一門學問，在研究設計階段方法學中相當重要。

二、AGES 研習內容

（一） 疫情調查[1]

腹瀉群聚事件：校園諾羅病毒感染。2011 年 11 月底，奧地利薩爾斯堡省通報一所職業學校有近40位學生發生上吐下瀉的病徵，而進行疫情調查。有效問卷共計351份，調查發現共計42名學生符合此群聚事件通報定義，透過回溯性世代研究(Retrospective cohort study)發現，該校餐廳提供之晚餐餐點中，酸奶醬(RR:16.2, 95%CI: 3.9-67.5 P<0.01)及火雞肉沙拉(RR:5.2, 95%CI: 2.3-11.8 P<0.01)疑似爲造成該腹瀉群聚事件的食物。該校餐廳已在事件發生後關閉，並進行大規模消毒清掃。衛生稽查人員調查亦發現，該校學生餐廳廚房並無依相關規定執行危害分析重要管制點系統制度(Hazard analysis critical control point, HACCP)，以管理餐點配製及料理過程，人員及食材的衛生清潔。該事件之病原爲諾羅病毒 GGII.7 及 GGII6 的混合型病毒，是奧地利第一件由該種混合型病毒感染的通報群聚事件，有關該病毒之毒性及傳播能力，則有待分析探討。有關該案發表論文請見附件一。

（二） 監測系統評估及監測資料分析[2]

1. 流行季流感病毒週監測

職於受訓及間，每逢流感季節（2011-2012, 2012-2013, 2013-2014）第 39-40 週至隔年 14-15 週，分析並更新流感季節監測週報。夏季則更新流感年報。有關奧地利流感監測系統架構等細節，請參考本署劉宇倫醫師 EPIET 計畫出國報告：

http://report.nat.gov.tw/ReportFront/report_detail.jspx?sysId=C10004690

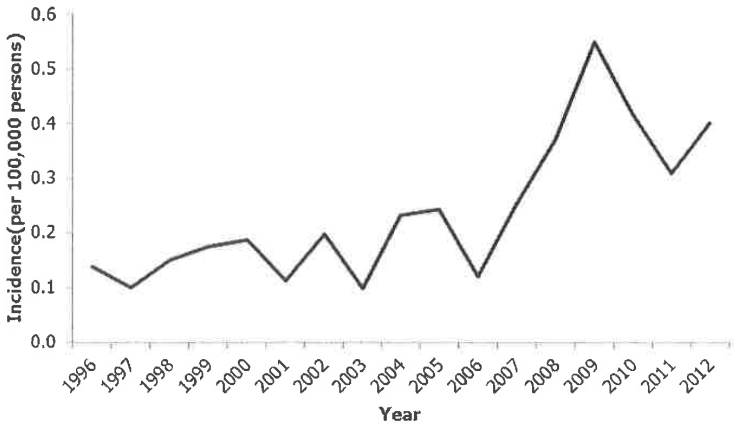
有關流感週報與年報（德文）請參考下列連結：

- http://www.bmg.gv.at/cms/home/attachments/8/0/4/CH1338/CMS1355145545267/influenza_jahresbericht_2011_2012_vadallirevbmgscd.pdf
- http://www.ages.at/gesundheit/mensch/influenza/aktuelle-influenzameldungen/

2. 李斯特菌感染症(Listeriosis)監測系統評估[3]

奧地利李斯特菌感染症監測於1996-2006年期間由位於Innsbruck李斯特菌國家參考實驗室負責通報個案資料彙整及呈報奧國聯邦衛生部（Bundesministerium fuer Gesundheit)。於2007年起，因衛生部於奧地利健康暨食品安全署(AGES)成立李斯特菌國家流行病學中心及國家參考實驗室，轉由該中心提報流行病學及實驗室檢驗相關資料。由圖二可見，奧地利李斯特菌症發生率自 2006 年顯著上升。2008 至 2012 年共計四起李斯特菌群聚事件，以 2009-2010 年該件最爲嚴重，造成奧地利，德國及捷克三國共計 34 名病患，其中 5 名死亡，該食物中毒群聚證實由一種軟乳酪 Quargel 造成。該乳酪於奧地利生產再外銷至他國。

下圖爲奧地利李斯特菌症通報個案發生率，1996-2012。

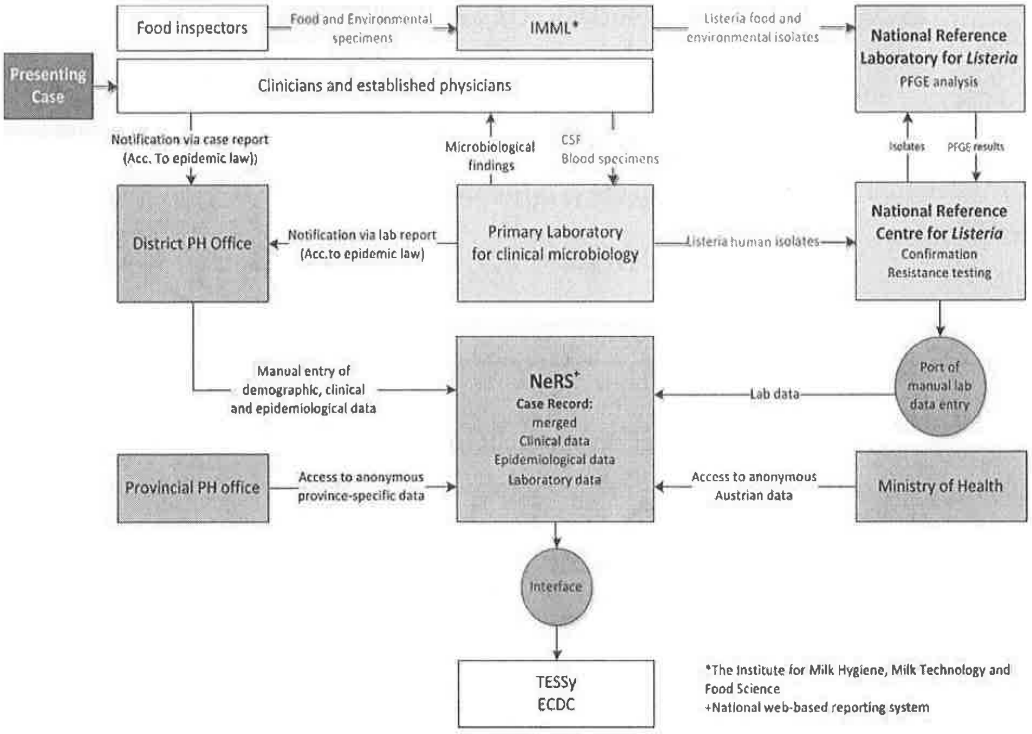


針對李斯特菌控制與預防，奧地利依據歐盟食品檢測及實驗室檢測規定 Dir. 92/46/EEC, (EC) No. 2073/2005, ISO18593, EN/ISO 11290-1 及 11290-2 執行相關檢測。以現成熟食爲例 (ready-to-eat food)，其中供嬰兒或特殊醫療目的之現成熟食需於 25 公克食品採樣中零檢出李斯特菌。其他類現成熟食產出時檢測可容許量規定同上述，若食品已於超市上架時檢測，可容許量則爲每克食品 100cfu。因一般非嬰幼兒上架現成熟食規定可容許量非零檢出，有可能因食品購買後儲存狀況不佳而造成大量增殖。相關歐盟其他食品衛生規定請參考下列連結：

http://ec.europa.eu/food/biosafety/hygienelegislation/directives_en.htm

奧地利李斯特菌監測系統依據人畜共通傳染病防治法(Zoonosengesetz)及傳染病防治法(Epidemiegesetz)成立。該系統目的爲及時監測李斯特菌病發生率及疫情而及時提供資訊供疾病管制及預防參考，並依監測資料提出可能假說進行研究。最終該疾病通報資料需定期上傳至 ECDC 傳染病監測系統(TESSy)。疾病通報定義於 2008 年以前依 WHO 規定，2008 年起則依歐盟規定 Decision No 2119/98/EC 執行。該通報系統軟體 (Epidemologische Meldesystem, EMS, NeRS)與其他傳染病通報軟體相同，並無獨立設計，由臨床醫師或實驗室主動通報疑似病例。

有關奧地利李斯特菌病通報系統架構的流程圖如下圖所示。



臨床醫師向區級衛生單位通報疑似病例，再由區級公共衛生官上傳個案資料於傳染病通報系統(NeRS)。另外，例行性檢測之環境或食品樣本經由環境或食品衛生稽查員送交 IMML (The institute for Milk Hygiene, Milk Technology and Food Science)檢測，其中陽性樣本再由國家實驗室分型。臨床醫師採集疑似病患之血液或腦脊髓液檢體後送交具李斯特菌檢測項目之臨床實驗室檢測，陽性檢體再由國家實驗室分型。由李斯特菌國家流行病學中心彙整及通報實驗室結果於 NeRS，在此將臨床及實驗室結果合併。省級公共衛生單位得使用 NeRS 查詢自治省份病患資料，但無權限查詢他省份資料。衛生部得查詢在國家李斯特菌流病中心彙整後的所有匿名資料，並將資料整合修正，提報 ECDC TESSy (The European Surveillance System)。

本次報告評估該系統的簡易性及時效性，證實 NeRS 於 2009 年啓用後，對於李斯特菌症通報的確提高其簡易性及時效性。有關該評估報告全文，請見附件二。

3. 歐盟會員國百日咳監測資料分析（ECDC 合作計畫）

近 20 年來，百日咳流行病學在世界多國有再度流行的趨勢，在歐洲，有數個國家的通報病例在未接種疫苗之嬰兒、基礎疫苗未接種完全之嬰兒、青少年及成人有明顯增加的趨勢。這樣的趨勢即使在高基礎疫苗接種率的西歐或北歐國家亦可發現（如英、德、西班牙等）。在荷蘭建議 ECDC 針對歐盟會員國百日咳現況提出對策之背景下，職協助 ECDC 敘述分析現有傳染病通報系統資料庫(TESSy)及協助於 2012 年 11 月份在西班牙巴賽隆納召開歐盟百日咳專家會議，邀集部份會員國百日咳專家及主要疫苗藥廠代表尋求解決方案以降低百日咳在歐盟造成的負荷。有多種因素影響近年多國百日咳通報個案上升，如因注射非細胞性百日咳混合疫苗(DTaP)獲得抗體逐年下降、醫師對百日咳認知提高於是通報成人百日咳個案頻率上升、實驗室診斷敏感度上升(PCR)、以及通報系統通報個案定義變動、菌株演化變異等。本計畫主要分析通報資料較爲完整的歐盟會員國，其中包括奧地利、英國、法國、義大利、荷蘭、挪威、瑞典、西班牙八國。分析從 1998 至 2011 年年齡組別發生率、年齡組別通報個案比例、通報個案定義類別分布、通報個案於小於 1 歲及 1-4 歲住院百分比、小於一歲通報個案疫苗接種情形等。此外，亦協助整合自 1990 至 2012 年該國百日咳預防接種時程表。通報個案資料完整度高的國家如挪威、英國另有 ECDC 統計學家協助進行時間序列分析。該計畫報告最終將以 ECDC 技術報告形式發表。

（三） 專題研究

奧地利百日咳流行病學分析研究。

以描述性流行病學方法觀察奧地利傳染病通報系統資料發現，百日咳通報病例有上升趨勢，且有地域上的差異。自 2006-2012，Styria, Salzburg, Upper Austria 及 Tyrol 四省份皆有發生率顯著上升趨勢。而其他五省份則未觀查到顯著上升。在年齡層上，分析現有 2009-2011 年通報資料，小於 15 歲的未成年人爲發生率顯著上升之族群。依據觀察資料提出研究假設。藉由進行橫斷式 KAP 調查(Cross-sectional knowledge, attitude, and practice survey)以網路及電話問卷方式收集開業醫師(General Practitioners)，兒科醫師及肺專科醫師(Pulmonologists)對於百日咳通報行爲，臨床診斷及實驗室診斷知識之資訊。再分析是否與通報個案地區差異趨勢有相關。有關該報告全文，請見附件三。

（四） 教學

授課主題爲食因性傳染病疫情調查訓練。爲期一天的教學經驗，訓練對象主要爲各省的公共衛生部門人員，醫師及食品抽查員，共計 28 位。教授的課程上午爲傳染病流行病學概論、疫病調查、分析流行病學概論（世代研究及病例對照研究爲主）。下午則利用本人與同仁共同撰寫的食因性傳染病案例進行案例討論，該病例研究由本人撰寫英文，再由同事協助修改爲德文。本次教學目的爲讓地方衛生官員了解 AGES 在食物中毒事件中所扮演的角色，。當地方單位尋求 AGES 介入調查時，地方衛生人員如何協助及配合調查，並理解基本流行病學詞彙及疫病調查基本步驟及意義。增進與地方衛生人員合作關係。有關該案例討論，請見附件四。

三、學術研討會

（一） ESCAIDE 2011-2013 (European Scientific Conference on Applied Infectious Disease Epidemiology)

ESCAIDE 是受訓期間每年皆需參加之國際研討會。本人於 2012 年該會議上口頭報告，報告主題爲“A foodborne norovirus outbreak in a boarding school, Austria, November 2011”。該研討會主要匯集歐盟會員國公共衛生專家及決策者，由 ECDC 主辦，每年都有數百位與會者參加。預計從 2013 年起，每年皆於瑞典斯德哥爾摩舉行，該城市即爲 ECDC 的所在地。本研討會議題主要包括藉食物和水之傳染病、監測系統評估、抗藥性議題、疫苗可預防性疾病、疫病調查、流感、病媒病毒傳染病、國際健康議題、結核病及其他呼吸道疾病、分子流行病學議題、人畜共通傳染病、性傳染病、新興方法學運用等，議題多元豐富，值得本署同仁參與發表。

（二） OEGHMP2012 (33rd Annual Meeting of the Austrian Society for Hygiene, Microbiology and Preventive Medicine)

該會議爲奧地利衛生、微生物及預防醫學年會，本次會議在薩爾斯堡舉行，爲期四天。多數會議內容以德文發表，但亦有以英文發表的報告。職於該會議以壁報方式報告奧地利諾羅病毒疫情事件。該壁報請見附件五。

（三） EHFG2012 (16th European Health Forum Gastein)

歐洲佳斯坦論壇爲歐盟健康相關議題的重要論壇，與會人士包含歐盟國會代表、歐盟食品安全局 (EFSA, European Food Safety Authority)、ECDC、多個歐洲 NGO 團體、醫學學會代表等。本署受國民健康署邀請，

派職就近代表參加，衛福部由邱淑媞署長帶領其他單位同仁與會。邱署長於該會口頭報告台灣如何成功宣導肥胖防治，實行全民健康減重活動，以達慢性病防治及全民健康之目標。該會與本署較相關之議題爲疫苗預防接種與媒體溝通，該座談會報告專家包括 ECDC 負責人及多位社群媒體代表（Facebook 及 Twitter 等），以及著名醫學期刊（NEJM）代表。探討政府防疫機關如何善用電視媒體、平面媒體及社交媒體以達正確疫苗宣導，並正視媒體對於疫苗接種率有顯著影響的事實。當政府推動預防接種時，說明會對象需較以前更爲多樣，除了電視媒體、平面媒體、相關團體及基金會之外，社群網絡平台的重要性上升，特別是施打對象爲年輕族群時(例 HPV 疫苗)。其中一位與會專家分享荷蘭如何運用 Facebook 建立遊戲平台，利用聊天室模式與 Facebook 用戶溝通，並解決疫苗接種相關疑惑及問題。HPV 疫苗施打活動其施打率在荷蘭因少數社群網站用戶造謠副作用以及與青少年性行爲及自殺等議題牽連，造成施打率不如預期，可見現今社群網絡媒體占有不可輕忽的影響力。

（四） IMED2013 (International Meeting on Emerging Diseases and Surveillance)[5]

職於該演討會運用壁報說明奧地利百日咳於 2005 至 2011 年的趨勢，並敘述病例數及通報率在不同年齡群、省分及發病月份的比較（附件六）。該會議對於新興傳染病特別是人畜共通傳染病以及 One health 議題相當重視。

（五） 台奧第二次傳染病國際研討會[4]

第一次台奧傳染病國際研討會於 2010 年 11 月份於本署舉行，本次研討會由奧方於 2013 年 5 月 13-16 日在維也納 AGES 微生物及傳染病醫學大樓舉行。台灣選派共計 11 位專家學者及本署長官參與，職負責會前籌劃

及接待，並於該研討會口頭報告。本次研討會主題包括結核病、細菌抗藥性、醫源性疾病、高致病性細菌、腸病毒、蟲媒病毒、傳染病監測議題、食因性傳染病等。台灣與會專家共計發表 11 篇口頭報告，奧地利 AGES 則發表 16 篇口頭報告。職於該次研討會中報告歐洲及奧地利百日咳流行病學近況，詳細會議資料請參考第二次台奧雙邊會議出國報告。本會議亦有雙邊專家學者經驗交流並商討未來可能合作方向之目的。台灣與會專家對於奧地利 AGES 食因性傳染病監測印象深刻，從人、環境到食品檢驗監測皆由 AGES 負責，更能有效將訊息統合分析，台灣則因分責於不同機構，於資訊統合上較爲不易。另外，實驗室硬體架構相當完善且符合相關國際規定，未來雙方研究人員彼此交流互訪我方應可獲益良多。

心得及建議

EPIET 受訓期間，與歐盟會員國傳染病負責機構的公衛人才一同受訓。在 AGES 工作期間，因爲德文語言能力有限，疫病調查時無法直接與地方公共衛生官聯繫，因此本人大部份受訓期間，偏重於資料分析。雖稱爲現場流行病學訓練生，本人與一同受訓的奧地利籍同事皆未曾到現場進行疫情調查。

自從 2007 年至今，本署已選派四位同仁赴奧地利 AGES 受訓，對於 AGES 傳染病流行病學部門之分責業務及傳染病已多所瞭解。 另外，奧地利傳染病通報系統非由 AGES 管轄，若研究之傳染病非由 AGES 管轄，如疫苗可預防疾病（Vaccine preventable diseases），則取得資料過程則需花較長時間。AGES 將於 2013 年 11 月取得傳染病通報系統管理權，屆時可直接評估該傳染病通報系統或運用該通報系統的資料。這使 EPIET 學員於 AGES 訓練期間獲取資料更爲容易。每隔三到四個月會有爲期一週的 EPIET 訓練課程，可藉此機會請教授課老師有關研究設計相關問題或聽取其他學員們的想法與經驗。ECDC 於訓練期末時，會諮詢學員對於 EPIET 課程及指導員的建議中，本人即建議 ECDC 可嘗試架設網路學習或諮詢平台，對於位於傳染病流行病學人力資源較少之會員

國的學員，能夠利用此平台與資源豐富會員國的學員或指導員，針對於受訓期間的任何流行病學或統計學等疑問，可藉由此平台提出討論。目前 ECDC 草擬架設 E-learning 平台中，以提供學員更多線上學習的機會。

在共計十週的課程中，印象最深刻的課程爲疫苗學，地點位於倫敦的 Public Health England (PHE, HPA 現已併入 PHE)。上課第一天第一堂課由 PHE 的首長 Dr. David L. Heymann 爲學員回顧疫苗的發展史。其他授課老師無論是 PHE 部門長官或受邀講者皆經驗豐富、課程內容相當精彩。讓我對於 PHE 人力資源豐富程度相當欽佩。於伯林 Robert Koch Institute 學習疫情調查所需使用之相關軟體，RKI 的統計部門人員授課清晰詳盡，學員在實作課程若有疑問時，皆可及時解答疑惑。軟體實作課程中，其中一位指導員因可口說多國語言讓本人印象深刻，使用學員的母語回答問題，讓學生更有自信可以提問。歐洲公衛人才通常具有第二國或多國外語能力，此爲勝任工作的必要條件之一。

在較具規模的公衛機構如德國 Robert Koch Institute (RKI)或英格蘭 Public Health English (PHE)，皆具有生物資訊及生物統計分析部門，部門的同仁提供資料分析及研究方法學的諮詢及協助，因此一篇刊登論文中，時有統計部門人員在作者群中。建議未來本署可儲備統計學、模組分析或生物資訊人才或部門，以供所有同仁諮詢及討論。傳染病負責機構設置資料分析顧問或部門，在同仁的例行業務或研究計畫中，若使用統計軟體分析資料有疑問時，則具該人力資源可一同討論，想必對該機構的研究、模組或資料分析運用必有相當大的助益。

本人與 ECDC 合作期間，體會到如果部門有統計人員可以提供諮詢，對於流行病學家有很大的助益。在短期三天於 ECDC 與統計專家討論使用 STATA 進行時間序列分析，使用該單位初期架構完成的視窗版模組，專供時間序列分析使用，縮短了資料分析的時間。另外，百日咳監測資料需要由歐盟會員國的專家確認資料的完整性及正確性，所以協調聯繫工作就佔了相當多的時間，可以想見 ECDC 需要維繫廣大的人脈網，才能夠縮短所有產出報告的時間。在 ECDC 工作相當注重語言能力，歐盟會員國使用的語言多樣，若能精通多國語言，自然更能勝任於工作。在 ECDC 工作的酬勞相當優渥，不過

斯德哥爾摩的物價約台灣的三四倍以上，且需要適應北歐的氣候及有限的日照時間。ECDC 的工作同仁都是歐洲各國優秀的公共衛生人才，在互相激勵合作下可以在工作上成長精進，是相當正向的工作團隊。本人於受訓期間，結識前疫情監測部門首長 Dr. Pasi Penttinen，並向其簡報本署登革熱防治經驗。Dr. Penttinen 亦受 AGES 邀請於本年度第二次台奧國際研討會介紹 ECDC 疫情監測及風險評估工作內容。ECDC 提供會員國之傳染病控制負責機構人員至瑞典斯德哥爾摩進行疫情監測及風險評估之短期訓練，該訓練內容藉直接於疫情監測部門工作，以學習該部門的業務及經驗，以促進 ECDC 與會員國疫情監測網絡之緊密程度。本人認爲該訓練極具價值以供我國緊急疫情事件之監測與評估參考，可嘗試作爲與 ECDC 未來合作的開端。

在歐洲生活期間，同期受訓學員來自不同歐盟國家，大多數的同學的語言能力相當驚人，部分學員精通多國語言，這也是本人感受的文化衝擊之一。從小就在台灣長大，發現國際觀及語言能力皆不及同期學員，部份原因是因爲不在歐洲成長，所以對於歐洲及非洲的歷史地理及文化並不熟悉。兩年訓練期間，共計約有十週可與同期學員見面上課，以及其餘時間在維也納與同事間互動後，對於歐洲的生活及文化較爲熟悉。奧地利維也納相當適合居住，空氣品質及居住生活品質佳，人口密度較台灣低，氣候較台灣乾燥許多，我在台灣多年來的過敏性鼻炎，到維也納後不藥而癒。維也納氣候宜人乾爽，唯冬季氣溫驟降，且十度以下低溫可持續至春季五月，是較需適應的主要差異。維也納物價約爲台灣的兩倍，薪資所得也約兩倍左右。在歐洲生活的期間，發現自己也因環境的變化而改變，較懂得品味生活、健康飲食及培養運動習慣。剛到維也納時，德語環境讓初期生活常碰壁，不過兩年下來，耳濡目染下，聽力也多少進步，亦較能輕鬆在德語環境下生活。

就比較台灣及奧地利疫情調查的差異。在奧地利，由各省自行管理省內的傳染病群聚事件調查，若疫情擴及跨省或多省，聯邦衛生部則會指派 AGES 傳染病流行病學部門進行疫情調查，並以週報及週會方式定期報告調查進度。若省內的疫情需要 AGES 提供協助時，AGES 得介入調查。因此，若單一個省內有傳染病疫情時，AGES 不會主動介入亦不會得知。在台灣，傳染病疫情調查系統提供本署各縣市通報的個案及縣市衛生

人員疫情調查問卷填答情況，結合法定傳染病個案通報系統的資料，讓法定傳染病疫情調查在各縣市的現況較奧地利的系統清楚。在法定傳染病通報系統方面，奧地利於2009年啓用法定傳染病個案通報系統，與本署法傳系統差異在於，開業醫師或醫療院所不具權限使用該系統，醫師需向區級公共衛生機構通報，由該區的系統負責人員上傳通報資料，其中包括個案個人資料、流行病學調查資料以及臨床上的資料。各省級公衛機構得查看該省各區個案匿名資料，無權限查閱他省資料。聯邦衛生部則得匿名查閱全國的資料。實驗室則向區級衛生機構及國家參考實驗室通報個案檢體檢測結果後，國家參考實驗室負責上傳檢測報告至法傳系統。未來奧地利法傳系統亦往簡化通報流程及時序性方向改善，讓醫師可直接申請帳號及通報傳染病個案。另外，若該傳染病可配合其他環境或食物檢體檢測資料進行調查，由國家參考實驗室彙整食物及環境樣本陽性分離株的資料。以李斯特菌症爲例，在食品及環境稽查員將待檢測食品及環境樣本送至乳製品衛生及食品科技所後，由該所負責檢測。若有李斯特菌檢測陽性之樣本，則將分離菌株送至參考實驗室進行後續分型，因此該參考實驗室具環境、食品及病患的資料。相關資料由同一單位彙整可讓流行病學調查更加快速。台灣因食品安全、環境衛生及人類傳染病等資訊由不同機關負責，因此若要調查疑似李斯特菌症個案，則需聯繫其他機關以獲取所需資訊，時效性可能因此延宕。AGES先前只具奧地利法傳系統部分法定傳染病的權限，在今年11月份由聯邦衛生部轉由AGES接管該系統後，現今AGES已具權限可評估及使用該系統。本署林詠青醫師計劃進行本署法傳系統與奧地利法傳系統比較。在本人於受訓期間使用奧地利法傳系統的百日咳資料發現，資料完整性不高，且資料品質於該系統啓用後前數年較差，希望未來藉由該次的法傳監測系統評估，兩國可互相學習彼此系統的優點。

本人綜上所述，具體建議如下：

1. 建議維持本署選派人員參加EPIET訓練，以儲備本署人力資源及持續建立與歐盟會員國公衛人才的聯繫。
2. 鼓勵同仁可投稿至ESCAIDE國際研討會，藉此提高與歐盟各國傳染病學專家的互動。

3. 建議本署可與 ECDC 商討未來人員參訓或計畫合作的可能性。唯 ECDC 隸屬於歐洲委員會(European Commission)下之一機構，申請正式合作的行政流程冗長且可能牽涉政治考量，建議可先從人員受訓及非正式計畫合作爲開端。本人提供之國際人脈清單可供聯繫參考。
4. 建議本署 FETP 訓練計畫課程或本署會議之外賓演講可嘗試邀請 ECDC 或歐盟會員國之公共衛生專家，提供除美國之外，從歐洲觀點切入探討傳染病相關議題。

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附件

附件一：諾羅病毒腹瀉群聚事件報告

附件二：奧地利李斯特菌監測系統評估報告

附件三：奧地利百日咳流行病學分析研究—橫斷式KAP 調查

附件四：教學案例—奧地利沙門氏菌群聚事件

附件五：諾羅病毒腹瀉群聚事件壁報

附件六：奧地利百日咳 2005 至 2011 年趨勢報告壁報

附件一

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A foodborne outbreak due to norovirus in a vocational school, Austria November 2011

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Schlüsselwörter: Brechdurchfall, Berufsschule, Internat, Küchenangestellte, Lebensmittel.

■ Summary

On 28th November 2011, a school physician informed the Austrian Agency for Health and Food Safety (AGES) of 40 cases of gastroenteritis that occurred on 24th and 25th November in a vocational school in the city of Salzburg, Austria. Two out of five students with gastroenteritis tested positive for norovirus (NV). A probable case involved diarrhoea or vomiting in a student, which occurred between 21st November and 5th December 2011. A confirmed case was a probable case with an NV-positive stool sample. Epidemiological findings led to suspect food items prepared by the school kitchen and consumed between 21st and 25th November as outbreak sources. All students at the school were eligible to be included in a retrospective cohort study. Forty-eight cases fulfilled the outbreak case definitions including three (6%) confirmed cases among a total of 351 responding students. The outbreak started on 23th November, peaked on 24th and ended on 5th December. The cohort study indicated a sour cream sauce (food-specific relative risk (RR): 16.1; 95% CI: 3.9–67.5) and a turkey-strip salad (RR: 5.2; 95% CI: 2.3–11.8) as the most likely sources, accounting for 85% of the 39 suspected foodborne cases.

■ Zusammenfassung

Ein Lebensmittel-bedingter Ausbruch von Norovirus in einer Berufsschule im November 2011 in Österreich

Ende November kam es zu einer Häufung von Brechdurchfällen bei Schülern einer Berufsfachschule mit Internat in Salzburg Stadt. Von zwei der fünf untersuchten Schüler war die Stuhlprobe Norovirus (NV) positiv. Die AGES wurde mit der Aufklärung beauftragt. Ein Ausbruchfall war definiert als Brechdurchfall bei einem Schüler mit Erkrankungsbeginn zwischen 21. November und 5. Dezember; ein bestätigter Ausbruchfall hatte zusätzlich eine NV-positive Stuhlprobe. Die deskriptive Epidemiologie ließ Speisen, die von der Schulküche zubereitet und zwischen 21. und 25. November von den Schülern konsumiert wurden, als Ausbruchquelle(n) vermuten. Zur Prüfung dieser Hypothese wurde mit den 370 Schülern eine retrospektive Kohortenstudie durchgeführt. Informationen über die Speisenkonsumation der Schüler an den besagten Tagen erhoben wir mittels eines selbst auszufüllenden Fragebogens. Wir berechneten die Tages-spezifische Erkrankungs-Befallsrate für 21.–25. November und für jede Speise das relative Erkrankungs-Risiko. Wir identifizierten 48 Ausbruchsfälle (drei bestätigt) unter den 351 vollständig befragten Schülern. Der Ausbruch dauerte von 23. November bis 5. Dezember, mit einem Fallzahl-Gipfel am 24. November. Höchste Erkrankungs-Befallsraten wurden bei den Schülern beobachtet, die an den Tagen 22., 23. und 24. November Speisen der Schulküche konsumiert hatten (10 %, 12,4 %, 4,7 %). Eine Sauercremesauce (RR: 16,1; 95 % CI: 3,9–67,5) und ein Putenstreifensalat (RR: 5,2; 95% CI: 2,3–11,8) erwiesen sich als plausibelste Quellen des Ausbruchs. Insgesamt konnten mit diesen Speisen 85% der 39 suspekt Lebensmittel-assoziierten Fälle erklärt werden. Als Ausbruchsstamm wurde eine NV-Hybride von Genotyp GGII.7 und GGII.6 identifiziert. Die Art des NV-Eintrags in die Schulküche bleibt ungeklärt, da keine Stuhluntersuchungen bei den Küchenangestellten durchgeführt wurden. Ein HACCP-Konzept (i.e. Gefahrenanalyse und kritische Lenkungspunkte) war in der Schulküche nicht etabliert.

Abbreviations: HACCP = hazard analyses and critical control points; NV = Norovirus; nt = nucleotide; GGII = genogroup II; AR = Attack rate

Genotyping identified the hybrid GGII.7/GGII.6 as the virus causing the outbreak.

The mode of NV entry into the school kitchen remains unclear as stool samples from kitchen workers have not been tested. However, the lack of a hazard analysis critical control point system (HACCP) in the school kitchen might have caused the failure of food safety procedures and facilitated the contamination of kitchen surfaces and food items with NV.

Introduction

Norovirus (NV) is a single-stranded RNA virus that can cause acute gastroenteritis in humans. NV can spread via aerosolized vomit, contaminated food and environmental surfaces and directly from person to person via the faecal-oral route (KOOPMANS, 2008; DREYFUSS, 2009). The infectious dose is low, ranging between 10–100 viral particles and the incubation period lasts on average from 24 to 48 hours (KRONEMAN et al., 2008; TEUNIS et al., 2008). The virus is increasingly recognized as a leading cause of foodborne disease in Europe and is frequently reported to be associated with NV-excreting food handlers (LOPMAN et al., 2004; KRONEMAN et al., 2006; KOOPMANS, 2008; DREYFUSS, 2009).

The virus is classified molecularly into genogroups (GG) and genotypes. Genome sequencing followed by phylogenetic analysis is the most common method for genotyping (DINGLE, 2004). Most NV outbreaks reported in the last five years in Europe have been caused by the GGII.4 genotype.

In Austria, notification of foodborne NV gastroenteritis has been mandatory since 2006 (BMG, 2009). According to the 2012 update of the European NV molecular platform (Noronet) in which the Austrian NV reference laboratory has participated since 2008, 34 NV outbreaks were registered in Austria in 2008, 39 in 2009, 54 in 2010 and 21 in 2011 (SCHMID et al., 2005; FRETZ et al., 2009; KRAUSE, 2009). The two dominant GGII genotypes registered were GGII.4-2006b in 2008 and 2009 and GGII.4-2010 in 2010 and 2011.

On 28th November 2011, a school physician informed the Austrian Agency for Health and Food Safety (AGES) of 40 cases of gastroenteritis that had occurred on 24th and 25th November in a vocational school in the city of Salzburg. Two of five stool specimens collected from students with gastroenteritis were positive for NV. Insufficient hand hygiene among the students was initially cited as the reason for the outbreak, putting the blame on the students affected. On 30th November, the provincial public health authority of Salzburg commissioned AGES to investigate the outbreak.

Material and Methods

We investigated a school outbreak of gastroenteritis due to NV and performed a retrospective cohort study among the students of the vocational school to identify the source(s).

Descriptive epidemiology

We defined a probable outbreak case as diarrhoea or vomiting in a student of the vocational school with disease onset between 21th November and 5th December 2011. A confirmed outbreak case was a probable case with a stool sample positive for NV. A suspected foodborne case was defined as an outbreak case with disease onset not later than 28th November, considering the kitchen closure on 26th November. The outbreak team engaged the school teachers in active case-finding, asking them to ask students whether they had fallen sick with diarrhoea or vomiting in the time period of interest. For each identified case, we collected information on age, sex, date of disease onset, symptoms (diarrhoea, vomiting, fever, nausea, stomach ache, and cramps) and on laboratory testing of stool specimen. The school physician interviewed the first 20 patients on exposure to food prepared by the school kitchen facility and on exposure to a vomiting case in order to generate hypotheses about potential sources of infection.

Analytical epidemiology

Epidemiological findings led us to suspect food items prepared in the school kitchen and consumed between 21th and 25th November as likely sources of infection with NV. All students registered at the school for the winter semester 2011/2012 and who had possibly consumed food prepared in the school kitchen facility were eligible to be included in the retrospective cohort study. Information on food items consumed at the school on any of the days of interest (21th–25th November) and at any meal (breakfast, lunch, dinner) was collected via self-administered questionnaires, together with information on boarding school status and demographics (age, sex). We entered data into the EpiInfo software version 7 and used Stata version 10 to calculate relative risks and 95% confidence intervals by chi-square test and Fisher's exact test.

To identify the date of risk of infection, we defined students exposed on specific days and day-specific cases. For the particular day under study, a day-specific case was a case exposed to any food item on that day and who fell sick within the following two days, taking into account the incubation period for NV of 24–48h (day-specific analysis) (SCHMID et al., 2007). In the second step, we compared for each food item the risk among exposed students with the risk among the unexposed per day (day-wise food-specific analyses), resulting in the food-specific relative risk (RR). We restricted these day-wise food-specific analyses to the days found to be associated with illness in the day-specific analysis. We conducted

stratified analyses to control for potential confounders or effects of modification of exposure to the different foods.

Laboratory investigations

The National Consultant Laboratory for Norovirus in Germany tested the stool specimens available from outbreak cases for the presence of NV using a real-time PCR as described previously (MILLER et al., 2002). Characterization of NV by genogroup was performed by a nested multiplex RT-PCR. The genotype was identified by direct sequencing and a neighbour-joining tree analysis using a consensus region of 275 nt (nucleotides) in the RNA-dependent RNA polymerase gene open reading frame 1 (ORF1) and a consensus region of 140 nt in the capsid gene open reading frame 2 (ORF2) (OH et al., 2003).

Environmental investigations

No staff in the school kitchen provided stool specimens for laboratory diagnostics. The public health authority did not collect food or environmental samples.

Results

Forty-eight cases fulfilled the outbreak case definitions including three (6%) confirmed cases. Thirty-seven cases (77%) reported nausea, 31 (65%) vomiting, 29 (60%) stomach ache, 24 (50%) diarrhoea and 16 (33%) fever. The median age was 17 years (range: 14–20), 39 cases were male (81.3%) and 38 (80%) were boarding students. We identified consumption of food prepared in the school kitchen facility as the only common link among the 20 case students interviewed by trawling questionnaire. The outbreak started on 23th November, peaked on the 24th and ended on 5th December. The shape of the outbreak curve suggested sources of infection on the 21st, 22nd, 23rd, 24th and possibly 25th November, followed by non-foodborne transmission of NV on 26th, 27th, 28th November and 2nd and 5th December (Fig. 1).

Analytical epidemiology

Of the 370 students registered at the school, including 207 boarding and 163 non-boarding students, we recruited 351 students for participation in the retrospective cohort study. These encompassed 196 boarding students (response rate: 94.7%) and 155 non-boarding students (response rate: 95.0%).

The overall disease attack rate was 14% (48/351). The median age of the cohort participants was 15 years (min 13; max 19) with a male: female ratio of 1:2. Males (RR: 2.2; 95% CI: 1.1–4.42) and boarding students (RR: 3.0; 95% CI: 1.5–5.8) were more likely to be a case. When stratified by boarding school status, males among the boarding students were more likely to be a case (RR: 3.4; 95% CI: 1.4–8.2, p=0.003). Of the 41 cases with available data on disease onset (for seven outbreak cases the onset of disease wasunknown), 39 were suspected to be foodborne cases and included in the day-specific analyses and subsequently in the day-wise food-specific analyses.

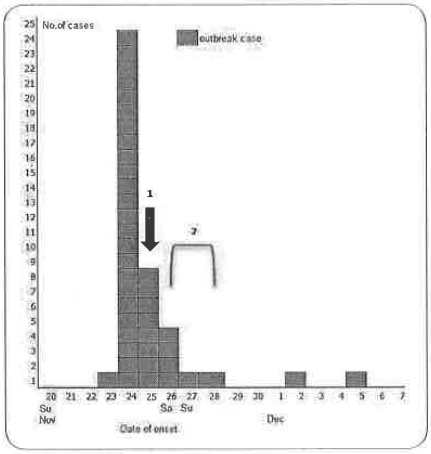

Fig. 1: Cases of an outbreak due to NV in Austria, November/December 2011 by date of clinical onset (n=41; in seven cases disease onset unknown); 1: indicates the day on which hand disinfectant effective against NV was provided and the school environment disinfected, 2: indicates period of kitchen closure

Highest disease attack rates (AR) were seen among the participants who had eaten any food on 22nd November and 23rd November (AR: 10%, 12.4%) (Tab. 1). Using 21st November – the day associated with the smallest AR (0.4%) – as reference, the day-specific relative risk (RR) of illness was 24.5 (95% CI: 3.3–179.6) for food consumption on 22nd November, 30.4 (95% CI: 4.2-220.9) for food consumption on 23rd November and 11.4 (95% CI: 1.5–88.3) for food consumption on 24th November. The AR associated with food exposure on 25th November did not differ significantly from the AR associated with food exposure on 21st November (1.7% versus 0.4%).

Based on these findings we restricted the day-wise food-specific analyses to 22th, 23th and 24th November. Compared with unexposed students, participants exposed on 22th November to the consumption of venison ragout, red cabbage/dumplings, cranberries, baked potatoes or sour-cream sauce were more likely to be a case (Tab. 2). After stratifying these food-specific analyses by exposure to sour-cream sauce, the food item with the highest relative risk and biological plausibility, consumption of venison ragout, red cabbage/dumplings, cranberries and baked potatoes was no longer associated with the risk of being a case (Tab. 3). Participants who consumed Wiener Schnitzel, potatoes or turkey-strip salad on 23th November were more likely to be a case than those who did not consume

these items (Tab. 2). After stratification of the food-specific analyses by consumption of turkey-strip salad, consumption of Wiener Schnitzel or potatoes was no longer associated with risk (Tab. 3). Of the 39 suspected foodborne cases, consumption of sour cream sauce on 22nd November or of turkey strip-salad on 23rd November can explain 33 (85%) cases, all of which occurred on 23rd–25th November. No food item consumed on 24th November was associated with the risk of being a case. The eight cases that occurred on 26th–28th November and on 2nd and 5th December are suspected to be secondary.

Tab. 1: Day-specific attack rate (AR%) of the days 21st–25th November 2011 in an Austrian NV outbreak in a vocational school

Days of food exposure	Day-specific exposed student[1] (N_{exp})	Day-specific case[2] n	AR (%) n/N ($_{exp}$)
Nov 21	245	1	0.4
Nov 22	240	24	10.0
Nov 23	242	30	12.4
Nov 24	215	10	4.7
Nov 25	60	1	1.7

[1]Day-specific exposed student defined as a cohort participant with food exposure on the day under study; the decreasing numbers of the day-specific exposed participants is due to exclusion of participants who had fallen sick before or on the day under study;
[2]Day-specific case defined as a student who fell sick within the two days following the day of exposure to food

Laboratory investigations

Three of seven stool specimens collected from student cases tested positive for NV genogroup (GG) II. Genotyping of the outbreak virus characterized the virus as a hybrid of the GGII.7 and GGII.6 genotypes. The hybrid showed high homology in the polymerase gene open reading frame 1 (ORF 1) (94.3%) to the GGII.7 genotype (GenBank acc. no. AB039777) and high homology in the capsid gene open reading frame 2 (ORF2) (94%) to the GGII.6 genotype (GenBank acc. no AJ277620).

Environmental investigations

According to the school physician, no members of the kitchen staff had taken sick leave and there was no indication that kitchen workers with diarrhoea had continued work in the week prior to and during the outbreak. There was no hazard analysis critical control point (i.e. HACCP) concept for food safety in place in the school kitchen.

Discussion

The epidemiological investigation of an outbreak of NV gastroenteritis including a total of 48 cases in an Austrian boarding school in November 2011 indicated a foodborne genesis for the majority of the cases. Insufficient hand hygiene of boarding school students may explain the few non-foodborne cases generated by person-to-person transmission.

Genotyping of NV from the outbreak cases identified the hybrid GGII.7/GGII.6 as the outbreak causing virus, which has not been previously reported in Austria. In Sweden, among 101 foodborne and waterborne NV outbreaks in 2002–2006, four of the foodborne outbreaks were also caused by this NV hybrid GGII.7/II.6a (LYSÉN et al., 2009). Most NV outbreaks reported in the last five years in Europe were caused by the GGI.3, I.4 and I.b genotypes and the GGII.4 genotype (SIEBENGA et al., 2008; VAN BEEK et al., 2012) but the spread of recombinant viruses such as hybrids of different polymerase and capsid genotypes has increased over the past five years (REUTER et al., 2006; LYSÉN et al., 2009). The public health impact of emerging recombinant NV strains is not yet known.

Tab. 2: Day-wise food-specific attack rate (AR%) and food-specific risk ratio (RR) for food items served on 22nd and 23rd November; 95% confidence intervals (CI) and p-values.

Food items	Food exposed			Food unexposed					
	Total	Cases	AR%	Total	Cases	AR%	RR	95 % CI	P
22nd November; N=344									
Sour-cream sauce	143	23	16.1	201	2	1.0	16.2	3.9–67.5	<0.01
Baked potatoes	161	23	14.3	183	2	1.1	13.1	3.1–54.6	<0.01
Ragout of venison	199	22	11.1	145	3	2.1	5.3	1.6–17.5	<0.01
Red cabbage/dumpling	184	19	10.3	160	6	3.8	2.8	1.1–6.7	0.02
Cranberries	137	15	11.0	207	10	4.8	2.3	1.1–4.9	0.03
23rd November; N=343									
Wiener Schnitzel	230	30	13.0	113	2	1.8	7.37	1.8–30.3	<0.01
Turkey-strip salad	139	25	18.0	204	7	3.4	5.24	2.3–11.8	<0.01
Potatoes	220	27	12.3	123	5	4.1	3.02	1.2–7.6	0.01

Tab. 3: Stratified analyses: Food-specific risk ratio (RR) for food items served on 22nd and 23rd November stratified by the two food items that are the most microbiologically plausible vehicles for NV (i.e. sour-cream sauce, turkey-strip salad); 95% CI

Exposures	Crude analyses	Stratified analyses	
	RR (95% CI)	RR (95% CI)	RR (95% CI)
22nd November		exposed to sour-cream sauce	not exposed to sour-cream sauce
Baked potato	13.1 (3.1–54.6)	∞	0.0
Ragout of venison	5.3 (1.6–17.5)	1.9 (0.5–7.6)	1.6 (0.1–24.9)
Red cabbage/ dumpling	2.8 (1.1–6.7)	1.0 (0.4–2.4)	1.8 (0.1–28.8)
Cranberry	2.3 (1.1–4.9)	1.2 (0.5–2.6)	0.0
23rd November		exposed to turkey-strip salad	not exposed to turkey-strip salad
Wiener Schnitzel	7.4 (1.8–30.3)	∞	2.8 (0.6–13.9)
Potatoes	3.0 (1.2–7.6)	0.9 (0.3–2.6)	2.8 (0.6–14.2)

As described in previously published NV outbreaks, defining outbreak cases for each day of exposure under study according to the incubation period of infection increases the likelihood of identifying probable sources of infection with a pathogen with such a short incubation period as NV (SCHMID et al., 2007; SCHMID et al., 2011a). Two dishes implicated by our findings - the sour cream sauce and the turkey-strip salad - are biologically plausible sources of infection with NV. The other food items also implicated by the findings of the day-wise food specific analyses such as baked potatoes or Wiener Schnitzel are rather biologically non-plausible as NV vehicles. This was confirmed by the findings of the stratified analyses, which indicated the two biologically plausible food items as effect modifiers for the others. Boarding students were more likely to be cases, which can be explained by the fact that sour-cream sauce and turkey-strip salad were served for dinner.

Preparation of cold meals not requiring heating has been repeatedly reported to be associated with foodborne outbreaks of NV (KOOPMANS and DUIZER, 2004; SCHMID et al., 2007; SHOWELL et al., 2007).

NV can easily enter kitchen facilities of schools, accommodations and health-care facilities via symptomatic and asymptomatic kitchen workers (SCHMID et al., 2007; MOE, 2009; MARSHALL and BRUGGINK, 2011). Up to 20% of people infected with NV do not have symptoms of gastroenteritis and may continue to work and to have contact with food (MOE, 2009; MARSHALL and BRUGGINK, 2011). A study in Japan showed that the mean viral load in stools found in asymptomatic food handlers was similar to that of symptomatic individuals (OZAWA et al., 2007). Foodborne outbreaks due to asymptomatic NV excretors among kitchen staff have been repeatedly reported. In Ireland in 2009, sandwiches, which were epidemiologically identified as the source of an outbreak, were suspected to have been contaminated by asymptomatic, NV-excreting food handlers (NICOLAY et al., 2011). In Austria in 2009, an outbreak of NV in a healthcare facility was traced back to asymptomatic kitchen staff excreting NV (SCHMID et al., 2011a). Another mode of spread of NV into kitchen facilities could be via kitchen workers, in whose households somebody had fallen sick from an NV infection. This was reported in an outbreak due to NV at a university cafeteria in Texas in 1998 (DANIELS et al., 2000) and in an outbreak among attendees of a party in Austria in 2007 (KUO et al., 2009). A study of NV viability indicated that NV can remain infectious for up to 28 days at 20 °C on the surface of a kitchen (LAMHOUJEB et al., 2009). The lack of a hazard analysis critical control point system (HACCP) in the school kitchen might be responsible for the failure of food safety and have facilitated the contamination of kitchen surfaces and food items by kitchen workers excreting NV. However, as no stool samples from the disease-free kitchen workers, no food or environmental samples and no information on the disease status of the kitchen workers' household members were available, the mode of entry of NV into the school kitchen remains unclear.

On 25th November (outbreak day 3), the school cleaning staff cleaned and disinfected the surfaces of the classrooms, toilets and public areas. On 26th November, the kitchen was closed for two days for cleaning and disinfection. The school physician trained students and kitchen workers in Hand hygiene by use of a hand disinfectant effective against NV (Bode Sterilium Virugard®, Hartmann, Heidenheim, Germany), which was provided in toilets and in the kitchen facility. Only two further cases were reported after November 28th (outbreak day 6).

We recommended implementation of an HACCP system, which is required by law in Austria but hard to control in boarding schools due to the lack of personnel resources. We advise school directors to comply with the Austrian guidelines for the control and prevention of NV outbreaks (SCHMID et al., 2011b).

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Listeriosis in Austria

An Evaluation of the Austrian *Listeria* Surveillance System

On behalf of the Chief Medical Officer
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2012-2013

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Introduction/Background

Introduction to the Disease

Listeriosis is a rare but potentially serious infectious disease caused by *Listeria monocytogenes*. *L. monocytogenes* is a Gram-positive bacteria that occurs ubiquitously in nature. Many ruminant animals (e.g. cow, goats) excrete the bacteria via faeces. Listeria serotypes are based on the two antigens O and H. Currently, there are twelve serotypes of L. monocytogenes (1/2a, 1/2b, 1/2c, 3a, 3b, 3c, 4a, 4b, 4c, 4d, 4e, and 7) recognized, of which three (1/2a, 1/2b, and 4b) cause the majority of human cases (95%); serotype 4b is most commonly associated with outbreaks. Most cases of human listeriosis are foodborne, related to contaminated raw food and undercooked food. Risk groups of listeriosis are pregnant women, newborns, and adults with a weakened immune system (1). A person with listeriosis usually has fever and muscle aches, sometimes preceded by diarrhea or other gastrointestinal symptoms. Symptoms in pregnant women include mild flu-like symptoms, headaches, muscle aches, fever, nausea, and vomiting. Most reported cases of invasive listeriosis present with life-threatening illness such as materno-fetal listeriosis or neonatal listeriosis, blood stream infection, and meningoencephalitis.

Listeriosis in Austria, until 2012

National Surveillance Data - Data Sources

From 1996-2006 data on the annual number of cases were provided by the National Reference Laboratory for Listeria, Innsbruck, Tyrol. Since 2007 the National Reference Centre and since 2010 the National Reference Laboratory for Listeria have been estalished by AGES, providing all laboratory case data. Since 2005 data on monthly and annual number of confirmed cases of listeriosis has been published at the website of the MoH.

From 1996 to 2005 the annual incidence increased from 0.14 to 0.24/100,000 with a total of 131 cases within the 10 years (1996: 11 cases; 2005: 20 cases). The rate decreased thereafter to 0.12/100,000 in 2006 (n=10). There was a steep increase to 0.55/100,000 persons in 2009 due to a multinational listeriosis outbreak (n=46) (figure 1).
The incidence of pregnancy-related listeriosis from 1996 to 2012 ranged between 0 and 0.1/100,000 population with peaks in 1998, 2002, 2008 and 2010 (Figure 3).
Serotype 4b and 1/2a accounted for the majority of cases from 1997- 2012 (data not shown).

Outbreaks 2003-2012

According to the annual surveillance report of listeriosis in Austria, there were no outbreaks reported from 2003 to 2007. From 2008 until 2012 a total of 4 outbreaks have been detected and investigated.
2008: a foodborne was outbreak associated with jellied pork contaminated with *Listeria monocytogenes* including 14 cases with onset of gastroenteritis within 1 week following dinner at a wine tavern on September 6.
2009/2010: A multinational Listeriosis outbreak with a total of 34 cases (25 Austrian cases) including five deaths. The microbiologically identified outbreak source was an acid curd cheese 'Quargel', produced in Austria.
2010: An outbreak of three cases was detected in May (source unknown)
2012: An outbreak of three cases was detected (source unknown) (figure 2).

Figure 1. Annual incidence of invasive listeriosis disease /100,000 persons, Austria, 1996–2012; Source: National surveillance data

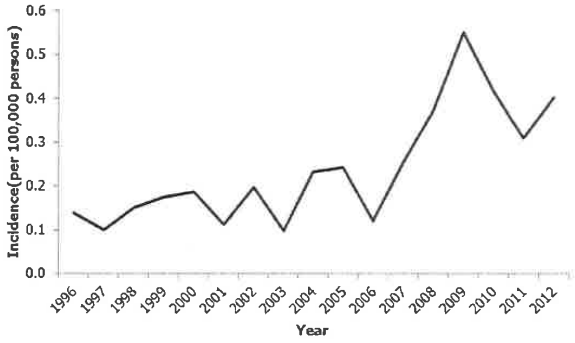
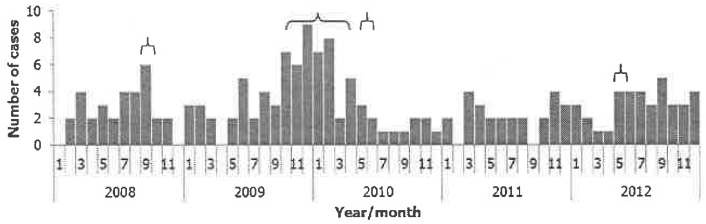
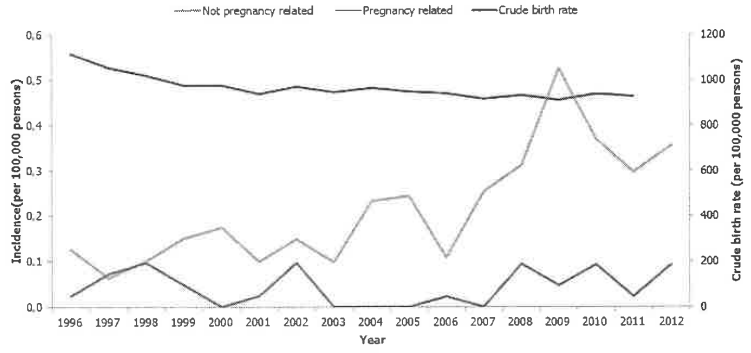


Figure 2. Number of invasive listeriosis disease by month of diagnosis, Austria, 2008-2012 (the bracket indicated cases within an outbreak)



The incidence of pregnancy-related and non-pregnancy related Listeriosis is illustrated in Figure 3. The incidence of non-pregnancy related Listeriosis increased since 2006 and reached a peak in 2009, the year in which the "Quargel" associated outbreak occurred.

Figure 3. Annual number of listeriosis cases in non-pregnant adults and children > 1 month of age (green line) and listeriosis cases in pregnant adults (blue lines), Austria, 1996–2012, Source: National surveillance data



The number of live births in 2012 is not available at the moment.

The number of invasive listeriosis disease cases and percentage of all the cases by province from 2008 to 2012 was given in the Figure 4.

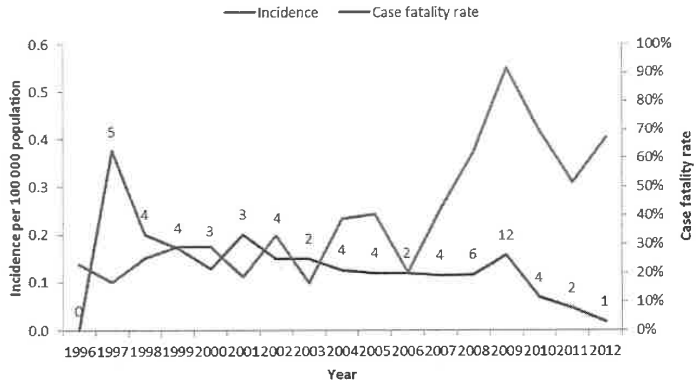
Figure 4. Annual incidence of invasive listeriosis disease (per 100,000 persons), number and percentage of cases by province, Austria, 2008-2012 (Source: National Reference Laboratory for *Listeria)*

		Province n (%)								
Year	Annual incidence	B	K	NÖ	OÖ	S	ST	T	V	W
2008	0.37	1(3)	1(3)	7(23)	4(13)	4(13)	5(16)	2(6)	1(3)	6(19)
2009	0.55	1(2)	4(9)	8(17)	3(7)	4(9)	5(11)	3(7)	1(2)	17(37)
2010	0.42	0	1(3)	10(29)	4(11)	5(14)	6(17)	1(3)	0	8(23)
2011	0.31	2(8)	4(15)	8(31)	3(12)	1(4)	4(15)	0	2(8)	2(8)
2012	0.40	2(5)	3(8)	5(14)	7(19)	7(19)	2(5)	3(8)	2(5)	6(16)

The color in red displayed the province with highest number of cases during 2008-2012

The trend of case fatality rate (CFR) decreased despite the incidence increase, the peak of increased CFR in 2009 was the year of the international outbreak (Figure 5).

Figure 5. Annual incience and case fatality, Austria, 1996-2012 (the number displayed the annual number of deaths)



Prevention and control of listeriosis

General recommendations to prevent an infection with *Listeria* include proper washing and handling food, cook meat and poultry thoroughly, store foods safely and choose safer food (e.g. pasteurized milk). Higher risk group such as pregnant women and immunocompromised individuals should avoid consumption of foods such as not well-cooked hot dogs, delicatessen meats, soft cheese and smoked seafood, which can be contaminated with *Listeria* (1). In addition, the utilities used in the kitchen such as knives, countertops, and cutting boards, and refrigerators should clean up often to avoid cross-contamination.

In public health perspectives, promptly detect and investigate cluster of listeriosis through effective *listeria* surveillance system is crucial in order to take public health actions and interventions.

The control measure is aimed at the farm and food-processing level, in order to prevent contamination of food products. To avoid raw milk contamination at farm, good farm practices (e.g. animal and waste management, water treatment, good hygienic conditions during milking and mastitis control) are essential to prevent the accumulation, survival, and transmission of pathogens.

At the processing factories, in order to prevent colonization of the processing environment by *L. monocytogenes*, plant layout and equipment should be designed to be more hygienic, such as without edges, crevices and dead spaces to facilitate good working routines and to ensure an effective sanitation process (2).

Standard prevention and control strategies in Austria

Austrian Agency for Health and Food Safety (AGES) has published Zoonoses Community Summary Report and listeriosis annual report for disseminating epidemiological data, standard prevention and control strategies. Emphasize kitchen hygiene and rules to minimise the risk of foodborne infection include cooking meat and fish thoroughly, boiling raw milk, and no consumption of raw meat and regular washing of hands.

The Austrian guidelines on microbiological critereia for milk and milk production are based on Directive 92/46/EEC of the EU commission (Discussion paper on strategy for setting microbiological criteria for foodstuffs in Community legislation). Detailed criteria regarding milk and milk products proposed by the Scientific Committee on Veterinary Measures relating to Public Health (SCVPH) in 2005 are given in Appendix 2.

Microbiological criteria for foodstuff on sampling and testing

The microbiological criteria according to EU investigation regulation (EC) No 2073/2005 valid since Jan 2006 on microbiological criteria for foodstuffs (e.g. dairy products and ready-to-eat food) are used for verification of good hygiene practices and HACCP-based procedures which are mandatory for the food business apply in Austria (3). The regulation differs in terms of food safety criterion for *L. monocytogenes* which classified into three food categories for ready to eat food and gives an overview of the appropriate sampling plans (Appendix 3).

Samples shall be taken from processing areas and equipment used in food production, when such sampling is necessary for ensuring that the criteria are met. In that sampling the ISO standard 18593 shall be used as a reference method. Food business operators manufacturing ready-to-eat foods and dairy products, which may pose a *L. monocytogenes* risk for public health, shall sample the processing areas (e.g. water, grease, salt bath) and equipment for *L. monocytogenes* as part of their sampling scheme.

The analytical reference method for detection and enrichment of *L. monocytogenes* is according to the European Committee for Standardization EN/ ISO 11290-1 and 11290-2 standard operating procedures. In Austria, the food and environmental specimens are examined in the laboratory of IMML base on the standard operating procedures (4).

Description of the surveillance system

Objective of the surveillance system

We identified five objectives of the Austrian Listeria surveillance system determined in the Epidemic Act (Epidemiegesetz, BGBL. Nr. 186/1950) and Zoonoses Act (Zoonosengesetz, BGBl. I Nr. 128/2005), which has been adapted to the goals for the Surveillance of Communicable Diseases in the EU (7) (the laws are illustrated in Appendix1).

1. Monitor trends in listeriosis incidence in order to assess the present situation in real-time to respond to rises above warning thresholds and to facilitate appropriate evidence-based action;
2. Detect and monitor any listeriosis outbreaks with respect to source, time, population and place, in order to provide a rationale for public health action;
3. Identify population groups at risk and in need for targeted prevention measures;
4. Generate hypotheses on (new) sources, modes of transmission and groups most at risk and identify needs for research and development and for pilot projects;
5. Report Austrian Listeria data to TESSy according to Decision No 2119/98/EC (6).

Population under surveillance

We consulted the federal institute Statistics Austria for information on the population under surveillance including age, sex and province of residence. The role of Statistics Austria is to provide reliably collected and expertly analyzed political, social and economic information in Austria and is owned by the state.
The comprehensive surveillance system includes the entire Austrian population under surveillance (8,489,482 in 2013). The Federal Republic of Austria lies in central Europe and covers an area of 83,870 sq km. Austria is surrounded by the Czech Republic, Germany, Hungary, Italy, Liechtenstein, Slovakia, Slovenia, and Switzerland. Austria is divided into nine provinces: Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg, and Vienna. The official national language is German although Croatian, Hungarian and Slovenian are recognized as regional languages. Austria is divided into a total of 106 district PH offices within the 9 provinces.

Case definitions

The surveillance system applies the case definition of listeriosis given by WHO until 2008. Since 2009, the case definitions comply with the new EU case definition (Decision No 2119/98/EC of the European Parliament and of the Council).

Table 1. Case definitions, EU

Case Definition		
Clinical Criteria	Stillbirth	
	the first month of life: at least 1 of the 5 following symptoms	• Granulomatosis infantiseptica • Meningitis or meningoencephalitis • Septicaemia • Dyspnoea • Lesions on skin, mucosal membranes or conjunctivae
	Pregnancy: at least 1 of the 3 following symptoms	• Abortion, miscarriage, stillbirth or premature birth • Fever • Influenza-like symptoms
	Other: at least 1 of the 4 following symptoms	• Fever • Meningitis or meningoencephalitis • Septicaemia • Localised infections such as arthritis, endocarditis, and abscesses
Laboratory Criteria At least 1 of the following 2	• Isolation of Listeria monocytogenes from a normally sterile site • Isolation of Listeria monocytogenes from a normally non-sterile site in a foetus, stillborn, newborn or the mother at or within 24 hours of birth	
Epidemiological Criteria At least 1 of the following 3 epidemiological links	• Exposure to a common source • Human to human transmission (vertical transmission) • Exposure to contaminated food/drinking water	
Additional information	• Incubation period 3-70 days, most often 21 days	
Case Classification	Possible case	Not applicable
	Probable case	Any person meeting the clinical criteria and with an epidemiological link
	Confirmed case	Any person meeting the laboratory criteria OR Any mother with a laboratory confirmed listeriosis infection in her foetus, stillborn or newborn

Type of the surveillance system

Since 1996 a compulsory, comprehensive, passive, case-based surveillance system for zoonoses and zoonotic agents has been in place. The Zoonoses Act (Bundesgesetz zur Überwachung von Zoonosen und Zoonoseerregern, BGBl I Nr. 128/2005) in 2005 re-defined the zoonoses and antibiotic resistance surveillance systems and the National Reference Centres for zoonotic agents (7).

Data Structure

Detailed description about data structure of the current case-based surveillance system for *listeria* is given in the chapter of evaluation result of simplicity (Figure 6).

For detection of food and environmental specimens with listeria contamination, the food inspectors collect specimens and submitted to the Institute for Milk Hygiene, Milk Technology and Food science (IMML) for further diagnosis. The isolates of *Listeria* were submitted to National Reference Laboratory for PFGE analysis. The laboratory data of both food and human specimens were generated by the National Reference Centre for *Listeria*. The notification data and the laboratory data are merged into one case record located in the National electronic web-based reporting system (NeRS). This dataset is uploaded regularly to TESSy by the Federal Ministry of Health (MoH).

The role of National Reference Laboratory for Listeria

The National Reference Laboratory for *Listeria* is located within the AGES at the Center for Foodborne infectious diseases, Institute for Medical Microbiology and Hygiene, Graz.
The designation was based on the EU Regulation (EC) Nr.882/2004 that each Member State is required to designate the relevant reference laboratories for specific tests of foods and human specimens. The jurisdiction of the National Listeria Reference Laboratory included for the test of human specimens and food products such as dairy products to detect infection or contamination of *Listeria monocytogenes.* The role and request form for the submission of isolates of *Listeria monocytogenes* were according to Food Safety and Consumer Protection Act (LMSVG) § 38 Abs. 1-6, § 74 and §75.

The role of the Institute for Milk Hygiene, Milk Technology and Food Science

The Institute for Milk Hygiene, Milk Technology and Food Science (IMML) is a teaching, research and food-sample testing institute at Department of Animal Production and Public Health in Veterinary Medicine, University of Vienna. IMML organize platforms for knowledge transfer, training events and lectures at conferences on current issues in food safety in Austria. In addition, IMML have also involved in the environment monitoring and product contamination chain investigations. IMML offers the interdisciplinary entanglement of activities with other universities and risk assessment bodies such as the Austrian Agency for Food and Food Safety (AGES) and other responsible authorities (8). The research of the IMML is organized into five working groups:
Innovative methods of detection,
Molecular epidemiology,
Adaptation of pathogenic microorganisms
Global aspects of food safety and
Food-associated Zoonotic Ecology (post-doctoral program of the University of Veterinary Medicine Vienna)
In addition to IMML, the Federal Institute for Alpine Dairy Farming (Bundesanstalt für Alpenländische Milchwirtschaft, abbreviated as BAM redwood) also monitors *Listeria* in dairy products since 2004 in Austria. BAM redwood also provides hygiene training and education courses for cheese technological information include control of *Listeria* (9).

Indicators

The indicators of the surveillance system are the monthly and annual number of cases at the MoH website and the annual incidence/100,000 population total and by age, sex, and province, the annual number of cases by serotype and PFGE (pulse filed gel-electrophoresis) type, 28-days mortality/100,000 population, case fatality and the annual number of registered outbreaks provided in the annual surveillance report of the National Reference laboratory.

Feedback

The annual report "Report on Zoonoses and Zoonotic agents" published by Ministry of Health and Austrian Agency for Health and Food Safety (AGES) is to disseminate information of surveillance of zoonoses in Austria, which include *listeria* infection. The MoH also publishes the number of *Listeria* cases online each month: "Monatliche Statistik meldepflichtiger Infektionskrankheiten" since 2005. The MoH has published the number of Listeria cases that are reported to the National electronic web-based reporting system (NeRS) each month on the "Monatliche Statistik meldepflichtiger Infektionskrankheiten", with a lag of one month. This is generated by National Reference Centre for *Listeria* and reported to MoH or directly extracted from NeRS by MoH since 2009. The annual report of Annual statistics of notifiable infectious diseases (Statistik meldepflichtiger Infektionskrankheiten vorläufiger Jahresbericht) has been published as the news letters by MoH, which includes listeriosis.

On the provincial public health directorate level, the provincial PH director is assigned the task of overseeing *Listeria*-surveillance and also supports the coordination of province-border-crossing outbreaks together with the Federal Zoonoses Commission. The provincial PH director has access to anonymous province-specific data within the NeRS in order to monitor the epidemiological trends. At the start of the following year, the total number of *Listeria* cases is made available only provisionally as the numbers are then corrected and confirmed over the course of the year. One additional advantage is that the *Listeria* data that is collected in the NeRS can also be submitted to TESSy via the MoH directly. Furthermore, the binational cooperation for *listeria* via Binational Consulting Laboratory for Listeria Germany / Austria established the bond between the Institute for Medical Microbiology and Hygiene, AGES and Robert Koch Institute to encourage the European network in German-speaking countries, with the consistent aim and better resources to control rare infectious disease such as listeriosis.

Action taken

The binational Austrian-German Consiliar Laboratory for Listeria in Vienna noticed a cluster of human isolates of *L.monocytogenes* serotype 1/2a in August 2009. Fourteen cases with onset of disease ranged from June 2009 to January 2010. An epidemiological investigation revealed 'Quargel' cheese produced by an Austrian manufacturer as the source of infection. The product was withdrawn from the Austrian, German, Slovakian and Czech markets on 23 January 2010 according to MoH (10). This was criticized as too long to recall the incriminated products. During that time, Austrian law illustrated that before any public health reaction such as food product recall, microbiological evidence of identical pathogen in the food product is required. As a direct influence of this outbreak, since 21 April 2010, the Austrian government amended its Food Safety and Consumer Protection Act (LMSVG) to enable products recall announcing by health authorities base on epidemiological evidence before microbiological evidence being confirmed (11).

Another room for improvement from the experience of this outbreak is risk communication to the public, especially if hard-to-reach group (e.g. the elderly) is involved. There were at least two additional cases associated to consumption of the contaminated Quargel after date of product recall, which means the information is not well disseminated to all the public at risk or some people reluctant to dispose of food even though information has been informed. House visit of the patient is important to be able to obtain possible food leftover and to advise other family members on precautionary procedures.

Methods of the evaluation of the Surveillance System

Goal

To assess whether the objectives of the surveillance system for Listeriosis are fulfilled

Aim

The aim of the evaluation of the surveillance system will be to assess whether the system has the appropriate simplicity and timeliness to reach the following objectives of the system:

> Detect and monitor any listeriosis outbreaks with respect to source, time, population and place, in order to provide a rationale for public health action.

Evaluation of the surveillance system

In the following we describe method/materials on the simplicity and timeliness before and after implementation of NeRS in 2009 (Table 2).

Table 2. Methods used for evaluation of the two selected attributes (simplicity and timeliness)

Attribute	Method
Simplicity	**Study objective:** To assess the simplicity of the *Listeria* surveillance system through identifying and comparing the number of components and data pathways, and the mode of data analysis before and after implementation of the National electronic web-based reporting system (NeRS) for statutorily notifiable diseases in Austria **Study design:** Before - After Intervention Study **Study population:** The whole population of Austria **Outcome:** The difference in the number of components and data transfer pathways before and after the implementation of NeRS **Data analysis plan:** Personal interviews will be performed with AGES Department of Infectious Disease Epidemiology and National Reference Centre for *Listeria* to compare the number of components and number of data transfers before and after the implementation of NeRS include Number of stakeholders involved in data production e.g. physicians, primary laboratories and the reference laboratories Document used to collect data Interface used to transfer data Stakeholders involved in data transfer (senders and receivers) Software used for data managing and data analysis (e.g. MS Excel and Epi info)
Timeliness	**Study objective:** To assess the timeliness of the *Listeria* surveillance system by measuring the median time of delivery process include from date of onset to blood or CSF specimen receipt at primary laboratories until the last step of case record entry into the NeRS **Study design:** Before - After Intervention Study **Study population:** The surveillance system before (-2008)and after the implementation of NeRS (2009-) **Outcome:** Median length of time between the interval between date of specimen collection and date of specimen arrival at the laboratory for the Listeria surveillance system, 1996-2008 date of onset, date of diagnosis and date of notification since 2009 **Data analysis plan:** Calculation of the median length of time mentioned above

Results of the Evaluation of the surveillance system

Simplicity

The number of components, data pathways, and the mode of data analysis were compared before (-2008) and after (2009-2011) implementation of the National electronic web-based reporting system (NeRS) in Austria (Figures 5). The implementation of the NeRS eliminated two steps in the case data reporting process between local and national level due to the direct entry of case data at local level. Previously, the data transfer step between the district public health office to the provincial public health department and the step between the provincial PH directorates to the Ministry of Health had been conducted on a monthly schedule to transfer case records to the national level. In addition, the National Reference Centre for *Listeria* no longer needs to provide the MoH with the data monthly and annually. The MoH is able to access Austrian dataset of listeriosis from the NeRS anonymously. The National Reference Laboratory for *Listeria* also entry the results of food and environmental samples through NeRS, in order to response and investigate possible foodborne listeriosis outbreaks promptly. The implementation of NeRS does simplify the surveillance system for *Listeria* in humans and animals (Figure 6).

Figure 6. Data flow in the case-based surveillance system for Listeria **after** the implementation of NeRS in Austria

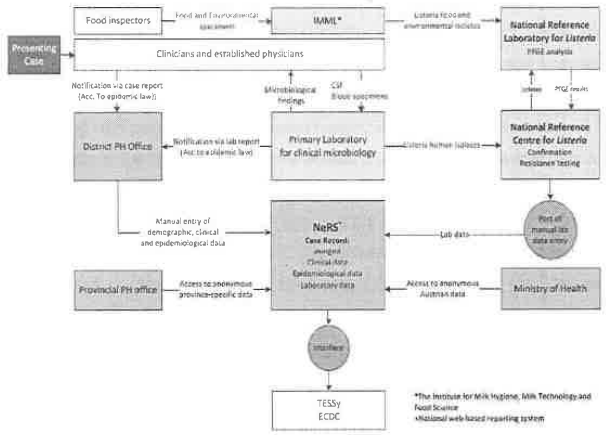


Figure 6 provides a detailed view on the current system case data generating components, data collection and transition. Arrows indicate the direction of the data transition, squares indicate the components participating in the surveillance system and circles indicate the mode of data entry into the National electronic web-based reporting system (NeRS) and TESSy.

The current structure of the case-based *Listeria* surveillance system has been in place since 2009, when the Ministry of Health implemented the National electronic web-based reporting system (NeRS). There are six main components which participate in the Listeria surveillance system for human in Austria: the Listeria-case-detecting clinicians and physicians with praxis, the district PH office, the primary laboratory, the National Reference Centre for *Listeria*, the National Reference Laboratory for Listeria, the National electronic web-based reporting system (NeRS) and the Ministry of Health.

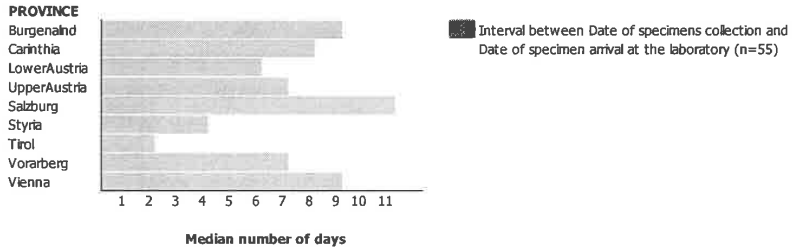
Timeliness

Monthly and annual report of notifiable communicable diseases (Monatliche Statistik meldepflichtiger übertragbarer Infektionskrankheiten and Jahresstatistik meldepflichtiger Infektionskrankheiten) have been uploaded on the official website of Ministry of Health included the number of cases for listeriosis since 2005 (12). Before 2005, listeriosis was not included in the annual surveillance report. However, the case-based information of listeriosis in Austria from the National Reference Laboratory of *Listeria* or the National Reference Centre for *Listeria* was available since 1997 onwards.

Timeliness of the Listeria surveillance system to compare prior to and after implementing National electronic web-based reporting system (NeRS) was calculated by measuring the median time of time-related information available in the dataset. From 1996 to 2008, date of specimen collection and date of specimen arrival at the primary laboratories are the only information available to calculate timeliness. The date of specimen arrival refers to the date when the CSF or blood specimens are received at the primary laboratories for clinical microbiology.

A total of 55 out of 172 cases with both information on the sampling date and date of specimens arrival at the primary laboratories available from 1996-2008, the period before NeRS has been implemented (Figure 7). The median days of the interval between date of specimen collected and date of specimens arrival at the primary laboratories are 6 days (Max: 688, Min: 0).

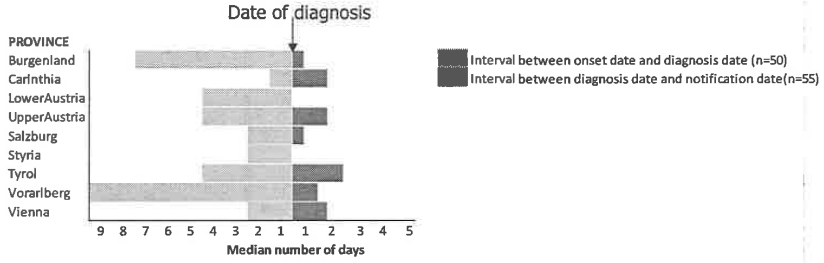
Figure 7. The median interval between date of specimen collection and date of specimen arrival at the primary laboratories for the *Listeria* surveillance system, 1996-2008, Austria



After the NeRS has implemented, there were three date variables that were used to calculate timeliness from *Listeria* case records from 2009 to 2011 (2012 not available): date of onset, date of diagnosis and date of notification.

A total of 96 out of 107 cases with the information on both the onset date and the diagnosis date available, the medians days of intervals from 2009-2011 are two days (Max: 17, Min: 0). A total of 101 out of 107 cases with the information on both the diagnosis date and the notification date available, the medians days of intervals from 2009-2011 are one day (Max: 28, Min: 0). Compare to the interval before the NeRS has been implemented, data transmission efficiency has improved. The information of cases with data available on both time-related variables and reported province were given in Figure 8. The median time between date of onset and date and diagnosis among the Austrian provinces range from 1.5 days in Carinthia to nine days in Vorarlberg during 2009 and 2011. The intervals between date of diagnosis and date of notification range from zero days in Styria to 2.5 days in Tyrol.

Figure 8. The median time between date of disease onset, date of diagnosis and date of notification among cases reported to NeRS within the *Listeria* surveillance system by province, 2009-2011



Discussion

Through establishing the surveillance system for listeriosis according to the Epidemic and Zoonoses Act, the incidence of listeriosis has been monitored to detect any possible cluster or outbreak. In combination with the result from food and environmental specimens, the surveillance system is able to detect and monitor any listeriosis outbreaks with respect to source, time, population and place, in order to provide a rationale for public health action.
The implementation of the NeRS enables the MoH to ransfer data to TESSy on a regular basis.

Based on the results from the attribute simplicity, the implementation of the NeRS eliminated two steps from the data reporting process. The NeRS provided the district, province and national levels of the surveillance system with direct access to analyse and monitor the trends of listeriosis in real-time. The NeRS also reduced the time needed between case identification and case reporting compared to the previous surveillance system structure. The results of the calculation of the timeliness of this step in the reporting process enables observation of the listeriosis trends in real-time in order to provide a rationale for public health action.

The limited date variables available in the former surveillance system provided limited information on the evaluation of timeliness of the system prior to implementation of the NeRS. Without the variables date of diagnosis and date of notification, we could not calculate timeliness when the data was made available at the national level.
One recommendation for further investigation would be to include attributes such as sensitivity and completeness, which have not yet been assessed, and thus a comprehensive conclusion whether system achieves all objectives is still pending.

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Appendix

1. The objective of surveillance system for *Listeria*

1 Monitor trends in listeriosis incidence in order to assess the present situation in real-time to respond to rises above warning thresholds and to facilitate appropriate evidence-based action;

ZOONOSES ACT–

i. §1 (1) and §3 (1) – goals for methodological surveillance established

ii. §8 and Annex 3 – Zoonoses report requirements

EPIDEMIC ACT –

iii. §2 (1) – all notifiable diseases are required to be reported to the appropriate district PH office within 24 hours

iv. §3 (2) – duties of federal zoonoses commission for zoonoses surveillance

v. §4 (8) – within framework of epidemiological surveillance, access to personal data of cases allowed

2 Detect and monitor any listeriosis outbreaks with respect to source, time, population and place, in order to provide a rationale for public health action;

ZOONOSES ACT–

i. §4 (1) – established outbreak response duties for provincial governors

ii. §7 – Data required to be collected in foodborne outbreaks

EPIDEMIC ACT –

iii. §26a (1) – all isolates must be sent to National Reference Laboratories for confirmation

3 Identify population groups at risk and in need for targeted prevention measures;

ZOONOSES ACT–

i. §5 (1) – general regulations of zoonoses surveillance include recognition, description and evaluation of potential health hazards

EPIDEMIC ACT

ii. §4 (4) – all data collected in the registry for notifiable diseases must also include prevention measures implemented

4 Generate hypotheses on (new) sources, modes of transmission and groups most at risk and identify needs for research and development and for pilot projects;

ZOONOSES ACT

i. §3 (2)– integrated risk assessment within zoonoses surveillance

5 Report Austrian Listeria data to TESSy according to Decision No 2119/98/EC.

2. The interim criteria proposed by the Scientific Committee on Veterinary Measures relating to Public Health (SCVPH), 2005

Food category	Criteria in current Community legislation	Interim criteria proposed in the opinion of the SCVPH	Other opinions or comments from the SCVPH
Cheeses made from raw milk and from thermized milk (Dir. 92/46/EEC)	*Listeria monocytogenes*	Retain (not concerning hard cheese)	
	Salmonella	Retain (not concerning hard cheese)	
Soft cheese (made from heat-treated milk) (Dir.92/46/EEC)	*Listeria monocytogenes*	Standard	
	Salmonella	Deletion	
	S. aureus, guideline	Standard	
	E. coli, guideline	Deletion	
	Coliforms, guideline	Replace with *Enterobacteriacae*	
Fresh cheese (Dir. 92/46/EEC)	*Listeria monocytogenes*	Standard for cheeses made from raw/thermised milk	
	Salmonella	Standard for cheeses made from raw/thermised milk	
	S. aureus, guideline	Deletion in cheese produced by fermentatiou	
Other cheeses than those mentioned above (Directive 92/46/EEC)	*Listeria monocytogenes*	Deletion	
	Salmonella	Deletion	
Butter (Dir. 92/46/EEC)	*Listeria monocytogenes*	Deletion	
	Salmonella	Deletion	
	Coliforms, guideline	Deletion	
Powdered milk (Dir. 92/46/EEC)	*Salmonella*	Standard	
	Listeria monocytogenes	Deletion	
	S. aureus, guideline	Deletion	
Frozen milk-based products (Dir. 92/46/EEC)	*Salmonella*	Deletion	
	Listeria monocytogenes	Deletion	
	S. aureus, guideline	None	
	Coliforms, guideline	Replace with *Enterobacteriacae*	
	Aerobic plate count, guideline	Deletion	
Liquid milk-based products and powdered milk-based products (Dir. 92/46/EEC)	*Salmonella*	Standard only for products made from raw/thermised milk	
	Listeria monocytogenes	Standard only for products made from raw/thermised milk	
	Coliforms, guideline	Replace with *Enterobacteriacae*	
	Aerobic plate count (for liquid heat-treated unfermented milk based products)	Guideline	

3. Sampling plans for *Listeria monocytogenes* according to Regulation (EC) 2073/2005

	Food category	Micro-organisms/their toxins, metabolites	Sampling plan (2)		Limits (3)		Analytical reference method (4)	Stage where the criterion applies
			n	c	m	M		
1.1	Ready-to-eat foods intended for infants and ready-to-eat foods for special medical purposes (5)	*Listeria monocytogenes*	10	0	Absence in 25 g		EN/ISO 11290-1	Products placed on the market during their shelf-life
1.2	Ready-to-eat foods able to support the growth of *L. monocytogenes*, other than those intended for infants and for special medical purposes	*Listeria monocytogenes*	5	0	100 cfu/g (6)		EN/ISO 11290-2 (8)	Products placed on the market during their shelf-life
			5	0	Absence in 25 g (7)		EN/ISO 11290-1	Before the food has left the immediate control of the food business operator, who has produced it
1.3	Ready-to-eat foods unable to support the growth of *L. monocytogenes*, other than those intended for infants and for special medical purposes (9) (8)	*Listeria monocytogenes*	5	0	100 cfu/g		EN/ISO 11290-2 (8)	Products placed on the market during their shelf-life

(2) n = number of units comprising the sample; c = number of sample units giving values between m and M.
(3) For points 1.1-1.25 m = M.
(4) The most recent edition of the standard shall be used.
(5) Regular testing against the criterion is not required in normal circumstances for the following ready-to-eat foods:—
those which have received heat treatment or other processing effective to eliminate *L. monocytogenes*, when recontamination is not possible after this treatment (for example, products heat treated in their fin
packaging),
— fresh, uncut and unprocessed vegetables and fruits, excluding sprouted seeds,
— bread, biscuits and similar products,
— bottled or packed waters, soft drinks, beer, cider, wine, spirits and similar products,
— sugar, honey and confectionery, including cocoa and chocolate products,
— live bivalve molluscs.
(6) This criterion shall apply if the manufacturer is able to demonstrate, to the satisfaction of the competent authority, that the product will not exceed the limit 100 cfu/g throughout the shelf-life. The operator may fi
intermediate limits during the process that must be low enough to guarantee that the limit of 100 cfu/g is not exceeded at the end of shelf-life.
(7) 1 ml of inoculum is placed on a Petri dish of 140 mm diameter or on three Petri dishes of 90 mm diameter.
(8) This criterion shall apply to products before they have left the immediate control of the producing food business operator, when he is not able to demonstrate, to the satisfaction of the competent authority, that th
product will not exceed the limit of 100 cfu/g throughout the shelf-life.
(9) Products with pH ≤ 4,4 or a_w ≤ 0,92, products with pH ≤ 5,0 and a_w ≤ 0,94, products with a shelf-life of less than five days shall be automatically considered to belong to this category. Other categories of product
can also belong to this category, subject to scientific justification.

Knowledge, practices and attitudes on pertussis among physicians in Austria, 2013

A cross sectional study among general practitioners, pediatricians and pulmonologists

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2012-2013

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Background

Epidemiology in Austria

The "Österreichische Gesellschaft für Pneumologie" (The Austrian Society of Pulmonology) raised the concern of an increasing trend in the pertussis notification rate since 2006 in Styria, one of the nine Austrian provinces based on national surveillance data. The provincial public health authority of the province Tyrol reported an increase in the notification rate of pertussis since 2009. The Chief Public Health Officer at the Austrian Federal Ministry of Health, PhD Dr. P. Rendi-Wagner mandated the Austrian Agency for Health and Food Safety (AGES) to investigate and identify potential reasons for these observations.

We analyzed the national surveillance data on pertussis cases for the time period 1990 to 2012 to describe the trends of annual notification rate of pertussis among the total Austrian population, by the nine Austrian provinces and by the age groups. Findings indicate that, after a period of decreasing and stable trend in the annual notification rate in the total Austrian population (Figure 1), there was increasing annual notification rate in four of the nine provinces including Styria (3.0-23.7/100,000), Upper Austria (1.4-6.8/100,000), Salzburg (0.4-8.9/100,000) from 2006 to 2012 and Tyrol from 2009 to 2012 (0.3-7.6/100,000) (Figure2a). In the other five Austrian provinces decreasing, stable or slightly increasing annual notification rate was observed from 1990-2012: Vienna (2.7-1.0/100,000), Carinthia (3.7-0.7/100,000), Lower Austria (1.9-2.3/100,000), Vorarlberg (2.1-4.8/100,000) and Burgenland (1.8-3.5/100,000) (Figure 2b).

Figure 1. Annual notification rate of pertussis in Austria, 1990-2012

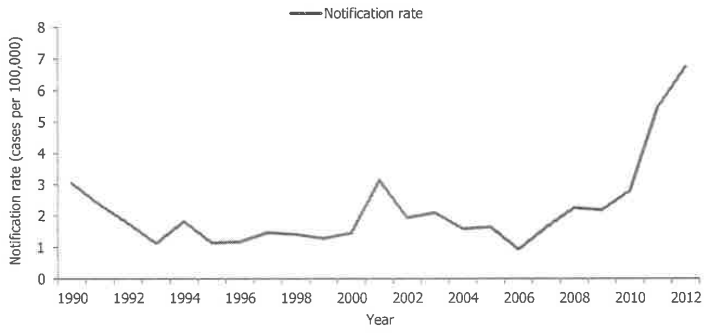


Figure2a. Annual notification rate of pertussis in Styria, Salzburg, Upper Austria and Tyrol (defined as high notification rate provinces), 2005-2012

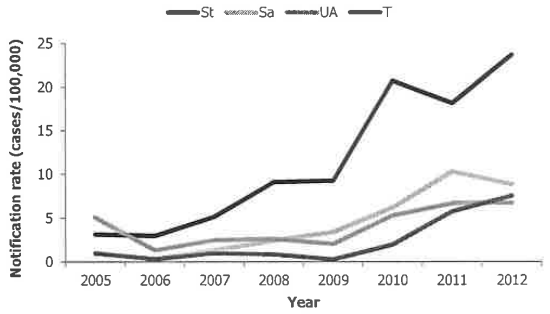
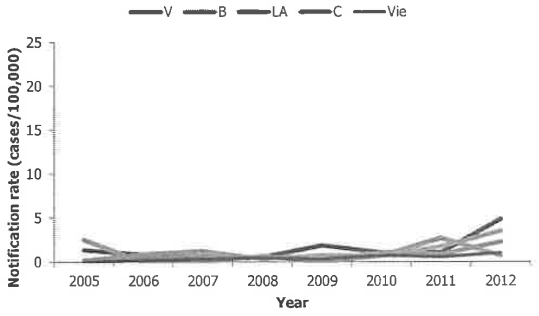


Figure2b. Annual notification rate of pertussis in Vorarlberg, Burgenland, Lower Austria, Carinthia and Vienna (defined as stable notification rate provinces), 2005-2012



Based on the data of the national electronic infectious disease reporting system (Elektronisches Epidemiologisches Meldesystem, EMS) from 2009-2012, we estimated the annual notification rate of pertussis by age group and assessed proportion of laboratory confirmed cases.

The age group <1 and 1-4 years showed a steep increase in the annual notification rate from 2009 (39.3/100,000; 3.5/100,000) to 2010 (66.3/100,000; 15.5/100,000) followed by a slight decrease in 2011 (61.3/100,000; 15.2/100,000) then peaked in 2012 (96.6/100,000; 25.2/100,000). The 5-9 and 10-14 years experienced a three to four times increase in the

annual notification rate from 2009 (2.5/100,000; 3.3/100,000) to 2011 (11.3/100,000; 11.6/100,000) then decreased in 2012 (10.9/100,000; 10.0/100,000). The 15-29 years old experienced only a slight increase since 2009. The notification rate among the ≥ 30 years increased more than double from 2009 (1.8/100,000) to 2012 (5.0/100,000). When grouping into the aged 0-14 and ≥15 years, we observed a considerable increase in the annual notification rate for the aged 0-14 years and only a marginal increase in the ≥ 15 years for the provinces of high notification rate including Upper Austria (10.8/100,000 to 39.7 /100,000), Salzburg (9.6/100,000 to 22.5/ 100,000) and Tyrol (1.8/100,000 to 16.9/ 100,000) from 2009-2012. In 2012, increase was also observed among aged 0-14 years in Burgenland (15.8/100,000) and Vorarlberg (23.0/100,000). In Styria, increased was observed in both age groups from 2009 through 2012 (0-14y: 7.7-45.5/100,000; ≥15 y: 9.6-20.3/100,000) (Figure3).

The majority (74%) of cases reported to the EMS were without laboratory confirmation. In 2012, a total of 334 (58%) cases classified as confirmed and 219 (38%) cases belonged to unknown or missing information on case classification.

Figure 3a. Annual notification rate of pertussis in the aged 0-14 years in Styria, Salzburg, Upper Austria, Tyrol, Vorarlberg and Burgenland, 2009-2012

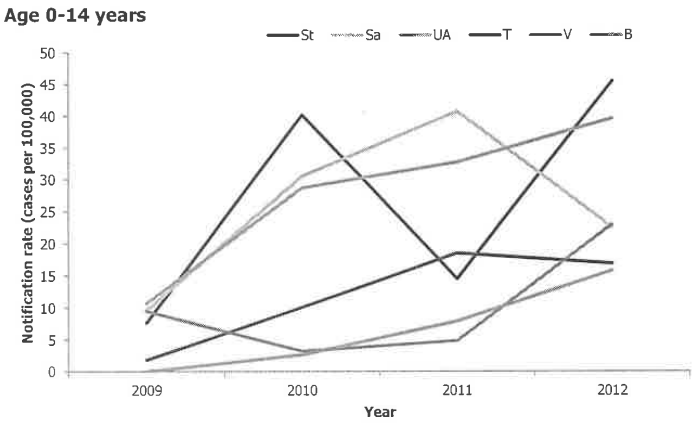


Figure 3b. Annual number of pertussis cases in the aged 0-14 years in Styria, Salzburg, Upper Austria, Tyrol, Vorarlberg and Burgenland, 2009-2012

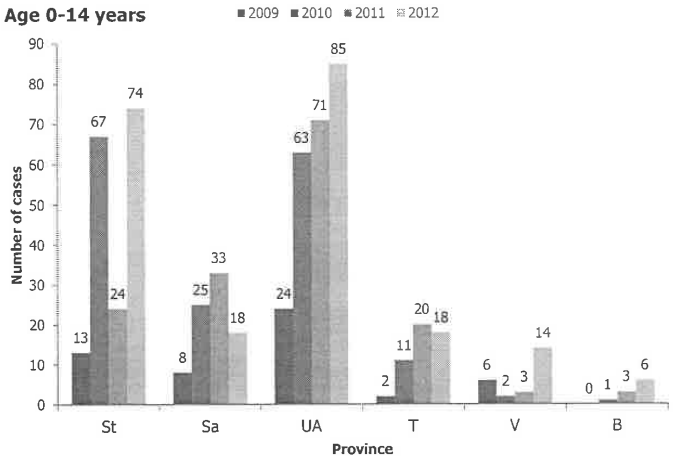
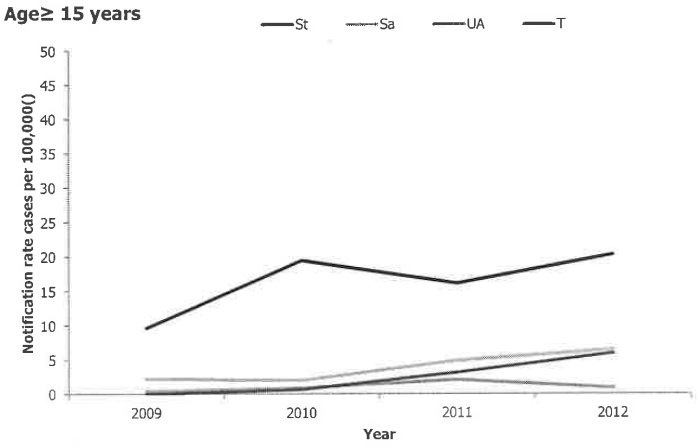


Figure 3c. Annual notification rate of pertussis in the aged ≥ 15 years in Styria, Salzburg, Upper Austria and Tyrol, 2009-2012



Clinical signs and symptoms of pertussis by age group

Base on the fact that signs and symptoms of pertussis differ by age, the Global Pertussis Initiative 2011 developed a useful algorithm that tailors criteria for clinical diagnosis of pertussis in 3 different age cohorts: 0–3 months, 4 months-9 years, and ≥10 years (figure 4a), recently published in the Journal of Clinical Infectious Diseases. Key indicators of the clinical manifestation of pertussis in infants aged 0-3 months are afebrile non-productive cough, which does not improve and may be accompanied with post-tussive emesis, apnea, cyanosis or seizure. In children aged 4 months-9 years, the typical clinical picture of pertussis is characterized by paroxysmal non-productive cough with whoop lasting ≥ 7 days. Pertussis in age group ≥10 years including adolescents and adults is characterized by a non-productive cough lasting ≥ 14 days with or without the typical paroxysmal pattern. Figure 4b gives in detail signs and symptoms defined for clinical case definition for surveillance purposes (1).

Figure 4a. Symptoms and signs for clinical diagnosis of pertussis among three age groups (0–3 months, 4 months-9 years and ≥10 years), source: Global Pertussis Initiative Roundtable Meeting 2011

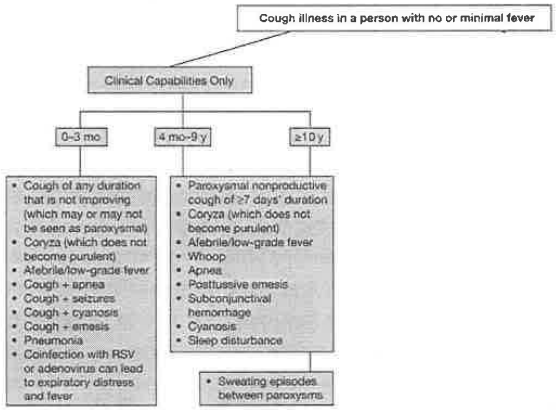
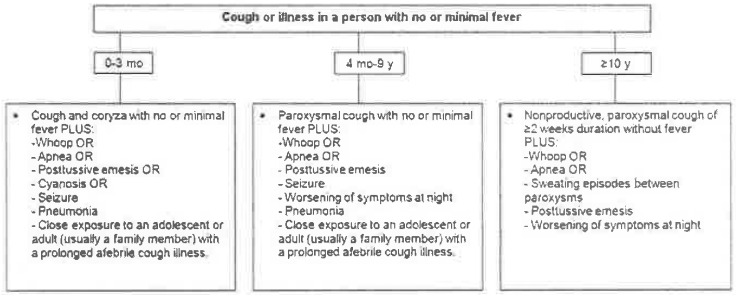


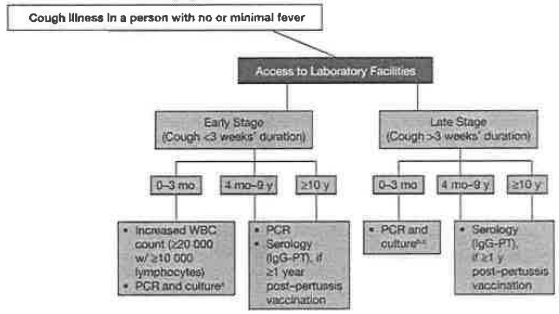
Figure 4b. Clinical case definition of pertussis for surveillance purposes, source: Global Pertussis Initiative Roundtable Meeting 2011



International recommendations for laboratory diagnostics of pertussis

The criteria for the laboratory diagnostic procedure also tailored to the age group 0–3 months, 4 months-9 years, and ≥10 years, developed by the Global Pertussis Initiative (figure 5).

Figure 5. Age group and disease stage specific criteria for the laboratory diagnosis of pertussis recommended by the Global Pertussis Initiative (GPI), source: Global Pertussis Initiative Roundtable meeting 2011



One differentiates between early and late disease stage based on the duration of cough (less/more than 3 weeks). In infants aged 0-3 months, the tests of choice are pertussis-specific PCR and culture for *Bordetella pertussis*. For infants, adolescents and adults (age group discrimination: 4 months-9 year; ≥10 years) presenting in the early disease stage, PCR and serological tests are appropriate. Most adolescents and adults present with late stage of disease therefore serology diagnosis is the only feasible diagnostic test. The measurement of IgG-anti-Pertussis Toxin (PT) is recommended; the cut-off value for seropositivity in a single serum sample is given between 60 IU/ml and 75 IU/ml (2); additionally the determination of the IgA anti-PT titer is advisable (cut-off value: 10-20 IU/ml). If the serum sample shows antibody-levels above the cut-off for single sample serology, the result can be interpreted as evidence of recent infection with *B. pertussis*. According to the clinical manifestations, if the diagnosis still cannot be confirmed by only single serum, the antibodies should be measured in a convalescent serum sample at 2-4 weeks interval. A dual cut-off between 62-125 IU/ml is used to define a recent infection for patients who were not vaccinated during the last 12 months(2).

Public Health rationale of the study

The resurgence of pertussis in Austria, as also observed in Europe (3), and the observed difference in the pertussis epidemiology between the Austrian provinces might be due to (a) increasing use of more sensitive clinical and/or laboratory diagnostic procedures, with differences between the provinces

(b) increasing case reporting by the diagnosing physicians, with differences between the provinces

(c) increasing awareness of pertussis among physicians, when examining a patient with respiratory symptoms (4), with differences between the provinces

(d) decreasing basic or booster vaccination coverage, and hereby true increase of transmission (the latter issue will not be covered by this survey)

The public health rationale of this *knowledge, attitude and practice survey* is to understand the particular epidemiological situation on pertussis in Austria, where a considerably increasing notification rate trends were observed in four provinces (referred as to high notification rate provinces) within the past 4-7 years. The other five Austrian provinces

(referred as to stable notification rate provinces) were observed stable level notification rate since 1990 or slightly increased notification rate within the past 1-2 years.

The overall aim of the survey is to assess the knowledge on pertussis, the attitudes towards case notification and the practice on laboratory diagnosis among general practitioners, pediatricians and pulmonologists. Secondly is to assess whether these factors differ between pertussis high notification rate provinces and pertussis stable notification rate provinces.

Based on our findings, appropriate measures are planned to be set by the Ministry of Health: these may include investment in encouraging the positive attitude towards case notification, increasing the practice on laboratory case confirmation and elevating the overall knowledge level on pertussis among physicians in Austria by education programs.

Further related projects currently on ongoing include the assessment of the laboratory capacity for diagnosis of *B. pertussis* infection in Austria and to assess the pertussis vaccination coverage by age.

The laboratory capacity of pertussis diagnostics in each province of Austria showed no significant differences on diagnostic criteria of pertussis. The primary vaccine coverage of pertussis in birth cohort 2000-2010 was not significantly different within provinces. The results of the two surveys revealed the differences of province-specific notification rate of pertussis were not associated with different diagnostic criteria for pertussis or different vaccine coverage of primary series among the provinces.

Objectives

Primary Objectives
To assess

- notification behavior/practice for pertussis,

- knowledge on clinical manifestation and laboratory diagnostic methods for pertussis, and

- attitude towards seeking laboratory confirmation for suspected pertussis cases

among general practitioners (GPs), pediatricians (Ps) and pulmonologists (Puls) in Austria (from now on in the study protocol collectively referred to as "physicians")

Secondary objectives

To determine whether there is a difference

- in the notification behavior/practice for pertussis between "physicians" of high notification rate provinces (1) and "physicians" of stable notification rate provinces (2),

- in the level of knowledge on pertussis (including clinical manifestation and laboratory diagnostic methods) between physicians of high notification rate provinces (as given above) and physicians of stable notification rate provinces, and

- in the attitude towards seeking laboratory confirmation for suspected pertussis cases between physicians of high notification rate provinces (as given above) and physicians of stable notification rate provinces

Hypotheses

Knowledge on pertussis, notification behavior/practice of pertussis cases and the attitude towards seeking laboratory confirmation differ between "physicians" of high notification rate provinces (I) and "physicians" of stable notification rate provinces (II)

(I) High notification rate provinces: defined as provinces with increasing pertussis annual notification rate from 2006 to 2012 or from 2009 to 2012 (i.e. Styria, Upper Austria, Salzburg and Tyrol)

(II) stable notification rate provinces: defined as provinces with stable or slightly increasing annual notification rate from 1990-2011, still at low level (i.e. Vienna, Lower Austria, Carinthia, Vorarlberg and Burgenland)

Method

Study design

A Descriptive and analytical cross-sectional study

The descriptive part of the cross-sectional study will measure a convenience sample of "physicians" including GPs, pediatricians, and pulmonologists registered in Austria.

- The quality of the notification behavior /practice (detailed definition see below)
- The level of knowledge on clinical manifestation (definition see below) and laboratory diagnostic procedures (definition see below)
- The frequency of laboratory confirmation seeking behavior (definition see below)

The analytical part of the cross-sectional study will measure whether there are differences in

- the quality of notification behavior/practice,
- the level of knowledge on clinical manifestations and laboratory diagnostic procedures,
- and the frequency of seeking laboratory confirmation in a clinically suspected case of pertussis

between physicians of high notification rate provinces and physicians of stable notification rate provinces

We will ascertain the exposure factors knowledge, notification practice and laboratory confirmation seeking behavior among Austrian physicians within a cross-sectional study. The results on the distribution of these exposure factors among the participating physicians across the nine provinces may help to explain the differences in the province-specific annual notification rate within the previous 4-7 years (until 2012).

Limitations related to this approach are explored in the paragraph study limitation.

Source population

The source population refers to the total of registered general practitioners (GPs), established and hospital pulmonologists, and pediatricians (Ps) in Austria, listed at the Austrian Chamber of Medical Doctors (Table 1). These professions are selected as they are most commonly involved in the consultation of a patient with *B. pertussis* infection. The list of the "physicians" was provided by the chamber.

Table1. Source population by province and professions (GPs, Pediatricians and Pulmonologists) in absolute number and number of physicians per 100,000 population

Source population	**Province***									
Occupation	**B**	**CA**	**LA**	**UA**	**SA**	**ST**	**T**	**V**	**Vie**	**Total**
GPs N (n per 100,000 population)	145 (50.5)	230 (41.3)	741 (45.6)	718 (50.5)	231 (43.0)	576 (47.4)	309 (43.0)	150 (40.0)	772 (44.1)	3872 (45.6)
Pediatricians N (n per 100,000 population)	22 (7.7)	44 (7.9)	153 (9.4)	150 (10.5)	65 (12.1)	132 (10.9)	100 (13.9)	42 (11.2)	361 (20.6)	1069 (12.6)
Pulmonologists N (n per 100,000 population)	5 (1.7)	18 (3.2)	45 (2.8)	58 (4.1)	16 (3.0)	61 (5.0)	23 (3.2)	9 (2.4)	122 (7.0)	357 (4.2)
Total N (%)	**172 (3)**	**292 (6)**	**939 (18)**	**926 (17)**	**312 (6)**	**769 (15)**	**432 (8)**	**201 (4)**	**1255 (24)**	**5298**
% Distribution of Austrian population	**3%**	**7%**	**19%**	**17%**	**6%**	**14%**	**8%**	**4%**	**21%**	**-**

*B: Burgenland, CA: Carinthia, LA: Lower Austria, UA: Upper Austria, SA: Salzburg, St: Styria, T: Tyrol, V: Vorarlberg, Vie: Vienna

Study sample/Study population
Convenience sampling

The response rate of prior single random sampling was not satisfactory (<20%). To increase the response rate, the task force of pertussis project decided to collect trawling questionnaires by convenience sampling.

Sample size calculation

The sample size calculation for a descriptive study using a hypothesized frequency of 50% for the expected proportion, a precision of 0.05, a significance level of 0.95, a correction for finite population revealed required sample size of 283 paediatricians, 350 general practitioners and 186 pulmonologists respectively. In the analytical cross-sectional study, we calculated the sample size for the analytical cross-sectional study in each specialty. 276 respondents in each medical specialty were aimed to be recruited base on the following prerequisite.

- 50% of the unexposed (low level of knowledge, unsatisfactory notification behaviour, unsatisfactory laboratory diagnostic seeking behaviour) with outcome (being a physician in high notification rate provinces);

- A ratio of unexposed / exposed = 1;
- Significance level =95 %;
- Power = 80%;
- Min. PR = 1.3;

In order to both describe and analyse the cross-sectional study with sufficient sample size, we aimed at recruiting 283 paediatricians, 350 general practitioners and 276 pulmonologists into the study. The distribution of the study sample by province is given in Table2.

Table2. Study sample by province in each specialty

		Province n/N (%)								
Medical specialty	**Total**	B	CA	LA	UA	S	St	T	V	Vie
GPs	**350**	13	21	67	65	21	52	28	14	69
Paediatricians	**283**	6	12	41	40	17	35	26	11	95
Pulmonologists	**276**	4	14	35	45	12	47	18	7	94

Pilot study

The final version of the questionnaire has been decided by the pertussis task force who represent involved medical societies. The decision from the task force was not to conduct a pilot study for validating the questionnaire.

Data collection

Information was collected by a self-administered questionnaire online or by telephone. We developed a 32-questions questionnaire in cooperation with the Austrian Society of Pulmonology (ÖGP), the Austrian Society of Pediatrics and Adolescent Medicine (ÖGKJ) and Austrian Society of General Practice and Family Medicine (ÖGAM) to describe the notification behavior, the knowledge on clinical manifestation and laboratory diagnosis, and the laboratory confirmation seeking behavior among the physicians. Additionally information will be collected on physician's professions, place of practice and the catchment area. The majority of questions are fixed-response questions. For ascertaining the laboratories, to which the specimens for pertussis confirmation are sent, and for ascertaining physicians' procedure of obtaining a nasopharyngeal swab, open questions was used (Table 10 in Appendix). The online questionnaire system (Question Pro) will close the questionnaire within 30 minutes to avoid answering the questionnaire with help of library consultation. The KAP questionnaire, except for demographic characteristics, was structured into four attributes:

(1) Notification behaviour/practice. The eight questions including 1-3, 8-11 and 31 with binary (Yes/No) answers were to describe and analyze the satisfactory notification behaviour/practice.

(2) Level of knowledge on clinical manifestation of pertussis. The nine questions including 4-7 and 14 with single or multiple choices were used to describe level of knowledge on clinical manifestation of pertussis. Two required questions including question 4 and 5 were applied to analyze high level of knowledge on clinical manifestation of pertussis. In question 4, high level of knowledge was defined by a cumulative score of 7-9 points from nine multiple choices.

(3) Level of knowledge on laboratory diagnostic procedure of pertussis. The 12 questions including 15-17, 19, 21-26, 28 and 30 were used to describe the level of knowledge on laboratory diagnostic procedure of pertussis. The seven required questions including 15-17, 19, 23-24 and 28 will be used to analyze level of knowledge on laboratory diagnostic procedure of pertussis. High level of knowledge on laboratory diagnostic procedure was defined by a cumulative score of distribution of ≥75 percentile out of 17 points in the seven required questions.

(4) Laboratory confirmation seeking behaviour of pertussis. Two questions including question 12 and 13 were used to describe laboratory confirmation seeking behaviour of pertussis. Satisfactory laboratory confirmation seeking behaviour of pertussis was defined as the frequency of a physician seeks laboratory diagnosis in a patient clinically suspected with *B. pertussis* infection was ≥75%.

Please see appendix for the detail of the questionnaire design.

Definitions

Definition of the outcome

1. Being a physician in one of the high notification rate provinces defined as a physician whose place of practice is in a province with increase in the annual notification rate of pertussis within the previous 4-7 years (i.e. Styria, Salzburg, Tirol and Upper Austria, until 2012) was observed.

2. A physician who report a laboratory confirmed case of pertussis

Definition of exposure factors under study

The exposure factors under study are:

Satisfactory **notification behaviour/practice**

High level of **knowledge on clinical manifestation** of pertussis

High level of **knowledge on laboratory diagnostic procedure** of pertussis

Satisfactory **laboratory confirmation seeking behaviour** of pertussis

Data analysis plan

After questionnaires are retrieved each survey participant will receive a unique identification number. All data will be analyzed anonymously. Employees of the Department of Infectious Disease Epidemiology at AGES will generate spreadsheet in MS Excel extracted from the software of online questionnaire called QuestionPro and perform data validation and cleaning. The sampling weight will be considered for each respondent based on the response rate of each province.

In the descriptive cross-sectional study, survey responses from participating physicians will be described on the proportion of physicians replied correct answers in each question and frequency of satisfactory notification practice, high knowledge level and satisfactory laboratory seeking behaviour in the respondents obtained from convenience sampling. (Table 4).

In the analytical cross-sectional study, we will compare satisfactory notification behavior, high level of knowledge on clinical manifestation and laboratory diagnosis, and satisfactory laboratory confirmation seeking behavior between "physicians" (as defined above) of high notification rate provinces and "physicians" of stable notification rate provinces (Table 5). For bivariate analyses chi square test for contingency tables will be used. Data analyses will be performed by using STATA version 11.
Secondary, we analyzed the respondents' knowledge of clinical manifestation and laboratory diagnosis and satisfactory laboratory confirmation seeking behavior between "physicians" who notified a laboratory confirmed case and those who did not notify a laboratory confirmed case by calculating the prevalence ratio (PR) and 95% confidence interval

Ethical considerations

Creation of the protocol does not include the collection of potentially identifiable or sensitive data on individuals. Any data analysis undertaken as part of the investigations to inform the protocol construction will be presented in aggregated form.

Project management

The list of study population would be provided by The Austrian Society of Pulmonology (ÖGP), the Austrian Society of Pediatrics and Adolescent Medicine (ÖGKJ) and Austrian Society of General Practice and Family Medicine (ÖGAM). The primary investigators at AGES are Dr. Shu-Wan Jian (EPIET fellow, Austrian FETP) and Dr. Daniela Schmid (Head of Department for Infectious Disease Epidemiology, AGES). All the received questionnaires will be owned by the Department for Infectious Disease Epidemiology at AGES.

Results

Study participants' description

The response rate of pediatricians is the highest of the three specialties, accounting for 53%. There were only 78 GPs out of all registered 3872 GPs responded the online questionnaire. We only described data of GPs but not analyzed the data due to its 2% respondents of the source population.

Table 3. Description of the response rate of the study sample in physicians by nine provinces (as of 30.09.2013)

	n/N (%)	High-rate provinces n/N (%)				Stable-rate provinces n/N (%)					P value
Medical specialty	Total	UA	Sa	St	T	B	Ca	LA	V	Vie	
GPs	78/350 (22)	12/65 (18)	4/21 (19)	21/52 (40)	9/28 (32)	2/13 (15)	2/21 (10)	15/67 (22)	2/14 (14)	11/69 (16)	0.06
Pediatricians	150/283 (53)	28/40 (70)	11/17 (65)	19/35 (54)	11/26 (42)	6/6 (100)	9/12 (75)	21/41 (51)	8/11 (73)	37/95 (39)	0.48
Pulmonologists	42/276 (15)	8/45 (18)	1/12 (8)	13/47 (28)	1/18 (6)	1/4 (25)	0/14 (0)	3/35 (9)	1/7 (14)	13/94 (14)	0.70

Descriptive cross-sectional study

We described knowledge on pertussis, the attitudes towards case notification and the attitude of seeking laboratory diagnosis among physicians by their specialty. The weighted proportion allows for sample weights within provinces to be representative in provincial distribution of the three specialties.

Table 4. Frequency of notification practice, knowledge on clinical manifestations and laboratory procedures and laboratory confirmation seeking behaviour in the total study population

Question no. and contents	n/N (weighted %)		
	GPs (Ntotal= 78)	Pediatricians (Ntotal= 150)	Pulmonologists (Ntotal= 42)
Notification practice (8 required questions)			
1. Awareness of pertussis as a notifiable disease	69/77 (90)	142/147 (96)	40/42 (93)
2. Awareness of notifying a pertussis case to PH authorities.	72/72 (100)	138/138 (100)	39/39 (100)
2a. Awareness of notifying a pertussis case to district PH authorities	57/72 (74)	86/138 (63)	19/39 (49)
3. Use the standardized notification form provided by MoH	49/76 (68)	110/142 (77)	30/40 (78)
8. Use an official case definition	22/73 (30)	39/144 (28)	13/40 (34)
9. Awareness of the ECDC case definition of pertussis	3/73 (4)	5/125 (4)	0/34 (0)

10. Notify a pertussis case based on the ECDC case definition	2/36 (5)	5/70 (8)	0/17 (0)
11. Notify a clinically suspected case	10/73 (16)	13/140 (8)	2/37 (5)
31. Notify a clinical suspected case again after having received a laboratory confirmation (report a lab. confirmed case)	41/64 (65)	100/135 (74)	20/32 (63)
Level of knowledge on clinical manifestation of pertussis (2 required questions)			
4. High level of knowledge on clinical signs and symptoms of pertussis infection (gained 7-9 points from total 9 points)	26/77 (34)	102/149 (67)	18/41 (40)
5. Differentiate the clinical signs and symptoms by age (1 point)	46/77 (59)	137/149 (91)	27/39 (69)
6.1. Duration of cough in children aged ≤ 3 months	51/73 (73)	129/142 (91)	23/30 (74)
6.2. Cough-related symptoms of pertussis in children between 4 months - 9 years	53/72 (74)	99/137 (72)	19/31 (69)
6.3. Duration of cough in children aged ≥ 10 years	64/73 (90)	125/142 (87)	26/34 (83)
7.1. High level of knowledge on the clinical case definition in young children ≤ 3 months (gained 7-10 points from total 10 points)	34/72 (44)	58/135 (41)	5/30 (12)
7.2. High level of knowledge on the clinical case definition in children between 4 months - 9 years (gained 7-10 points from total 10 points)	15/70 (20)	40/131 (32)	9/30 (31)
7.3. High level of knowledge on the clinical case definition in children aged ≥ 10 years and adults (gained 7-10 points from total 10 points)	31/71 (42)	64/130 (49)	17/34 (44)
14. Three weeks threshold between early stage and late stage of pertussis infection	41/73 (57)	60/127 (46)	17/31 (59)
Level of knowledge on laboratory diagnosis (8 required questions)			
15. Chose correct tests for laboratory confirmation in the aged ≤ 3 months with clinically suspected B. pertussis infection (three points)	15/67 (20)	36/139 (25)	11/34 (27)
16. Chose correct diagnostic tests to confirm a clinical cases in children aged > 3 months, adolescents and adults (three points)	10/68 (14)	35/143 (26)	7/36 (25)
17. Chose correct diagnostic tests to confirm a clinical case in a cough duration of ≥ 3 weeks (three points)	21/68 (29)	26/140 (17)	6/37 (20)
19. Chose correct immunoglobulin(s) for serological testing (IgM alone is an incorrect answer) (three points)	47/67 (67)	104/135 (78)	23/34 (61)
23. Chose correct answer on the duration of not using IgG for diagnosis of pertussis in patients following pertussis vaccination (one point)	43/60 (76)	70/117 (59)	18/30 (63)
24. Chose we cannot use IgG-titer to discriminate recent	41/65 (63)	120/134 (90)	27/33 (80)

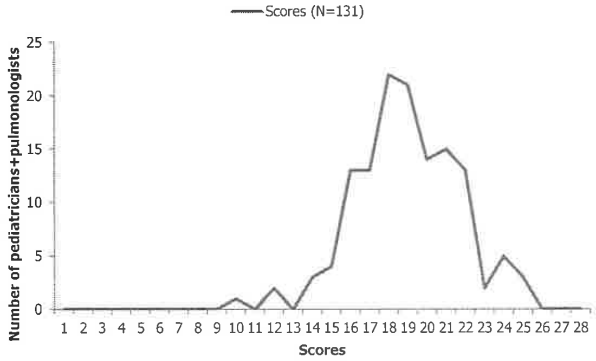
vaccination and current infection (one point)			
28. Chose correct types of specimens obtained for PCR or culture (gained 2.4-3 points from total 3 points)	14/66 (20)	36/139 (26)	2/36 (5)
21. Ask vaccination history from patients	69/70 (99)	131/132 (99)	28/32 (87)
22. Inform the information of vaccine history to the laboratory	54/68 (81)	96/128 (74)	17/31 (56)
Laboratory confirmation seeking behavior			
12. High frequency of seeking laboratory diagnostics (Frequency ≥75%)	44/73 (60)	122/142 (86)	25/39 (63)
13. The reasons for NOT seeking laboratory diagnostics			
a. The treatment started immediately as a case of pertussis is clinically suspected; there is no added value for awaiting the laboratory results, which will be too late.	36/78 (46)	47/150 (31)	11/42 (26)
b. The sensitivity and specificity of the laboratory diagnostic tests for pertussis are poor	6/78 (8)	18/150 (12)	8/42 (19)
c. Laboratory diagnostic test for pertussis is too expensive and funding is not covered by the social insurance companies	9/78 (12)	7/150 (5)	6/42 (14)
Place of practice			
a. General Practice ("Ordination")	73/77 (95)	66/150 (42)	19/42 (41)
b. General Hospital	3/77 (4)	65/150 (45)	22/42 (57)
c. University Hospital	1/77 (1)	19/150 (13)	1/42 (2)

Frequency distribution of scores

Level of knowledge (clinical manifestation+ laboratory diagnostics)

A total of 131 pediatricians and pulmonologists replied all the questions included in ranking. 61 physicians and pulmonologists who did not complete the questions were excluded. The total 27 scores included question 4, 5, 15, 16, 17, 19, 23, 24 and 28. The distribution of scores gained among the 131 participants was given in Figure 6.

Figure 6. Distribution of scores on level of knowledge of pertussis in pediatricians and pulmonologists

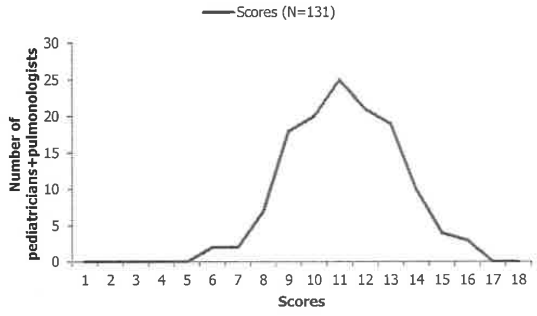


(Average: 17.9, Median: 17.8, Maximum: 24.4, Minimum: 8.6)

Level of knowledge (laboratory diagnostics)

A total of 131 pediatricians and pulmonologists replied all the questions included in ranking. 61 physicians and pulmonologists who did not complete the questions were excluded. The total 17 scores included question 15, 16, 17, 19, 23, 24 and 28. The distribution of scores gained among the 131 participants was given in Figure 7.

Figure 7. Distribution of scores on level of knowledge on laboratory diagnostics of pertussis in pediatricians and pulmonologists



(Average: 10.1, Median: 10.0, Maximum: 15.4, Minimum: 4.6, SD: 2.14, 75% Percentiles: 11.8)

Analytical cross-sectional study

Table 5. Prevalence of satisfactory notification practice, high knowledge level and satisfactory laboratory seeking behaviour among the study **paediatricians & pulmonologists** of high-rate provinces and stable-rate provinces

Attributes	High-rate provinces (N=92)		Stable-rate provinces (N=100)		
	n/N (column%*)	95%CI	n/N (column%*)	95%CI	P value
Satisfactory notification practice					
1. Aware pertussis is a notifiable disease	86/89 (96.0)	88.3-98.8	96/100 (95.7)	89.0-98.4	0.82
2. Aware report to district PH authority	53/92 (56.6)	46.0-66.6	52/85 (62.1)	51.1-71.9	0.79
3. Use MoH notification form	66/87 (76.2)	65.9-84.1	74/95 (76.9)	67.0-84.5	0.75
4. Use official case definition	23/88 (26.9)	18.3-37.6	29/96 (29.7)	21.2-39.8	0.54
5. Notify a clinical suspected case	7/84 (7.6)	3.6-15.3	8/93 (7.8)	3.8-15.3	0.95
6. Notify again after receive a lab. confirmation report	25/91 (27.7)	19.3-38.1	22/76 (29.4)	19.9-41.1	0.75
Level of knowledge on clinical manifestations					
1. High level of knowledge on clinical manifestation (high: 7-9 point, total: 9 points)	32/92 (34.0)	24.8-44.5	40/100 (42.4)	32.8-52.6	0.46
2. Differentiate clinical manifestation by age (Yes/No)	15/89 (17.5)	10.6-27.4	9/99 (9.4)	4.9-17.3	0.11
High level of knowledge on laboratory diagnostic procedures	47/92 (50.3)	39.9-60.7	51/100 (51.5)	41.5-61.4	0.99
(high ≥11.8 point, total: 17 points)					
Satisfactory laboratory confirmation seeking behaviour (seek lab confirmation in ≥75% of all patients)	70/86 (83.3)	74.2-89.6	77/95 (80.1)	70.4-87.1	1.00

Attributes	Mean (median)	Mean (median)	P value
Knowledge on clinical manifestation (range:0-9 points)	6.86 (7)	6.76 (7)	0.59
Knowledge on laboratory diagnostic procedures (range:0-17 points)	10.17 (10.2)	10.12 (9.8)	0.88

*Weighted proportion that allows for sample weights within provinces

Assessing whether knowledge level and laboratory seeking behaviour differ between the pediatricians+pulmonologists who reported a laboratory confirmed cases of pertussis in high notification rate provinces and those in stable notification rate provinces

Table 6. Attributes for being a **pediatricians & pulmonologists** who notified a laboratory confirmed case of pertussis (replied Yes for Question31)

Variables	Confirmed case reporter n/N (%*)	NOT confirmed case reporter n/N (%*)	PR (95%CI)
High level of knowledge on clinical manifestations			
1. High level of knowledge on clinical manifestation in general (high: 7-9 point, total: 9 points)	78/107 (73.0)	29/107 (27.0)	1.05 (0.85-1.32)
2. Differentiate clinical manifestation by age	104/147 (70.9)	43/147 (29.1)	0.93 (0.70-1.25)
High level of knowledge on laboratory diagnostic procedures	55/74 (73.9)	19/74 (26.1)	1.06 (0.87-1.29)
high ≥11.8 point (75% percentile)			
total: 17 points			
Satisfactory laboratory confirmation seeking behaviour	99/133 (74.1)	34/133 (25.9)	1.2 (0.89-1.63)
(seek lab confirmation in ≥75% of all patients)			
Attributes	**Mean (median)**	**Mean (median)**	**P value**
Knowledge on clinical manifestation (range:0-9 points)	6.88 (7)	6.74 (7)	0.51
Knowledge on laboratory diagnostic procedures (range:0-17 points)	10.30 (10.2)	9.89 (9.6)	0.35

*Weighted proportion that allows for sample weights within provinces

Table 7. Attributes for being a **"pediatrician &pulmonologist"** who notified a laboratory confirmed case and practice in high-rate provinces compare to those who practice in stable-rate provinces.

Variables	High-rate provinces (N=92)				Stable-rate provinces (N=100)			
	Sample size	Confirmed case reporter	Notification prevalence % (95%CI)	PR (95%CI)	Sample size	Confirmed case reporter	Notification prevalence % (95%CI)	PR (95%CI)
Knowledge on clinical manifestations								
Median or low level of knowledge (0-6 point)	26	19	72.7 (51.8-86.8)	Ref.	34	23	67.2 (49.5-81.1)	Ref.
High level of knowledge (7-9 point)	50	35	69.6 (54.7-81.2)	0.96 (0.70-1.31)	57	43	75.5 (62.2-85.3)	1.12 (0.84-1.50)
Differentiate clinical manifestation by age								
No	11	9	78.2 (41.6-94.8)	Ref.	8	6	73.5 (35.0-93.5)	Ref.
Yes	64	44	68.9 (56.0-79.4)	0.88 (0.59-1.30)	83	60	72.2 (61.2-81.0)	0.98 (0.62-1.55)
Knowledge on laboratory diagnostics								
Median or low level of knowledge (0 - <11.8 point)	43	26	59.3 (43.4-73.5)	Ref.	50	39	76.9 (62.5-86.9)	Ref.
High level of knowledge (11.8 -17 points)	33	28	84.8 (67.2-93.9)	1.43 (1.06-1.94)	41	27	66.5 (50.4-79.5)	0.86 (0.66-1.14)
Laboratory confirmation seeking behaviour								
Seek confirmation in <75% of all patients	14	8	57.1 (31.1-79.7)	Ref.	17	11	64.4 (39.5-83.4)	Ref.
Seek confirmation in ≥75% of all patients	62	46	73.3 (60.1-83.4)	1.28 (0.79-2.10)	71	53	74.8 (62.9-83.8)	1.15 (0.79-1.71)
Place of practice								
General Practice ("Ordination")	35	20	55.7 (38.4-71.8)	Ref.	42	28	64.8 (48.6-78.2)	Ref.
General Hospital	30	24	81.5 (63.7-91.7)	3.50 (1.10-11.1)	44	34	77.9 (62.9-87.9)	1.20 (0.91-1.59)
University hospital	11	10	87.4 (45.7-98.3)	5.49 (0.60-50.7)	5	4	80.0 (30.0-97.4)	1.23 (0.75-2.03)

Binomial regression

The binomial regression was to test which attributes are the independent variables to be associated with confirmed-case notification behavior among pediatricians and pulmonologists. We adjusted the effects of the variables that were significant associated with notification behavior in the prior analysis which included place of practice and level of knowledge on laboratory diagnostics.

In high-rate provinces, pediatricians and pulmonologists who practice in a university hospital are 1.55 times more likely to notify a laboratory confirmed case than those who practice in general practices, after adjusting the effects of other variables.

In high-rate provinces, pediatricians and pulmonologists who have high level of knowledge on laboratory diagnostics of pertussis are 1.35 times more likely to notify a laboratory confirmed case than those who have median or low level of knowledge, after adjusting the effects of other variables.

In stable-rate provinces, the variables of interests were not significant.

Table 8. Independent attributes for being a confirmed case reporter in high-rate and stable rate provinces from binomial regression analysis

Variable	High-rate provinces Adjusted PR (95%CI) for confirmed case reporter	Stable-rate provinces Adjusted PR (95%CI) for confirmed case reporter
Place of practice		
General Practice ("Ordination")	Ref.	Ref.
General Hospital	1.32 (0.94-1.87)	1.18 (0.88-1.57)
University Hospital	1.55 (1.12-2.17)	1.16 (0.63-2.13)
Level of knowledge on laboratory diagnostics		
Median or low level of knowledge (0 - <11.8 point)	Ref.	Ref.
High level of knowledge (11.8 -17 points)	1.35 (1.02-1.80)	0.90 (0.67-1.19)

Discussion

The survey was originally designed based in a single random sampling method by telephone interviews. However, the response rate was only 6% (21/360). The task force of pertussis project decided to trawl the questionnaire by online survey and convenience samplings from the physicians registered in Austria.

The physicians less frequently (28-34%) considered official case definition when they notified a pertussis case. Few physicians (0-4%) aware of ECDC case definition, which might be due to the official case definition in Austria for pertussis notification was complied with EU case definition, the term "ECDC case definition" might be confused with "EU case definition". Only 10% of the responding physicians had ever reported a possible case of pertussis, as opposed to more than 60% of respondents who had reported a laboratory confirmed case of pertussis. The responding pediatricians had highest proportion (67%) of high level of knowledge on clinical manifestations of pertussis and differentiate the symptoms by age (91%), as compared to GPs (34%) and pulmonologists (40%), who less frequently differentiated the symptoms by age (59% and 69% respectively). Pediatricians had gained significantly higher points of knowledge on pertussis than pulmonologists (18.2 and 16.9, respectively; P=0.01). The frequency of seeking laboratory diagnosis in patients of suspected pertussis infection was highest in pediatricians (86%) and lowest in GPs (60%).

The analytical study identified two independent determinants of notifying a laboratory confirmed case of pertussis among pediatricians and pulmonologists who practice in provinces of high notification rate of pertussis. The pediatricians and pulmonologists who practice in a university hospital and who have high level of knowledge on laboratory diagnostics of pertussis were significantly more likely to notify a laboratory confirmed case of pertussis.

Limitations

Participation bias would be possible in a nonprobability sampling such as convenience sampling.

Recall bias should be no issue as we ask for current behavior (notification behavior and laboratory confirmation seeking behavior).

Instrument bias should be avoided as much as possible as we use fixed-response questions in the majority of questions.

Interviewer bias will try to be avoided by interviewer training.

It is possible that the notification behavior and the laboratory confirmation seeking behavior among the participants (perhaps also among nonparticipating physicians) will change after participation in the survey. This effect is described as "Question-Behavior Effect" (6, 7). Any influence by "Question-Behavior Effect" should be assessed by further analyses in the annual notification rate of pertussis by province in Austria from 2013 onwards.

In addition, the reporting bias might occur if the physicians prevaricate to avoid the truth of notification frequency during telephone interviews. However, there were only 20 respondents participated through telephone interviews.

The non-respondents of the online self-administered survey cannot be contacted by telephone while no contact information of participants was reachable. However, the head of medical societies will inform their members again to participate in the online survey.

The result of the study might not be representative of the general practitioners, pediatricians and pulmonologists registered in Austria, as the respondents is rather low (22% 53% and 15%, respectively).

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Appendix

List of case definition

Table 10. EU Case definition by EU Commission Decision of 28 April, 2008 (8)

Case definition	
Clinical criteria	Any person with a cough lasting at least two weeks and at least one of the following three: paroxysms of coughing, inspiratory "whooping", Post-tussive vomiting or Any person diagnosed as pertussis by a physician or Apnoeic episodes in infants
Laboratory criteria	At least one of the following three: Isolation of *Bordetella pertussis* from a clinical specimen Detection of *Bordetella pertussis* nucleic acid in a clinical specimen *Bordetella pertussis* specific antibody response Serology results need to be interpreted according to the vaccination status
Epidemiological criteria	An epidemiological link by human to human transmission Additional information Incubation period 6-20 days, most often 10 days
Case classification	
Possible case	Any person meeting the clinical criteria
Probable case	Any person meeting the clinical criteria and with an epidemiological link
Confirmed case	Any person meeting the clinical and the laboratory criteria

Table 11. The distribution of the 31 questions in the four categories of interests and the characteristics of answers

Question no. and contents	No. of options	Tape of answers	Optional / Required question
Notification behavior (8 required questions)			
1. Do you regard pertussis as a notifiable disease?	2	Binary (Y/N)	R
2. If yes, to whom should you notify a pertussis case	2	Binary	R
3. Do you use the standardized notification form for notifying a case of any notifiable disease provided by Federal Ministry of Health?	2	Binary	R
8. Do you use an officially recommended case definition?	2	Binary	R
9. Do you know the ECDC (European Centre for Disease Prevention and Control) case definition of pertussis?	2	Binary	R
10.If yes, do you notify a pertussis case based on the ECDC case definition criteria?	2	Binary	R
11. Do you already notify a clinically suspected case (= clinical criteria fulfilled, laboratory criteria not yet fulfilled)?	2	Binary	R
31. Do you notify a clinical suspected case again after having received a laboratory confirmation?	2	Binary	R
Level of knowledge on clinical manifestation of pertussis (2 required questions)			
4. Which clinical signs and symptoms are compatible with a case of pertussis (multiple choice)	9	Multiple choices High:7-9	R
5. Do you differentiate the clinical signs and symptoms by age (for example age-groups defined as 0-3m; 4m-9y; >10y)?	2	Binary	R
6. Cough is a major symptom of B. pertussis infection. The characteristics of clinical manifestation and duration of symptoms rely on age. Which statement is true? 6.1. Which clinical picture is compatible with pertussis in children aged ≤ 3 months? (Single choice)	3	Single choice	O
6.2. Which symptoms in children between 4 months - 9 years should be considered for whooping cough? (Single choice)	3	Single choice	O
6.3. Which symptoms in children aged ≥ 10 years and adults should be considered for whooping cough? (Multiple choice)	3	Single choice	O
7. To meet the clinical case definition, ≥ 1 symptoms should persist accompanying with cough. 7.1. Which symptoms are in accordance with the clinical case definition in young children ≤ 3 months?	10	Multiple choices High:8-10	O
7.2. Which symptoms are in accordance with the clinical case definition in children between 4 months - 9 years?	10	Multiple choices High:8-10	O
7.3. Which symptoms are in accordance with the clinical case definition in children between children aged ≥ 10 years and adults?	10	Multiple choices High:8-10	O
14. Which duration of cough is regarded as the threshold between early stage and late stage of disease?	3	Single choice	O
Level of knowledge on laboratory diagnosis (8 required questions)			
15. Which diagnostic test(s) is your first choice for laboratory confirmation in young children ≤ 3 months old with clinically suspected *B. pertussis* infection? (general)	3 (3 points)	Multiple choices	R
16. Which diagnostic test(s) is your first choice for laboratory confirmation in children > 3 months old, adolescents and adults with clinically suspected B. pertussis infection while cough lasted < 3 weeks?	3 (3 points)	Multiple choices	R

(general)			
17. Which diagnostic test(s) is your first choice for laboratory confirmation in children > 3 months old, adolescents and adults with clinically suspected B. pertussis infection while cough lasted ≥ 3 weeks? (general)	3 (3 points)	Multiple choices	R
19. Which immunoglobulin as the measurement(s) is (are) regarded of high diagnostic reliability (=highest sensitivity and highest specificity) for the serological confirmation of pertussis? (serology)	3 (3 points)	Multiple choices	R
23. How long should IgG-titer not be used to diagnosis pertussis because of cross-reaction in patients <1 year after pertussis vaccine formulation? (serology)	3 (3 points)	Single choice	R
24. Do you regard the level of IgG-titer to be reliable for discriminating between recent vaccination and current infection? (serology)	2 (3 points)	Binary (Y/N)	R
26. In the acute or convalescent cases, do you use follow-up serum specimens (taken at least three weeks apart) to confirm the suspected B. pertussis infection? (serology)	2 (3 points)	Binary (Y/N)	R
28. Which specimen do you regard as eligible for PCR or culture testing? (general)	5 (3 points)	Multiple choices	R
21. Do you ask for pertussis vaccination history from your patients? (general)	2	Binary (Y/N)	O
22. If Yes, Do you inform the information to the laboratory for submitting specimens? (general)	2	Binary (Y/N)	O
25. Do you regard the level of IgG-titer to be reliable for distinguishing between previous infection and current infection? (serology)	2	Binary (Y/N)	O
30. How do you perform a nasopharyngeal swab?	Open quesions		O
Laboratory confirmation seeking behaviour (2 required questions)			
12. How often do you seek laboratory diagnostics for a patient clinically suspected with B. pertussis infection?	5	Single choice (Satisfactory: ≥75%)	R
13. Please give the reasons for NOT seeking laboratory diagnostics for a patient suspected with B. pertussis infection	4	Multiple choices	R

Questionnaire

The questionnaire for clinical physicians about notification, clinical manifestation and laboratory diagnostic methods of pertussis, Austria, 2013

Pertussis-Fragebogen für klinisch tätige Ärztinnen und Ärzte

Interview Nr: □ □ □

Fachgebiet: □ Allgemeinmedizin □ Kinderheilkunde □ Lungenheilkunde

Lokalisation der ärztlichen Tätigkeit (hauptsächlich):

□ Ordination/Praxis □ Krankenhaus der Normalversorgung □ Universitätsklinik

Bundesland:

□ Wien □ Burgenland □ Oberösterreich □ Niederösterreich □ Steiermark □ Salzburg □ Kärnten □ Tirol □ Vorarlberg

PLZ: □ □ □ □ Stadt/ Ortschaft: _____

Einzugsgebiet des Krankenhauses bzw. der Ordination:

1. Ist Keuchhusten eine meldepflichtige Krankheit?

□Ja □Nein

2. Falls ja, an wen ist ein Fall von Pertussis zu melden?

□ zuständige Bezirksverwaltungsbehörde
□ zuständige Landessanitätsdirektion
□ Bundesministerium für Gesundheit

3. Benützen Sie zur Meldung eines Falles von Pertussis das *Melde(Anzeige-) formular für meldepflichtige Krankheit*, welches vom Bundesministerium für Gesundheit vorgegeben ist?

□Ja □Nein

4. Welche klinischen Zeichen und Beschwerden sind vereinbar mit Keuchhusten?

☐ (1) Hochfieberhafte Bronchitis

☐ (2) Hustenanfälle mit hustenbedingten, unkontrollierbaren und anhaltenden Exspirationen, gefolgt von einem ausgeprägten inspiratorischen Jauchzen oder Keuchen (=inspiratory whoop)

☐ (3) Durch massive Hustenanfälle ausgelößtes Erbrechen

☐ (4) Paroxysmaler Husten mit einer Dauer von ≥14 Tagen

☐ (5) Paroxysmaler produktiver Husten mit einer Dauer von ≥7 Tagen

☐ (6) Paroxysmaler, nichtproduktiver Husten mit einer Dauer von ≥7 Tagen

☐ (7) Paroxysmaler Husten nicht notwendigerweise mit typischer Keuchhusten-charakteristik, ohne Apnoeepisoden, ohne Erbrechen und ohne Zunahme der Beschwerden in der Nacht

☐ (8) Hustenbedingte Petechien im Gesicht oder subkonjunktivale Einblutungen

☐ (9) Hustenbedingte Apnoeepisoden

☐ (10) Andere klinische Zeichen und Beschwerden, bitte benennen _____.

5. Beurteilen Sie klinische Zeichen und Symptome bei V.a. Pertussis altersgruppen-spezifisch, für Altersgruppen ≤ 3 Monate, zwischen 4 Monaten und 9 Jahren, >10Jahre?

☐ Ja ☐Nein

6. Husten ist ein zentrales Symptom von Pertussis. Bei V.a. Keuchhusten wird die Hustencharakteristik und -dauer altersabhängig bewertet. Welche Aussage ist zutreffend?

6.1. Bei Kindern **≤ 3 Monaten** sollte Pertussis erwogen werden...

☐ ... **nur** bei paroxysmalem Husten ≥ 1 Wochen
☐ ... **nur** bei paroxysmalem Husten ≥ 2 Wochen
☐ ... Husten jeglicher Dauer und Form (paroxysmal/oder non-paroxysmal) bei fehlender Besserung

6.2. Bei Kindern zwischen **4 Monate - 9 Jahre** sollte Pertussis erwogen werden...

☐ bei produktivem Husten ≥ 2 Wochen mit Temperatur ≥ 39°C.
☐ bei nicht-produktivem, paroxysmalem Husten ≥ 1 Woche
☐ Husten jeglicher Dauer und Form

6.3. Bei Kindern **≥ 10 Jahren, Jugendlichen und Erwachsenen** sollte Pertussis erwogen werden:

☐ bei nicht-produktivem, paroxysmalem Husten >= 1 Woche
☐ bei nicht-produktivem, paroxysmalem Husten >= 2 Woche
☐ Husten jeglicher Dauer und Form

7. Neben dem Husten zeigt sich Pertussis in aller Regel mit einer ebenfalls altersabhängigen Begleitsymptomatik. Zur Erfüllung der klinischen Falldefinition müssen neben der Hustensymptomatik zusätzlich ≥ 1 Begleitsymptom bestehen.

7.1. Bei Kindern **≤ 3 Monate** sind im Sinne der klinischen Falldefinition folgende Symptome oder Umstände relevant:

☐ (1) inspiratorischer "whoop" (der Hustenanfall ist assoziiert mit hustenbedingten, unkontrollierbaren und anhaltenden Exspirationen, an die sich ein ausgeprägtes inspiratorisches Jauchzen oder Keuchen)
☐ (2) Nächtliche Aggravierung des Beschwerdebildes
☐ (3) Apnoe
☐ (4) Posttussives Erbrechen
☐ (5) Zyanose
☐ (6) Schweißausbrüche zwischen den Hustattacken
☐ (7) Krampfanfälle
☐ (8) Pneumonie
☐ (9) non-produktiver Schnupfen
☐ (10) naher Kontakt zu einer Person (zumeist Familien-/Haushaltmitglied) mit prolongiertem Husten

7.2. Bei Kindern zwischen **4 Monate - 9 Jahre** sind im Sinne der klinischen Falldefinition folgende Symptome oder Umstände relevant:

☐ (1) inspiratorischer "whoop" (der Hustenanfall ist assoziiert mit hustenbedingten, unkontrollierbaren und anhaltenden Exspirationen, an die sich ein ausgeprägtes inspiratorisches Jauchzen oder Keuchen)
☐ (2) Nächtliche Aggravierung des Beschwerdebildes
☐ (3) Apnoe
☐ (4) Posttussives Erbrechen
☐ (5) Zyanose
☐ (6) Schweißausbrüche zwischen den Hustattacken
☐ (7) Krampfanfälle
☐ (8) Pneumonie
☐ (9) non-produktiver Schnupfen
☐ (10) ohne sonstige Begleitsymptome
☐ (11) Naher Kontakt zu einer Person (zumeist Familien-/Haushaltmitglied) mit prolongiertem Husten

7.3. Bei Kindern **≥ 10 Jahren und Erwachsenen** sind im Sinne der klinischen Falldefinition folgende Symptome oder Umstände relevant:

☐ (1) inspiratorischer "whoop" (der Hustenanfall ist assoziiert mit hustenbedingten, unkontrollierbaren und anhaltenden Exspirationen, an die sich ein ausgeprägtes inspiratorisches Jauchzen oder Keuchen)
☐ (2) Nächtliche Aggravierung des Beschwerdebildes
☐ (3) Apnoe
☐ (4) Posttussives Erbrechen
☐ (5) Zyanose
☐ (6) Schweißausbrüche zwischen den Hustattacken
☐ (7) Krampfanfälle
☐ (8) Pneumonie
☐ (9) non-produktiver Schnupfen
☐ (10) ohne sonstige Begleitsymptome
☐ (11) naher Kontakt zu einer Person (zumeist Familien-/Haushaltmitglied) mit prolongiertem Huste

8. Benutzen Sie im klinischen Alltag offizielle Falldefinitionen?
□ Ja □Nein

8.a Wenn ja, von welcher Institution/ Organisation?

□ CDC
□ Robert Koch Institut
□ EU/ECDC
□ WHO
□ andere, bitte benennen Sie diese_____

9. Kennen Sie die Falldefinition des ECDC (Europäisches Zentrum für die Prävention und die Kontrolle von Krankheiten)?

□ Ja □ Nein
Wenn ja, nennen Sie die Definitionskriterien
_____

10. Wenn ja, haben Sie bisher die ECDC Falldefinition als Basis für die offizielle behördliche Meldung verwendet?

□ Ja □ Nein

11. Melden Sie bereits den klinischen Pertussis-Verdacht (klinische Kriterien erfüllt, Laborkriterien noch nicht erfüllt)?

□Ja □Nein

12. Wie oft veranlassen Sie beim klinischen Verdacht auf ein Pertussis eine Labordiagnostik?

□ In jedem Fall
□ In ca. 75% aller Fälle
□ In ca. 50% aller Fälle
□ In ca. 25% aller Fälle
□ In < 25% aller Fälle

13. Was sind Ihre Gründe, warum Sie bei Verdacht auf Pertussis **KEINE** Labordiagnostik veranlassen?

□ Beim klinischen Verdacht wird sofort mit einer Therapie begonnen und die Ergebnisse der Labordiagnostik treffen meist zu spät ein
□ Die Sensitivität und Spezifität der Labordiagnostik ist unzureichend
□ Die notwendige Labordiagnostik ist zu teuer und wird im ambulanten Bereich nicht von den Krankenkassen übernommen
□ Andere Gründe, bitte benennen_____

14. Bei Pertussis wird zwischen einer frühen Phase und einer späten Phase der Krankheit unterschieden. Wann beginnt die Spätphase?

□ nach 3 Wochen Hustensymptomatik
□ nach 6 Wochen Hustensymptomatik
□ nach 9 Wochen Hustensymptomatik

15. Welche diagnostischen Tests sind bei Kindern ≤ 3 Monate zur Bestätigung des klinischen Verdachts geeignet?

□ Serologie
□ PCR
□ Kultur

16. Welche diagnostischen Tests sind bei Kindern > 3 Monate, Jugendlichen und Erwachsenen mit einer Hustendauer von < 3 Wochen zur Bestätigung des klinischen Verdachts geeignet?

□ Serologie
□ PCR
□ Kultur

17. Welche diagnostischen Tests sind bei Kindern > 3 Monate, Jugendlichen und Erwachsenen mit einer Hustendauer von ≥ 3 Wochen zur Bestätigung des klinischen Verdachts geeignet?

□ Serologie
□ PCR
□ Kultur

18. In welcher Situation sind serologische Untersuchungen in der Regel nicht sinnvoll?

□ Im ersten Jahr nach einer Pertussis-Impfung
□ Bei Kindern ≤ 3 Monate
□ Bei allen gegen Pertussis geimpften Personen

19. Die Bestimmung von welchen Immunglobulinen wird zur Bestätigung einer Pertussis-Infektion als diagnostisch sinnvoll (ausreichende Sensitivität und Spezifität) erachtet?

□ IgG-anti-PT
□ IgA-anti-PT
□ IgM-anti-PT

20. Erhalten Sie von Ihrem Labor nur qualitative (positiv / negativ) oder auch quantitative (Angabe einer Titerhöhe) Ergebnisse?

□ Nur qualitative Ergebnisse (positiv oder negativ)
□ Nur quantitative Ergebnisse (Titer-Angabe)
□ Qualitative und quantitative Ergebnisse

21. Fragen Sie Ihre Patienten auch nach stattgehabten Pertussis-Impfungen?

□Ja □Nein

22. Falls ja, geben Sie diese Information an das untersuchende Labor weiter?

□Ja □Nein

23. In welchem Abstand zu einer Pertussis-Impfung sollte der IgG-Titer aufgrund von möglicher Kreuzreaktionen mit größer Zurückhaltung interpretiert werden?

☐ Innerhalb des ersten Jahres nach einer Pertussis-Impfung
☐ Innerhalb der ersten 2 Jahre nach einer Pertussis-Impfung
☐ Innerhalb der ersten 5 Jahre nach einer Pertussis-Impfung

24. Halten Sie die Höhe des IgG-Titers als zuverlässig für die Unterscheidung zwischen einer stattgehabten Impfung und frühere Infektion?

☐Ja ☐Nein

25. Halten Sie die Höhe des IgG-Titers als zuverlässig für die Unterscheidung zwischen einer aktuellen und früheren Infektion?

☐Ja ☐Nein

26. Lassen Sie bei Patienten ein Serumpaar (im Abstand von > 3 Wochen) zur Bestätigung einer frischen Infektion mit Bordetella pertussis untersuchen?

☐Ja ☐Nein

27. Zu welchem Labor schicken Sie Ihre Serum-Proben?

---

28. Welche Proben sind für die Durchführung einer Pertussis-PCR oder –Kultur sinnvoll?

☐ (1) Rachenabstrich (oraler Zugang)
☐ (2) Nasen-Rachen-Abstrich (nasaler Zugang)
☐ (3) Sputum
☐ (4) Nasensekret (nasopharyngeales Aspirat)
☐ (5) EDTA Blut

29. Zu welchem Labor schicken Sie Ihre Proben?

Für die Kultur _____
Für die PCR_____

30. Wie führen Sie einen Nasen-Rachen-Abstrich (nasaler Zugang)

---

31. Melden Sie einen durch das Labor bestätigten Pertussis-Fall erneut an die Behörde?

☐Ja ☐Nein

32. Verordnen Sie symptomatischen Patienten mit labordiagnostisch bestätigter Pertussis...

☐ ... in jedem Fall ein Antibiotikum unabhängig von der Dauer der Erkrankung
☐ ... ein Antibiotikum nur innerhalb der ersten 3-4 Krankheitswochen
☐ ... ein Antibiotikum nur innerhalb der ersten 3-4 Krankheitswochen, in wenigen Ausnahmen auch noch später

Vielen Dank für Ihre Zusammenarbeit!

Lebensmittelbedingte Ausbruchsabklärungen Workshop

AGES Spargelfeld,Vienna, Austria, 11 September 2013

A Gastroenteritis outbreak, Austria

(Exercise: 3.5 hours)

This case study is based on an investigation that was performed by:
VOSS, E. SIMONS, C. MICULA, C. KORNSCHOBER, R. ABLEITNER, J. STIRLING, B. GLEISS, S. KARNER-ZUSER, L. HRIVNIAKOVA, S. KASPER, F. ALLERBERGER and D. SCHMID

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Learning Objectives

After completing the case study, participants should be able to:

- Describe the steps of an outbreak investigation
- Generate and interpret an epidemic curve
- Calculate and interpret attack rates and risk ratios
- List the necessary environmental and laboratory investigations
- Make recommendations for the implementation of control measures

Introduction

On July 27, 2011, Austrian Agency for Health and Food Safety (AGES) received a mandate from Federal Ministry of Health to investigate an outbreak. The signal has been detected by the Austrian Reference Centre for *Salmonella* on July 18, 2011 with the specimens from a cluster of six patients showed indistinguishable PFGE patterns of Salmonella Typhimurium DT3 isolates, among those four of the notified cases had attended a party in Vienna on July 13.

It was decided to further investigate the outbreak to determine its extent and to identify the source of infection and the likely reservoir(s) of the outbreak strain in order to control the outbreak and prevent possible future outbreaks.

Step 1- Confirm outbreak and diagnosis

Step2- Form outbreak control team

Question 1: What next steps would you take in investigating the outbreak? (15 mins)

Form communication team

The ten steps of an outbreak investigation:

- *Confirm outbreak and diagnosis: contact the laboratories*
- ***Form outbreak control team**: the outbreak control team may consist of district or provincial medical officers, epidemiologists, microbiologists, environmental health officers, clinicians, food inspectors, engineers, veterinarians...some of them would be team coordinators*
- *Define a case: Case definition: standard set of criteria (time, place, person and clinical/biological criteria) for deciding if a person should be classified as suffering from the disease under investigation*
- *Identify cases and obtain information*
- *Describe data by time, place person: When did they become ill? Where do they live? Who are the cases?*
- *Develop hypothesis*
- *Test hypothesis: analytical studies*
- *Additional studies*
- *Communicate results: outbreak report , publication*
- *Implement control measures: prophylaxis, exclusion and isolation, public warning, hygienic measures...*

Investigate etiological agent, mode of transmission, vehicle of transmission, source of contamination, population at risk and exposure causing illness

Step 3- Define a case

Question 2: How would you define a case? (10 mins)

Multiple case definitions

- *Possible:*
- *Probable: Gastroenteritis in an attendee of the party on July 13 with disease* onset between July 14th and 21st. *(At some occasions you can't generate a case definition with a specific time frame at the moment, so a sensitive case definition would be used)*
- *Confirmed: A probable case with a stool sample positive for S. Typhimurium DT3*

The definition of index case and primary case

Step 4- Identify cases and obtain information

Question 3: How would you carry out further case finding? What other information would you like to obtain? (15 mins)

Trawling a questionnaire

Active case-finding was performed by the public health authorities by interviewing known cases on their knowledge of other attendees who suffered from gastroenteritis.

For each case, information on demographic information (i.e. age, sex) date of disease onset, symptoms (diarrhoea, vomiting, fever, nausea, stomach ache and cramps) and on laboratory testing of stool specimen were collected.

Exposures and known risk factors

*We conducted trawling interviews with the first ten case-patients on exposure to food and on physical or household contact to gastroenteritis cases within the **three** days (incubation period: 12-72 hours) preceding disease onset in order to generate hypotheses about the potential source(s) of infection.*

Organize information: Generate case line list

Names, Date of Birth, Address, Date of symptom onset, Signs and symptoms, Date of notification, Date of diagnosis, Treating physicians, Hospital stay, Epidemic linkage, Laboratory results...

After actively finding cases from the attendees of the party, a total of 25 cases met the outbreak definition, including twelve confirmed cases.

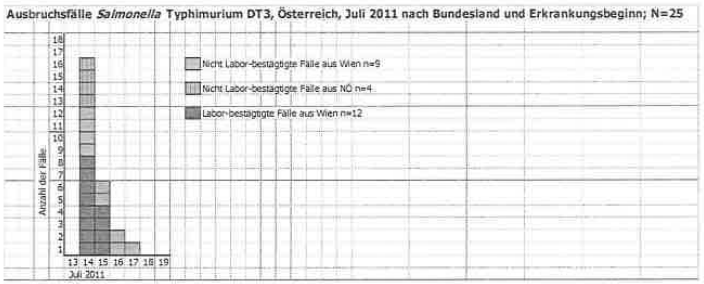
Table 1. List of case-patients among the attendees in a party, Vienna, July 13, 2011

Case ID	Gender	Age	Province	Dateof Onset	Time of Onset	Laboratory confirmation
1	F	27	Wie	15.07.2011	07:00	N
2	M	28	Wie	14.07.2011	20:00	Y
3	M	70	Wie	14.07.2011	12:00	Y
4	F	25	Wie	15.07.2011	07:00	N
5	F	75	Wie	14.07.2011	21:00	Y
6	M	41	Wie	15.07.2011	08:00	Y
7	F	71	Wie	14.07.2011	20:00	N
8	F	69	Wie	14.07.2011	18:00	N
9	F	52	Wie	16.07.2011	NA	N
10	M	51	Wie	17.07.2011	NA	N
11	M	82	Wie	15.07.2011	18:00	Y
12	F	63	NÖ	14.07.2011	19:30	N
13	M	72	NÖ	14.07.2011	19:30	N
14	M	68	Wie	15.07.2011	07:00	Y
15	F	13	Wie	14.07.2011	15:00	Y
16	F	35	Wie	16.07.2011	NA	N
17	F	70	NÖ	14.07.2011	18:00	N
18	M	71	NÖ	14.07.2011	12:00	N
19	F	75	Wie	14.07.2011	16:00	Y
20	M	25	Wie	14.07.2011	12:00	N
21	M	71	Wie	15.07.2011	01:30	N
22	F	38	Wie	14.07.2011	12:00	Y
23	M	35	Wie	14.07.2011	11:00	Y
24	M	6	Wie	14.07.2011	12:00	Y
25	M	87	Wie	14.07.2011	18:00	Y

Step 5- Descriptive study- Describe data by time, place and person

Question 4: Please generate an epidemic curve and interpret the data. (20 mins)

Answer:



The epidemic curve helps to develop hypotheses: incubation period, etiological agent, type of source, type of transmission, time of exposure.

Time and place:
The shape of the epidemic curve suggested a common point source of infection. The outbreak lasted from July 14th to July 17th and peaked with 16 cases on July 14th, indicating a point source active on July 13th, which corresponds to the date of the party.

Person:
The median age was 63 years (min: 6, max: 87) with a male-to-female ratio of 1.1:1 (males n=13).

Step 6- Develop hypothesis

Question 5: Do you have any hypothesis at this stage based on the information available? (10 mins)

Who is at risk of becoming ill?

What is the disease?

What is the source and the vehicle?

What is the mode of transmission?

The hypothesis was that exposure of the attendees to the infectious agent took place on 13 July, the date of the party held

Food items served for the part: meat, eggs, fruits....

Food ingredients of the food items

Water contamination

Common animal contact

Step 7- Test hypothesis: analytical studies

Question 6: What kind of studies would you like to use in order to test the hypotheses? Why? (15 mins)

Analytical studies:

Cohort studies

-attack rate exposed group

-attack rate unexposed group

Case-control studies

-proportion of cases exposed

-proportion of control exposed

Advantages and disadvantages of cohort and case control studies *(source : FEM wiki)*

	Cohort studies	***Case control studies***
Suited for rare diseases	*No*	*Yes, since starting with a set of cases*
Suited for rare exposures	*Yes, since starting with exposure status*	*No*
Allows for studying several exposures	*Difficult but examples exists (Framingham study)*	*Yes*
Allows for studying several outcomes	*Yes*	*No*
Disease status easy to ascertain	*Sometimes difficult*	*Easier since starting point of the study*
Exposure status easier to ascertain	*Yes, since starting point of the study. Except for retrospective cohorts*	*Sometimes difficult. Information biases.*
Allows computation of risk and rates	*Yes*	*No*
Allows computation of effect	*Computation of risk ratio and rate ratio*	*Estimation of risk ratio, rate ratio from odds ratio*
Allows studying natural history of disease	*Yes. Easier to show that cause precedes effect.*	*More difficult. Temporality between cause and effect difficult to establish*
Based on existing data sources	*Difficult*	*Yes, but access to information sometimes difficult*
Easiness to find a reference group	*Usually not difficult to identify an unexposed population*	*No. Major potential biases when selecting a control group*
Sample size	*Large*	*Small*
Cost	*Elevated except if retrospective cohorts*	*Smaller*
Time required	*Long, sometimes very long except if retrospective cohorts*	*Shorter*
Follow up	*Difficult, loss to follow up*	*No follow up*
Logistics	*Heavy. Many staff, large data sets. Long duration*	*Easier*
Concept	*Easy to understand*	*Difficult to understand particularly if case cohort or density case control study*
Ethical issues	*Major if studying risk factors. Interruption of study if exposure shown to be harmful. Need for intermediate analysis.*	*None since outcome already happened.*

The hypothesis was that exposure of the attendees to the infectious agent took place on 13 July, the date of the party held. It was decided to further look at the role of the food attendees consumed that day. A ***retrospective cohort study*** among all the 39 attendees of the party was carried out in July 2011 by telephone interviews using a standardized questionnaire. Data on exposure to different food items (i.e. suckling pig, potato salad, pickled cabbage, Yogurt-raspberry cake…) was collected.

For the cohort study, a more specific case definition was used restricting the time frame. A probable case was defined as gastroenteritis (at least two of the symptoms listed on the questionnaire) in a person attending the party in Vienna on July 13 with disease onset between July 14 and 21, 2013. A confirmed case was defined as a probable case with a stool sample positive for S. Typhimurium DT3.

All 39 attendees of the party completed the questionnaire and were included in the food-specific cohort analyses. Table 2 listed the food items and beverages consumed for the party.

Question 7: Please calculate and fill the blank regarding attack rates (AR) and risk ratios (RR) associated with each of the food items and water samples. Interpret the results. (20 mins)

Table 2: Salmonella Typhimurium DT3 outbreak in Austria, July 2011; Results of the food-specific cohort analyses; Food unexposed defined as participants having not consumed or having consumed a small portion of the food item under study

Food items	Food exposed			Food unexposed				
	ill	total	AR%	ill	total	AR%	RR	95% C.I.
Sucklingpig/dumpling filling	24	37		1	2			0.3-5.3
Potato salad	21	29		4	10			0.8-4.0
Pickled cabbage	22	34		3	5			0.5-2.3
Chocolate cake	7	11		18	28			0.6-1.7
Yogurt-raspberry cake	17	24	70.8	8	15	53.3	1.3	0.8-2.3
Lemon cake	11	19	57.9	14	20	70.0	0.8	0.5-1.3
Egg-liqueur cake	12	16	75.0	13	23	56.5	1.3	0.8-2.1
Tap water	9	13	69.2	16	26	61.5	1.1	0.7-1.8
Mineral water	11	16	68.8	14	23	60.9	1.1	0.7-1.8
Beer	11	15	73.3	14	24	58.3	1.3	0.8-2.0
Wine	8	14	57.1	17	25	68.0	0.8	0.5-1.4
Champagne	9	12	75.0	16	27	59.3	1.3	0.8-2.0

Step 8- Additional studies

Question 8: What other additional investigation you would like to conduct in order to verify your hypothesis? (15 mins)

- *Microbiological investigation of food samples*

Food leftovers were tested for Salmonella as described elsewhere.

- *Molecular typing*

Stool samples from 13 cases were available for testing for enteric pathogens, including Salmonella, Shigella, Yersinia, Campylobacter and enterohaemorrhagic E. coli. Human and non-human isolates were serotyped according to the Kauffmann-White scheme , phage typed and genotyped by the use of variable number of tandem repeats (VNTR)-analysis and by pulsed-fi eld gel electrophoresis (PFGE) using the restriction enzyme XbaI.

- *Veterinarian investigation*
- *Environmental investigation*
- *Trace back investigation (when you have the preliminary result of possible contaminated food items)*

Egg producers identified as epidemiologically outbreak-related by trace-back analyses were sampled in accordance with the sampling strategy specified by the Austrian 15-week regulatory monitoring program (Bundesministerin für Gesundheit, Familie und Jugend, 2007), including one sample of 150 g dust and two paired boot swabs per flock.

Sampling of the pig farm was performed according to the European baseline survey on Salmonella positivity in breeding pig holdings (Bundesministerium für Soziale Sicherheit und Generationen, 2001) and included paired boot swabs, pooled faeces samples, dust samples and feed samples. The samples from the egg-producing and pig-producing holdings were tested for Salmonella

Twelve (92%) out of 13 outbreak case-patients who provided stool specimens were positive for S. Typhimurium DT3. Samples of the potato salad, the pickled cabbage salad and the roast suckling pig were all negative for *Salmonella* spp.

The pig farm that provided the suckling pig was operated by the caterer, who works mainly as a pig farmer. Three pooled faeces samples, two paired boot swabs and one dust sample out of the 21 environmental samples collected at the farm on August 1 tested positive for S. Typhimurium DT3. In addition, two of the three flocks in one laying-hen holding from whom the caterer purchased the eggs as ingredients of the suckling pig dumpling also tested positive for S. Typhimurium DT3. All the human isolates, the six environmental samples from the pig farm and egg samples from the laying-hen holding shared indistinguishable PFGE and VNTR profiles.

In late August 2011, another outbreak was investigated involving a total of 13 cases among 25 visitors of a wine tavern in Lower Austria. Stool specimens obtained from three of the eight laboratory confirmed cases tested positive for S. Typhimurium DT3 accompanying indistinguishable VNTR and PFGE patterns from the human, laying hen holding and egg isolates obtained during the investigation of the previous DT3 outbreak in July.

Step 9-Communicate results: outbreak report, publication

Question 9: Based on all the findings, what conclusions would you like to draw and communicate to the public? (20 mins)

Please look at the summary described at the last page

Step 10- Implement control measures

Question 10: What kind of specific control measures were required to be implemented during and after the outbreak? (20 mins)

Interrupt transmission and control the source of the pathogen

The eggs originated from the laying hen holding (laying hen holding A) involved in the DT3 outbreak in July before a marketing ban was imposed on August 16th as part of the control measures for the preceding DT3 outbreak. The DT3 positive flock was culled on August 31.

General control measures

Cross-contamination of foods should be avoided. Uncooked meats should be kept separate from produce, cooked foods, and ready-to-eat foods. Hands, cutting boards, counters, knives, and other utensils should be washed thoroughly after touching uncooked foods. Hand should be washed before handling food, and between handling different food items.

Better education of food industry workers in basic food safety and restaurant inspection procedures may prevent cross-contamination and other food handling errors that can lead to outbreaks. Wider use of pasteurized egg in restaurants, hospitals, and nursing homes is an important prevention measure.

Education people that contact with live poultry and their environment can be a source of human Salmonella infections. Live poultry can be carrying Salmonella bacteria but appear healthy and clean and show no signs of illness. People should wash their hands after contact with animal feces.

Question 11: What can be learned from this outbreak to prevent possible future outbreaks? (20 mins)

The cooperation and communication between the experts in an outbreak investigation team including experts from human medicine, veterinary medicine and food safety officers are important.

What can you do to prevent future outbreaks as a PH officer, a medical officer, a food inspector and a veterinarian?

Summary

This was the first documented foodborne outbreak of S. Typhimurium DT3 in Austria. Following a party on July 13 2011, 25 of 39 attendees fell sick with gastroenteritis. Food-specific cohort analyses of food items served at the party identified potato salad as the possible outbreak source, even though at weak levels of statistical significance limited by smaller cohort size. Accepting this significance level led to the hypothesis that potato salad was contaminated with the outbreak strain during preparation through contact with the suckling pig or eggs used for the pig filling. The suckling pig, the egg-containing dumpling filling and the potato salad were indeed all prepared in close vicinity in the caterer's kitchen. According to the observations of the food inspector, the potato salad was not processed as required by the Austrian guidelines on hygiene in commercial kitchens, which stipulates that the pH value of potato salad must be ≤4.5.

This hypothesis was supported by the microbiological findings associated with the outbreak. The caterer also operated the pig farm that supplied the suckling pig. The S. Typhimurium DT3 isolates from the pig farm, two flocks of the laying hen holdings and the outbreak cases were indistinguishable from one another.

The eggs originated from the laying hen holding involved in the outbreak were imposed on August 16 as part of the control measures. After the incident of the second outbreak, the DT3 positive flock was culled on August 31. No more human cases of S. Typhimurium DT3 were detected at the National Reference Centre for *Salmonella* (as of May 2012).

The two Austrian foodborne outbreaks (the party outbreak and the tavern outbreak) linked to a single laying hen holding contaminated with identical S. Typhimurium DT3 strains within a short time interval were confined to two neighbouring Austrian provinces. The outbreak investigation identified eggs as the likely vehicle for S. Typhimurium. Educational materials warning food caterers and customers and advising them on how to reduce the risk for *Salmonella* infection from live poultry should be distributed with all live poultry and eggs purchases.

Reference

A.Voss, E. Simons, C. Micula, c. Kornschober, R. Ableitner, J. Stirling, B. Gleiss, S. Karner-Zuser, L. Hrivniakova, S. Kasper, F. Allerberger and D. Schmid. A foodborne outbreak due to Salmonella Typhimurium DT3 seemingly linked to more than one reservoir, Austria July 2011. Wiener Tierärztliche Monatsschrift 2012 99: 30-37.

A foodborne outbreak due to norovirus in a vocational school, Austria, November 2011

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Background

- According to the 2012 update of noronet (European NV molecular platform), there were for Austria 34 registered in 2008, 39 in 2009, 54 in 2010, and 21 NV outbreaks in 2011. The 2 dominant GGII genotypes were GGII.4 2006b in 2008/2009, and GGII.4 2010 in 2010/ 2011.
- On 28 Nov: school physician informed AGES about 40 cases of gastroenteritis
- Cases occurred on 24-25 Nov in a vocational school in city Salzburg
- 3/7 stool specimens from diarrhea case-students were positive for NV
- On 30 Nov, the provincial public health authority Salzburg mandated AGES to investigate the outbreak.

Methods

Descriptive epidemiology: active case finding by school teachers, description of cases by place, time and person; collection of information on food exposure and exposure to vomiting case
Outbreak Case definition: a probable outbreak case is diarrhea/vomiting in a student of affected school with disease onset between 21 Nov- 5 Dec 2011; a confirmed outbreak case is probable case with NV positive stool sample; a suspected foodborne outbreak case is a outbreak case with disease onset not later than 28 Nov, considering date of kitchen closure on 26 Nov.

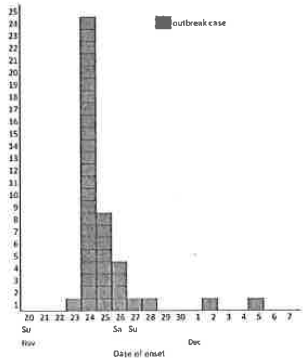
Analytical epidemiology: cohort study
Cohort of interest: 370 students registered at the school for 2011/2012 and a possible consumer of food prepared in school kitchen facility for on days 21-25 Nov, 2011.
Data collection: Information on food items consumed at school on 21-25 Nov collected via self-administered questionnaire.
Plan of analyses: I: day-specific analysis yielding day-specific attack rates (AR%),, II: day-wise food-specific analyses yielding food-specific risk ratios. Day-wise food-specific analyses were restricted to these days found associated with illness in day-specific analysis.
Stratified analyses: to control for potential confounding or effect modification of the different food exposures.

Results

Descriptive epidemiology

48 cases fulfilled outbreak case definitions consumption of food prepared in the school kitchen facility was only common link among case-students interviewed by trawling questionnaire. Shape of the outbreak curve suggested sources of infection on the days 21, 22, 23, 24 and possibly on 25 November, followed by non-foodborne transmission of NV on 26, 27, 28 Nov, 2 and 5 Dec (Figure 1).

Figure 1; cases by date of onset of an outbreak due to NV in Austria, November 2011 (n=41)



Analytical epidemiology I

Day-specific analysis
Using Nov. 21 with the smallest AR% as reference for computing day-specific risk ratios for 22-25 Nov. (Table 1).

Table 1; Day-specific attack rate (AR) and risk ratio (RR) of 21-25 November

Days of exposure	Day-specific exposed (N_{exp})	Day-specific case n	AR (%)	RR	95% CI
21 Nov	245	1	0.4	Reference	
22 Nov	240	24	10.0	24.5	3.3-179.6
23 Nov	242	30	12.4	30.4	4.2-220.9
24 Nov	215	10	4.7	11.4	1.5-88.3
25 Nov	60	1	1.7	4.1	0.3-64.3

Highest attack rates (ARs) and risk ratios (RRs) were seen among students, who have eaten any food on 22 and 23 Nov.
No significant difference was found in day-specific attack rate between the two days 21 Nov and 25 Nov.

Laboratory investigation

Genotyping of the outbreak virus characterized the virus as a hybrid of GGII.7 genotype and GGII.6 genotype. The hybrid showed high homology in the polymerase gene open reading frame 1 (ORF 1) (94.3%) to the GGII.7 genotype and high homology in the capsid gene open reading frame 2 (ORF2) (94 %) to the GGII.6 genotype.

Analytical epidemiology II

Day-wise food-specific analyses
Table 2; Food-specific risk ratios (RR) for 22 and 23 Nov; 95% confidence interval (CI) and p-value.

Food items	Total	RR	95%CI	P
22 November; N=344				
Sour cream sauce	143	16.2	3.9-67.5	0.00
Baked potato	161	13.1	3.1-54.6	0.00
Ragout of venison	199	5.3	1.6-17.5	0.00
Red cabbage/ dumpling	184	2.8	1.1-6.7	0.02
Cranberry	137	2.3	1.1-4.9	0.03
23 November; N=343				
Wiener Schnitzel	230	7.37	1.8-30.3	0.00
Turkey strip salad	139	5.24	2.3-11.8	0.00
Potatoes	220	3.02	1.2-7.6	0.01

Students who consumed venison ragout, red cabbage/dumplings, cranberries, baked potato or sour cream sauce on 22 Nov,
Students who consumed Wiener Schnitzel, potatoes or turkey strip salad on 23 Nov were more likely to be a case (Table 2)

Stratified analyse indicated two items independently associated with the disease risk:
Sour cream sauce: 16.2 (95%CI:3.9-67.5)
Turkey strip salad: 5.2 (95%CI:2.3-11.8)

Outbreak control measures: On 25 Nov (outbreak day 3), the school cleaning staff cleaned and disinfected the environmental surfaces of the classrooms, toilets, and public areas. On 26-27 Nov the kitchen was closed for cleaning and disinfection.

Conclusions

- Epidemiological findings indicated two biologically plausible outbreak sources: sour cream sauce and turkey strip salad.
- Genotyping of the outbreak NV identified a hybrid - GGII.7/GGII.6, which has not been reported before in Austria.
- Lacking a HACCP in the school kitchen might have facilitated contamination of kitchen surfaces and food items.
- The mode, how NV entered school kitchen, remained unclear due to lacking information on presence of asymptomatic excreting kitchen workers, and disease status of kitchen workers' household members.
- We recommend implementation of a HACCP, which is required by law in Austria, but hardly to be controlled in boarding school due to lack of personal resources.
- We advise the school director to comply with the AGES guidelines for control and prevention of NV outbreaks.

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附件六

附件六

Increasing incidence of pertussis in Austria, 2005-2011

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Background

- Within the previous 3-5 years, a substantial rise in reported cases of pertussis has been noticed in two of the nine Austrian provinces
- The Federal Ministry of Health mandated the AGES to assess the observed different trends and to generate hypotheses on possible reasons for the findings on trend differences among the provinces
- Since 2010, primary pertussis vaccine series have been recommended among infants aged 3mo, 5mo and 12mo

Methods

- National surveillance data were used: monthly aggregated data for 2005-2008; cased-based data for 2009-2011
- Case definition used: WHO recommendation until 2008; EU/ECDC recommendation since 2009 onwards
- From 2005-2011: Annual incidence of total Austrian population, and by province
- From 2009-2011: Annual incidence by age-group and age-group specific proportional distribution by onset month

  Province-specific proportional distribution of cases by case classification (possible, probable, confirmed)

Results

- From 2006-2011; in 3/9 provinces incidence increased :
  Styria: by 3.5/100,000/y, **Sa**lzburg: by 1.9/100,000/y, **UA**: by 1.0/100,000/y
- From 2009-2011; in province **T**yrol increase from 0.3-5.8/100,000.
- The other 5 provinces showed stable incidences ("low/stable incidence provinces")
- In 3 of the 4 "high-incidence provinces", age-group 0-14 y only affected
- In 1 of the 4 "high-incidence provinces", both age-groups 0-14 y und ≥15 y affected (Fig. 1, 2 and 4).

Fig.1. Pertussis incidence in the nine provinces of Austria, 2005-2011

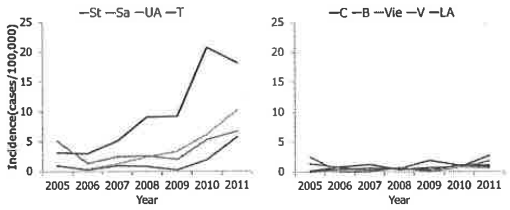
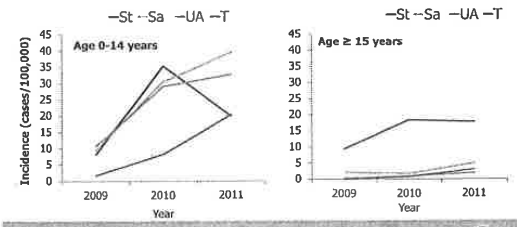
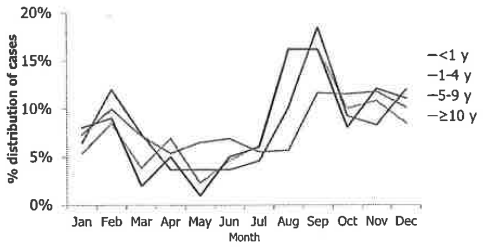


Fig. 2. Pertussis disease incidence by age group, Austria, 2009-2011



- In the 0-9 years old: cases (10-19%) peaked in Aug/Sep and in February (9-12%)
- In the ≥ 10 years old, cases peaked (10-12 %) from Sep.-Dec. (Fig. 3)

Fig. 3. Proprotional case distribution by age and month of onset, 2009-2011



No significant difference in the case distribution by classification between "high-incidence provinces" and "low/stable provinces" (p=0.639) during 2009-2011

Fig. 4. Geographical location of the four "high-incidence provinces" (in grey) and the five "low/stable incidence provinces" (in white) in Austria

Conclusions

- Based on the national surveillance data we found four provinces, which experienced a considerable increase within the past 3-5 years (= high incidence provinces)
- The other five provinces showed stable incidence or decreasing trend (=low/stable incidence provinces)
- In one of the four "high incidence provinces" all age groups were affected: Styria
- The hypotheses on reasons for the provincial differences in the annual incidence trend:
  - Different notification behaviour of physicians
  - Clinical misclassification of cases
  - Laboratory misclassification of cases
  - Different province specific vaccine coverage of primary or booster immunisation

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