

P01 Written reminders increase vaccination coverage in Danish children.

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Introduction

Vaccination coverage is suboptimal in Denmark with a MMR2 coverage of 84 % and a five-year DTaP-IPV booster coverage of 77 % for the 2009 birth cohort. We evaluated the effect of a national initiative of written reminders to parents of children aged 6½ years with at least one missing vaccine.

Methods

Between 15th May 2014, and 14th May 2015 the Statens Serum Institute send out reminders to 12.267 children aged 6½. The children and their parents were identified in the Civil Registration System and the vaccination status was obtained from the Danish Vaccination Registry (DDV), which comprise all childhood vaccinations for children living in Denmark born from 1996 and onwards. We compared vaccination coverage with a control group of children who turned 6½ between 15th May 2013, and 14th May 2014.

Results

At total of 116.098 (86.8%) children were fully vaccinated at age 6½. Reminders were sent to 12.267 children (9.2%). The children reminded at age 6½ years showed an increase of 2.6 % percent for the MMR2 and 2.3 % for the DiTeKiPol booster. The cohort of children turning 6½ in this period was 66.682 and the control group was 66.790. The number of children having received the second MMR were 56.416(84.6%) for the intervention group and 54.744(82%) for the control group.

For the DiTeKiPol booster the coverage was 86.3% for the intervention group and 84% for the control group.

Conclusions

In a Danish setting written reminders has a positive effect on the vaccination coverage. This further increases the incitement for using written reminders to parents of children lacking one or more childhood vaccines. Since November 2015 reporting all given vaccines including travel vaccines to the DDV is mandatory and the DDV can also be utilized for reminders on follow up vaccines as DiTe-boosters for the adult population.

P02 Danish Children Hospitalized with Chickenpox, Clinical Characteristics and the Sensitivity of the Danish National Patient Register

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Introduction

Denmark has no national surveillance of infections with Varicella Zoster Virus (VZV) and the disease burden is unknown. Several countries worldwide have introduced varicella vaccination in national immunization schemes with marked decrease of disease burden as a result and the need to evaluate national epidemiology in Denmark is evident.

In this study, we describe children hospitalized with chickenpox at four pediatric departments in Denmark. We compare prospectively registered cases to information available in the Danish National Patient Register (NPR) and validate the sensitivity and completeness of the register.

Methods

Prospective surveillance of children hospitalized with chickenpox was carried out at four pediatric departments in Denmark from 1/4 2014 to 31/5 2015. We collected demographics and clinical information at discharge of a child with chickenpox. In NPR we identified all children discharged with an ICD10 code of chickenpox from the four departments. We used a capture-recapture analysis to estimate the true number of hospitalized children with chickenpox.

Results

By active surveillance, we identified 86 children admitted with chickenpox and eligible for clinical description. 36% had underlying disease, 5% were immunodeficient. 69% had complications and CNS was the most common organ system involved. One child had angitis of the CNS/stroke and one child had acute disseminated encephalomyelitis. The number of children discharged with chickenpox in NPR was 125. The estimated true number of hospitalized children was 169 (CI: 155-183) and the sensitivity of NPR 74%.

Conclusions

Although chickenpox is usually a mild and self-limiting disease of childhood, serious complications can arise and affect previously healthy children. The National Patient Register is likely to underestimate the true burden of chickenpox hospitalizations and this should be accounted for in future studies of the burden of Varicella zoster virus in Denmark.

P03 Tailored communication on MMR vaccination targeting a Somali community in Sweden

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Introduction

The project targets a Somali community in the districts Rinkeby and Tensta, Stockholm County, where the MMR (Measles, Mumps and Rubella) vaccination coverage is low (70%) and the risk for measles outbreak is high. Parents fear the MMR vaccine due to the belief that it will cause autism. In a qualitative study conducted in 2013, using the Tailoring Immunization Program (TIP) methodology developed by WHO, Somali parents asked for more information on vaccines and vaccine-preventable diseases (VPD). In the Somali culture the oral tradition is strong and knowledge and information is spread by personal and social traditional structures and networks. Since written communication is not fully utilized a project was initiated focusing on interventions using oral communication pathways to tackle the myth linked to MMR vaccine.

Method

A broad tailored communication package based on digital, oral and visual information such as films, videos and lectures in Somali was developed. The project also includes a peer-to-peer component where trained peers in the community convey knowledge and support families in promoting information for health. Staff at the child welfare centers were also offered lectures with updated information on vaccine issues with an emphasis on how to communicate with vaccine hesitant parents.

Results

The tailored communication package was developed and tested throughout 2015 and for 2016 the focus will be on implementing and evaluating the package. The Public Health Agency of Sweden (PHAS) has a mission to evaluate interventions and methods used within the public health sector. RE-AIM (Reach-Effectiveness-Adoption-Implementation-Maintenance), a framework for evaluation of public health interventions has been identified as a possible model which will be piloted within the project.

Conclusions

Tailored interventions on communicating about immunization are needed to be tested and evaluated as tools to motivate changes in parental attitudes and to increase vaccination

coverage among hard-to-reach/serve groups.

P04 A qualitative interview study exploring the attitudes of NHS healthcare workers to flu vaccination in England

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Introduction

Flu vaccination is recommended for all frontline NHS staff, both to protect themselves from flu and also to reduce the risk of transmission to patients, many of whom are particularly vulnerable to the complications of flu. In the 2014/15 flu season, 54.9% of frontline healthcare workers were vaccinated. Vaccination rates have increased over the last 6 years from 26.4% in 2009/10. However, this falls short of the minimum uptake target of 75%.

Public Health England (PHE) commissioned a qualitative interview study to explore the attitude of healthcare workers towards flu vaccination.

Ideas explored included attitudes towards:

a variety of infection prevention and control approaches to find out why some are accepted and not others

the role of the flu vaccine in their duty of care

Methods

A qualitative interview study with NHS healthcare workers was carried out in Oct 2015

A purposive sample was selected to include groups with poor uptake of flu vaccine to enable comparison between these and groups known to have better uptake

Results

Where individual responses are negative, they are often shaped by issues of personal choice, and personal beliefs about health and the efficacy of the flu vaccine

Where they are positive, they are shaped by patient-centred working, and the sense of a duty of care

Most participants had not thought about flu vaccination as an element of infection prevention and control, but most saw the logic of the idea

A duty of care argument provoked a more mixed response

Conclusions

Strategies to increase uptake should include the idea of infection prevention and control, with soft messaging about a general duty of care towards patients, and promotion of the benefits for staff, in terms of protecting them, their colleagues and families

P05 The World health Organisation's tailoring Immunisation programmes (TIP): Working with the Charedi community in North London

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Introduction

As part of efforts to eliminate measles and rubella, the World Health Organisation Regional Office for Europe (WHO/Europe) developed *Tailoring Immunisation Programmes* (TIP) to raise awareness and overcome barriers to vaccination in groups with sub-optimal coverage rates.

TIP provides tools to identify susceptible populations, determine barriers to vaccination and implement evidence-based interventions.

The TIP methodology is being implemented in north London, within the Charedi community

Methods

The programme included a literature review, an epidemiological analysis, a service evaluation and a community questionnaire, culminating in recommendations to inform the tailoring of immunisation services.

Results

There were challenges identifying community members from primary care held records
A sub-optimal coverage of routine childhood immunisations has caused a disproportionate burden of vaccine preventable diseases VPDs in the community, when compared to the rest of the population.

Continuing outbreaks of VPDs lead to a considerable health burden and are resource intensive in terms of healthcare e.g. hospitalisations and outbreak control measures

The community is highly skewed towards children and average household sizes are much larger than average. GP surgeries serving the community have up to 3 times the number of 0-4 year olds registered, compared to the national average.

Increased household size leads to issues with the community accessing immunisation services
There was no evidence that religious beliefs had a direct impact on immunisation uptake.

Conclusions

Consideration should be given to recording community membership on primary care medical records to enable effective monitoring of immunisation status and VPDs

Immunisation services must grow proportionately to ensure the needs of this expanding population are met

Services should take family size into account when planning to provide shorter waiting times, child friendly and culturally appropriate facilities

Existing community specific services e.g. children's centre clinics should be evaluated to ensure continuous improvement and value for money

P06 Nurses' search behaviour regarding information on vaccine-preventable diseases and immunisation

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Introduction: Child Healthcare Centre (CHC) nurses are according to the literature the most important and trusted sources of parents' information about vaccine-preventable diseases (VPDs) and immunisation. It is essential that they have evidence-based information, communication training, and tools to help them communicate effectively with parents. Public health authorities can play an important role in providing such support, but need to identify the most suitable communication channels for reaching CHC-nurses, and to obtain better knowledge about their needs.

The aims of the study were to identify

- main sources used by CHC-nurses when searching for information about VPDs and immunisation

- CHC-nurses' further needs concerning information about immunisation.

Methods: A questionnaire was sent out by e-mail to all nurses (n = 2449) in Swedish CHCs.

The questionnaire contained 19 multiple-choice questions about demographics and professional experience, knowledge levels, searching behaviour, sources, and opinions on information material and further needs.

Results: The response rate was 50 percent. Preliminary results indicate that CHC-nurses primarily search within their organisation when looking for information on VPDs and immunisation. The most commonly used source is the regional CHC-unit, followed by the web based national manual for CHC and relevant national authorities. When specifically looking for answers to parental questions, CHC-nurses most often turn to colleagues.

When asked about their further needs for information about immunisation, many respondents bring up the need for arguments and other supporting tools when communicating with vaccine

hesitant parents. There is also a great demand for education and possibilities to discuss critical issues with a trusted source of information.

Conclusions: The results will be of good use in the national health agencies' further work with developing communication strategies concerning immunisation. It is of great importance to use regional and local channels of communication to reach out to the intended audience.

P07 Influenza-like illness among children: Young children suffer, primary care takes the strain, society bears the cost.

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IntroductionThe seasonal variation of influenza-like illness (ILI) is well known, but costs are rarely studied. This Swedish regional healthcare register study aimed to calculate the overall disease burden of ILI for children, including direct and indirect costs.
MethodsWe examined seasonal variation and associated costs of influenza-related healthcare visits in both primary and hospital care for seven years (2005-2012) for all children 2-17 years, (about 78 000 children) in an open cohort in a defined Swedish region. ILI was defined as ICD-10: Upper Respiratory Infections (J00-J06); Influenza, Pneumonia, Bronchitis (J09 - J15, J20); Otitis media (H65-H67).
ResultsDuring the 10-week influenza season peak, ILI-visits in primary care for children 2-17 years increased compared to pre-influenza season by OR 1.64 [95%CI 1.61-1.68]. The visits almost doubled for children 2-4 years, OR 1.96 [95% CI 1.89-2.04]. Annually, for children 2-17 years old, 10% of total healthcare costs and 29% of costs in primary care were attributable to ILI. This represents 31.6% of all their recorded visits to primary health care. The number of parents absent from work to care for ill children (as reimbursed by social insurance) closely mirrored the pattern of seasonal ILI visits (see Figure). ILI and associated absence from work generated annual direct healthcare costs of € 0.4 million, and indirect costs in loss of production of € 2.5 - 3.3 million, both per 10,000 children/year.
ConclusionsPrimary health care handles the vast majority of influenza and ILI visits for children, where the youngest children are the most affected by ILI. Increased direct costs in primary care but also indirect costs during influenza season were predominantly related to these youngest children (2-4 years). The major part of society's ILI-costs were caused by parental work absence due to caring for ill children.

This study was partly supported by AstraZeneca

P08 Resuming enhanced surveillance of immunization of children born to hepatitis-B infected mothers in Denmark from July 2014-July 2015

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Introduction

Universal screening of pregnant women for hepatitis B virus antigen (HBsAg) was introduced in Denmark in 2005, replacing selective screening.

A two-year trial period of enhanced surveillance was initiated in 2005, where general practitioners were advised about immunization of children born to hepatitis-B infected mothers. Universal screening became permanent in 2007, and the enhanced surveillance stopped. Based on the results of our evaluation of the universal screening, the enhanced surveillance was resumed in June 2014,

We describe the coverage of Hepatitis B immunoglobulin (HBIG) and hepatitis B vaccine (HBvacc) given within 48 hours after birth, and coverage of the second HBvacc within five

weeks of age, to children born to hepatitis-B infected mothers from July 2014 to July 2015, compared with data from the evaluation of the universal screening in 2008-2010.

Methods

A retrospective cohort study of children born in July 2014 to July 2015 to hepatitis-B infected mothers in Denmark. Data was collected from the national pregnancy screening surveillance and the Danish vaccine register.

Results

During 2008-2010 respectively 161, 158 and 125 children were born to hepatitis-B infected mothers in Denmark. 86 %, 94% and 94% respectively, were given HBIG and HBvacc at delivery, within 48 hours of birth. Reintroduction of enhanced surveillance resulted in 100% of children being hepatitis B vaccinated and given HBIG at delivery, within 48 hours.

The coverage of the second HBvacc given within 5 weeks of age increased significantly from 41% in 2008-2010 to 52% in our study (95 CI 0.02-0.2). Vaccination coverage of the second HBvacc within 10 weeks increased, although non-significantly from 81% to 87% (95 CI -0.7-0.8).

Conclusion

Enhanced surveillance of the universal pregnancy screening, increase hepatitis-B immunization coverage at birth and vaccination at 5 weeks, in children born to hepatitis-B infected mothers in Denmark.

P09 Practice-level description of primary care outcomes for the assessment of influenza disease burden in children in England

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Introduction: Influenza is associated with increased incidence of respiratory illnesses. This study describes the distribution of practice-level incidence rates (IRs) of seven influenza-related disorders in children ascertained through to general practitioner (GP) practices in England, where childhood influenza vaccination implementation is currently being rolled out.

Methods: Demographic and diagnoses data on 4,341,884 subjects (including 821,227 children) across 323 practices was retrospectively obtained for four consecutive influenza seasons (2010-2014) from the Clinical Research Practitioners Datalink. A season was defined from September-April, and diagnoses by Disease Read codes. The distribution of crude practice-level IRs was summarised by means and coefficient of variation (CV) across practices for each diagnosis and each season. IRs for the total population were also described.

Results: Table 1 describes the distributions of IRs of influenza-related diagnoses for children and the total population, respectively. Across seasons, similar variation patterns were observed for all diagnoses in both population groups, with a reduced incidence observed during the 2013-2014 season.

Conclusions: Trends in IRs for all diagnoses are consistent with Public Health England annual influenza reports, and support the use of such retrospective study designs to assess/inform childhood vaccination impact in coming years. Future studies will require careful handling of inter-practice diagnosing variations.

Study sponsored by AstraZeneca.

These data were previously presented at the 33rd Annual Meeting of the European Society for Paediatric Infectious Diseases, 12-16 May 2015, Leipzig, Germany.

P10 Association between news media coverage, MMR vaccination uptake and measles cases in Denmark

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Introduction

We attempt to quantify the effect of media coverage on the uptake rate of the measles, mumps and rubella (MMR) vaccine in the period 1997-2014. As a secondary goal we wish to illustrate the interplay between the number of measles cases, MMR related media coverage and MMR vaccination uptake.

Methods

We used curated data on vaccines and measles cases in combination with uncurated news data mined from the web. Correlation was calculated between MMR related news coverage and vaccination uptake, and vaccination uptake and measles cases. News coverage was defined as the number of articles matching a specific query. To determine the significance of the correlation between MMR related news coverage and vaccination uptake, we also calculated the correlation between vaccination uptake and 99 non-MMR related queries.

Results

For monthly intervals the correlation between MMR related news coverage and vaccination uptake was insignificant, $p=0.886-0.104$. While for yearly intervals, there was a strong, statistically significant correlation, $p<0.001-0.037$. The yearly magnitude of the correlation between the MMR related media and the vaccination uptake was between 0.43-0.48, while the average magnitude of the correlation between non-MMR related media and vaccine uptake was 0.09-0.17. Additionally we saw only a positive correlation, meaning that more MMR related media coverage correlates with higher MMR uptake. We found that the vaccination uptake for the small children was more correlated with media than with the number of measles cases. For older children the correlation between vaccination uptake and news media was comparable to the correlation between vaccination uptake and the number of measles cases.

Conclusions

The positive correlation between vaccination uptake and news media seems to indicate that news media in general are important players in public health, and that organizations and bodies responsible for health communication need an active and positive interaction with the media.

P11 Uptake and timeliness of rotavirus vaccination in Norway: the first year post-introduction

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Background: To minimize vaccine-associated risk of intussusception following rotavirus vaccination, Norway adopted very strict age limits for initiating and completing the vaccine series at the time rotavirus vaccination was included in the national immunization program (NIP), October 2014. Although Norway has a high coverage for routine childhood vaccines, these stringent age-limits could negatively affect rotavirus coverage. We documented status and impact of rotavirus vaccination on other infant vaccines in Norway within the first four months to one year after its inclusion in the NIP.

Methods: We used individual vaccination data from the national immunization registry to calculate coverage for rotavirus and other vaccines and examine adherence to the

recommended schedules. We identified factors associated with completing the full rotavirus series by performing multiple logistic regressions analyses. We evaluated potential changes in vaccine uptake and timeliness of others routine vaccine after the introduction of rotavirus vaccine.

Results: Rotavirus coverage achieved within four months-one year after vaccine introduction was 77-88% for dose one and 65-80% for dose two, respectively. Of fully vaccinated children, 98% received both vaccine doses within the upper age limit; 90% received both doses according to the recommended schedule. The child's age at the initiation of rotavirus series and being vaccinated with diphtheria-tetanus-pertussis-polio-Hib vaccine were the strongest predictors of completing the full rotavirus course. No major changes in uptake and timeliness of other vaccines were observed after introduction of rotavirus vaccine.

Conclusions: High vaccine coverage together with a highly satisfactory adherence to the strict age limits for vaccine administration was achieved during the first year of introduction, indicating robustness of the NIP.

P12 Healthcare Utilization, Daycare Attendance and Parental Absenteeism Associated with Rotavirus Gastroenteritis in Norway

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Introduction: To capture economic benefits of rotavirus vaccination, information about healthcare utilization and lost workdays associated with rotavirus hospitalizations is needed. We analyzed healthcare use, daycare attendance, and parental absenteeism among children <5 years of age hospitalized with acute gastroenteritis (AGE) in Norway.

Methods: We conducted a post-discharge telephone interview with caregivers of children hospitalized with AGE in four hospitals during April-August 2015. Data on healthcare utilization before and after hospitalization, daycare attendance, and lost workdays among caregivers were collected for both rotavirus-positive and negative children.

Results: Of 217 caregivers interviewed, 97% had contacted a healthcare provider due to a child's illness before hospitalization. Of the contacts made, 75% were office visits and 25% were telephone calls. Among 111 caregivers with rotavirus-positive children, 97% had sought healthcare before hospitalization with 67% of contacts being office visits. Contact was made with: emergency outpatient clinics (53%), general practitioners (40%), hospitals (4%), and private/other providers (4%). After hospital discharge, 26% of gastroenteritis cases sought healthcare; these contacts were mainly telephone calls (51%). The children in the study were normally cared for at home (49%), in daycare centers (49%) or privately (2%). Children attending daycare (n=106) were absent for a mean duration of 6.2 days (range: 2-14 days) during illness. Among caregivers of these children, 71% were absent from work for a mean of 5.7 workdays (range: 1-16 days) per child. The duration of daycare absence was the same for rotavirus-positive and rotavirus-negative children, but the proportion of caregivers reporting work absence was 7% higher and the duration of work loss 0.4 days longer among caregivers of rotavirus-positive children.

Conclusion: Healthcare utilization and parental absenteeism associated with hospitalizations due to AGE and, in particular, rotavirus gastroenteritis in young children in Norway imposes a considerable economic burden on the national healthcare system and society.

P13 Cost-Effectiveness of Ongoing Rotavirus Vaccination in Norway

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Introduction: Norway introduced universal rotavirus vaccination in the childhood immunization program in October 2014. We conducted a cost-effectiveness analysis to document the economic impact of the ongoing vaccination program. Cost-effectiveness was estimated from a healthcare and societal perspective for both Rotarix® and Rotateq®.

Methods: An age-structured dynamic rotavirus transmission model was developed to estimate vaccination impact and account for herd protection. The model predicted the number of rotavirus-associated outcomes (hospitalizations, deaths, primary care visits) with and without vaccination during the first five years after vaccine introduction; 2015-2019. Real world data on vaccine uptake and cost estimates of rotavirus-associated outcomes were used to populate the model. We computed the costs and health gains of each strategy for a range of vaccine prices. Cost-effectiveness was computed as cost per quality adjusted life year (QALY) expressed as an incremental cost-effectiveness ratio (ICER). The national threshold for cost-effective interventions of € 73 444 per QALY was used.

Results: In the baseline scenario, a rotavirus vaccination program with a 90% vaccine coverage rate and a 93% vaccine efficacy against severe disease would reduce rotavirus-associated hospitalizations and deaths by 67%, primary healthcare visits by 63%, and home care episodes by 57% within the 5-year study period. In 2019, an estimated ICER for rotavirus vaccination program from a healthcare perspective is €645 for Rotarix® and €8 322 per QALY for Rotateq®. From a societal perspective, an estimated ICER for vaccination is €104 518 for Rotarix® and € 96 841 per QALY for Rotateq®.

Conclusion: Ongoing rotavirus vaccination in Norway is cost-effective both from a healthcare and societal perspective.

P14 A Nordic Vaccine Network for collaboration on cell-mediated immunity as a tool to better predict immunity to vaccine preventable diseases?

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Introduction

Current vaccines mostly mediate protection through induction of specific serum antibodies. Defined antibody levels have been established as immunological correlates of protection for most vaccines. Consequently, surveillance of immunity to vaccine-preventable diseases (VPD) have been conducted by serological testing. There is, however a growing body of evidence that cell-mediated immunity (CMI), including memory B-cells, also contributes to protection, where antibodies either do not provide protection or have waned to non-protective levels.

Method

A literature review on vaccine-induced CMI from the past 12 years were conducted. Information was gathered on CMI-related methods currently used at the Public Health Agency of Sweden (PHAS) and other relevant institutions in the Nordic and other countries. The applicability of these methods for large-scale surveillance of vaccine-induced immunity was analysed. EMA, ECDC, research laboratories and some vaccine producers were also consulted. In addition, a survey on currently or planned CMI-related work within VPD immune surveillance in the Nordic countries was performed.

Results

This review highlights what is known about the immune parameters responsible for protection against VPDs in the Swedish national immunisation program and other VPDs that may be included in the program. It provides an orientation on the state-of-the-art on CMI analysis and possible use in vaccine surveillance to design optimized immunization schedules, and evaluation of new CMI-stimulating vaccines and adjuvants. Some of the most commonly used CMI-assays are discussed, such as detection of cytokine responses; phenotyping and characterization of T/B-cells; assessment of T-cell proliferation and assessment of antigen-specific cytotoxicity.

Conclusions

Analysis of CMI would be informative, and would increase our knowledge on vaccine-induced protection and on mechanisms of immune responses. However, large-scale analysis of CMI is costly, labour- and competence-intensive, therefore we are proposing a collaborative Nordic vaccine network for CMI studies and research.

P15 Patterns of vaccination in children of families with an anthroposophic lifestyle. Is there a connection to decreased allergic sensitization?

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Introduction

It is known that lifestyle affect the progress of allergic disease, but debated whether vaccination as one factor has an impact.

Aims: This study aimed to study the association between age of first vaccination for children, received MMR-vaccination and allergic sensitization at five years of age. Also the first vaccination was outlined according to lifestyle group.

Methods

From the ALADDIN-study 249 families with anthroposophic, partly anthroposophic and non-anthroposophic lifestyle were included. Using medical records the children were stratified by age at first vaccination and received MMR-vaccination and the lifestyle groups were compared for allergic sensitization, defined as detected specific IgE-antibodies ≥ 0.35 kU_A/L for at least one allergen. *Results.* Anthroposophic lifestyle was associated with lower frequency of allergic sensitization (p-value 0.012). No association was seen between age of first vaccination, received MMR-vaccination, any vaccination and allergic sensitization. A majority (55%) in the anthroposophic group vaccinated after twelve months of age, and more often for one single disease, and 25% were unvaccinated at five years. In the non-anthroposophic group 96.3% were vaccinated for at least five diseases before six months of age and all before twelve months of age.

Conclusion

No association was seen between age of first vaccination, MMR-vaccination or no vaccination, and allergic sensitization. Children in families with an anthroposophic lifestyle were more prone to deviate from the national vaccine program.

P16 Varicella-associated mortality, hospitalizations and primary healthcare visits in Norway, 2008-2012

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Introduction

Varicella infection causes considerable health burden and economic costs due to associated healthcare visits and work absenteeism. We studied the incidence of varicella-associated hospitalizations and consultation rates in primary healthcare in Norway and associated mortality.

Methods

The study included the entire population of Norway. We used individual patient data from the national databases on primary healthcare visits and hospital contacts occurring during 2008-2012 and data on all-cause mortality from 1996-2012. Patients with varicella-specific codes

listed in any diagnostic position were included. We estimated rates of varicella-associated mortality, hospitalizations and primary healthcare contacts by age and sex.

Results

During 2008-2012, 56,134 persons had 73,065 varicella-associated contacts with primary healthcare; 80% were in children under age 10 years. The average annual contact rate for varicella in primary care was 231 cases per 100,000, peaking at 2,627 cases per 100,000 in children aged one year. A total of 2,399 varicella-associated hospitalizations occurred during 2008-2012 accounting for 5,948 hospitalization days in 1,956 patients; 58% were among children. The average annual hospitalization rate was four cases per 100,000 with 34 cases per 100,000 among children \leq 3 years. Children in the first year of life and adults \geq 60 years stayed in hospital longest. Serious varicella-associated complications accounted for at least 25% of all hospitalizations. A total of 44 varicella-associated deaths were reported during 1996-2012, including seven deaths in children. The annual rate of varicella-associated mortality was estimated 0.6 deaths per one million.

Conclusions

A considerable burden is associated with varicella-associated deaths and varicella cases in both primary care and hospital sector among children and adults in Norway.

P17 Herpes zoster-associated mortality, hospitalizations and primary healthcare visits in Norway, 2008-2012

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Introduction

Herpes zoster (HZ) affects all age groups, but the risk of disease is highest in elderly. One third of zoster cases develop complications resulting in multiple hospitalizations and primary healthcare visits. We studied HZ-associated mortality, hospitalizations and primary healthcare contacts in Norway.

Methods

The study included the entire population of Norway. We used individual patient data from the national databases on primary care and hospital contacts occurring during 2008-2012, and data on all-cause mortality between 1996 and 2012. Patients with HZ-specific codes listed in any diagnostic position were included. We estimated the annual incidence of HZ-related deaths, hospitalizations and primary healthcare contacts by age and sex.

Results

During 2008-2012, a total of 121,726 HZ-associated contacts in primary healthcare occurred in 54,000 patients. During the same period, 10,991 hospital contacts due to HZ occurred in 5,756 patients, corresponding to 27,269 hospital treatment days. In primary healthcare, the annual contact rate for HZ was 223 cases per 100,000 with a highest rate of 759 cases per 100,000 in adults aged \geq 80 years. The annual rate of hospital contacts due to HZ was 14 cases per 100,000, with the highest rate - 88 per 100,000 - among adults aged \geq 80 years. Among HZ-associated hospital contacts, 17% were due to uncomplicated HZ, and 14% due to post-herpetic neuralgia. The proportion of hospital contacts due to HZ-associated complications increased by age with the highest proportion at age \geq 80 years. HZ was reported as one of the causes of death in 343 persons during the 1996-2012. In 58% of deaths, HZ was contributing cause of death corresponding to annual mortality of 4.4 deaths per 1 mill.

Conclusion

The majority of HZ-associated hospitalizations and primary healthcare visits in Norway are among elderly. Further research is needed to fully quantify the national burden of HZ in Norway.

P18 Cost-effectiveness of switching from trivalent to quadrivalent influenza vaccination in Finland

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Background

Trivalent influenza vaccines encompass both circulating influenza A subtypes and one influenza B lineage; however, predictions have been unreliable on which of two antigenically distinct circulating lineages of influenza B will dominate. Quadrivalent seasonal influenza vaccines contain strains from both influenza B lineages. This analysis assesses the cost-effectiveness of switching from trivalent inactivated influenza vaccination (TIIV) in Finland to quadrivalent vaccination, using inactivated (QIIV) or live-attenuated (Q-LAIV) vaccines.

Methods

A transmission model simulated the dynamics of influenza infection while accounting for indirect (herd) protection. Evidence suggests live-attenuated vaccines are more efficacious by strain than inactivated vaccines. Prior distributions for key transmission parameters were repeatedly sampled and simulations which fitted the available information on influenza in Finland recorded. The resulting posterior parameter distributions were used in a probabilistic sensitivity analysis in which economic parameters were sampled, simultaneously encompassing uncertainty in the transmission and economic parameters. The cost-effectiveness of a range of trivalent and quadrivalent vaccine policies over a 20-year time horizon was assessed from a societal perspective.

Results

The simulated temporal incidence pattern of symptomatic infections corresponded well with case surveillance data. A switch in children (2-<18 years) from the current TIIV to Q-LAIV was estimated to avert annually approximately 55,000 symptomatic infections (95% range 29,200-92,200), 8,600 GP consultations (5,000-13,500), 300 hospitalisations (160-560) and 35 deaths (17-65), and was cost-saving relative to TIIV (€349 million averted (€164-€595) in 2014€, discounted at 3%). A scenario with Q-LAIV in children and QIIV in other ages had the highest probability of being the most cost-effective scenario considered.

Conclusions

This analysis demonstrates that quadrivalent vaccination is highly cost-effective. A quadrivalent policy using Q-LAIV in children has the highest probability of being cost-effective, reducing the burden of influenza-related disease.

Acknowledgements

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P19 HPV vaccination adverse event reporting in the Nordic countries - are there cases relevant to recent safety concerns beyond Denmark?

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Introduction

A number of safety signals (complex regional pain syndrome CRPS, postural orthostatic tachycardia syndrome - POTS, and chronic fatigue syndrome - CFS) with common symptomatology have arisen for HPV vaccines from a number of countries throughout the world, and Denmark is the largest source of cases of POTS in Europe. Using data driven clustering methodology we have previously identified a combination of the reported adverse event terms of headache, dizziness, syncope or fatigue to be disproportionately reported in the

case series relevant to this signal.

Objective

The aim of this investigation was to describe the HPV vaccine adverse event reporting patterns between the Nordic countries and to determine if relevant cases have been reported from other Nordic countries.

Methods: All individual case safety reports submitted to VigiBase®, the WHO international database of suspected adverse drug reactions, as of 1st January 2016 from the Nordic countries were identified. A descriptive analysis of the case reports was performed.

Results

Denmark has the highest number of adverse event reports as well as an earlier date of introduction of HPV vaccine into the vaccination program and the highest vaccination coverage in early cohorts. In contrast, Sweden has the highest proportion of serious reports; a serious report indicates either significant medical event, hospitalisation, or disability. Reports of POTS, CRPS, and CFS, as well as potential, undiagnosed case reports are greatest in Denmark. However, case reports relevant to the safety signals exist in most all Nordic countries.

Conclusion

All Nordic countries which currently include HPV vaccine in their childhood vaccination program have received case reports which are potentially relevant to ongoing safety concerns. Furthermore, the majority of these reports describe cases which have not been labelled as either POTS, CRPS or CFS and may not have been included in previous evaluations of these safety signals.

P20 Impact of universal versus targeted vaccination policy on childhood influenza vaccination rates in children with/without high-risk conditions in the UK

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Introduction

The extension of the UK's influenza immunisation programme to 2-3-year-olds in 2013/2014 and 2-4-year-olds in 2014/2015 provides an opportunity to examine the effect of universal versus targeted vaccination policy on vaccination rates in children with and without high-risk conditions for developing influenza-related complications.

Methods

All children aged 2-17 years on 1 September of each season (2012/2013, 2013/2014 and 2014/2015) with ≥ 12 months' medical history in the UK Clinical Practice Research Datalink (CPRD) were included in this analysis.

Information on administration of influenza vaccine was retrieved from immunisation, clinical, and therapy records between 1 September and 28 February of each season. High-risk conditions were defined using definitions adapted from PRIMIS specifications (University of Nottingham).

Results

In total, 807,277, 747,597 and 653,250 children were included for the 2012/2013, 2013/2014 and 2014/2015 seasons, respectively.

Conclusions

Vaccination rates increased in 4-year-olds with and without high-risk conditions in 2014/2015, while uptake remained consistently high in 2-3-year-olds during the second season of the extended programme, and higher than in season 2012/2013, including for children with high-risk conditions.

This study was sponsored by AstraZeneca.

These data were previously presented at the 9th World Congress of the World Society for Pediatric Infectious Diseases, 18-21 November 2015, Rio de Janeiro, Brazil.

P21 Infants are younger at onset of pertussis if the mother is the probable source of infection

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Introduction

After several years of stable and low incidence of pertussis in Sweden, incidence increased during 2014, with highest incidence in infants (<1 year old). Pertussis remains a serious and life-threatening disease for infants, especially the youngest. Knowledge about the source of infection is important in order to define prevention strategies. We have analysed data on case-contact of pertussis in infants. Data was prospectively collected 2009-2014 within the framework of an enhanced surveillance study in Sweden.

Methods

Laboratory confirmed infant pertussis cases were identified between January 2009 to December 2014. A structured interview with questions concerning severity of disease and source of transmission was conducted. Parents were asked if someone in close contact with the infant had been coughing for more than a week during the month prior to the onset of the infant's pertussis episode.

Results

A total of 207 infant cases were included. Of these, 157 infants (76 %) had been in close contact with one person with cough. Other infants included had either zero, two or three close contacts with cough. The single contact distribution was; 34 % (mother), 24% (father), 15 % (sibling) and 25 % (other person). Median age at onset of pertussis was 46, 89, 93 or 89 days if the mother, father, sibling or another person had cough.

Estimated risk for the infants to be hospitalised was somewhat increased if the mother had cough, RR 1.2 (95 % CI: 0.96 -1.59).

Conclusions

The mother was the most probable source of infection. Infants of mothers with cough were significantly younger at onset of pertussis and had an elevated risk of hospitalisation. Our results indicate the importance of early diagnosis and treatment of mothers of newborns, and post-exposure antimicrobial prophylaxis to infants in order to decrease the disease burden of pertussis in infants.

P22 Increasing ascertainment of Pertussis

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Introduction

To increase ascertainment of the burden of pertussis disease in individuals presenting early to primary care and in younger age groups where invasive sampling might deter further investigation, oral fluid (OF) antibody testing for children aged 5-16 years was introduced in 2013 and PCR testing extended to include all age groups from July 2014 during a national outbreak in England (whereas previously only hospitalised infants were eligible for PCR testing). OF and PCR testing for hospitalised infants are offered by the Respiratory and Vaccine Preventable Bacteria Reference Unit (RVBPRU) and PCR testing for all age groups by Public Health England laboratories (PHEL).

Methods

OF data reported by RVPBRU between 01/01/2013-31/12/2015 was analysed. An OF titre of >70 arbitrary units (aU) of anti-pertussis toxin IgG was taken as consistent with recent infection. All confirmed cases were followed up for vaccination history.

PCR data reported by RVPBRU and PHELs was analysed to compare pre (01/01/2013-30/06/2014) and post (01/07/2014-31/12/2015) expansion of testing.

Results

RVPBRU received 852 OF samples of which 684 (80%; [684/851]) were aged 5-16 years. In this age group 385 (57%) of 678 tested samples were positive for a recent infection. There were 336 cases confirmed solely by OF testing; 16% (336/2047) of total confirmed cases aged 5-16 years.

PCR testing for hospitalised infants <1 year was available throughout and 55% (133/242) of such cases were confirmed by PCR compared to 50% (82/165) pre-expansion. In non-infant groups the highest increase was in children aged 1-4 years where 11% (11/104) were PCR confirmed compared to 9% (7/79) prior to expansion.

Conclusions

OF testing increased ascertainment by 20% (336/1711) in children aged 5-16 years. PCR testing should be encouraged to diagnose and treat all age groups presenting early to primary care in order to minimise infant morbidity and death through onward transmission.

P23 Lower incidence of pneumonia in infants under 3 months of age vaccinated with BCG

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Background

Recent studies have suggested live vaccines to have non-specific effects that protect against other than the specific infections the vaccines are targeted against. The national vaccination program (NVP) in Finland was changed on September 1st, 2006: before the live tuberculosis vaccine (BCG,) was given to all newborn babies and afterwards it was given to babies of parents in defined risk groups (mainly immigrants). Thus, the vaccination coverage in newborns diminished from almost 100% to 5-10% overnight. We studied the potential non-specific impact of BCG vaccination in the frame of Finnish NVP using before-after design.

Methods

According to pre-defined protocol, we compared the pneumonia incidence between children born 1.1.2004-30.6.2006 (BCG-eligible) and age- and season-adjusted reference cohort born 1.1.2007-30.6.2009 (unvaccinated) to Finland-born parents using Poisson regression. Pneumonia was defined as hospitalization notified to National Care Register with ICD10 diagnosis compatible with pneumonia (J10, J11, J12 to J18, J85.1 and J86) as the primary discharge diagnosis. Follow-up began at birth and lasted 3 months (the scheduled age for DTaP-IPV-Hib vaccination), and until first birthday.

Results

Altogether 125781 BCG-vaccine-eligible and 127324 non-eligible children were included. The incidence rate ratio of the BCG-eligible cohort compared to unvaccinated cohort for hospital-treated primary pneumonia was 0.73 (95%CI 0.55-0.96) for the 3-month follow-up. There were no differences after the age of 3 months when children were scheduled for their first inactive vaccination (table).

Conclusions

This analysis suggests that BCG vaccination is associated with lower incidence of pneumonia during the first three months of life. The observed difference cannot be attributed to lung tuberculosis, since only few cases have occurred in Finland in children during the follow-up years. The disappearance of the impact after administration of inactive vaccine has been described earlier, and it also speaks against biased comparison because of e.g. varying influenza and RSV virus epidemics.

P24 Vaccination: what do parents in England really think?

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Introduction

National vaccination programmes in England have been informed by a series of surveys undertaken into attitudes of parents towards childhood immunisation since 1991. These have helped establish and track parental views on the diseases, vaccines, information needs and the immunisation experience.

Methods

Home interviews took place in 275 randomly selected locations in England. Sampling was stratified by region and deprivation score. Interviewers established at the door whether there were eligible primary care givers of children aged <5 years old willing to participate. All interviews were conducted in person by trained interviewers using Computer Assisted Personal Interviewing.

Results

Interviews were undertaken between 19/1/2015-1/4/2015 with 1130 parents of children aged 0-2 years and 999 parents of children aged 3-4 years; a total of 1792 parents of whom 337 had children of both ages.

There was a decline in the proportion of parents recalling having seen recent immunisation information to 53%. There was also a fall in the proportion of parents who recalled seeing anything recently that might make them doubt getting their child immunised (12% compared to 17% in 2010) and such information was most likely to come from the internet, family or friends. Health professionals were seen as the most trusted source of advice on immunisation.

Significantly more parents automatically had their child's immunisations done when due (72% in 2010, 90% in 2015). In 2015, 7% (rounded) postponed their child's immunisations (19% in 2010): 5% had them done later; 2% intended to have them done and 1% were uncertain. Only 2% of parents actually refused immunisations for their child.

Conclusions

The overwhelming majority of parents are having their children vaccinated automatically when their vaccines are due with acceptance at the highest level in more than a decade. This is consistent with recent trends in increased vaccine coverage.

P25 Increased cutaneous diphtheria in England : 2014-15

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Introduction

Diphtheria is a vaccine preventable disease caused by *Corynebacterium diphtheriae*, *C. ulcerans*, or *C. pseudotuberculosis*, which carry and express the diphtheria toxin gene (*tox*). Cases can present with respiratory and/or cutaneous symptoms and severity is linked to vaccination status. Since the introduction of mass immunisation in 1942 diphtheria has become increasingly rare in the UK.

Public Health England conducts enhanced national surveillance of laboratory confirmed toxigenic diphtheria in England.

Methods

From 1st April 2014, the national reference laboratory has used realtime PCR to confirm the identity of these isolates and determine if the *tox* gene is present. If detected, the isolate undergoes an Elek test to detect expression of toxin. All toxigenic isolates are followed up in line with national public health guidelines which were updated in 2014 (interim) and 2015.

Results

Between April 2014 and December 2015 the national reference laboratory received 114 isolates for confirmatory testing. In total, seven toxigenic cases were detected. Five cutaneous infections including three imported *C. diphtheriae* infections, and two indigenous *C. ulcerans* infections with animal contact. Two further *C. ulcerans* isolates, one respiratory and one from abscess pus were reported, also with animal contact. This compares with only six cutaneous toxigenic isolates between 2004 and 2013, five *C. diphtheriae* and one *C. ulcerans*. An additional six non-toxigenic *tox* gene bearing *C. diphtheriae* isolates (NTTB) were identified during this period, four from wound swabs and two from throat swabs.

Conclusions

An increased number of cutaneous toxigenic corynebacteria isolates was identified in the study period compared to the previous 10 years. The introduction of testing by realtime PCR resulted in the identification of six NTTB *C. diphtheriae* cases of which three were part of a cluster associated with a dermatology clinic.

P26 IMPACT OF PROTEIN D-CONTAINING PNEUMOCOCCAL CONJUGATE VACCINES ON NON-TYPEABLE HAEMOPHILUS INFLUENZAE ACUTE OTITIS MEDIA AND NASOPHARYNGEAL CARRIAGE

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Introduction

Inclusion of protein D (PD) in the pneumococcal non-typeable Haemophilus influenzae (NTHi) PD-containing vaccine, PHiD-CV, offered potential to extend protection against acute otitis media (AOM) to include NTHi disease.

Methods

We reviewed evidence from pre-clinical, clinical and post-marketing studies of PD-containing pneumococcal conjugate vaccine (PCV) to better describe the clinical utility of PD in preventing NTHi AOM.

Results

Proof-of-concept for prevention of NTHi AOM by PD-containing formulations was demonstrated in pre-clinical studies and a clinical trial (POET study in children¹). A phase III trial of PHiD-CV suggested effects on NTHi AOM but did not provide conclusive evidence on efficacy (COMPAS²). Positive point estimates of efficacy against NTHi AOM observed in COMPAS and POET contrast with negative point estimates observed in a study of non-PD-containing PCV formulations (FinOM^{3,4}). Implementation of PHiD-CV in routine clinical practice worldwide has shown encouraging reductions in OM for <2-year-olds, in some cases greater than predicted assuming efficacy against pneumococcal vaccine-types alone. Pathogen-specific data remain limited but in one study where available⁵, a trend towards a reduction in NTHi OM was observed. Trends for transient reductions in NTHi nasopharyngeal carriage (NPC) were observed in some randomized controlled trials (e.g. COMPAS) and post-marketing surveillance studies. Clinical significance of these findings is unclear as NTHi NPC may not be tightly linked to disease.

Conclusion

Available data suggest that PHiD-CV may decrease NTHi AOM. More evidence including pathogen-specific outcomes is warranted.

¹Prymula, Lancet-2006; ²Tregnaghi, PLoS Med-2014; ³Eskola, NEJM-2001; ⁴Kilpi, CID-2003;

⁵Leach, BMC Inf Dis-2015.

P27 Uptake of seasonal influenza vaccination in health care workers in EU/EEA MS assessed for the 2014/2015 influenza season by the VENICE III network

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Introduction

The European Council recommendation on seasonal influenza vaccination adopted in 2009 encourages EU/EEA Member States (MSs) to improve vaccination coverage among healthcare workers (HCWs). Similarly, the WHO SAGE in their recommendation from 2012 states that HCWs are an important priority group. Following these recommendations reported policy and measured/estimated uptake of seasonal influenza vaccines in health care workers was assessed.

Methods

A standardized online survey questionnaire was developed by the VENICE III network and made available to all EU/EEA MS gatekeepers.

Results

Of 30 responding countries, 29 recommended seasonal influenza vaccine to HCWs ahead of the 2014/2015 influenza season. In Denmark, no national recommendation was available, but most regions and municipalities offered vaccination free of charge.

Vaccination was recommended to all HCWs in 23 EU/EEA MS, while another 5 recommended vaccination to staff in close patient contact or staff caring for immunocompromised patients only. In the UK, vaccination was recommended in Northern Ireland and Scotland for all HCWs, while England and Wales recommended front line HCWs only.

No MS enforces mandatory vaccination of staff. Some health care settings in MSs required unvaccinated staff to wear a mask during the influenza season.

Uptake of seasonal influenza vaccination in HCWs was reported from fourteen EU/EEA MS (CY, GR, HR, HU, IE, LT, NL, NO, PL, PT, RO, SI, ES, UK) and ranged between 5-55%.

Information was collected by the administrative method (n=13) or the survey method (n=1).

Uptake in health care workers was often but not always lower than uptake in older populations, with a median uptake of approximately 40% in older populations (n=23) compared to approximately 25% among HCWs (n=14).

Conclusions

There is an opportunity for collection of uptake in HCWs in more EU/EEA MS and in those reporting there is room for significant improvement in uptake of seasonal influenza vaccination.