Near-Real Time Monitoring of Vaccine Uptake of Pregnant Women in a Primary Care Sentinel Network: Ontological Case Definition Across Heterogeneous Data Sources

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Abstract

Vaccination against influenza is important in pregnancy for the health of both mother and unborn baby. Influenza introduces risks to pregnancy and to the baby who relies on maternal antibodies for protection. Because the data associated with pregnancy is fragmented across multiple providers of health care, it is challenging to conduct pregnancy-related public health surveillance using a single data source. We report the integration of a novel ontological approach to identifying pregnancies in routine data with a web-based dashboard that feeds back information to general practices in a sentinel network. As a result, practices receive information about how well they are performing influenza vaccination in pregnancy in near-real-time.

Keywords:

Electronic Health Records, Pregnancy, Vaccines;

Introduction

Uptake of influenza vaccine in pregnancy is very important because there are considerable associated risks, both to mother and unborn baby. Influenza in pregnancy can result in preterm delivery and also morbidity and mortality for the mother. This was apparent in the 2009 pandemic. In the UK hospital and maternity data give a complete retrospective overview of data, but this is not available for many months after collection. Public health bodies need near real-time monitoring of vaccine uptake in pregnancy and also to be able to study influenza vaccine effectiveness.

Monitoring influenza vaccination during pregnancy is challenging due to the suboptimal recording of pregnancy data in computerised medical record (CMR) systems [1]. Pregnant women are considered to be a risk group in influenza immunisation programmes and therefore require to be monitored by sentinel networks. The Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC) works in collaboration with Public Health England (PHE) to monitor influenza, other infections, and vaccine effectiveness – particularly influenza - in England.

Pregnancy related data is sparse are often scattered across the health care providers. Obstetric care is frequently shared between midwives, the family physician, and specialist obstetric units. Therefore data is stored in different formats and locations.

Dashboards that visualise health data are increasingly being used as decision support tools to make health care delivery more dynamic. This paper describes how a pregnancy case identification method was incorporated into an updated version of the dashboard that is currently being used to monitor the vaccine uptake of pregnant women in the sentinel network.

Methods

Identification of pregnant women from routine data

We developed an algorithm that accurately inferred pregnancies even when the availability of pregnancy-related data was limited. This was achieved by adopting an ontological approach for case finding [2]. Ontological approaches use technology agnostic information structures and can make use of existing technology stacks that assist with semantic reasoning and formal validation of the relationship between concepts used. An ontological approach to identifying pregnancies and associated complications uses a systematic approach to derive this information from routine data. Both direct pregnancy codes and surrogate markers, such as therapeutic data, can be used to identify cases. The ontological concepts were identified from a combination of literature searches and input from experienced General Practitioners. The concepts were annotated using two coding systems used in computerised medical record systems within the sentinel network (i.e. Clinical Terms version 3 (CTV3) and Read V2). The pregnancy ontology was implemented using the OWL (web ontology language) standard using Protégé ontology authoring environment. The pregnancy ontology is currently hosted on the BioPortal ontology repository. We implemented the pregnancy case identification algorithm using Structured Query Language (SQL).

Integration of the pregnancy algorithm outputs with the winter wellness dashboard

The dashboard was developed as part of a "Winter Wellness" dashboard. The purposes of the dashboard were to feedback to the practices about their clinical care. The dashboard interface contained a combination of tabular and graph displays [3].

The RCGP RSC database is refreshed on a weekly basis using increment data extracted from contributing general practices in the sentinel network. The weekly increment update is followed by the execution of the pregnancy case identification algorithm on the weekly data. This allows the identification of additional pregnancy outcomes recorded during the week. This information is processed with the vaccination data received through the same weekly increment data to ascertain the status of vaccination of pregnant women in the sentinel network.

Results

We were able successfully to integrate the vaccination data of pregnancy women in the winter wellness dashboard. The dashboard allowed the user to view the number of pregnant women eligible for influenza vaccination and the number of pregnant women that were administered with the influenza vaccination. RCGP RSC has over 200 practices currently uploading over 2 million patient records each week (www.rcgp.org.uk/rsc) into a freely available national report about influenza and over thirty other monitored conditions. We have now added the ability to report on the uptake of influenza vaccine in pregnancy.

We seem to have a similar cumulative vaccination rate in pregnant women as non-pregnant women in the same age-group The vaccination rates shown in Figures 1 and 2 are the vaccination performance of the sentinel network for the current season from ISO week 35 (2018) to 11 (2019). This information can also be obtained on the dashboard for each practice by entering a practice specific code.
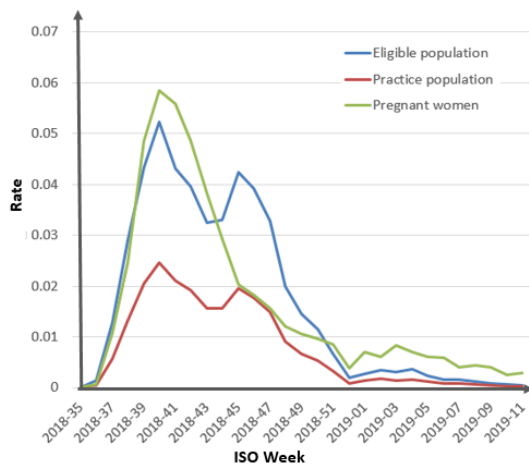

Figure 1 – The graph indicates the rate of practice population, rate of population eligible for vaccination and rate of pregnant women vaccinated at each ISO week (from week 35(2018) to week 11(2019))

Figure 1 indicates two peaks in weekly vaccination (week 40 and 44) when most influenza clinics are held at general practices for the current season. Figure 2 provides a cumulative rate of vaccination for the three groups described above. This information is particularly useful to understand if the vaccination programmes within the general practices are in a trajectory to meet the seasonal vaccination targets set.

Discussion

The use of the ontological approach also allowed us to consistently ascertain pregnancies throughout a network that uses and two different types of clinical coding systems for recording pregnancy events. We anticipate that this method will also make it easy to adapt the case identification in the system to the needs of SNOMED CT once this is fully adopted in English primary care.
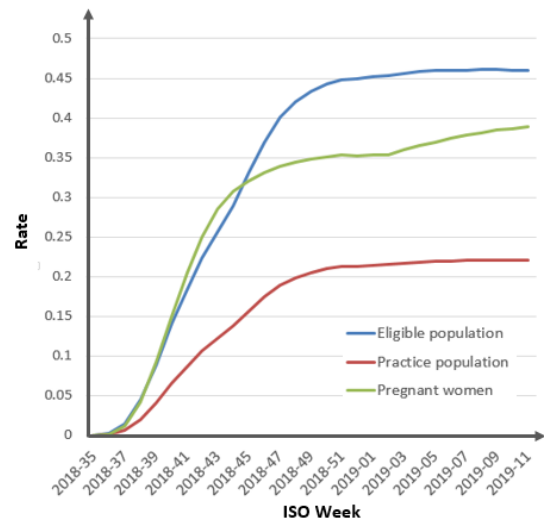

Figure 2- The graph indicates the cumulative rate of practice population, rate of population eligible for vaccination and rate of pregnant women that were vaccinated each ISO week (from week 35(2018) to week 11(2019)) from the beginning of the influenza season

Conclusions

To our knowledge this poster reports the first near-real time monitoring dashboard for influenza vaccine uptake in primary care. Realising this goal was particularly challenging due to suboptimal data quality of pregnancy events in primary care and the heterogeneity of the CMR systems we collect data from and coding systems in use. A web-based dashboard is now operationalised and providing weekly feedback of vaccine uptake to general practices in our sentinel network and will deliver reports about the level of uptake in our nationally representative network of practices to public health colleagues.

Acknowledgements

References

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