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Trends of influenza vaccination coverage in pregnant women, a ten-year analysis from a French healthcare database

Mélodie Corbeau

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UNIVERSITÉ CLERMONT AUVERGNE
UFR DE MÉDECINE ET DES PROFESSIONS PARAMÉDICALES

THÈSE D'EXERCICE

pour le

DIPLÔME D'ÉTAT DE DOCTEUR EN MÉDECINE

par

CORBEAU, Mélodie

Présentée et soutenue publiquement le 22 juin 2021

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Signature du directeur de thèse :



Mélodie CORBEAU



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Liste des abréviations

ALD : Affection Longue Durée

ATC : Anatomical Therapeutic Chemical class

CCAM : Common Classification of Medical Acts

CI : Confidence Interval

CMUc : Couverture Maladie Universelle complémentaire

CNIL : Commission Nationale Informatique et Libertés

COVID-19 : Coronavirus Disease 2019

C-section : Cesarean-section

DTP : Diphtérie Tétanos Polio

ECDC : European Centre for Disease Prevention and Control

EPICES : Evaluation de la Précarité et des Inégalités de santé dans les Centres d'Examens de Santé

EGB : Echantillon Généraliste des Bénéficiaires

HIV : Human Immunodeficiency Virus

ICD-10 : International Classification of Diseases, Tenth revision

IVC : Influenza Vaccination Coverage

OR : Odd Ratio

SPF : Santé Publique France

T1,2, 3 : first, second or third Trimester of Pregnancy

UK : United Kingdom

USA : United States of America

WHO : World Health Organization

1 Introduction

Influenza is an acute respiratory infection caused by *Myxovirus influenza*, a virus whose subtypes A and B are responsible for seasonal outbreaks worldwide. The World Health Organization (WHO) estimates at a billion the number of influenza cases every year, 3 to 5 million severe cases and 290 000 to 650 000 deaths [1].

Pregnant women are more likely to develop a severe form of influenza [2–6] associated with obstetrical complications such as prematurity and miscarriage [7,8].

Every year, a vaccine is developed with the latest epidemiological information on the circulating subtype in the southern hemisphere. The efficacy and innocuity of the vaccine during pregnancy have been well established in numerous studies [9–20], as well as its protective effect for the infant through passive immunization [21–23].

In Europe the majority of countries have recommended vaccination for pregnant women, whatever the term of pregnancy [24], since the WHO issued its recommendation in 2012 [25]. In France, the influenza vaccination has been recommended for pregnant women since 2009 (in the 2nd and 3rd trimester) and generalized in 2012 to all stages of pregnancy [25,26]. Therefore, it should be prescribed to all pregnant women, to avoid severe forms of influenza and to protect their infant.

However, a report issued by the European Centre for Disease Prevention and Control (ECDC) in 2017 showed that the influenza vaccination coverage (IVC) in pregnant women in Europe remained low and uneven, from 0.3% to 56.1% in 2014-2015 and was not monitored by most of the member states, including France [24]. A few studies all based on classical surveys with different methodologies estimated the IVC in France to be between 5.4% and 26% [27–30]. In order to avoid the usual biases arising from classical surveys (selection bias and generalization

of the findings), leading to a great variability in coverage estimates, and since the influenza vaccination is prescribed and fully reimbursed by the social security, we propose to use the French national healthcare insurance database to provide estimates of the IVC in pregnant women.

In this study we sought to analyze the evolution of the annual IVC in pregnant women in France from 2009 to 2018, to evaluate the impact of the WHO 2012 recommendation [25] on vaccination behavior, and to identify determinants of influenza vaccination uptake in pregnancy.

2 Methods

2.1 Data source and design

A repeated annual cross-sectional study was performed by using data from the “Echantillon Généraliste des Bénéficiaires” (EGB), a representative sample of the French population, from January 1, 2009 to December 31, 2018. The EGB database contains the healthcare data of about 660 000 people, representing 1/97th of the French population. This sample of insured patients is randomized, anonymized and representative of the health care protected French population [31,32]. EGB contains sociodemographic information on the beneficiaries, as well as data on various health expenses reimbursed by the French healthcare insurance. That includes prescribed medications (identified according to their anatomical therapeutic chemical class, ATC), consultation with medical and para-medical professional, in private practice as well as public hospital, hospitalization and laboratory expenses. We can also find data on chronic diseases such as ALD (long-term disease) codes, diagnosis and medical history coded during hospitalization using ICD-10 (international classification of diseases, tenth revision) and medical procedures referenced according to the CCAM (common classification of medical acts). The data have been collected since 2005 and are available after a two-year period.

The EGB database is a validated tool for pharmacoepidemiological studies in France and has already proven to be a reliable tool to assess vaccination coverage for other reimbursed vaccines [33–35].

2.2 Study population

All women who had data recorded on a delivery, vaginal birth, or caesarian section in the EGB database, during the period from January 1, 2009 to December 31, 2018 were included. The exclusion criteria were unwanted pregnancy and denial of pregnancy. We did not exclude pregnancies that resulted in stillbirth, or therapeutic abortion after 22 weeks of gestation.

The corresponding ICD 10 diagnosis codes and CCAM medical procedures are listed in supplementary tables 1-3.

2.3 Exposure

Influenza vaccine exposure of the pregnant women included was identified through the reimbursement for a seasonal influenza vaccine in the EGB database, up to nine months before the date of their delivery, using two codes indicating dispensation (ATC J07BB and PRS_NAT 3331). We assumed that a vaccine purchased was injected afterwards and we calculated the IVC based on the number of pregnant women who had a reimbursed influenza vaccine.

To evaluate the impact of the WHO 2012 recommendation [25] on vaccination in the first trimester, we formed 3 subgroups of women according to their term of pregnancy during the vaccination campaign that takes place from October to January. Women who gave birth in January were labeled T3 as they were in their third trimester during the vaccination campaign. Likewise, those who gave birth in April were labelled T2, and those who gave birth in July were labeled T1.

2.4 Collected data

The collected data concerned were pre-existing medical condition, age, parity, CMUc (universal complementary healthcare insurance), and prescriber's specialty.

We used the French influenza vaccination recommendation to select women with pre-existing conditions who would have been targeted by the vaccination campaign outside of their pregnancy. Various conditions were included, and grouped in pulmonary, cardiac, neurological, renal, and hepatic disease, diabetes, and immunodeficiency (including HIV, stem cell and all organ transplantations, inflammatory and autoimmune diseases, hematological disease such as sickle cell disease and cancer).

Data were extracted from the EGB database using the CCAM, ICD-10, or long-term chronic disease codes (supplementary tables 5-7).

CMUc was used as a proxy for precarity since it is an insurance available only to patients with low income, to insure their access to healthcare free of charge. The women affiliated with the CMUc were considered socioeconomically deprived.

2.5 Data analysis

The population was described by means and standard deviations for continuous data and by numbers and percentages for categorical data.

Analysis of influenza vaccination of pregnant women was carried out using Chi squared test (or Fisher's exact test when appropriate) for categorical data and using Student's t-test for continuous data. Odds ratio (of vaccination) between groups are presented with their 95% confidence interval.

To validate the reliability of our data and the computation method of IVC, we compared the IVC calculated through EGB in patients over 65 years old to French official influenza vaccination data (Santé Publique France, SPF).

All tests were two-sided. A p-value < 5% was considered statistically significant, but the interpretations were based-on size of differences with clinical view (rather than just regarding the p-value), as significant tests do not always reflect clinically relevant differences when involving large samples. All analyses were performed using SAS Enterprise Guide (SAS Institute Inc, Cary, NC, USA).

2.6 Ethics approval

There was no requirement for ethical approval for this study. The EGB database guarantees the confidentiality and anonymity of all data (agreement by the French Data Protection Authority, CNIL, June 14, 2005).

3 Results

3.1 Validation data

Compared to the nation-wide official influenza vaccination data (SPF) (Figure 1), data from the EGB database showed a similar trend of influenza vaccination coverage in the French population over 65 years old.

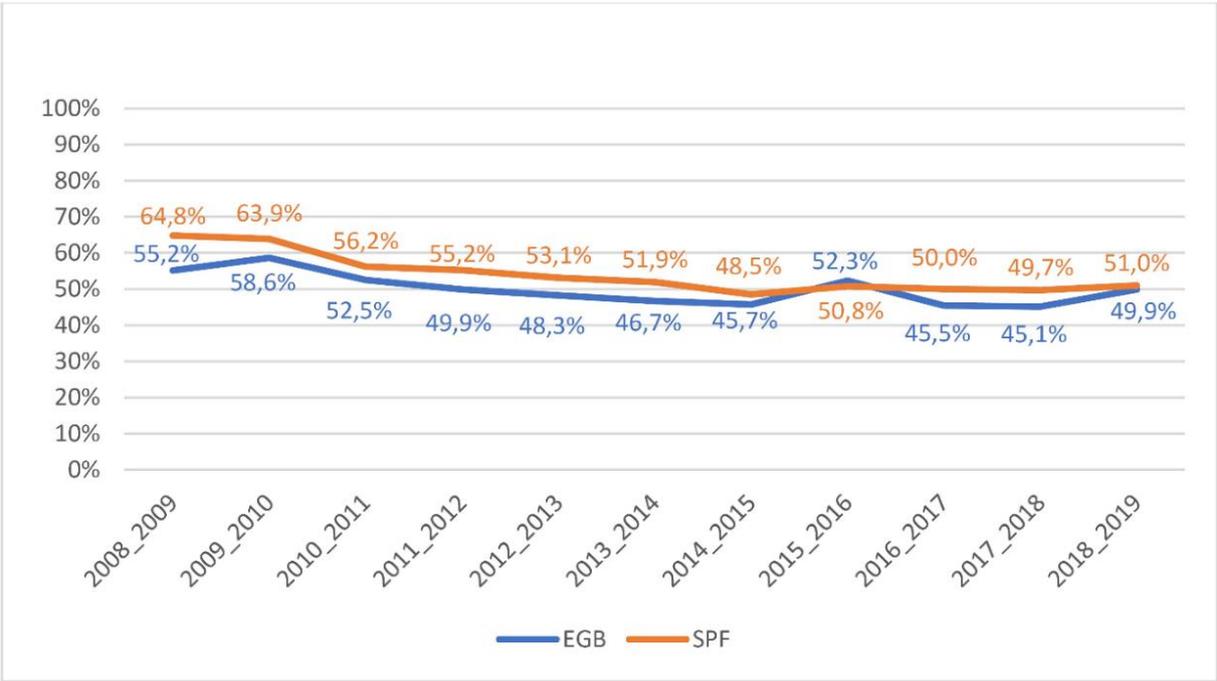


Figure 1: Influenza vaccination coverage in the French population over 65 years old in EGB and French Public Health data (SPF).

EGB: Echantillon généraliste des bénéficiaires ; SP: Santé Publique France

3.2 Influenza vaccination coverage in pregnant women

From January 1, 2009 to December 31, 2018 a total of 73 314 pregnant women were identified in the EGB database. Fifty-two denial of pregnancy and 1 055 unwanted pregnancies were

excluded from our cohort. A total of 72 207 pregnant women were included in the study (Figure 2), whose characteristics appear in the Table I.

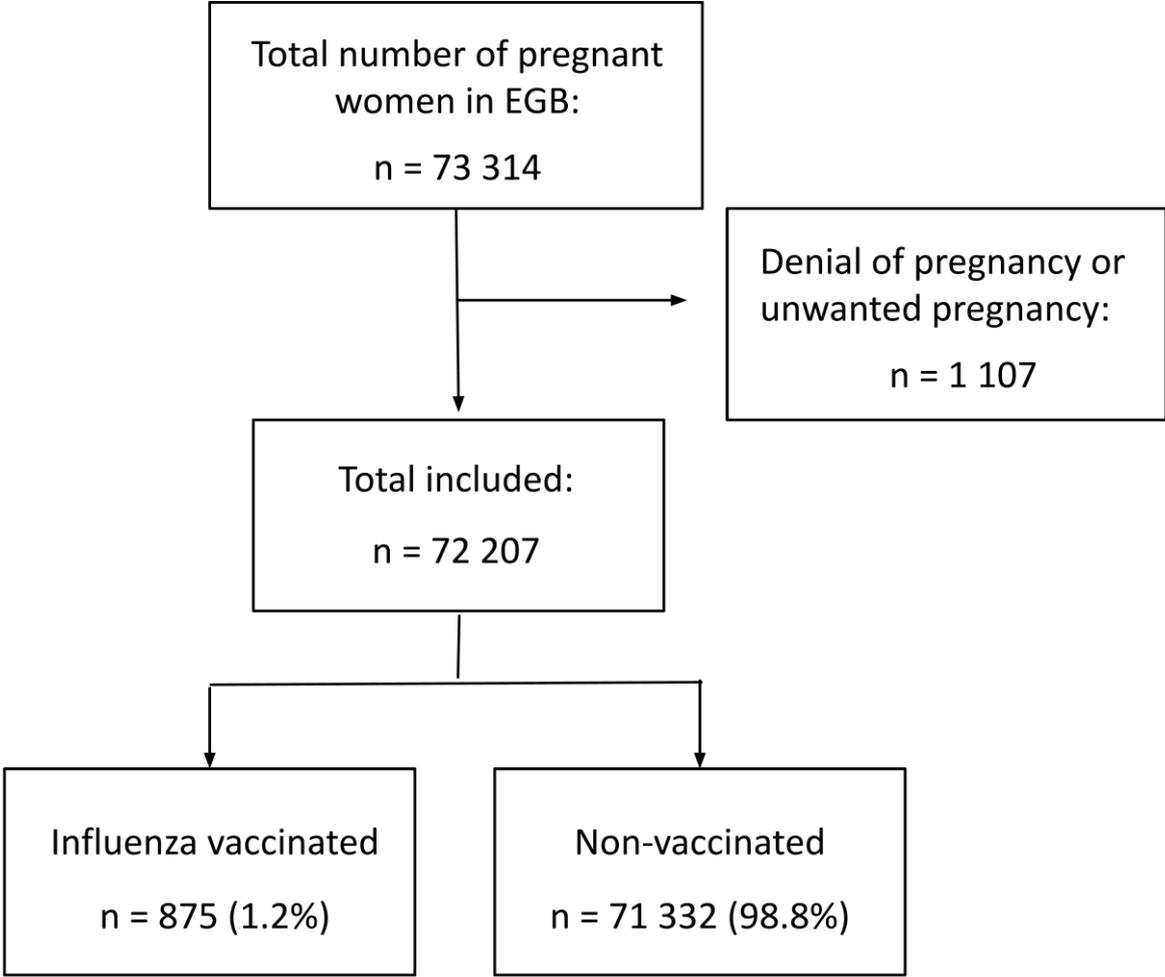


Figure 2: Flow chart of the study

The overall influenza vaccination coverage (IVC) was 1.21% in the 2009-2018 period (n=875/72 207; 95%CI 1.14-1.30). The IVC significantly increased after the 2012 recommendation, from 0.33% in the 2009-2012 period, to 1.79% in the 2013-2018 period (p<0.001) (Figure 3).

| | Unvaccinated | Vaccinated | | | |
|----------------------------------|--------------|-------------|---------|------|------------|
| | n (%) | n (%) | p-value | OR | 95% CI |
| Total | 71332 (100) | 875 (100) | | | |
| Age | 30.3 ± 5.40 | 32.0 ± 5.15 | <0.001 | | |
| < 25 | 10162 (14.3) | 63 (7.2) | | | |
| 25-29 | 21691 (30.4) | 215 (24.6) | | 1.60 | 1.21-2.12 |
| 30-34 | 23402 (32.8) | 316 (36.1) | | 2.18 | 1.66-2.86 |
| ≥35 | 16075 (22.5) | 281 (32.1) | | 2.82 | 2.14-3.71 |
| Socioeconomic deprivation (CMUc) | 12512 (17.5) | 129 (14.7) | 0.030 | 0.81 | 0.67-0.98 |
| Preexisting condition | 5847 (8.2) | 150 (17.1) | <0.001 | 2.32 | 1.94-2.77 |
| Pulmonary disease | 1198 (1.7) | 46 (5.3) | <0.001 | 3.25 | 2.4-4.4 |
| Cardiac disease | 1633 (2.3) | 45 (5.1) | <0.001 | 2.31 | 1.7-3.13 |
| Neurological disease | 163 (0.2) | 3 (0.3) | 0.487 | 1.5 | 0.48-4.71 |
| Renal disease | 137 (0.2) | 12 (1.4) | <0.001 | 7.23 | 3.99-13.09 |
| Sickle-cell disease | 128 (0.2) | 6 (0.7) | <0.001 | 3.84 | 1.69-8.73 |
| Diabetes | 392 (0.5) | 36 (4.1) | <0.001 | 7.77 | 5.49-11 |
| Immunodeficiency | 1057 (1.5) | 35 (4) | <0.001 | 2.77 | 1.96-3.91 |
| Hepatic disease | 293 (0.4) | 9 (1.0) | 0.005 | 2.52 | 1.29-4.91 |
| Obesity | 2561 (3.6) | 39 (4.5) | 0.171 | 1.25 | 0.9-1.73 |
| Multifetal pregnancy | 1394 (2.0) | 21 (2.4) | 0.344 | 1.23 | 0.8-1.9 |
| Parity | | | 0.821 | | |
| 1 | 34698 (48.6) | 429 (49.0) | | 1.02 | 0.89-1.17 |
| ≥2 | 36634 (51.4) | 446 (51.0) | | 0.98 | 0.86-1.12 |
| Prematurity | 6307 (8.8) | 70 (8.0) | 0.383 | 0.9 | 0.7-1.15 |
| Still birth | 203 (0.3) | 1 (0.1) | 0.345 | 0.4 | 0.06-2.86 |
| C-section | 14534 (20.4) | 197 (22.5) | 0.119 | 1.32 | 1.13-1.55 |
| Therapeutic abortions | 214 (0.3) | 1 (0.1) | 0.316 | 0.38 | 0.05-2.71 |

Table I: Influenza vaccination and associated factors among pregnant women from 2009 to 2018

OR: odd ratio calculated with Wald test

CI: confidence interval

CMUc: universal complementary healthcare insurance

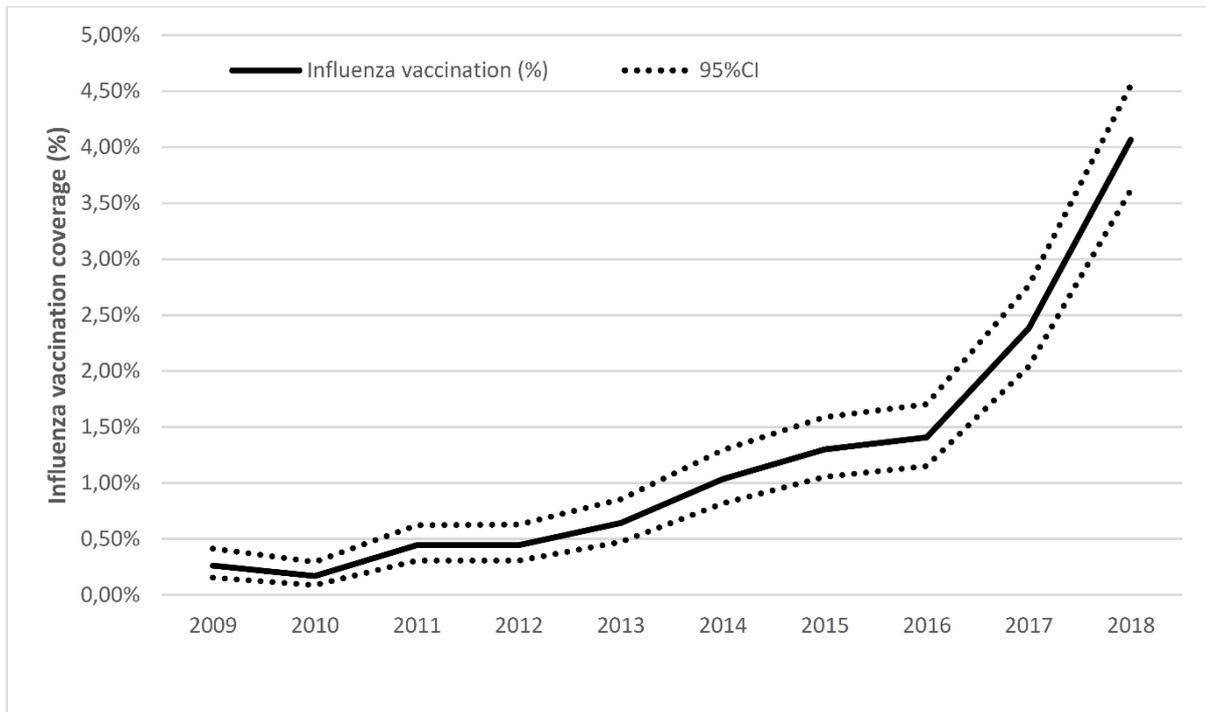


Figure 3: Evolution of the influenza vaccination coverage from 2009 to 2018

Vaccinated women were slightly older, less socially deprived, and had more pre-existing medical condition. There was no difference regarding the pregnancy outcome in the vaccinated and non-vaccinated population.

The mean gestational age at delivery was 38.9 weeks in both vaccinated and non-vaccinated populations. The mean gestational age of vaccination was 22.9 weeks \pm 9.7.

The identified prescribers were mainly family physicians (58%), followed by gynecologists (21%) and midwives (4%). Some specialists sporadically prescribed the vaccine (total of 5%) and 12% were dispensed directly by the pharmacists.

Women were most likely to be vaccinated if they were in their 2nd or 3rd trimester of pregnancy during the official vaccination campaign (Figure 4), but the vaccination rate increased for all three trimesters after the 2012 recommendation was issued.

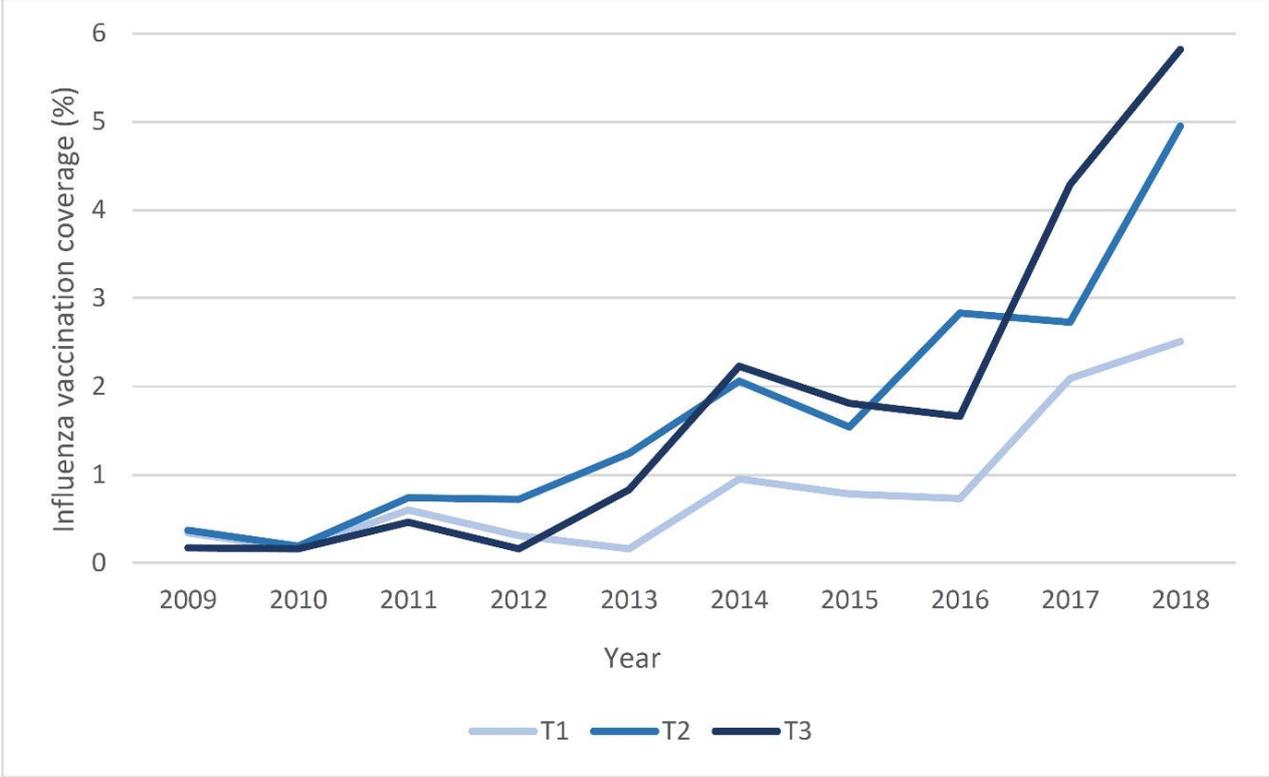


Figure 4: Evolution of influenza vaccination coverage by trimester of pregnancy during the vaccination campaign.

3.3 Influenza vaccination determinants

The vaccinated population was older than the non-vaccinated one (respectively 32 and 30.3 years old, $p < 0.001$) and the vaccination rate increased proportionally with the age of the population (see Table I). Women younger than 25 years old had a low coverage (0.6%) whereas women over 35 years old were more likely to get the influenza vaccine (1.7%; OR: 2.82, 95%CI 2.14-3.71). Socio-economically deprived women were less likely to be vaccinated

(OR: 0.81, 95%CI: 0.67-0.98). Women with pre-existing medical conditions at risk for severe influenza had an overall higher vaccination rate (2.5%; OR: 2.32, 95%CI: 1.94-2.77). Of all the disease, renal disease and diabetes were associated with the highest vaccination rates (respectively 8.1% and 8.4%), and obesity with the lowest (1.5%).

The vaccination behavior was not influenced by multifetal pregnancy (OR: 1.23, 95%CI 0.8-1.9) or by parity: primiparous and multiparous women had the same vaccination rate (1.2%).

4 Discussion

4.1 Main results

To our knowledge, this is the first study to evaluate the trend of influenza vaccination coverage in pregnant women over such a long period (10 years) in a nationally representative population-based sample. Additionally, due to the large sample size, several correlates of influenza vaccination in pregnant women could be investigated.

Our primary endpoint was to analyze the evolution of the IVC in pregnant women in France from 2009 to 2018 using the French national healthcare database. We showed that the IVC increased significantly since the 2012 recommendation but remained very low (up to 4.1% in 2018). In addition, the coverage for women who started their pregnancy during the vaccination campaign remained lower than those of women in their 2nd and 3rd trimester, thus questioning the impact of the recommendation, that encouraged the vaccination of women at all term of pregnancy. The IVC was higher for older women, and women with pre-existing condition at risk for severe influenza, and lower in socially deprived women as often described in other studies [30,36–38].

The vaccines were mainly prescribed by family physicians, even though gynecologists are usually the main healthcare providers during the pregnancy (68% according to Descamps et al.)[30]. It is most likely due to the fact that family physicians are traditionally in charge of immunizations.

4.2 Comparison with data from the literature

In Europe, the European Centre for Disease prevention and Control (ECDC) regularly compares the coverage rate in member states. In 2016-2017 the IVC was known for 9 member states, and ranged from 0.5% in Slovenia to 58.6% in the UK (median 25.0%) [39]. In other northern countries similar rates were found, 48.1% in the USA [40], and 30.8% in New Zealand in 2018 [38].

Most data available in France are based on surveys and range from 7% to 26%.

In 2014, Gaudelus et al. found an IVC in pregnant women of 7% through an online survey based on self-administered questionnaires [27]. In 2015, Loubet et al. found a IVC of 26% through an online survey, with a small non-representative sample and many selection bias [29]. Then Descamps et al. calculated an IVC of 7.4% based on the National Perinatal Survey, a large national study conducted in March 2016 [30]. This data was obtained through a declarative method where women were interviewed by a healthcare professional in the postpartum ward before discharge. Our study finds a IVC of 2.4% for women who gave birth in the same period of time (vs 7.4%) and part of this difference can be explained by a social desirability bias [41] and recall bias that may over-estimate the IVC in any declarative vaccination evaluation. Hu et al compared survey data and administrative data in children's vaccination, to evaluate the impact of recall bias by their mother. The results showed the frequency of over-reporting of vaccination in the survey data, up to 6.6% for DPT vaccine, linked to social desirability bias [42].

4.3 Influenza vaccination determinants

The determinants of low IVC in pregnant women have been well studied and two main obstacles to the vaccination are identified. The first obstacle is the lack of proposition from healthcare providers worldwide. In France, as in many other countries, only 25% of women are offered the vaccination [27,43–46], when Canada or the United States offers it to 75% of women [47,48]. It is often linked to the vaccination status of the healthcare provider, that is also known to be very low [49,50]. The second obstacle is the refusal of the vaccine by pregnant women who either fear an impact of the vaccination on the pregnancy or underestimate the gravity of severe influenza. The refusal rate in France is 68% [27,30].

The education of healthcare professional is key to improve IVC in pregnant women [44]. Psarris et al. led a study in Greece in 2018 where the proposition rate rose from 27% to 100% and the IVC from 14% to 94% after a simple information campaign towards healthcare professionals [43].

Another determinant is the availability of the vaccine. Alessandrini et al. led a cross-sectional multicenter study in three maternities in Paris, where vaccination was available immediately during prenatal consultations, free of charge. The coverage increased from 0% to 35.4% [51].

4.4 Strengths and limitations of the study

The main strengths of the study are the size of the study population and the reproducibility of the calculation of the IVC through the EGB database. Our administrative method is reliable to assess a vaccination coverage in a limited time, on a large representative sample, with less bias than a declarative study. Our IVC results on patients over 65 years old are similar to the French official data, validating the use of the database to evaluate the IVC.

Its limitations are those of the database, that can only record reimbursed vaccines, leaving out over the counter purchase and workplace vaccination. Influenza vaccination is recommended for patients over 65 years old, with chronic disease, obese patients, and pregnant women and their vaccine is supposed to be prescribed and fully reimbursed. In addition, anyone can buy it over the counter, for a reasonable price. We assumed that a pregnant woman would turn to her physician before making any health decision during her pregnancy and would have the prescription for the vaccine. However, women who purchased the vaccine over the counter on their own initiative or got the injection in their workplace would have been falsely classified as “unvaccinated” in our study.

Even though our data cannot be fully exhaustive due to this easy access to the vaccine outside of the traditional health care pathway, our results are useful for analysis and comparison purposes.

We identified some limitations in our secondary endpoints:

Pre-existing medical condition were assessed through the existence of a long-term disease data claim, or hospital discharge quotation of an act or a pathology, as well a medication prescribed related to the pathology. We may have overlooked woman that had a condition that put them at risk of a severe influenza, but who requires no specific treatment and had no record of it in their files.

Parity was estimated with the data available in EGB and is indicative. The data collected goes back to 2005, and any pregnancy occurring before that date will not have been taken into account, as well as any prior pregnancy that may have taken place abroad.

We chose to define socioeconomic deprivation by the CMUc affiliation, a specific health insurance with full coverage for low-income patients. However, socioeconomic deprivation is

a wider concept that includes criteria such as insecure employment, lack of familial support, and reduced access to culture, sport or vacation [52]. The EPICES score (Evaluation of precariousness and Inequalities in Health Examination Centers) is more reliable to describe socioeconomic deprivation [53,54]. Unfortunately, it requires data that are not available on the EGB database.

4.5 Perspectives for research and healthcare

The IVC could be improved by information campaigns towards all healthcare professionals involved with pregnancy care, and towards women in general. A national information campaign was issued on French television to promote influenza vaccination during the winter of 2020-2021, and pregnant women were listed as a priority. The impact of such campaigns could be monitored, by issuing IVC data yearly.

Our evaluation of IVC in pregnant women with the EGB database may lead the way to other vaccination evaluations, such as pertussis vaccination coverage. A pertussis booster is often needed to properly protect the newborn from a severe infection, and an evaluation of the vaccination coverage could help improve this protection.

Finally, from the beginning of the COVID-19 pandemic, pregnant women were considered at high-risk of severe forms of the disease, and they were included in specific clinical trial to demonstrate the mRNA vaccine safety and efficacy [55]. The vaccination, while limited at first to women with comorbidities, or with high-exposure professions, was then recommended for all pregnant women in their 2nd and 3rd trimester. The large-scale communication towards healthcare professionals on the necessity of COVID-19 vaccination during pregnancy may have a positive impact on the IVC in the future.

5 Conclusion

The influenza vaccination coverage in pregnant women has significantly increased in France since the 2012 WHO recommendation, particularly during the 2nd and 3rd trimester of pregnancy, but remains very low (4.1% in 2018). Older women and women with a pre-existing condition at risk for severe influenza were more likely to be vaccinated whereas socio-economic deprived women had a lower coverage. Parity and multifetal pregnancy did not influence the vaccination behavior. The influenza vaccine was mainly prescribed by family physicians. The influenza vaccination needs to be generalized during pregnancy, and a communication campaign towards women and healthcare professionals would be a good start.

Conclusion

La couverture vaccinale antigrippale chez la femme enceinte a augmenté significativement depuis la recommandation de l'OMS en 2012, particulièrement aux deuxièmes et troisièmes trimestres de grossesse, mais reste trop bas (4,1% en 2018). Les femmes plus âgées, et présentant des comorbidités à risque de forme grave de grippe avaient une meilleure couverture vaccinale, alors que les femmes précaires étaient en moyenne moins vaccinées. La parité et les grossesses multiples n'avait pas d'impact sur la couverture vaccinale. Le vaccin antigrippal était prescrit en majorité par les médecins généralistes. La vaccination antigrippale devrait être généralisée pendant la grossesse, et pour cela, une campagne d'information à destination des femmes enceintes et des professionnels de santé pourrait être proposée.

Clermont-Ferrand, le

Pierre CLAVELOU
Doyen - Directeur



Vu, le Président du Jury de Thèse, Pr Olivier LESENS

(Date et Signature)

3.06.2021

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7 Supplementary material

7.1 Table 1 – International Classification of Diseases (ICD-10) Codes for delivery

| | |
|------|---|
| O60 | Preterm labor and delivery |
| O601 | Preterm labor with spontaneous preterm delivery |
| O603 | Preterm delivery without spontaneous labor |
| O67 | Labor and delivery complicated by intrapartum hemorrhage, not elsewhere classified |
| O68 | Labor and delivery complicated by fetal distress |
| O680 | Labor and delivery complicated by fetal heart rate anomaly |
| O681 | Labor and delivery complicated by meconium in amniotic fluid |
| O682 | Labor and delivery complicated by fetal heart rate anomaly and meconium in amniotic fluid |
| O683 | Labor and delivery complicated by biochemical evidence of fetal stress |
| O688 | Labor and delivery complicated by other evidence of fetal stress |
| O689 | Labor and delivery complicated by fetal stress, unspecified |
| O69 | Labor and delivery complicated by umbilical cord complications |
| O690 | Labor and delivery complicated by prolapse of cord |
| O691 | Labor and delivery complicated by cord around neck, with compression |
| O692 | Labor and delivery complicated by other cord entanglement, with compression |
| O693 | Labor and delivery complicated by short cord |
| O694 | Labor and delivery complicated by vasa previa |
| O695 | Labor and delivery complicated by vascular lesion of cord |
| O698 | Labor and delivery complicated by other cord complications |
| O699 | Labor and delivery complicated by cord complication, unspecified |
| O755 | Delayed delivery after artificial rupture of membranes |
| O756 | Delayed delivery after spontaneous or unspecified rupture of membranes |
| O757 | Vaginal delivery following previous cesarean section |
| O80 | Encounter for full-term uncomplicated delivery |
| O800 | Single vertex delivery |
| O801 | Single breech delivery |
| O808 | Other single spontaneous delivery |
| O809 | Single spontaneous delivery, unspecified |
| O81 | Single delivery by forceps and vacuum extractor |
| O810 | Low forceps delivery |
| O811 | Mid cavity forceps delivery |
| O812 | Mid cavity forceps V with rotation |
| O813 | Other and unspecified forceps delivery |
| O814 | Vacuum extractor delivery |
| O815 | Delivery by combination of forceps and vacuum extractor |
| O82 | Single delivery by cesarean section |
| O820 | Delivery by elective cesarean section |
| O821 | Delivery by emergency cesarean section |
| O822 | Delivery by cesarean section with hysterectomy |

| | |
|------|--|
| O828 | Other single delivery by cesarean section |
| O829 | Delivery by cesarean delivery, unspecified |
| O83 | Other assisted single delivery |
| O830 | Breech extraction |
| O831 | Other assisted breech extraction |
| O832 | Other manipulation-assisted delivery |
| O833 | Delivery of viable fetus in abdominal pregnancy |
| O834 | Destructive operation for delivery |
| O838 | Other specified assisted single delivery |
| O839 | Assisted single delivery, unspecified |
| O84 | Multiple delivery |
| O840 | Multiple delivery, all spontaneous |
| O841 | Multiple delivery, all by forceps and vacuum extractor |
| O842 | Multiple delivery, all by cesarean section |
| O848 | Other multiple delivery |
| O849 | Multiple delivery, unspecified |
| Z370 | Single live birth |
| Z371 | Single stillbirth |
| Z372 | Twins, both liveborn |
| Z373 | Twins, one liveborn, one stillborn |
| Z374 | Twins, both stillborn |
| Z375 | Other multiple births, all liveborn |
| Z376 | Other multiple births, some liveborn |
| Z377 | Other multiple births, all stillborn |
| Z379 | Outcome of delivery, unspecified |

7.2 Table 2 - CCAM acts (French classification for clinical procedures) for delivery

| | |
|---------|---|
| JQGA002 | Delivery by elective cesarean section, by laparotomy |
| JQGA003 | Delivery by cesarean section during labor by laparotomy |
| JQGA004 | Delivery by emergency cesarean section by laparotomy |
| JQGA005 | Delivery by vaginal cesarean section |
| JQGD001 | Single breech delivery |
| JQGD002 | Multiple delivery, primiparous |
| JQGD003 | Single breech delivery with minimal extraction, primiparous |
| JQGD004 | Single breech delivery, primiparous |
| JQGD005 | Single breech delivery, multiparous |
| JQGD007 | Multiple delivery, multiparous |
| JQGD008 | Single breech delivery with minimal extraction, multiparous |
| JQGD010 | Single vertex delivery, primiparous |
| JQGD011 | Manipulation-assisted breech delivery |
| JQGD012 | Single vertex delivery, multiparous |
| JQGD013 | Single breech delivery with maximal extraction, primiparous |

7.3 Table 3 - ICD codes for non-inclusion criterias

| | |
|------|---------------------|
| Z640 | Unwanted pregnancy |
| Z33 | Denial of pregnancy |

7.4 Table 4 - ICD codes for secondary endpoints

| | |
|------|---|
| Z641 | Problems related to multiparity |
| Z354 | Supervision of pregnancy with grand multiparity |

7.5 Table 5 - ICD-10 Codes CIM for medical risk factors

7.5.1 Chronic pulmonary diseases

| | |
|------|---|
| J45 | Asthma |
| J450 | Predominantly allergic asthma |
| J451 | Nonallergic asthma |
| J458 | Mixed asthma |
| J459 | Other and unspecified asthma |
| Z870 | Personal history of diseases of the respiratory system |
| 0995 | Diseases of the respiratory system complicating pregnancy, childbirth, and the puerperium |
| J961 | Chronic respiratory failure |
| J441 | Chronic obstructive pulmonary disease with acute exacerbation, unspecified |
| J448 | Other specified chronic obstructive pulmonary disease |
| J969 | Respiratory failure, unspecified |
| P279 | Unspecified chronic respiratory disease originating in the perinatal period |
| J40 | Bronchitis, not specified as acute or chronic |
| J410 | Simple chronic bronchitis |
| J411 | Mucopurulent chronic bronchitis |
| J418 | Mixed simple and mucopurulent chronic bronchitis |
| J42 | Unspecified chronic bronchitis |
| J448 | Other specified chronic obstructive pulmonary disease |
| J670 | Hypersensitivity pneumonitis due to organic dust |
| J684 | Chronic respiratory conditions due to chemicals, gases, fumes, and vapors |
| M954 | Acquired deformity of chest and rib |
| Q768 | Other congenital malformations of bony thorax |
| Q769 | Congenital malformation of bony thorax, unspecified |
| Q32 | Congenital malformations of trachea and bronchus |
| Q33 | Congenital malformation of lung |

| | |
|------|--|
| Q330 | Congenital cystic lung |
| J47 | Bronchiectasis |
| J980 | Diseases of bronchus, not elsewhere classified |
| P271 | Bronchopulmonary dysplasia originating in the perinatal period |
| Q336 | Hypoplasia and dysplasia of lung |
| E84 | Cystic fibrosis |
| E840 | Cystic fibrosis with pulmonary manifestations |
| E848 | Cystic fibrosis with other manifestations |
| E849 | Cystic fibrosis, unspecified |

7.5.2 Cardiac diseases

| | |
|-------|---|
| Q20 | Congenital malformations of cardiac chambers and connections |
| Q209 | Congenital malformation of cardiac chambers and connections, unspecified |
| Q26 | Congenital malformations of great veins |
| Q231 | Congenital insufficiency of aortic valve |
| Q248 | Other specified congenital malformations of heart |
| Q249 | Congenital malformation of heart, unspecified |
| I110 | Hypertensive heart disease with (congestive) heart failure |
| I130 | Hypertensive heart and renal disease with (congestive) heart failure |
| I1300 | Hypertensive heart and renal disease with heart failure, LVEF \geq 50 |
| I1302 | Hypertensive heart and renal disease with both (congestive) heart failure and renal failure |
| I1309 | Hypertensive heart and renal disease, unspecified |
| I1320 | Hypertensive heart and renal disease with heart and renal failure, LVEF \geq 50 |
| I1321 | Hypertensive heart and renal disease with heart and renal failure, LVEF \geq 40, and $<$ 50 |
| I1322 | Hypertensive heart and renal disease with heart and renal failure, LVEF $<$ 40 |
| I1329 | Hypertensive heart and renal disease with heart and renal failure, LVEF unspecified |
| I25 | Chronic ischemic heart disease |
| I251 | Atherosclerotic heart disease |
| I252 | Old myocardial infarction |
| I253 | Aneurysm of heart |
| I254 | Coronary artery aneurysm and dissection |
| I255 | Ischemic cardiomyopathy |
| I256 | Silent myocardial ischemia |
| I258 | Other forms of chronic ischemic heart disease |
| I259 | Chronic ischemic heart disease, unspecified |
| I499 | Cardiac arrhythmia, unspecified |
| I426 | Alcoholic cardiomyopathy |
| I427 | Cardiomyopathy due to drugs and other external agents |
| I50 | Heart failure |

| | |
|-------|---|
| I500 | Congestive heart failure |
| I5000 | Congestive heart failure, LVEF \geq 50 |
| I5001 | Congestive heart failure, LVEF \geq 40, and $<$ 50 |
| I5002 | Congestive heart failure, LVEF $<$ 40 |
| I5009 | Congestive heart failure, LVEF unspecified |
| I501 | Left ventricular failure |
| I5010 | Left ventricular failure, LVEF \geq 50 |
| I5011 | Left ventricular failure, LVEF \geq 40, and $<$ 50 |
| I5012 | Left ventricular failure, LVEF $<$ 40 |
| I5019 | Left ventricular failure, LVEF unspecified |
| I509 | Heart failure, unspecified |
| I517 | Cardiomegaly |
| I38 | Valvular insufficiency of unspecified valve |
| I059 | Mitral valve disease, unspecified |
| I069 | Rheumatic aortic valve disease, unspecified |
| I079 | Tricuspid valve disease, unspecified |
| I080 | Multiple valve diseases |
| I081 | Disorders of both mitral and tricuspid valves |
| I082 | Disorders of both aortic and tricuspid valves |
| I083 | Combined disorders of mitral, aortic and tricuspid valves |
| I088 | Other multiple valve diseases |
| I089 | Multiple valve disease, unspecified |
| I091 | Rheumatic diseases of endocardium, valve unspecified |
| I099 | Rheumatic heart disease, unspecified |
| I238 | Other current complications following acute myocardial infarction |
| I348 | Other nonrheumatic mitral valve disorders |
| I349 | Nonrheumatic mitral valve disorder, unspecified |
| I350 | Aortic valve stenosis |
| I359 | Aortic valve disorder, unspecified |
| I379 | Pulmonary valve disorder, unspecified |
| I44 | Atrioventricular and left bundle-branch block |
| I45 | Other conduction disorders |
| I459 | Conduction disorder, unspecified |
| I471 | Supraventricular tachycardia |
| I472 | Ventricular tachycardia |
| I479 | Paroxysmal tachycardia, unspecified |
| I49 | Other cardiac arrhythmias |
| I498 | Other specified cardiac arrhythmias |
| I499 | Cardiac arrhythmia, unspecified |
| I978 | Other postprocedural disorders of circulatory system, not elsewhere classified |
| Q229 | Congenital malformation of tricuspid valve, unspecified |
| Q231 | Congenital insufficiency of aortic valve |
| Q233 | Congenital mitral insufficiency |
| E854 | Cardiac amyloidosis |
| O994 | Diseases of the circulatory system complicating pregnancy, childbirth, and the puerperium |

| | |
|------|--|
| O998 | Other specified diseases and conditions complicating pregnancy, childbirth, and the puerperium |
| Z867 | Personal history of diseases of the circulatory system |
| Z95 | Presence of cardiac and vascular implants and grafts |

7.5.3 Neurological disease

| | |
|-------|---|
| I64 | Stroke, not specified as hemorrhage or infarction |
| Z8660 | Personal history of diseases of the nervous system and sense organs |
| G459 | Transient cerebral ischemic attack, unspecified |
| I694 | Sequelae of stroke, not specified as hemorrhage or infarction |
| M63 | Disorders of muscle in diseases classified elsewhere |
| G60 | Hereditary and idiopathic neuropathy |
| G71 | Primary disorders of muscles |
| G710 | Muscular dystrophy |
| G712 | Congenital myopathies |
| G713 | Mitochondrial myopathy, not elsewhere classified |
| G72 | Other myopathies |
| G722 | Myopathy due to other toxic agents |
| G724 | Inflammatory myopathy, not elsewhere classified |
| G728 | Other specified myopathies |
| G729 | Myopathy, unspecified |
| A80 | Acute poliomyelitis |
| A800 | Acute paralytic poliomyelitis, vaccine-associated |
| A801 | Acute paralytic poliomyelitis, wild virus, imported |
| A802 | Acute paralytic poliomyelitis, wild virus, indigenous |
| A803 | Acute paralytic poliomyelitis, other and unspecified |
| A804 | Acute nonparalytic poliomyelitis |
| P358 | Congenital poliomyelitis |
| B91 | Sequelae of poliomyelitis |
| G700 | Myasthenia gravis |
| G702 | Congenital and developmental myasthenia |
| G711 | Myotonic disorders |
| G122 | Motor neuron disease |
| J986 | Paralysis of diaphragm |
| S278 | Diaphragm injury |

7.5.4 Renal diseases

| | |
|------|---------------------------------------|
| N009 | Acute nephritic syndrome, unspecified |
| N03 | Chronic nephritic syndrome |

| | |
|------|--|
| N031 | Chronic nephritic syndrome, focal and segmental glomerular lesions |
| N032 | Chronic nephritic syndrome, diffuse membranous glomerulonephritis |
| N033 | Chronic nephritic syndrome, diffuse mesangial proliferative glomerulonephritis |
| N034 | Chronic nephritic syndrome, diffuse endocapillary proliferative glomerulonephritis |
| N035 | Chronic nephritic syndrome, diffuse mesangiocapillary glomerulonephritis |
| N036 | Chronic nephritic syndrome, dense deposit disease |
| N037 | Chronic nephritic syndrome, diffuse crescentic glomerulonephritis |
| N038 | Other glomerulonephritis |
| N144 | Toxic nephropathy, not elsewhere classified |
| N17 | Acute renal failure |
| N170 | Acute renal failure with tubular necrosis |
| N171 | Acute renal failure with acute cortical necrosis |
| N172 | Acute renal failure with medullary necrosis |
| N18 | Chronic kidney disease |
| N180 | End-stage renal disease |
| N181 | Chronic kidney disease, stage 1 |
| N182 | Chronic kidney disease, stage 2 |
| N183 | Chronic kidney disease, stage 3 |
| N184 | Chronic kidney disease, stage 4 |
| N185 | Chronic kidney disease, stage 5 |
| N188 | Other chronic kidney disease |
| N189 | Chronic kidney disease, unspecified |
| N19 | Unspecified kidney failure |
| N28 | Other disorders of kidney and ureter, not elsewhere classified |
| N280 | Ischemia and infarction of kidney |
| N288 | Other specified disorders of kidney and ureter |
| N289 | Disorder of kidney and ureter, unspecified |
| N29 | Other disorders of kidney and ureter in diseases classified elsewhere |
| N298 | Other disorders of kidney and ureter in other diseases classified elsewhere |
| N990 | Postprocedural renal failure |
| I120 | Hypertensive renal disease with renal failure |
| I129 | Hypertensive renal disease without renal failure |
| I139 | Hypertensive heart and renal disease, unspecified |
| K767 | Hepatorenal syndrome |
| N040 | Nephrotic syndrome with minor glomerular abnormality |
| N042 | Nephrotic syndrome, diffuse membranous glomerulonephritis |
| N043 | Nephrotic syndrome, diffuse mesangial proliferative glomerulonephritis |
| N044 | Nephrotic syndrome, diffuse endocapillary proliferative glomerulonephritis |
| N045 | Nephrotic syndrome, diffuse mesangiocapillary glomerulonephritis |
| N046 | Nephrotic syndrome, dense deposit disease |
| N047 | Nephrotic syndrome, diffuse crescentic glomerulonephritis |
| N048 | Nephrotic syndrome, other morphological lesions |
| N049 | Nephrotic syndrome, unspecified |

7.5.5 Sickle cell disease

| | |
|------|--|
| D57 | Sickle-cell disorders |
| D570 | Sickle-cell anemia with crisis |
| D571 | Sickle-cell anemia without crisis |
| D572 | Double heterozygous sickling disorders |
| D573 | Sickle-cell trait |
| D578 | Other sickle-cell disorders |

7.5.6 Diabetes

| | |
|------|--|
| E10 | Type 1 diabetes mellitus |
| E108 | Type 1 diabetes mellitus with unspecified complications |
| E109 | Type 1 diabetes mellitus without complications |
| E11 | Type 2 diabetes mellitus |
| E118 | Type 2 diabetes mellitus with unspecified complications |
| E119 | Type 2 diabetes mellitus without complications |
| E14 | Unspecified diabetes mellitus |
| E148 | Unspecified diabetes mellitus with unspecified complications |
| E149 | Unspecified diabetes mellitus without complications |

7.5.7 Immunodeficiency

| | |
|------|---|
| D802 | Selective deficiency of immunoglobulin A [IgA] |
| D803 | Selective deficiency of immunoglobulin G [IgG] subclasses |
| D808 | Other immunodeficiencies with predominantly antibody defects |
| D81 | Combined immunodeficiencies |
| D811 | Severe combined immunodeficiency [SCID] with low T- and B-cell numbers |
| D812 | Severe combined immunodeficiency [SCID] with low or normal B-cell numbers |
| D813 | Adenosine deaminase [ADA] deficiency |
| D816 | Major histocompatibility complex class I deficiency |
| D817 | Major histocompatibility complex class II deficiency |
| D818 | Other combined immunodeficiencies |
| D819 | Combined immunodeficiency, unspecified |
| D822 | Immunodeficiency with short-limbed stature |
| D828 | Immunodeficiency associated with other specified major defects |
| D830 | Common variable immunodeficiency |
| D831 | Common variable immunodeficiency with predominant immunoregulatory T-cell disorders |

| | |
|--------|---|
| D832 | Common variable immunodeficiency with autoantibodies to B- or T-cells |
| D838 | Other common variable immunodeficiencies |
| D839 | Common variable immunodeficiency, unspecified |
| D848 | Other specified immunodeficiencies |
| D849 | Immunodeficiency, unspecified |
| Z94802 | Allogeneic hematopoietic stem-cell transplantation, bone marrow transplant, related donor |
| Z94804 | Allogeneic hematopoietic stem-cell transplantation, bone marrow transplant, unrelated donor |
| Z940 | Kidney transplant status |
| Z941 | Heart transplant status |
| Z942 | Lung transplant status |
| Z943 | Heart and lungs transplant status |
| Z944 | Liver transplant status |
| Z945 | Skin transplant status |
| Z946 | Bone transplant status |
| Z947 | Corneal transplant status |
| Z948 | Other transplanted organ and tissue status |
| Z94802 | Allogeneic hematopoietic stem-cell transplantation, bone marrow transplant, related donor |
| Z94804 | Allogeneic hematopoietic stem-cell transplantation, bone marrow transplant, unrelated donor |
| Z949 | Transplanted organ and tissue status, unspecified |
| B24 | Unspecified human immunodeficiency virus [HIV] disease |
| B240 | Unspecified pre-acquired immunodeficiency syndrome [AIDS] |
| B241 | Unspecified full-blown AIDS |
| B249 | Unspecified HIV infection |

7.5.8 Hepatic diseases

| | |
|------|--|
| B180 | Chronic viral hepatitis B with delta-agent |
| B181 | Chronic viral hepatitis B without delta-agent |
| B182 | Chronic viral hepatitis C |
| B189 | Chronic viral hepatitis, unspecified |
| B199 | Unspecified viral hepatitis without hepatic coma |
| C787 | Secondary malignant neoplasm of liver and intrahepatic bile duct |
| D376 | Liver, gallbladder, and bile ducts neoplasm |
| K701 | Alcoholic hepatitis |
| K703 | Alcoholic cirrhosis of liver |
| K704 | Alcoholic hepatic failure |
| K709 | Alcoholic liver disease, unspecified |
| K711 | Toxic liver disease with hepatic necrosis |
| K713 | Toxic liver disease with chronic persistent hepatitis |

| | |
|------|---|
| K714 | Toxic liver disease with chronic lobular hepatitis |
| K715 | Toxic liver disease with chronic active hepatitis |
| K716 | Toxic liver disease with hepatitis not elsewhere classified |
| K718 | Toxic liver disease with other disorders of liver |
| K719 | Toxic liver disease, unspecified |
| K738 | Other chronic hepatitis, not elsewhere classified |
| K739 | Chronic hepatitis, unspecified |
| K740 | Hepatic fibrosis |
| K746 | Other and unspecified cirrhosis of liver |
| K754 | Autoimmune hepatitis |
| K758 | Other specified inflammatory liver diseases |
| K759 | Inflammatory liver disease, unspecified |
| K768 | Other specified diseases of liver |
| K769 | Liver disease, unspecified |
| K831 | Obstruction of bile duct |
| P591 | Inspissated bile syndrome |
| P788 | Other specified perinatal digestive system disorder |
| Z871 | Personal history of diseases of the digestive system |

7.5.9 Obesity

| | |
|-------|--|
| E6600 | Obesity due to excess calories in adults with a body mass index (BMI) ≥ 30 kg / m ² or more and < 40 kg / m ² , or obesity due to excess calories in children |
| E6601 | Obesity due to excess calories in adults with BMI ≥ 40 kg / m ² and < 50 kg / m ² |
| E6602 | Obesity due to excess calories in adults with BMI ≥ 50 kg / m ² |
| E6609 | Obesity due to excess calories in adults, BMI not specified |
| E6610 | Drug-induced obesity with BMI ≥ 30 kg / m ² and < 40 kg / m ² , or drug-related childhood obesity |
| E6611 | Drug-induced obesity with BMI ≥ 40 kg / m ² and < 50 kg / m ² |
| E6620 | Morbid obesity with alveolar hypoventilation, with BMI ≥ 30 kg / m ² and < 40 kg / m ² |
| E6690 | Unspecified obesity, adult with BMI ≥ 30 kg / m ² and < 40 kg / m ² , or unclear childhood obesity |
| E6691 | Unspecified obesity, adult with BMI ≥ 40 kg / m ² and < 50 kg / m ² |
| E6692 | Unspecified adult obesity, with BMI ≥ 50 kg / m ² |
| E6699 | Unspecified adult obesity, with BMI not specified |

7.6 Table 6 – Long term disease codes for preexisting condition at risk for severe influenza

| | |
|--------|--|
| ALD 1 | Stroke |
| ALD 2 | Bone marrow failures and others chronic cytopenias, myelo-dysplastic syndromes |
| ALD 5 | Chronic cardiac arrhythmia |
| ALD 6 | Chronic hepatitis and cirrhosis of liver |
| ALD 7 | Severe immunodeficiency, Human Immunodeficiency Virus infection, severe immunodeficiency |
| ALD 8 | Type 1 and 2 diabetes |
| ALD 9 | Severe neuromuscular disorders |
| ALD 10 | Sickle cell disease |
| ALD 13 | Ischemic heart disease |
| ALD 14 | Severe respiratory insufficiency due to chronic obstructive pulmonary disease |
| ALD 18 | Cystic fibrosis |
| ALD 19 | Chronic kidney disease |
| ALD 21 | Polyarteritis nodosa, lupus erythematosus, systemic sclerosis |
| ALD 22 | Rheumatoid arthritis |
| ALD 24 | Crohn disease |
| ALD 25 | Multiple sclerosis |
| ALD 27 | Ankylosing spondylitis |
| ALD 28 | Transplanted organ or tissue |
| ALD 30 | Malignant tumor, malignant neoplasm of lymphoid, hematopoietic and related tissue |

7.7 Table 7 - ATC drugs related to condition at risk for severe influenza

| | |
|------|---|
| A 10 | Drugs used in diabetes |
| C01 | Cardiac therapy |
| C02 | Antihypertensives |
| C03 | Diuretics |
| C07 | Beta blocking agents |
| C08 | Calcium channel blockers |
| C09 | Agents acting on the renin–angiotensin system |
| L02B | Hormone antagonists and related agents |
| L04 | Immunosuppressants |
| R03 | Drugs for obstructive airway diseases |

SERMENT D'HIPPOCRATE (Conseil national de l'ordre des médecins)

Au moment d'être admise à exercer la médecine, je promets et je jure d'être fidèle aux lois de l'honneur et de la probité.

Mon premier souci sera de rétablir, de préserver ou de promouvoir la santé dans tous ses éléments, physiques et mentaux, individuels et sociaux.

Je respecterai toutes les personnes, leur autonomie et leur volonté, sans aucune discrimination selon leur état ou leurs convictions. J'interviendrai pour les protéger si elles sont affaiblies, vulnérables ou menacées dans leur intégrité ou leur dignité. Même sous la contrainte, je ne ferai pas usage de mes connaissances contre les lois de l'humanité.

J'informerai les patients des décisions envisagées, de leurs raisons et de leurs conséquences. Je ne tromperai jamais leur confiance et n'exploiterai pas le pouvoir hérité des circonstances pour forcer les consciences.

Je donnerai mes soins à l'indigent et à quiconque me les demandera. Je ne me laisserai pas influencer par la soif du gain ou la recherche de la gloire.

Admise dans l'intimité des personnes, je tairai les secrets qui me seront confiés. Reçue à l'intérieur des maisons, je respecterai les secrets des foyers et ma conduite ne servira pas à corrompre les mœurs.

Je ferai tout pour soulager les souffrances. Je ne prolongerai pas abusivement les agonies. Je ne provoquerai jamais la mort délibérément.

Je préserverai l'indépendance nécessaire à l'accomplissement de ma mission. Je n'entreprendrai rien qui dépasse mes compétences. Je les entretiendrai et les perfectionnerai pour assurer au mieux les services qui me seront demandés.

J'apporterai mon aide à mes confrères ainsi qu'à leurs familles dans l'adversité.

Que les hommes et mes confrères m'accordent leur estime si je suis fidèle à mes promesses ; que je sois déshonorée et méprisée si j'y manque.

SERMENT D'HIPPOCRATE

En présence des Maîtres de cette FACULTE et de mes chers CONDISCIPLES, je promets et je jure d'être fidèle aux lois de l'Honneur et de la Probité dans l'exercice de la Médecine.

Je donnerai mes soins gratuits à l'indigent et je n'exigerai jamais un salaire au-dessus de mon travail. Admis dans l'intérieur des maisons, mes yeux ne verront pas ce qui s'y passe, ma langue taira les secrets qui me seront confiés et mon état ne servira pas à corrompre les mœurs ni à favoriser le crime.

Respectueux et reconnaissant envers mes MAÎTRES, je rendrai à leurs enfants l'instruction que j'ai reçue de leurs pères.

Que les HOMMES m'accordent leur estime si je suis fidèle à mes promesses. Que je sois couvert d'OPPROBRE et méprisé de mes confrères si j'y manque.

Trends of influenza vaccination coverage in pregnant women, a ten-year analysis from a French healthcare database

Abstract

Background Pregnant women have a high risk of severe influenza, associated with obstetrical complications. The World Health Organization (WHO) has recommended influenza vaccination for all pregnant women since 2012, but the vaccination coverage remains low worldwide, especially in Europe, due to a lack of proposition from the health care providers, and a high refusal rate from the women. The primary aim of this study was to estimate the influenza vaccination coverage (IVC) in a population of pregnant women in France, and to analyse its evolution from 2009 to 2018. The secondary objective was to describe the vaccinated population and to find determinants associated with the vaccination.

Methods This retrospective cohort study is based on the EGB French health care database, a representative sample of the French population containing data from the health insurance system. All pregnant women who delivered medically or spontaneously over the 2009-2018 period were included.

Results In the 2009-2018 period, only 1.2% pregnant women were vaccinated against influenza ($n=875/72\ 207$; 95%CI 1.14-1.30). The IVC significantly increased after the 2012 WHO recommendation, from 0.33% to 1.79% ($p<0,001$) but remained low (4.1% in 2018). Women younger than 25 years old had a low coverage (0.6%) whereas women over 35 years old were more likely to get the influenza vaccine (1.7%; OR: 2.82, 95%CI 2.14-3.71). The vaccination behavior was not influenced by multifetal pregnancy or parity, but socio-economically deprived women were less likely to be vaccinated (OR: 0.81, 95%CI: 0.67-0.98). Women with pre-existing medical conditions had an overall higher vaccination rate (2.5%; OR: 2.32, 95%CI: 1.94-2.77). The vaccine was mainly prescribed by family physicians (58%).

Conclusion Influenza vaccination in pregnant women in France remains very low, particularly in younger, healthy women, and measures such as information campaigns need to be undertaken to improve the coverage.

Key-words Pregnancy ; influenza ; vaccination ; coverage ; EGB

Evolution de la couverture vaccinale antigrippale chez les femmes enceintes de 2009 à 2018 à partir de la base de données EGB

Résumé

CONTEXTE : Les femmes enceintes ont un risque accru de contracter une forme grave d'infection grippale, allant jusqu'à la détresse respiratoire, associé à de nombreuses complications obstétricales. Depuis 2012, l'Organisation Mondiale de la Santé recommande la vaccination antigrippale à toutes les femmes enceintes, quel que soit le terme de leur grossesse, mais la couverture vaccinale reste basse dans le monde dans cette population. Les femmes enceintes refusent souvent le vaccin, mais il est également insuffisamment proposé par les professionnels de santé.

OBJECTIF : L'objectif principal de l'étude était d'évaluer l'évolution de la couverture vaccinale antigrippale chez les femmes enceintes en France sur 10 ans, et de mesurer l'impact de la recommandation de 2012 sur le comportement vaccinal. Les objectifs secondaires étaient de décrire la population vaccinée pour caractériser les éléments en faveur de la vaccination.

METHODE : Cette étude pharmaco-épidémiologique rétrospective a été menée à partir de la base de données EGB (Echantillon Généraliste des Bénéficiaires), et a inclus toutes les femmes ayant accouché sur la période de l'étude, à l'exception des dénis de grossesse et grossesse non désirées (n=72 207). La couverture vaccinale a été calculée à l'aide des données de remboursement des vaccins antigrippaux.

RESULTATS : La couverture vaccinale a augmenté de façon significative de 2009 à 2018 (de 0,33% à 1,79% ; $p < 0,001$) mais reste globalement basse (jusqu'à 4,1% en 2018). Les femmes les plus jeunes et celles considérées comme précaires étaient les moins vaccinées, alors que les femmes présentant une comorbidité avaient une couverture vaccinale plus élevée. Le vaccin était majoritairement prescrit par des médecins généralistes (58%).

CONCLUSION : La couverture vaccinale antigrippale reste basse en France malgré les recommandations, particulièrement chez les femmes les plus jeunes, en bonne santé. Des campagnes d'informations auprès des femmes et des professionnels de santé pourraient être entreprises pour améliorer cette couverture vaccinale.

Mots clés : vaccination, grippe, grossesse, EGB, couverture vaccinale.