

BACKGROUND

INFLUENZA & PERTUSSIS: PREGNANT & NEWBORN CONCERNS

Pertussis and influenza are prominent, common infections with more than 15,000 and 50,000,000 annual U.S. cases respectively.^{1,2} Compared to the general population, pregnant patients and newborns are more susceptible to infection complications. For example, pregnant patients with influenza have higher risks of ICU admission, pneumonia progression, and adverse perinatal outcomes.³ Infants under 6 months are more susceptible to infections due to their incomplete, developing immune system. In fact, majority of morbidity and mortality attributed to pertussis infection occurs in infants 3 months or younger.⁴ Furthermore, the earliest recommended vaccination age for influenza is 6 months; for pertussis, 2 months – leaving a considerable window of vulnerability.⁵

VACCINATION RECOMMENDATION: PREGNANT PATIENTS

According to the Advisory Committee on Immunization Practices (ACIP), it is critical and recommended for pregnant patients to receive annual influenza (flu) vaccine and Tetanus, diphtheria, pertussis (Tdap) vaccine every pregnancy, irrespective of prior history. The influenza immunization of pregnant patients can decrease risk of infection and accompanying complications. With both flu and Tdap immunizations, pregnant patients not only can “cocoon” their newborns by preventing infection spread but can also passively transfer their antibodies to their infants to cover their window of vulnerability.^{3,4} Because of the importance of flu and Tdap vaccines in pregnancy and their established use safety,⁶ previous studies have investigated barriers to vaccine uptake in pregnant populations. Miseducation and fear of harm from vaccines present major barriers to vaccine uptake,^{7,8} and race, number of provider visits, provider vaccine recommendation, and parity may also be predictors of vaccine uptake.^{8,9,10}

PURPOSE & RESEARCH QUESTIONS

The purpose of this study was to find ways to improve flu and Tdap vaccination rates in pregnant patients at the University of Tennessee Family Medicine Clinic at Memphis (UTFMC-M). The research questions were the following: At UTFMC-M,

1. What were the age, race, and insurance of the patient sample?
2. What were the flu & Tdap vaccination rates in eligible pregnant patients?
3. How did the UTFMC-M vaccination rates compare to national vaccination rates?
4. Were there trends that may indicate barriers to vaccine uptake (physician encouragement, number of prenatal visits, trimester age at first prenatal visit, high risk clinic status (HRC), parity, age)?

METHODOLOGY

- A query search of all UTFMC-M patients was performed to identify any patients who were pregnant from September 1, 2019 -April 24, 2020 (included the 2019-2020 flu season). n= 465.
- Data was extracted from the NextGen Enterprise EMR system.
- Inclusion/exclusion criteria: Flu and Tdap vaccine eligibility based on ACIP recommendations included Flu shot eligible patients = any gestation age (0-41 weeks); Tdap eligible patients = ≥27 weeks. ≥2 visits to the UTFMC-M High Risk Clinic (HRC), a clinic that specifies in high risk pregnant patient care, was noted as positive HRC admittance status.
- IBM SPSS 26 was used for all statistics.
- Chi-square independence and Mann-Whitney U tests were run to determine the relationship between vaccination rates and the variables of interest.
- A 95% CI was approximated by calculating 2 standard errors for the upper and lower limits to compare clinic vaccination rates to national vaccination rates.

RESULTS

Q1 ANSWER: UTFMC-M PREGNANT PATIENT PREDOMINANT DEMOGRAPHIC

- **Age:** 26.6 years (mode).
- **Race:** 84.3% Black (8.2% White, 3.2% Hispanic, 0.9% Asian, 0.4% American Indian/Alaskan Native, 0.6% other, 2.4% unlisted).
- **Insurance:** 88% insured by TennCare (Medicaid) (9.2% commercial, 1.1% self-pay).

Q2 ANSWER: UTFMC-M VACCINATION RATES

- **Flu** (Fig. 1): Among pregnant eligible patients (any gestation age, n=465), 50.1% were flu-vaccinated.
- **Tdap** (Fig. 1): Among pregnant eligible patients (≥27 weeks, n=317), 73.8% were Tdap-vaccinated.
- **Both** (Fig. 1): Among pregnant Tdap & Flu eligible patients (≥27 weeks, n=317), 52.1% were Flu & Tdap-vaccinated.



Factors Associated with Influenza & Tdap Vaccine Uptake in Pregnant Patients at the UT Family Medicine Clinic

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RESULTS

Fig. 1: UTFMC-M Vaccination Rates

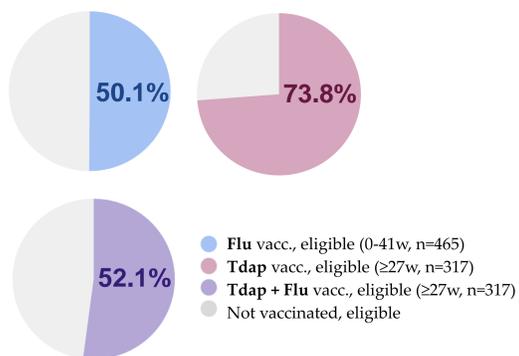
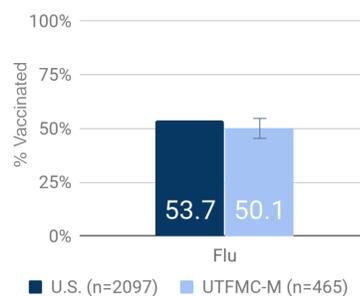
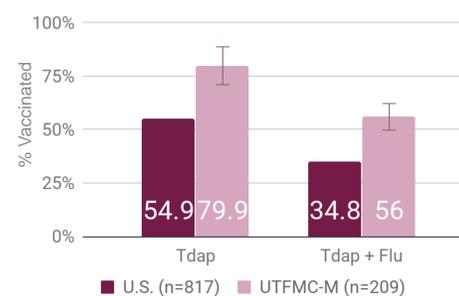


Fig. 2a: U.S. vs. UTFMC-M Flu Vaccine Rates



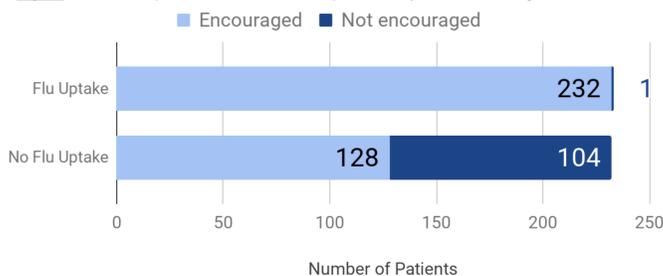
U.S. national survey pregnant sample from 2018-2019 flu season.⁸ UTFMC-M pregnant sample (2019-2020). The samples compared may not be equivalent. $p=0.05$.

Fig. 2b: U.S. vs. UTFMC-M Tdap & Both Vaccine Rates



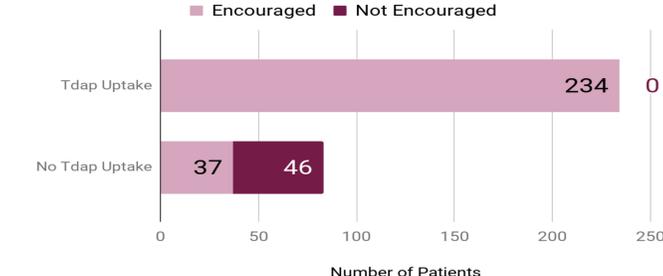
U.S. national survey pregnant subgroup who delivered live births in the 2018-2019 flu season.⁸ UTFMC-M pregnant subgroup who delivered in query timeframe (2019-2020). The samples compared may not be equivalent. $p=0.05$.

Fig. 3a: Relationship Between Vaccination Uptake & Physician Encouragement



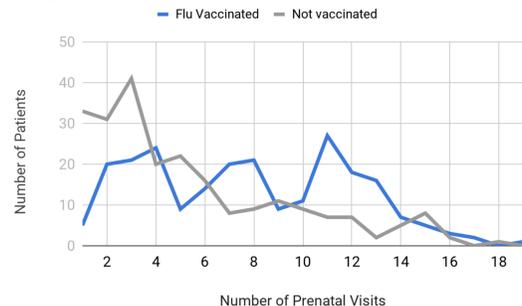
There was a positive relationship, $X^2 (1, N = 465) = 131, p < 0.001$, between physician encouragement of the flu vaccine and uptake.

Fig. 3b: Relationship Between Vaccination Uptake & Physician Encouragement



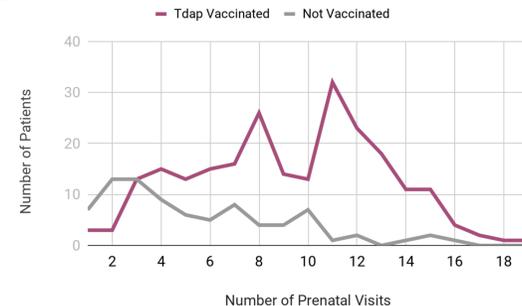
There was a positive relationship, $X^2 (6, N = 465) = 476, p < 0.001$, between physician encouragement and Tdap uptake.

Fig. 4a: Comparing Prenatal Visits & Flu Uptake



There was a significant difference ($U=17467.5, p < 0.001$) in number of prenatal visits between the vaccinated group ($M = 8$) and not vaccinated group ($M=4$).

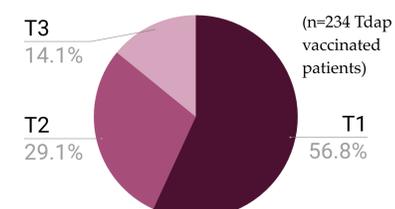
Fig. 4b: Comparing Prenatal Visits & Tdap Uptake



There was a significant difference ($U=4599.5, p < 0.001$) in number of prenatal visits between the vaccinated group ($M=9$) and not vaccinated group ($M=4$).

Figure 5: Relationship between Trimester at first visit & Tdap Vaccination Status

There was a significant relationship, $X^2 (6, N = 465) = 47.635, p < 0.001$. 56.8% of patients that received the Tdap vaccine (n=234) were in Trimester 1 (T1) at the first prenatal visit.



RESULTS

Q3 ANSWER: US VS. UTFMC-M VACCINATION RATES

- **Flu** (Fig. 2a): The national rate (53.7%)⁸ was within the UTFMC-M flu rate 95% confidence interval (50.1%, 95% CI: 45.5-54.7%, $p=0.05$).
- **Tdap** (Fig. 2b): The UTFMC-M rate among patients who delivered (79.9%, 95% CI: 74.4-85.4%, $p=0.05$) was higher than the national rate (54.9%, among those who delivered live births).⁸
- **Both** (Fig. 2b): The UTFMC-M rate among patients who delivered (56.0%, 95% CI: 49.1-62.8%, $p=0.05$) was higher than the national rate (34.8%, among those who delivered live births).⁸

Q4 ANSWER: RELATIONSHIPS BETWEEN VACCINATION & VARIABLES OF INTEREST

No significant associations were found between vaccination and HRC status, Parity, and Age. However, statistically significant relationships were found among the below variables:

- **Physician Encouragement**
 - There was a positive relationship between encouragement and vaccination (Fig. 3).
 - There was a positive relationship between Flu vaccine encouragement and Tdap vaccination, $X^2 (3, N = 465) = 96.994, p < 0.001$; between Tdap encouragement and flu vaccination, $X^2 (2, N = 465) = 61.9, p < 0.001$.
- **Number of Prenatal Visits**
 - Mean rank no. of visits in those who were vaccinated was higher than those who were not vaccinated (Fig. 4).
 - The flu-vaccinated group had a median of 8 visits; Tdap-vaccinated group, 9 visits; unvaccinated patients, 4 visits (Fig. 4).
- **Trimester age at 1st prenatal visit**
 - There was a relationship between trimester age at 1st prenatal visit and Tdap vaccination only (Fig. 5).
 - 56.8% of Tdap-vaccinated patients were in trimester 1 at the first visit; smaller proportions of vaccinated patients were in later trimesters (Fig. 5).

DISCUSSION

SUMMARY

- UTFMC-M vaccine rates were on par with U.S. flu vaccine rates and higher than U.S. Tdap and Tdap & Flu (“both”) vaccination rates.
- There were statistically significant relationships between vaccine uptake at UTFMC-M and physician encouragement, number of prenatal visits, and trimester age at first prenatal visit.
- There were no significant relationships between vaccine uptake and UTFMC-M HRC admittance for high risk pregnancies, parity, or age.

STUDY LIMITATIONS

- US vs. UTFMC-M rates: The US and UTFMC-M samples were likely not equivalent: UTFMC-M sample was predominantly black and Medicaid insured; the national study sample, more diverse.⁸ Additionally, UTFMC-M rates among patients who delivered could not directly compare with US rates among patients who delivered live births. Thus the comparison was only a preliminary exploration of the data.
- Physician Encouragement: EMR did not state encouragement status. All vaccinated patients and those who declined, both factors specifically documented in EMR notes by physician, were assumed to have received physician encouragement.
- Multiple comparisons (esp. a posteriori) may increase error rates. However, the current study consisted of a priori comparisons, which are theoretically acceptable for preliminary data exploration.

RECOMMENDATIONS

The U.S. Department of Health & Human Services goal for influenza immunization during pregnancy is 80%.¹¹ The Centers for Disease Control & Prevention recommend that all pregnant patients receive the Tdap vaccine ideally between 27-36 weeks gestation.¹² Based on these and on our study’s findings we recommend the following:

- Continue to encourage vaccination at every visit.
 - Continue booking multiple visits (8 for flu, 9 for Tdap).
 - Try to prioritize Tdap vaccination higher on problem list for those who are late prenatal patients.
 - Focus on flu vaccine encouragement and education.
- Previous rate improvement measures have focused on addressing the issues of miseducation, fear of harm to the baby,⁷ and physician vaccine encouragement^{9,10} through the following strategies:^{7,13}
1. Provide educational updates to physicians on vaccination during pregnancy from the Assistant Secretary for Health.
 2. Educate patients about vaccine safety and efficacy.⁹
 3. Provide quarterly clinic rate reports to all healthcare staff.
 4. Create standing orders for vaccine encouragement by all providers.
 5. Train nurses on encouraging vaccination and taking initiative in helping complete immunization for eligible patients.¹⁴