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# Small interface changes have dramatic impacts: how mandatory fields in electronic medical records increased pertussis vaccination rates in Australian obstetric patients

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## ABSTRACT

**Introduction** Electronic health records have been widely introduced into clinical practice. The aim of this study was to determine whether a small interface change could improve compliance with a key quality indicator, namely antenatal pertussis vaccination.

**Methods** Audits were performed between 1–31 July 2015 and 1–31 July 2017 of all deliveries at the Centenary Hospital for Women and Children to determine compliance with antenatal pertussis vaccination. The single difference between time points was changing the interface so the antenatal pertussis vaccination field became compulsory.

**Results** 275 and 299 women delivered in the audit periods. Vaccination rates almost doubled (52.7% vs 91.4%,  $p < 0.0001$ ).

**Conclusion** Small interface changes increase compliance. Interface change could be considered for key quality outcomes in patient care.

## INTRODUCTION

Numerous strategies have been trialled to improve vaccination rates in pregnant women. They have had mixed success. A recent review reported the most successful strategies to increase pregnancy vaccination compliance were direct recommendation by a treating healthcare provider on the benefits of vaccination in pregnancy,<sup>1,2</sup> advocacy that vaccination protected both the baby and the mother,<sup>3</sup> and a high level of vaccine knowledge in parents.<sup>2</sup> Despite these strategies, vaccination rates remain poor.<sup>1,2</sup>

One strategy that has not been trialled is the use of a mandatory field in an electronic health record. As electronic health records become the standard of care, a small interface change to create a mandatory field might help improve evidence-based compliance with key quality indicators such as antenatal vaccination. The aim of this study was to determine whether a small interface change to create a mandatory field for the key quality in obstetric clinical

## Summary

- ▶ There are no studies in the literature that address how changes in interfaces in electronic medical records can improve guideline uptake.
- ▶ The conclusions identified in this study could be utilised in other public health issues within maternity care such as smoking cessation.

indicator of antenatal pertussis vaccination would result in improved vaccination rates.

## METHODS

A retrospective audit study was performed. Records of all women who delivered at the Centenary Hospital for Women and Children, Canberra, Australia, between 1–31 July 2015 (baseline period) and 1–31 July 2017 (follow-up period) were audited.

In the baseline period, staff were educated about pertussis vaccination, a free clinic was established to vaccinate pregnant women, and patient education posters were displayed in clinical areas. The electronic health record antenatal attendance screen prompted staff to indicate whether pertussis vaccination had been offered and accepted or declined. Answers could be selected from a pull-down list. Once the prompt was answered, the response was autopopulated for future antenatal encounters. However, clinicians could close the antenatal attendance screen leaving the question blank, as completion of the question was not compulsory.

In the follow-up period, a small interface change was made to the antenatal attendance screen. The pertussis question became compulsory. The electronic health record antenatal attendance screen could not be closed unless the clinician had entered a specific response to

the query about pertussis vaccination. All earlier strategies for vaccination compliance remained in place.

The audit periods were selected to ensure there would be at least 250 births in each time period, generating a total sample size of 500 women. This sample size was calculated to have a greater than 80% power to detect a change in vaccination rates from 50% to 80%, assuming an alpha error of 0.05.

Data were collected using the Central Birth Outcome System electronic medical record and the Clinical Information System, identifying consecutive patients who delivered in the audit time frames. All women who delivered a baby of more than 20 weeks' gestation were included. Data collected included maternal demographic data, newborn outcome data and pertussis vaccination responses, which were independently verified with vaccine batch records.

Discrete data were analysed using number and per cent for discrete data, and mean and SD for normative continuous data. Data were compared using  $\chi^2$  test for discrete data and Student's t-test for continuous data. In multivariate analysis, all variables significant at  $p < 0.1$  were included in the model.

## RESULTS

A total of 275 and 299 women delivered at the Centenary Hospital for Women and Children in the baseline and follow-up audit periods.

Maternal and neonatal characteristics in the two audit periods are summarised in table 1. There were no significant differences in any demographic variable between the two audit periods with the exception of maternal age. The average maternal age in the 2015 cohort was 33.3 years compared with 31.5 in the 2017 cohort ( $p = 0.001$ ). In regard to birth modality, there was a significant trend towards fewer vaginal births and more caesarean section deliveries in the second audit period ( $p = 0.05$ ). There were no differences identified in newborn characteristics between the two periods (all  $p > 0.05$ ).

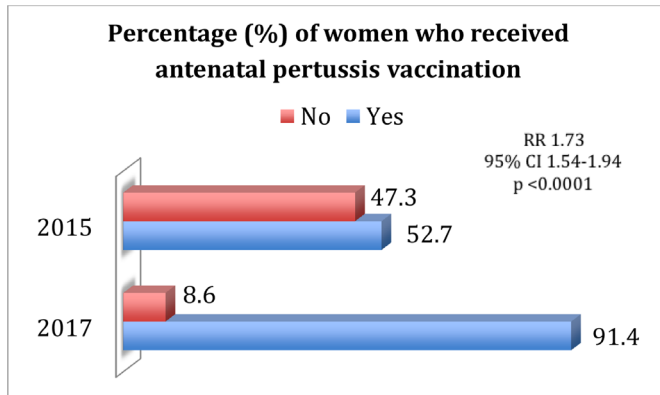
Figure 1 summarises the difference in pertussis vaccination rates between the baseline and follow-up periods. There was a significant increase in the percentage of women who were vaccinated for pertussis, with the rate almost doubling (baseline 146, 52.7%; postintervention 275, 91.4%; relative risk (RR) 1.73, 95% CI 1.54 to 1.94;  $p < 0.0001$ ). Multivariate analysis showed the only variable associated with a significant influence on pertussis vaccination rate was the difference in audit period following intervention ( $p < 0.0001$ ).

## DISCUSSION

The introduction of a mandatory field in an electronic health record resulted in 91.4% of women receiving antenatal pertussis vaccination compared with 52.7% when the field was optional. The baseline vaccination rate was

**Table 1** Demographics and characteristics of mothers and newborns between the two audit periods

	2015	2017	P value
Age in years, mean (SD)	33.3 (5.12)	31.5 (4.99)	0.001
Gravidity, n (%)			0.06
1	91 (32.9)	86 (28.6)	
2	82 (29.6)	117 (38.9)	
3 or more	104 (37.5)	98 (32.6)	
Parity, n (%)			0.21
Primiparous	118 (42.6)	113 (37.5)	
Multiparous	159 (57.4)	188 (62.5)	
Birth type, n (%)			0.05
Normal vaginal delivery	172 (62)	157 (52)	
Assisted vaginal delivery	31 (11)	47 (16)	
Caesarean section	74 (27)	97 (32)	
Maternal Indigenous, n (%)			
Yes	8 (2.9)	11 (3.0)	0.61
No	269 (97.1)	290 (97.0)	
Gender, n (%)			0.81
Male	145 (52.3)	154 (51.2)	
Female	132 (47.7)	146 (48.5)	
Not stated	0 (0.0)	1 (0.3)	
Body mass index ( $\text{kg}/\text{m}^2$ ), mean (SD)	25.3 (6.07)	26.07 (7.12)	0.18
Birth weight (g), mean (SD)	3244.87 (728.59)	3302.24 (655.76)	0.32
Gestation (days), mean (SD)	271.39 (22.24)	272.88 (18.73)	0.38



**Figure 1** Percentage of women who received antenatal pertussis vaccination between the two audit periods.

consistent with rates reported by the Australian Department of Health, suggesting baseline vaccination strategies at the hospital were as effective as those employed nationally.<sup>1</sup> The significant rise following the introduction of a small interface change to create a mandatory data field demonstrates that this step can enhance compliance.

The success of the intervention was multifactorial. It used a tool that was developed within an existing electronic medical record infrastructure, avoiding the complications and resistance that can arise when introducing changes into medical record systems. The mandatory nature of the tool forced the healthcare provider to provide a response before moving onto other assessments. If the mandatory field was not completed, clinicians received an automatic prompt message to complete the field and discuss the role and benefits of antenatal pertussis vaccination. This message encouraged clinicians to briefly interact about vaccinations. Such brief interventions have been proven to be effective in many areas of medicine, including vaccination.<sup>4</sup>

Electronic medical records have become an important tool in improving adherence to clinical guidelines and improving outcomes. A review article by White and Kenton<sup>5</sup> assessed the use of electronic medical record-based tools in educating healthcare providers on cervical cancer screening guidelines. The results showed that the use of electronic records significantly improved compliance with guidance and reduced inappropriate testing.

Electronic records have started to complement, and in some areas replace, patient-held records in the obstetrics settings. A study by Hawley *et al*<sup>3</sup> compared paper versus electronic medical records and the compliance rates of various outcome measures and clinical guidelines. There were significantly higher compliance rates in many of the pregnancy screening, assessment and advice variables.

A limitation of the study is that this is not a randomised trial and there may be other factors that affected vaccination rates despite multivariate analysis.

This study is the first to evaluate the effect of a small interface change of creating a mandatory field to enhance compliance with a key maternity quality indicator. This is a promising result with scope for further research on the role of mandatory fields and prompts to enhance clinician behaviour in other areas such as antenatal influenza vaccination rates, venous thromboprophylaxis assessment and smoking in pregnancy interventions. These results suggest that minor interface changes can have significant impact.

**Competing interests** None declared.

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## REFERENCES

1. Beard FH. Pertussis immunisation in pregnancy: a summary of funded Australian State and territory programs. *Commun Dis Intell Q Rep* 2015;39.
2. Yuen CYS, Tarrant M. Determinants of uptake of influenza vaccination among pregnant women – a systematic review. *Vaccine* 2014;32:4602–13.
3. Hawley G, Jackson C, Hepworth J, *et al*. Sharing of clinical data in a maternity setting: how do paper hand-held records and electronic health records compare for completeness? *BMC Health Serv Res* 2014;14.
4. Wong VWY, Fong DYT, Tarrant M. Brief education to increase uptake of influenza vaccine among pregnant women: a study protocol for a randomized controlled trial. *BMC Pregnancy Childbirth* 2014;14:1–7.
5. White P, Kenton K. Use of electronic medical record-based tools to improve compliance with cervical cancer screening guidelines. Effect of an educational intervention on physician practice patterns. *Obstet Gynecol* 2013;17:175–81.