Text4baby Influenza Messaging and Influenza Vaccination Among Pregnant Women

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Introduction: Pregnant women are at risk for severe influenza-related complications; however, only 52% reported receiving an influenza vaccination during the 2013–2014 influenza season. Text4baby, a free national text service, provides influenza vaccination education and reminders to pregnant women. This study examined reported influenza vaccination during pregnancy among Text4baby participants who reported receiving influenza messages and women who reported never participating in Text4baby.

Methods: Opt-in Internet Panel Surveys (April 2013 and 2014) of pregnant women collected demographic and other characteristics; influenza vaccination knowledge, attitudes, and behaviors; and Text4baby participation. Women aged 18–49 years, pregnant anytime from October to January (N=3,321) were included. Text4baby influenza message recallers reported receiving Text4baby influenza messages during their current/most recent pregnancy (n=377). Text4baby non-participants reported never receiving Text4baby messages (n=2,824). Multivariable logistic regression was performed (2014–2016) controlling for demographic and other characteristics, high-risk conditions, and provider recommendation and offer to vaccinate. Adjusted prevalence ratios (APRs) were calculated. Random sampling was assumed for this non-probability sample.

Results: Text4baby recallers were more likely than non-participants to report influenza vaccination regardless of receipt of provider recommendation and/or offer to vaccinate (provider recommendation/offer APR=1.29, 95% CI=1.21, 1.37, provider recommendation/no offer APR=1.52, 95% CI=1.07, 2.17). Among women receiving neither a provider recommendation nor offer to vaccinate, Text4baby recallers were more than three times as likely to report influenza vaccination compared with non-participants (APR=3.39, 95% CI=2.03, 5.67).

Conclusions: Text4baby status was associated with higher influenza vaccination, especially among women whose provider did not recommend or offer the vaccine. Encouraging Text4baby enrollment may help ensure influenza vaccination is given to protect mothers and infants.
The Centers for Disease Control and Prevention (CDC) recommends all women who are or will be pregnant during an influenza season be vaccinated to protect them and their infants from influenza; however, only 52% received the vaccination during the 2013–2014 influenza season. A provider’s recommendation with or without an offer to vaccinate increases self-reported vaccination rates among pregnant women. Reminder/recall systems have been shown to improve vaccination coverage; texting has been used to deliver reminders and education because of its prevalent use and popularity among minorities and people with lower income and education levels.

Text4baby is a free mobile health (mHealth) service for pregnant women and mothers with infants aged <1 year that sends three weekly texts with health content timed to a woman’s due date or her infant’s birthday. Text4baby educates women about important health issues, encourages contact with providers, and promotes healthy behaviors. More than 1,400 partners nationwide promote the service and major medical associations share the service as a tool for their members. Women enroll in various ways, including by text, online, via the Text4baby mobile app, and directly via health plans and Medicaid agencies. Text4baby content is developed in accordance with established patient care guidelines and is kept current by the ongoing involvement of a Content Development Council comprising leading national medical health organizations and federal partners.

Text4baby identified maternal influenza vaccination as a critical issue to target and implemented seasonal modules of messages encouraging influenza vaccination. The 2012–2013 module included two components: (1) education tailored to participant-reported reasons for non-vaccination, and (2) an opportunity to schedule a text reminder to get vaccinated. Details on the design, content, and evaluation of the 2012–2013 module are published elsewhere. The 2013–2014 module included information on low-cost influenza vaccination and a separate vaccination reminder. It also included two new components: (1) a coupon offer for a free influenza vaccination for mothers through a partnership with Rite Aid, and (2) additional education about influenza vaccination for infants sent to mothers with infants aged >6 months during influenza season.

The objective of this study is to compare self-reported influenza vaccination coverage during pregnancy among Text4baby participants who reported they received Text4baby influenza messages and women who reported that they never participated in Text4baby.

METHODS

Study Sample

The data sources for this study were two Internet Panel Surveys conducted by CDC targeting pregnant women aged 18–49 years to collect information on influenza vaccination, demographic characteristics, access to care during pregnancy, and knowledge, attitudes, and behaviors regarding influenza vaccination. Since the 2010–2011 influenza season, CDC has conducted this survey in early April for end-of-season influenza vaccination estimates. Survey data from April 2013 and 2014 were used for this study.

Measures

Women aged 18–49 years who were pregnant anytime from August 2012 through early April 2013 and from August 2013 through early April 2014 were recruited from SurveySpot, an opt-in general population internet panel operated by Survey Sampling International. Pregnant women were primarily recruited through a message advertising the survey on the main panel websites, inviting panelists to view the survey eligibility questions and sending an email invitation to a sample of panelists whose profiles indicated that they were women aged 18–49 years living in the U.S. A total of 2,047 eligible women completed the April 2013 survey and 2,042 completed the April 2014 survey, with completion rates of 93% and 96%, respectively. For this study, the sample was restricted to women who were pregnant anytime during the usual peak influenza vaccination period from October 2012 through January 2013 for the April 2013 survey and from October 2013 through January 2014 for the April 2014 survey (1,702 from April 2013, and 1,619 from April 2014; N=3,321). To develop statistical measures for this analysis, random sampling was assumed in this non-probability sample. A non-probability sample was used, given that surveys of rare populations, such as pregnant women, can be time-consuming and costly and few national surveys collect information about receipt of influenza vaccination. For each year, the final sample was weighted through post stratification weighting to represent the age group, race/ethnicity, and geographic distribution of the U.S. population of pregnant women based on data from National Vital Statistics Reports and the Guttmacher Institute, 1990–2008.

The April 2013 and 2014 surveys included Text4baby questions about receipt of Text4baby messages and about the helpfulness of the influenza messages (Figure 1). The primary outcome of this study was self-reported influenza vaccination coverage, defined as vaccination received before and during pregnancy since July (July 2012 for the April 2013 survey and July 2013 for the April 2014 survey).

The total population of pregnant women in the U.S. in each year and the distribution of pregnant women by age and race/ethnicity groups were determined from reported data published in the National Vital Statistics Reports by the National Center for Health Statistics in June 2012, and included combined data on live births from birth certificate information, data on spontaneous abortions from the National Survey of Family Growth, and data on induced abortions from CDC’s Abortion Surveillance System. The distribution of U.S. pregnant women aged 18–44 years by Census region in 2008 was determined based on estimates provided for each state in the Guttmacher Institute’s state data center, and included pregnancies that ended in live births and spontaneous and induced abortions.
Survey respondents who reported being pregnant anytime during October through January were grouped as follows: (1) “Text4baby influenza message recallers” were women who reported they received Text4baby influenza messages during their current or most recent pregnancy (those who responded yes to Text4baby Questions 1 and 3), and (2) “non-participants” were women who reported they did not receive any Text4baby messages (those who responded no to Text4baby Question 1; Figure 1). Current and former Text4baby enrollees who reported they did not receive influenza messaging during their current or most recent pregnancy (those who responded yes to Text4baby Question 1, yes [current enrollee] or no [former enrollee] to Question 2, and no to Text4baby Question 3) were excluded, given that their past exposure to influenza messaging sent via the Text4baby platform could not be determined (Figure 1).

**Statistical Analysis**

Differences in characteristics between Text4baby influenza message recallers and non-participants were tested using chi-square tests. The difference in vaccination coverage by demographic and access to care characteristics, high-risk conditions, Text4baby status, and provider recommendation and offer to vaccinate was assessed in a bivariate logistic regression model. To examine whether Text4baby status was independently associated with influenza vaccination coverage, weighted multivariable logistic regression analyses were performed controlling for demographic and access to care characteristics and high-risk conditions. Variables for inclusion were decided a priori based on factors previously reported to be associated with influenza vaccination. Year of the survey was included in the initial model to control for differences in Text4baby influenza messaging between seasons. Interaction between provider recommendation/offer X Text4baby status on vaccination coverage was tested. All analyses were conducted in 2014–2016 using SAS, version 9.3 survey procedures and SAS callable SUDAAN, version 11.1. Crude and Adjusted Prevalence Ratios (CPRs and APRs) and 95% CIs were estimated using predicted marginal proportions. Respondents gave informed consent to participate at the time of admission to the SurveySpot panel. The surveys were determined to be non-research by CDC and Abt Associates.

**RESULTS**

Among eligible women who completed the April 2013 or 2014 survey and were pregnant anytime from October
through January (N=3,321), 497 (15.0%) reported they were current (378) or former (119) Text4baby enrollees (Figure 1). Most current enrollees (327 [86.5%]) and slightly less than half of former enrollees (50 [42.0%]) reported they received influenza messages from Text4baby during their current or most recent pregnancy, for a total of 377 Text4baby influenza message recallers (Figure 1). The 120 Text4baby enrollees who reported they did not receive Text4baby influenza messages during their current or most recent pregnancy were excluded (Figure 1); excluded Text4baby enrollees were more likely to report public insurance than Text4baby recallers (53.3% of excluded enrollees reported public insurance vs 42.6% of Text4baby recallers).

Text4baby recallers (n=377) were more likely than non-participants (n=2,824) to be older (aged 25–49 years [72.2% vs 66.0%, respectively]), non-white (70.5% vs 61.9%), college educated or greater (57.6% vs 49.7%), married (70.2% vs 61.9%), currently working (66.4% vs 48.1%), receiving public insurance (57.4% vs 40.3%), and pregnant for the first time (55.1% vs 44.3%) (Table 1). Text4baby recallers were also more likely to report that they had a high-risk medical condition (54.1% vs 31.8%) and received a provider recommendation and offer to get vaccinated (82.0% vs 56.4%). More than three quarters (77.0%) of Text4baby recallers reported Text4baby influenza messages helped them make a decision about the vaccination (Question 4) and 88.6% reported that the influenza messages helped them remember to get vaccinated (Question 5) (Table 1).

Crude influenza vaccination coverage and the bivariate and multivariable associations between vaccination coverage and participant characteristics are shown in Table 2. Demographic and access to care characteristics and high-risk conditions were included in the multivariable model to control for possible confounding. Provider recommendation and offer and an interaction term between provider recommendation and offer X Text4baby status were included to examine differences by strata. Survey year was not associated with vaccination status and was not included in the model.

Women in the following groups had higher crude influenza vaccination rates: those living in the Northeast (versus South), aged 25–49 years (vs 18–24 years), those who were college educated or greater (versus less than a college education), married (versus not married), living at or above the poverty threshold (versus below poverty), currently working (versus not working), who reported a high-risk condition (versus no high-risk condition), and who reported six or more provider visits (versus zero to five visits). Non-Hispanic black women had lower crude influenza vaccination rates than non-Hispanic white women. Rates of vaccination were lowest for those who received neither a recommendation nor an offer (13.5%), higher for those who received a recommendation but no offer (39.5%; CPR=2.92, 95% CI=2.33, 3.66), and highest for those who received a provider recommendation and offer (70.5%; CPR=5.21, 95% CI=4.28, 6.35). Influenza vaccination coverage for Text4baby recallers was 81.3% compared with 47.1% for non-participants (CPR=1.73, 95% CI=1.61, 1.85; Table 2).

After adjusting for potential confounders and effect modification, vaccination rates remained higher among the following groups: those who were college educated or greater (college degree APR=1.10, 95% CI=1.02, 1.19; greater than college degree APR=1.15, 95% CI=1.03, 1.28), those living at or above the poverty threshold (APR=1.12, 95% CI=1.01, 1.24), who were Text4baby recallers (APR=1.44, 95% CI=1.30, 1.58), who reported a high-risk condition (APR=1.11, 95% CI=1.04, 1.19), and who reported receiving a provider recommendation with or without an offer to vaccinate (provider recommendation/offer APR=4.04, 95% CI=3.26, 5.00; provider recommendation/no offer APR=2.42, 95% CI=1.90, 3.07). Vaccination rates remained lower for non-Hispanic black women compared with non-Hispanic white women (APR=0.87, 95% CI=0.77, 0.98).

The test for interaction between provider recommendation and/or offer X Text4baby status in the multivariate model was significant (p<0.01). For women who reported that their provider recommended and offered the vaccination (n=1,865), Text4baby recallers were more likely to report influenza vaccination than non-participants (APR=1.29, 95% CI=1.21, 1.37). Similarly, among those who received a provider recommendation but no offer to vaccinate (n=493), Text4baby recallers were more likely to report influenza vaccination (APR=1.52, 95% CI=1.07, 2.17). Finally, among those who received neither a provider recommendation nor offer to vaccinate (n=755), Text4baby recallers were more than three times as likely to report receipt of influenza vaccination (APR=3.39, 95% CI=2.03, 5.67).

**DISCUSSION**

In this study, Text4baby participants who reported receiving Text4baby influenza messages were more likely than non-participants to report influenza vaccination, and the effect was strongest among those who received neither a provider recommendation nor an offer to vaccinate. This finding supports the potential of Text4baby to improve influenza vaccination coverage among a group with historically low vaccination coverage, those who receive neither a provider recommendation nor
Table 1. Text4baby Influenza Message Recalling and Non-Participant Characteristics, 2012–2013 and 2013–2014 Internet Panel Surveys, U.S.

| Participant characteristics | Message recallers, n (weighted %) (n=377) | Non-participants, n (weighted %) (n=2,824) | p-value |
|-----------------------------|------------------------------------------|-------------------------------------------|---------|
| Overall                     | 377 (12.5)                               | 2,824 (87.5)                              |         |
| Age group, years            |                                          |                                           |         |
| 18–24                       | 79 (27.8)                                | 731 (34.0)                                | 0.04*   |
| 25–49                       | 298 (72.2)                               | 2,093 (66.0)                              |         |
| Race/ethnicity              |                                          |                                           |         |
| White, non-Hispanic         | 121 (29.5)                               | 1,178 (38.1)                              |         |
| Black, non-Hispanic         | 44 (20.3)                                | 279 (18.1)                                |         |
| Hispanic                    | 157 (39.7)                               | 1,109 (36.4)                              |         |
| Other, non-Hispanic         | 55 (10.5)                                | 258 (7.3)                                 | 0.01*   |
| Census regions              |                                          |                                           |         |
| Region 1: Northeast         | 84 (22.3)                                | 492 (16.9)                                |         |
| Region 2: Midwest           | 68 (16.3)                                | 669 (21.0)                                |         |
| Region 3: South             | 138 (37.0)                               | 1,041 (36.9)                              |         |
| Region 4: West              | 87 (24.3)                                | 622 (25.2)                                | 0.05*   |
| Education                   |                                          |                                           |         |
| Less than college degree    | 147 (42.4)                               | 1,329 (50.3)                              |         |
| College degree              | 167 (40.4)                               | 1,163 (39.1)                              |         |
| Greater than college degree | 63 (17.2)                                | 332 (10.6)                                | <0.001**|
| Parity                      |                                          |                                           |         |
| First pregnancy             | 210 (55.1)                               | 1,191 (44.3)                              |         |
| Previously pregnant         | 167 (44.9)                               | 1,633 (55.7)                              | <0.001**|
| Marital status              |                                          |                                           |         |
| Yes                         | 281 (70.2)                               | 1,889 (61.9)                              |         |
| No                          | 96 (29.8)                                | 935 (38.1)                                | 0.01*   |
| Poverty statusa             |                                          |                                           |         |
| Below poverty               | 81 (24.6)                                | 540 (21.8)                                |         |
| At or above poverty         | 295 (75.4)                               | 2,276 (78.2)                              | 0.28    |
| Working statusb             |                                          |                                           |         |
| No                          | 124 (33.6)                               | 1,437 (51.9)                              |         |
| Yes                         | 253 (66.4)                               | 1,387 (48.1)                              | <0.001**|
| Insurance coverage          |                                          |                                           |         |
| Any public                  | 199 (57.4)                               | 981 (40.3)                                |         |
| Private/military only       | 170 (42.6)                               | 1,708 (59.7)                              | <0.001**|
| High-risk conditionsc       |                                          |                                           |         |
| Yes                         | 193 (54.1)                               | 918 (31.8)                                |         |
| No                          | 184 (45.9)                               | 1,906 (68.2)                              | <0.001**|
| Number of provider visits   |                                          |                                           |         |
| 0–5 visits                  | 119 (31.4)                               | 931 (34.0)                                |         |
| 6–10 visits                 | 136 (37.6)                               | 1,069 (37.7)                              |         |
| > 10 visits                 | 122 (31.0)                               | 824 (28.3)                                | 0.54    |
| Provider recommendation and/or offer for influenza vaccinationd | | | |
| Recommended and offered     | 314 (82.0)                               | 1,551 (56.4)                              |         |
| Recommended with no offer   | 31 (8.8)                                 | 462 (17.0)                                |         |
| No recommendation or offer  | 27 (9.2)                                 | 728 (26.6)                                | <0.001**|
| Did the flu message you received from “Text4baby” help you make a decision about getting the flu shot this season? | 296 (77.0) | N/A | N/A |
| Did the flu message you received from “Text4baby” help you remember to get a flu shot this season? | 280 (88.6) | N/A | N/A |

Note: Boldface indicates statistical significance (*p<0.05; **p<0.01).

aBelow poverty was defined as categorized by the U.S. Census Bureau (www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html).

bThose who were employed for wages and the self-employed were grouped as working. Those who were out of work, homemakers, students, retired, or unable to work were grouped as not working.

cConditions associated with increased risk for serious medical complication from influenza, including chronic asthma, a lung condition other than asthma, a heart condition, diabetes, a kidney condition, a liver condition, obesity, or a weakened immune system caused by a chronic illness or by medicines taken for a chronic illness.

dExcluded women who did not visit a provider since August 2012 (n=27) or women who did not know whether they received a provider recommendation or offer (n=55).

eAmong women who received Text4baby influenza messages and influenza vaccination (n=318).
offer to vaccinate. Text4baby and Text4baby partners implement national and community-based campaigns to reach and enroll women who may not be connected to the healthcare system. Text4baby can serve as a reminder system that providers can offer to further encourage influenza vaccination in addition to providing a recommendation and offer to be vaccinated. More than three quarters of Text4baby influenza message recallers reported that Text4baby influenza messages helped them make a decision about vaccination and reminded them to be vaccinated. Given these results, it is possible that the positive association between Text4baby status and vaccination may be attributed specifically to Text4baby influenza modules. Findings from this study are consistent with two RCTs that found a positive association between text-based influenza messaging and documented influenza vaccination among children, adolescents, and pregnant women. Findings are also consistent with a federally funded evaluation that found Text4baby pregnant participants were significantly more likely to report influenza vaccination compared with participants who had never heard of Text4baby. An evaluation of the 2012–2013 Text4baby influenza module found text reminders and information on low-cost influenza vaccination effective at improving reported influenza vaccination among Text4baby mothers. Finally, findings are consistent with qualitative research that suggests multi-component approaches, including positively framed, tailored messages that highlight vaccination benefits for pregnant women and their children—all of which were incorporated as part of the Text4baby influenza modules—may lead to increased vaccination.

To the authors’ knowledge, this study was the first to use a sample of women from across the U.S. to examine the association between reported receipt of specific text messages within a texting intervention and a preventive health recommendation, and more specifically, the first to use a sample of pregnant women from across the U.S. to assess the association between receipt of Text4baby messages and a preventive health recommendation. The approach taken to examine a texting intervention by means of an existing survey allowed for quick assessment and serves as a model for other mHealth interventions in need of timely evaluation given the rapid evolution of technology and survey mechanisms. Future mHealth evaluations should consider controlling for health consciousness when using an external control group and assessing the number and specific content of messages and different incentives, such as the coupon offer for a free influenza vaccination that resulted in a 1.7% redemption rate during the 2013–2014 flu season, which could lead to improved outcomes. The use of non-probability sampling for public health evaluations should also be further assessed, particularly for evaluations involving rare populations.

Limitations
This study has limitations. First, all data, including vaccination status, were self-reported and not independently validated. Second, the association between Text4baby status and vaccination may be biased if women who enroll in Text4baby are more likely to be health conscious and therefore more likely to get vaccinated or if they have other demographic characteristics or health seeking behaviors not measured in this study that are associated with increased vaccination. However, findings from the aforementioned Text4baby evaluation show no significant differences in health information seeking, referenced as a key dimension of health consciousness, between Text4baby participants and other prenatal patients who heard of Text4baby but decided not to sign up. Third, this study reports an association between Text4baby status and influenza vaccination among a sample of volunteer members of a non-probability Internet panel. Because the sample was not randomly selected, estimates of sampling error are usually not considered valid and not computed. Statistical measures of association were computed as a guide to assess the value of Text4baby on uptake of influenza vaccination. Population-based surveys of a rare population, such as pregnant women, are time-consuming and potentially costly. The Internet Panel Surveys are the only national surveys that collect information about receipt of influenza vaccination and vaccine-related knowledge, attitudes, and behaviors. The estimates of vaccination coverage may be biased if the selection processes for entry into the survey and a woman’s decision to participate were related to receipt of vaccination. To reduce bias, data were weighted to be more representative of the U.S. population of pregnant women. Additionally, comparisons to influenza vaccination coverage estimates among pregnant women from population-based surveys such as the Behavioral Risk Factor Surveillance System have shown that, whereas Internet Panel Survey estimates are consistently higher, trends in coverage are similar. Finally, it is possible that the magnitude of association between Text4baby status and vaccination could be overstated among women who received neither a provider recommendation nor an offer for vaccination if Text4baby messages encouraged early vaccination and providers assessed vaccination status before providing a recommendation or offer. The magnitude of the association could also be overstated if Text4baby enrollees who truly received the influenza messages, but did not remember receiving them, were excluded and if this group of enrollees was less likely to be vaccinated than Text4baby influenza message recallers.
Table 2. Influenza Vaccination Coverage, Pregnant Women, by Characteristics, 2012–2013 and 2013–2014 Internet Panel Surveys, U.S.

| Participant characteristics | Crude vaccination coverage, n | Crude vaccination coverage, weighted % (95% CI) | Crude prevalence ratio CPR (95% CI) | Adjusted prevalence ratio APR (95% CI) |
|----------------------------|-------------------------------|---------------------------------------------|------------------------------------|---------------------------------------|
| Age group, years           |                               |                                             |                                    |                                       |
| 18–24                      | 850                           | 47.2 (43.5–50.8)                            | ref                                | ref                                   |
| 25–49                      | 2,471                         | 53.5 (51.4–55.6)                            | **1.13 (1.04–1.24)**               | 0.97 (0.90–1.06)                      |
| Race/ethnicity             |                               |                                             |                                    |                                       |
| White, non-Hispanic        | 1,353                         | 53.6 (50.8–56.5)                            | ref                                | ref                                   |
| Black, non-Hispanic        | 335                           | 44.1 (38.7–49.6)                            | **0.82 (0.72–0.94)**               | **0.87 (0.77–0.98)**                  |
| Hispanic                   | 1,311                         | 51.4 (48.5–54.3)                            | 0.96 (0.89–1.04)                   | **0.93 (0.87–1.00)**                  |
| Other                      | 322                           | 57.7 (52.1–63.2)                            | 1.08 (0.96–1.20)                   | 1.05 (0.95–1.16)                      |
| Census regions             |                               |                                             |                                    |                                       |
| Region 1: Northeast        | 592                           | 56.3 (52.0–60.7)                            | **1.15 (1.04–1.27)**               | 1.02 (0.93–1.11)                      |
| Region 2: Midwest          | 762                           | 53.1 (49.2–56.9)                            | 1.09 (0.99–1.19)                   | 1.00 (0.91–1.09)                      |
| Region 3: South            | 1,236                         | 48.9 (45.8–52.0)                            | ref                                | ref                                   |
| Region 4: West             | 731                           | 50.2 (46.3–54.1)                            | 1.03 (0.93–1.14)                   | 0.97 (0.89–1.06)                      |
| Education                  |                               |                                             |                                    |                                       |
| Less than college degree   | 1,543                         | 44.2 (41.5–47.0)                            | ref                                | ref                                   |
| College degree             | 1,370                         | 57.3 (54.5–60.2)                            | **1.30 (1.20–1.40)**               | **1.10 (1.02–1.19)**                  |
| Greater than college degree| 408                           | 62.1 (57.0–67.2)                            | **1.40 (1.27–1.56)**               | **1.15 (1.03–1.28)**                  |
| Parity                     |                               |                                             |                                    |                                       |
| First pregnancy            | 1,453                         | 53.3 (50.5–56.1)                            | 0.93 (0.87–1.00)                   | 0.94 (0.88–1.00)                      |
| Previously pregnant        | 1,868                         | 49.7 (47.2–52.2)                            | ref                                | ref                                   |
| Marital status             |                               |                                             |                                    |                                       |
| Yes                        | 2,248                         | 55.7 (53.4–57.9)                            | **1.26 (1.16–1.37)**               | 1.06 (0.98–1.15)                      |
| No                         | 1,073                         | 44.1 (40.8–47.3)                            | ref                                | ref                                   |
| Poverty status             |                               |                                             |                                    |                                       |
| Below poverty              | 654                           | 43.0 (38.9–47.1)                            | ref                                | ref                                   |
| At or above poverty        | 2,658                         | 53.8 (51.8–55.9)                            | **1.25 (1.13–1.39)**               | **1.12 (1.01–1.24)**                  |
| Working status             |                               |                                             |                                    |                                       |
| No                         | 1,624                         | 45.8 (43.2–48.5)                            | ref                                | ref                                   |
| Yes                        | 1,697                         | 56.9 (54.3–59.4)                            | **1.24 (1.15–1.34)**               | 1.06 (0.99–1.13)                      |
| Insurance during pregnancy |                               |                                             |                                    |                                       |
| Any public                 | 1,238                         | 50.5 (47.4–53.5)                            | ref                                | ref                                   |
| Private/military           | 1,932                         | 54.0 (51.6–56.4)                            | 0.94 (0.87–1.01)                   | 1.05 (0.97–1.13)                      |
| High-risk conditions       |                               |                                             |                                    |                                       |
| Yes                        | 1,151                         | 59.0 (56.0–62.1)                            | **1.25 (1.16–1.34)**               | **1.11 (1.04–1.19)**                  |
| No                         | 2,170                         | 47.3 (45.0–49.6)                            | ref                                | ref                                   |
| Number of provider visits  |                               |                                             |                                    |                                       |
| 0–5 visits                 | 1,095                         | 45.1 (41.9–48.3)                            | ref                                | ref                                   |
| 6–10 visits                | 1,250                         | 54.1 (51.0–57.1)                            | **1.20 (1.09–1.31)**               | 1.02 (0.94–1.10)                      |
| > 10 visits                | 976                           | 55.2 (51.7–58.6)                            | **1.22 (1.11–1.34)**               | 0.99 (0.91–1.08)                      |
| Text4baby status           |                               |                                             |                                    |                                       |
| Text4baby influenza message recaller | 377 | 81.3 (76.9–85.7) | **1.73 (1.61–1.85)** | **1.44 (1.30–1.58)** |
| Text4baby non-participant  | 2,824                         | 47.1 (45.1–49.1)                            | ref                                | ref                                   |
| Provider recommendation and/or offer for influenza vaccination | | | | |
| Received recommendation and offer | 1,932 | 70.5 (68.2–72.7) | **5.21 (4.28–6.35)** | **4.04 (3.26–5.00)** |
| Recommendation but no offer | 512   | 39.5 (34.9–44.1) | **2.92 (2.33–3.66)** | **2.42 (1.90–3.07)** |
| No recommendation or offer | 779   | 13.5 (10.9–16.2) | ref                                | ref                                   |

(continued on next page)
Table 2. Influenza Vaccination Coverage, Pregnant Women, by Characteristics, 2012–2013 and 2013–2014 Internet Panel Surveys, U.S. (continued)

| Participant characteristics                  | Crude vaccination coverage, n | Crude vaccination coverage, weighted % (95% CI) | Crude prevalence ratio CPR (95% CI) | Adjusted prevalence ratio APR (95% CI) |
|---------------------------------------------|------------------------------|-----------------------------------------------|------------------------------------|-------------------------------------|
| Interaction between provider recommendation and/or offer for influenza vaccination and Text4baby status |                              |                                               |                                    |                                     |
| Received recommendation and offer          |                              |                                               |                                    |                                     |
| Text4baby influenza message recallers      | 314                          | 88.0 (84.0–91.9)                              | 1.32 (1.24–1.40)**                 | 1.29 (1.21–1.37)**                  |
| Text4baby non-participants                 | 1,551                        | 66.8 (64.2–69.4)                              | ref                                | ref                                 |
| Received recommendation but no offer       |                              |                                               |                                    |                                     |
| Text4baby influenza message recallers      | 31                           | 63.2 (45.2–81.1)                              | 1.67 (1.23–2.28)*                 | 1.52 (1.07–2.17)*                  |
| Text4baby non-participants                 | 462                          | 37.8 (33.0–42.6)                              | ref                                | ref                                 |
| No recommendation or offer                 |                              |                                               |                                    |                                     |
| Text4baby influenza message recallers      | 27                           | 41.5 (21.6–61.3)                              | 3.46 (2.04–5.84)**                 | 3.39 (2.03–5.67)**                  |
| Text4baby non-participants                 | 728                          | 12.0 (9.4–14.6)                               | ref                                | ref                                 |

Note: Boldface indicates statistical significance (*p < 0.05; **p < 0.01).

1. Below poverty was defined as categorized by the U.S. Census Bureau (www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html).
2. Those who were employed for wages and the self-employed were grouped as working. Those who were out of work, homemakers, students, retired, or unable to work were grouped as not working.
3. Conditions associated with increased risk for serious medical complication from influenza, including chronic asthma, a lung condition other than asthma, a heart condition, diabetes, a kidney condition, a liver condition, obesity, or a weakened immune system caused by a chronic illness or by medicines taken for a chronic illness.
4. Excluded women who did not visit a provider since August 2012 (n=27) or women who did not know whether they received a provider recommendation or offer (n=55).

CONCLUSIONS

This study suggests Text4baby participants who reported receiving Text4baby influenza messages were more likely to report influenza vaccination than non-participants, even among women whose provider already recommends and offers the vaccine. Text4baby participants in this study were more likely to report influenza vaccination among the more vulnerable group of women whose providers do not recommend or offer the vaccine. Text4baby is an example of an evidence-based intervention, a reminder system, designed to increase vaccination and enhance care. In recent years, the American College of Obstetricians and Gynecologists has included information on Text4baby in a mailing to providers with resources on influenza for patients and families. Study findings support the need for continued efforts not only to encourage busy providers to recommend and offer vaccination, but also to reinforce a recommendation and offer with other approaches, like Text4baby, that can maximize opportunities to provide preventive care to protect mothers and infants.

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