Backfire Effect of Salient Information on Vaccine Take-up Evidence from Scared-Straight Intervention in Rural Northern Nigeria

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Abstract

This paper evaluates the effect of salient information on the tetanus vaccine take-up using the field experiment among women of childbearing age in rural northern Nigeria. We use scared-straight flipcharts, which show the graphical information to prime painful tetanus symptoms of muscle spasm, to induce fear to increase the risk perceptions of tetanus and thus to lead to the increased level of the vaccine take-up. We find that the scared-straight intervention backfired among women without previous experiences of the tetanus vaccination; it decreased the take-up of the tetanus vaccination, while it increased their perceived risk of disease and fear level. We discuss the potential meahcnisms for this backfire. Overall, we do not recommend this tactic to improve the vaccination rate among our target population.

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Vaccination is an extremely cost-effective way to improve health. For example, treating one case of measles costs 23 times the cost of one vaccination, and $24 is saved for every $1 spent on the diphtheria-tetanus-pertussis (DTP) vaccine (Ehreth, 2003). Despite the huge benefits of preventing diseases at low cost, the persistent low vaccine take-up remains a puzzle (for example, see Suk, Lopalco, and Celentano, 2015).

One possible reason of the low vaccine take-up is the low risk perceptions of the disease. To increase the risk perceptions of the disease, we use the loss-framed message (or fear appeals) to emphasize the severe and negative consequences of not taking up the vaccination; the disease severity. This paper reports results of a field experiment designed to evaluate the effect of salient information about disease severity on tetanus vaccine take-up among women of childbearing age in rural Nigeria.

Loss-framed messaging involves the emphasis on the negative consequences of non-vaccination such as severity of disease, while gain-framed messaging involves the emphasis on the positive effects of vaccination such as the long-term health benefits. The effectiveness of loss-framed message in improving health behaviors, compared to the gain-framed message has been inconsistent in extant studies. For example, while O'Keefe and Nan (2012) found that there was no significant difference in persuasion between gain- and loss-framed messages, there is some evidence that loss-framed messages are more persuasive in promoting vaccination behaviors (Abhyankar et al. 2008, Gerend and Shepherd 2007).

This method of emphasizing the disease severity can also be framed as fear appeals. Fear appeals are persuasive messages that arouse fear. Substantial amounts of researches have been done to test the effectiveness of fear appeals in health-related issue (Witte and Allen, 2000). Many claimed that the fear appeals motivate the desirable health behaviors. For example,

Dillard and Anderson (2004) imposed the threat of influenza on respondents by emphasizing severe symptoms and examined whether they were motivated to receive influenza vaccines. They found that threats increased vaccine take-up and stronger threats worked better. On the other hand, there are significant amount of literatures which state that the fear appeals do not affect health behaviors or they can even have a counterproductive effect (Job R, 1988). Jepson and Chaiken (1990) found that the fear has an adverse effect on information processing that can lead to adverse health behaviors. Witte and Allen (2000) suggested that fear appeals work better if the fearful information comes along with high-efficacy messages. Efficacy messages involve a suggestion which advices respondents to seek for health behaviors in order to avoid the fearful consequences that fear appeals emphasizes.

In this study, we assume that the effectiveness of fear appeals is different by individual's previous experiences of vaccination as risk perceptions of the disease can be formed through the experience of vaccination. We assume that women who had experiences of the vaccine take-up have high risk perceptions, while women who never had the vaccination have low risk perceptions. Then, we hypothesize that, while women with previous vaccination experiences do not respond to the salient information of disease severity by increasing the vaccine take-up because they might already high perception of the disease risk, the fear appeals are effective in increasing the vaccine take-up among women without such experiences because the baseline risk perceptions are relatively low among them, which can be increased through the fear appeal intervention.

To examine the effectiveness of the salient information on the vaccine take-up, we randomly provide the salient information using 'scared-straight' flipcharts to respondents in the treatment arm while women in the control group receive the control flipcharts.[1] The scared-straight flipcharts contain the graphical information to emphasize and prime about the disease severity while the control flipcharts only contain the written explanation about the disease severity. To

[1]We call the flipcharts that contain the salient information about the disease severity 'scared-straight' flipcharts. 'Scared-straight' originally referred to a program intended to deter juveniles from future crimes by showing them the severity of life in prison to emphasize the consequence of bad behaviors (Petrosino et al., 2014). We call a message that emphasizes the severity of a disease 'scared straight' because the purpose of this message is to emphasize the consequence of non-vaccination, bad behavior.

control for the level of information on the disease, both flipcharts have disease information such as the causes and symptoms of tetanus.

We study tetanus toxoid vaccines that are the most effective in preventing maternal and neonatal tetanus and available free of charge to pregnant women in most of Nigerian clinics, but do not attain high take-up. Nigeria is one of 25 countries where tetanus is still a major public health problem (WHO, 2013). Providing tetanus toxoid vaccines to mothers most effectively protects both mothers and newborn babies from tetanus. Fatality from neonatal tetanus reaches almost 100 percent without medical treatment, which is difficult to obtain in rural Africa (Blencowe et al, 2010). Furthermore, tetanus has salient symptoms that fit to our scared-straight intervention. The most apparent symptom is the muscle spasm with the severe pain.

We find that the scared-straight intervention decreased the likelihood of the vaccine take-up among women who had never received the tetanus vaccination. While the scared-straight intervention backfired in increasing the vaccine take-up among our target population who never receiped the vaccine, this salient information increased the risk perceptions of tetanus as well as did it induce emotional response such as stated fear and the increase in the heart rate among women without experiences of the tetanus vaccination. This backfire effect on the vaccine take-up might have been due to the denial response to the scary information among women without experiences of vaccination who have low self-efficacy.

On the other hand, we find, as expected, no effect of scared-straight intervention on the vaccine take-up among women with experiences of the tetanus vaccination. However, we find that they increased the perceived risk of tetanus as well as the stated fear of tetanus. In other words, the intervention did not induce the behavioral change although it increased the perceived risk and arouse the fear, presumably because the perceived risk had already reached the high level before the intervention.

This paper contributes to the literature on fear appeals by measuring the rigorous causal effectof fear appeals on actual vaccination behaviors instead of hypothetical behaviors, which

are commonly examined in extant studies (e.g., Nyhan et al., 2014), as well as heart rate, an objective measure of emotional response.

The remaining of the paper is organized as follows. The next section explains the experimental design and data. Section 2 conducts empirical analyses on the effect of scared-straight intervention. The last section concludes.

1 Experiment Design and Data

1.1 Sampling

Our study was conducted in Jada local government area (LGA) of Adamawa state in the north-eastern region of Nigeria in March-May 2013. In Adamawa state, 58.8 percent of women received two or more injections against tetanus during their last pregnancy, while southern states achieve about 75 to 80 percent (NPC and ICF Macro, 2014). The sample was drawn from three-stage sampling, as follows. First, we sampled health clinics where respondents receive vaccination. Second, within the catchment area of each sampled clinic, we sampled villages within which we measured social interactions. Third, within each sampled village, we sampled individuals for whom we measured vaccination behaviors. In the first stage, ten health clinics were selected, such that they were geographically spread across Jada LGA, which is divided into 11 wards, or administrative districts. Out of the 11 wards, we focused on nine rural wards, each of which has one to five public health clinics. We selected the main health clinic from each ward, with an exception of one large ward where we selected two clinics (i.e., 10 clinics in total). The catchment areas of each clinic were defined by the primary healthcare development agency responsible for national immunization campaigns.

In the second stage, we sampled the total of 80 villages from the catchment areas of these 10 clinics. Our analysis focuses on social interactions within villages, because a village is considered the main social space among individuals in rural northern Nigeria. Villages were selected if they

had more than 10 households and the total number of villages within the catchment area did not exceed 15; if it did, priority was given to villages furthest from the clinic. We excluded small villages in order to efficiently collect a sufficient number of respondents.

In the third stage, we sampled women of childbearing age, who are the relevant population for preventing neonatal tetanus. We selected one eligible woman between the ages of 15 and 35 from each household. The survey team visited all the households in each village to find out if there were any eligible women. A woman was ineligible if she had received a tetanus vaccination within six months prior to the survey (to avoid overdose). In cases where there was more than one eligible woman in a household, the first priority was given to pregnant women. If there were no eligible pregnant women in the household, the second priority was given to women who had never received a tetanus vaccination. If we still did not find any eligible women with a priority, then women who had not receive a tetanus vaccine in the past 6 months were invited to participate in the project. If there was more than one woman who was eligible under the same priority, a participant was selected based on the alphabetical order of her first name. We sampled a total of 2,530 eligible women in 80 villages. In the sample, on average, a health clinic covers 305 women (range: 80-439) in 9.6 villages (range: 6-22), and a village covers 50.1 women (range: 9-189). Excluding respondents with incomplete information of key variables, the base analysis sample consists of 2,482 women.

It should be noted that, with the nonrandom sampling of health clinics and villages, our sample is not representative in Jada LGA. The findings of the paper have limited external validity.

1.2 Experimental design

To examine the effect of the salient information about the severity of tetanus, some women were randomly selected to be primed about disease severity to measure the impact of priming on vaccine take-up. They received the 'scared straight' message while others received the control

message. The message was conveyed to each respondent through a flipchart. We prepared two different flipcharts: one with frightening pictures of tetanus patients (i.e., the scared straight flipchart) and another without such graphic information (i.e., the control flipchart). Appendix 1 shows the comparison of scared-straigt and control flicpharts.

This study is based on a larger study that measures the relative importance of psychic costs of vaccination compared to monetary costs as potential barriers to vaccination. We define psychic costs as residuals that cannot be explained by monetary factors, such as beliefs and perceptions about vaccines which could influence vaccination decisions. To this end, we randomized the conditionality of cash incentives in the larger study (Sato and Takasaki, 2018). We randomized two different conditions under which a woman could receive cash incentives, either clinic attendance (Clinic CCT) or vaccination at the clinic (Vaccine CCT). To capture the effect of scared-straight intervention, we compared respondents under Vaccine condition (required to receive a vaccination to obtain cash rewards) who were shown the control flipchart (Vaccine CCT) with those who were shown the scared straight flipchart (Vaccine condition & Fear). For the comparison between Clinic condition and Vaccine condition to be valid in capturing the psychic costs of vaccination, all respondents under Clinic condition also received the control message.

We also randomized the amount of conditional cash transfers (CCT) that was offered to individual respondents to evaluate the effect of cash incentives on the vaccine take-up. Within each village, the amount of cash incentives that was offered was randomly assigned to each respondent, as detailed below: 5 naira (approximately 3.3 US. cents, CCT5), 300 naira (2 US. dollars, CCT300), or 800 naira (5.3 US. dollars, CCT800). The overall research design is shown in Online Appendix 1.

In each village, every day, interviewers brought 20 questionnaires. Each questionnaire indicated which flipcharts to be shown (scared-straight vs. control flipcharts) in the middle page. When starting the interview with each respondent, the interviewer randomly picked one questionnaire out of the 20. In this way, the assignment of information is random within villages.

1.3 Baseline, Intervention, and Post-Intervention

The baseline questionnaire was administered to all women in the sample to capture their prior knowledge, beliefs, and attitudes about tetanus and tetanus vaccination, as well as their own and their household's baseline characteristics, such as demographics, health, and economic status, and their social networks.

Immediately after completing the baseline questionnaire, the intervention took place if respondents agreed to participate in the intervention (all agreed). They were given information about tetanus using flipcharts as well as told how much they could receive if they visited the assigned health clinic within 7 days from the baseline survey. Respondents were then provided a voucher that they could redeem at the assigned health clinic.

The assignment of health clinic for each respondent was determined based on the village where she resided. The voucher indicated the respondent's name, her unique ID assigned in the project, date of the intervention, name of the health clinic assigned to attend, and the amount of cash compensation to be provided (5, 300, or 800 naira) if she received the vaccine.

Upon arriving at the assigned health clinic (if they decided to visit the clinic), all women were asked to form a line to wait to be served. In each clinic, an interviewer (who was a different interviewer than the ones who had conducted the baseline surveys) administered a brief questionnaire to each attendee when she was served.

At the beginning of the interview, the respondent was provided the vaccine by the health staff once the interviewer confirmed that she was willing to receive a vaccination. The interviewer then recorded in the questionnaire form that she received the vaccine. The questionnaire at health clinics recorded the date and time of the attendee's visit, the means of transport from her house to the clinic, transportation costs paid, and perceptions about tetanus toxoid vaccination. It also asked about other services she would like to utilize, as well as other household members she had brought along, if any.

At the end of the interview, payment was made to respondents in exchange for the voucher

indicating the assigned amount. Later, each redeemed voucher was matched with the baseline data.

1.4 Descriptive Statistics and Balance Tests

The analysis is based on 2,482 women aged 15 to 35 years old for whom information of basic baseline characteristics and GPS coordinates are available. Respondents were on average 25 years old, 50 percent were Muslim and the other half were Christian. About half had not received any education, 24 percent had primary school education, and 26 percent had secondary school education or more. Many respondents (43.5 percent) engage in paid work such as selling agricultural produce, and the average amount of household earnings per capita in the past month is about 5,000 naira (approximately 33.3 US dollars).

Fifteen percent had never been married; around 18 percent were pregnant at the time of the baseline survey; and about 77 percent had at least one child. The majority of respondents, 73.7 percent, had previously visited the health clinic to which they were assigned in this study. The mean distance from respondents' houses to the assigned clinic was 1.7 kilometers; around 47 percent of respondents lived within 1.5 kilometers of the clinics.

In the whole sample, more than one third of respondents (37.8 percent) thought that they were likely to contract tetanus; on average, respondents thought that 30 people out of 100 would die of tetanus; and substantial proportions of respondents (35 to 50 percent) felt worried about tetanus, thought that tetanus is bad, and felt that it is important to get protected from tetanus. On average, respondents thought that 22 people out of 100 could be saved from tetanus with vaccines (vaccine efficacy). The mean baseline heart rate was very high, 86.8 beats per minute.

Because this study focuses on the differential effect of salient information by experiences of tetanus vaccination, Appendix 2 shows the descriptive statistics by experiences of tetanus vaccination. Out of the total sample, 40.8 percent had received tetanus-toxoid vaccination at least once before the study. Women without experiences are significantly younger, but more of

them have secondary education or more. They are less likely to be married, less likely to have children, and less likely to have visited the health clinic. They are less likely to have a paid job, but higher household earning per capita.

In terms of risk perceptions, we find that women without experiences have consistently lower risk perceptions than women with experiences. This is consistent with our hypothesis. Women with experiences of the tetanus vaccination already achieves higher level of risk perceptions, and thus the salient information is unlikely to be effective on the vaccine take-up among them. On the other hand, women without experiences of the tetanus vaccination still have low level of risk perceptions, thus the scared-straight intervention can be potentially effective in increasing the vaccine take-up among them by increasing their risk perceptions through the intervention.

Table 1 shows the balance test of baseline characteristics and risk perceptions between women who were shown the scared-straight flipcharts and women who were shown the control flipcharts. Table 1 columns 1-3 show the balance among total sample, column 4 to 6 show the balance among women who never received the tetanus vaccine before the intervention, and columns 7 to 9 show the balance among women who had received the tetanus vaccine before the intervention.

Overall, the results indicate that the randomization performed well. Among total sample, most variables are balanced across interventions including the prior tetanus vaccination experience except some variables (Table 1 columns 1 to 3). Respondents who received the scared-straight intervention were less likely to have secondary school education or more, more likely to be worried about tetanus, to feel that it is important to protect against tetanus, and they have higher average heart rate than respondents under control group.

The equality of means between treatment types (scared-straight flipcharts vs. control flipcharts) is not statistically rejected at conventional levels for all the variables among women who never received tetanus vaccine (columns 4 to 6). Among women who had received the tetanus vaccine before the intervention, the pregnancy status is higher among those who were shown the scared-straight flipcharts than among women who were shown the control flipcharts by 6.6 percentage

points (columns 7 to 9). We control for the pregnancy status for all the regression analysis.

2 Result

This section evaluates the effect of scared-straight flipcharts on behavioral and perception changes. We highlight the differential effect of the scared-straight intervention by the experience of tetanus vaccination on vaccine take-up and risk perceptions. When we evaluate the overall effect of the intervention on the vaccination take-up for the total sample, regardless of the experience of the tetanus vaccination, we find no effect on the vaccine take-up (Table not shown). As we have an extensive discussion of this ineffective intervention in our previous paper among the total sample (Sato and Takasaki, 2018), this section focuses on the differential effect of the priming intervention on the vaccine take-up.

Through the result section, we show the main results with village fixed effects, assuming that women in a village share some unobserved characteristics. However, because all the women in a village were instructed to visit the same health clinic for receiving tetanus vaccination, some unobserved characteristics of respondents might vary by health clinics, rather than by villages. Thus, we also show results with health facility fixed effects. Results are consistent with either fixed effects. To estimate the effect of scared-straight flipcharts on behavioral and perception changes, we estimate

$$\begin{aligned} Y_{ij} = \alpha + \beta_1 ScaredStraight_{ij} + \beta_2 ReceivedVaccineBefore_{ij} \\ + \beta_3 ScaredStraight * ReceivedVaccineBefore_{ij} + X_{ij}\mu + v_j + \epsilon_{ij} \end{aligned} \tag{1}$$

where Y_{ij} is a dummy variable that takes 1 if a woman i in village or within a catchment area of health facility j receives a tetanus vaccine; $ScaredStraight$=1 if a woman i is assigned to a treatment group who were shown the scared-straight flipcharts; $ReceivedVaccineBefore$=1 if a woman i received a tetanus vaccine prior to our intervention. We control for various character-

istics such as age, age squared, education level, marital status, ethnicity, religion, the number of babied delivered, pregnancy status, minutes to the village head's house, total number of household members, roof material, whether a respondent has a paid work. We control for the village or health facility fixed effect v_j.

2.1 Backfire Effect of Scared-Straight Flipcharts on Vaccination Take-up

Among women who had never received tetanus vaccination before the intervention, showing scared-straight flipcharts backfired: it decreased the likelihood of receiving the tetanus vaccine at the clinic. Table 2 shows that being exposed to scared-straight flipcharts decreases the vaccine take-up by 3.9 to 6.1 percentage points. On the other hand, we found that the effect of scared-straight flipcharts is null among women who had experiences of receiving the tetanus vaccine.

Appendix 3 shows the differential effect of the scared-straight intervention by the cash incentives offered to respondents. Among women without experiences of the vaccination, there is no differential effect of the intervention by the amount of cash incentives offered together with scared-straight flipcharts (Appendix 3 Panel A and B columns 2). However, the negative effect of the scared-straight intervention is the most prevalent among women who received the lowest amount of cash incentive; showing the scared-straight flipcharts decreased the likelihood of the vaccine take-up by 6.4 to 10.7 percentage points if there were offered 5 naira and if they never received the tetanus vaccine before. On the other hand, this negative effect of the scared-straight intervention disappeared among women who were offered medium or the highest amount of cash incentives. The null effect of scared-straight flipcharts among women with experiences of vaccination is persistent regardless of the amount of cash incentives offered (Appendix 3 Panel A and B columns 4). Although the effect of the scared-straight intervention is the lowest if women were offered the highest amount of cash incentives, their effect is still not statistically different from zero.

So far, the regression specification includes women whose condition for cash incentives was the clinic attendance, as well as women whose condition was the vaccine take-up. However, because our primary focus in this study is to evaluate the effect of flipcharts intervention on the vaccine take-up, we can restrict the sample into women whose condition for cash incentives was the vaccine take-up. The result remains consistent (Table not shown). Showing the scared-straight flipcharts decreased the likelihood of the vaccine take-up by 3.7 to 6.0 percentage points among women without experiences of tetanus vaccination and its effect is the largest if they were offered the lowest amount of cash incentives, while it did not have any effect among women with experiences of tetanus vaccination.

Because the experience of the tetanus vaccination is correlated with risk perceptions (Appendix 2), we also evaluate the differential effect of the scared-straight intervention on the vaccine take-up by the risk perceptions (Table not shown). Overall, we find that the scare-straight intervention reduces the likelihood of the vaccine take-up among women with lower risk perceptions of the disease. For example, if a respondent is not worried about tetanus, the intervention lowers the vaccine take-up by 4.2 to 4.9 percentage points. If a respondent does not think that it is important to be protected from tetanus, the intervention lowers the vaccine take-up by 7.6 to 8.0 percentage points (Table not shown). These results are consistent with the main result that the priming intervention reduces the vaccine take-up among women without the experiences of tetanus vaccination because they have lower risk perceptions about tetanus (Appendix 2).

The backfire effect of the scared-straight intervention among women who had never received the tetanus vaccine is a puzzle. The next section runs several exercises to explore possible reasons for this negative effect by evaluating the effect of intervention on risk perceptions and emotional arousal. On the other hand, the null effect of the intervention among women with experiences of the tetanus vaccination is consistent with our hypothesis; because they already had high risk perceptions of tetanus as shown in Appendix 2, the salient information about the disease severity does not induce the behavioral change. Nonetheless, the next section contrasts the intervention

effect on the risk perceptions and emotional arousal by women's experiences of the vaccination.

2.2 Identifying Mechanisms of Backfire Effect

This section explores mechanisms under which showing the scared-straight flipcharts decreased the vaccine take-up among women who had never received the tetanus vaccine, while it did not induce the behavioral change among women who had received the tetanus vaccine.

2.2.1 Risk Perceptions

First, we assume that there is a positive correlation between risk perceptions and the vaccine take-up. Then, we expect that showing the scared-straight flipcharts did not increase the risk perceptions of tetanus nor did it increase the perceived importance of tetanus vaccine among women who had experiences of receiving tetanus vaccine because they did not respond to the scared straight flipcharts in terms of the vaccine take-up. On the other hand, among women who had never received the tetanus vaccine, we expect that showing the scared-straight flipcharts decreased the risk perceptions of tetanus as well as the perceived importance of tetanus vaccination because they decreased the vaccine take-up.

Table 3 shows the differential effect of the scared-straight intervention on the risk perceptions. Contrary to our hypothesis, we find no differential effect of the intervention on the risk perceptions by women's experiences of the tetanus vaccine take-up. Overall, the scared-straight intervention increased the risk perceptions, regardless of experiences of the tetanus vaccination. Among women who never received the tetanus vaccine, it increased the average number of people they think die of tetanus by 3.56, the likelihood of them worrying about tetanus, of perceiving that tetanus is bad, and of perceiving that it is important to protect themselves from tetanus by 15.1, 15.4, and 12.5 percentage points respectively more than the control flipcharts (Table 3 columns 1 to 6).

Among women who had experiences of receiving the tetanus vaccine, the effect of the scared-

straight intervention on risk perceptions is statistically the same as that among women who had never received the tetanus vaccine. One exception is the number of people they think die of tetanus (Table 3 column 2). The scared-straight intervention did not increase the number of people they think die of tetanus among women who had received tetanus vaccine while it did among women without experience of the tetanus vaccination, although its differential effect is insignificant.

Because there is no differential effect of the scared-straight intervention on risk perceptions by the experience of the tetanus vaccine take-up, the change in the stated risk perceptions do not explain why the scared-straight intervention backfired on the vaccine take-up among women without experiences of the tetanus vaccination.

2.2.2 Emotional Arousal

Although showing the scared-straight flipcharts did not induce the differential risk perceptions by the experiences of the tetanus vaccination, it might have induced the differential emotional responses to the intervention by the experiences, in particular the fear of the disease. The differential emotional response might have led to the differential effect of the intervention on the vaccine take-up.

Thus, as a second exercise, we evaluate the differential effect of the scared-straight intervention on the emotional responses by the experiences of the tetanus vaccination. Assume again that there is a positive correlation between the level of fear about the disease and the tetanus vaccine take-up. Then, we hypothesize that showing the scared-straight flipcharts did not increase the fear of tetanus among women who had experiences of receiving tetanus vaccine because they did not respond to the scared straight flipcharts in terms of the vaccine take-up. On the other hand, among women who had never received the tetanus vaccine, we expect that the control flipcharts increased the fear level more than the scared-straight flipcharts did because the take-up of the vaccine take-up is lower among women who were shown the scared-straight flipcharts.

Table 4 shows the differential effect of scared-straight intervention on several measurements of emotional responses. Among women who had never received the tetanus vaccine, the scared-straight intervention increased the fear level; it increased the likelihood of being frightened, being tense, and being nervous by 29.9, 32.1, and 30.3 percentage points, respectively more than the control flipcharts (Table 4 columns 1 to 3). It even increased the heart rate by 4.69 more than the control flipcharts (column 4). This result contradicts with our hypothesis that the scared straight flipcharts would not make women feel more fearful than the control flipcharts. Among women who had experiences of the tetanus vaccination, the scared-straight intervention increased the fear level more than the control flipcharts did, and the increase in the fear level among them was larger than among women who never had tetanus vaccination (Table 4 columns 1 to 4).[2]

Overall, we find that women with experiences of the tetanus vaccination stated to feel more fearful of tetanus due to the scared straight intervention than women without experiences, although women with experiences did not respond to the scared-straight flipcharts in terms of the actual vaccine take-up. On the other hand, women without experiences reduced the vaccine take-up due to the scared straight intervention while they actually responded to the intervention in terms of the stated feeling, although they were not as responsive in terms of the stated fear level as women with experiences of the tetanus vaccination. Thus, the stated fear level does not explain the differential effect of the scared-straight intervention by women's experiences of vaccination.

The result that the scared-straight intervention backfired among women without experiences of the vaccination is puzzling because both types of women with and without experiences of tetanus vaccination increased the risk perceptions and the fear level of the disease but the vaccine take-up does not correspond to such increases in perceptions and fear.[3]

[2]The results with including belief measurements for covariates are similar to the main results.

[3]Because we find the stronger backfire effect if respondents were offered the lowest amount of cash incentives among those without experiences of vaccination (Table 2 column 2), we evaluate the change in risk perceptions and emotional response to the priming intervention only among women who were offered the lowest amount of cash incentives (Appendix 3). We find the consistent results; both women with and without experiences of the tetanus vaccination increased the risk perceptions and the fear level of the disease. However, the intervention increased the risk perceptions more among women without the experiences for some indices of risk perceptions

Let us examine each type of women separately. Women with experiences of the tetanus vaccination did not increase the vaccine take-up due to the scared-straight intervention, although it increased the risk perceptions and fear level. However, as explained, it is consistent with our hypothesis; because women with experiences of the tetanus vaccination already have high level of the risk perceptions of tetanus as we see in Appendix 2, the salient information does not alter the vaccination behavior. Although the intervention increased the perceived risk perceptions and fear level, it did not induce the behavioral change because the baseline level of risk perceptions was already high.

On the other hand, the scared-straight intervention backfired among women without experiences of the tetanus vaccination, but it also increased the risk perceptions slightly more than women with experiences did as well as the fear level but less than women with experiences did.

One possibility why the backfire effect is not explained by the stated risk perceptions nor by stated fear is that the stated risk perceptions and fear level do not reflect the actual level of risk perceptions and the fear level. However, this possibility is less likely because we captured the objective measure of the response to the fear, the heart rate, and we find the similar effect of the scared-straight intervention on it as on other subjective measurement of the fear (Table 4).

The second possibility is that women without experiences of tetanus vaccination might have responded to the scared-straight flipcharts by not thinking about the information provided through the flipcharts because the flipcharts were too scary. In the psychology literature, this phenomenon is known as denial (for example, see Ruiter et al, 2014; O'Neill and Nicholson-Cole, 2009; Peters, Ruiter, and Kok, 2013). This hypothesis of denial is consistent with results that the scared-straight intervention did not increase the stated fear level and even the heart rate among women without experiences as much as it did among women with experiences (Table 4). When one feels too scared of something, she might stop thinking about it completely, and thus we observe less change in the fear level after the intervention among women without experiences

(Appendix 3 columns 1 and 2). This result is even more puzzling because the greater increase in risk perceptions should lead to the increased vaccine take-up among women without experiences, which did not happen.

of the vaccination than among women with experiences. Appendix 3 further shows the suggestive evidence to support this 'denial' channel. Among women without experiences of vaccination, the scared-straight intervention qualitatively backfired more if they were offered the smallest amount of cash incentives than if they were offered the higher amount of incentives, although the difference is insiginificant (Appendix 3 column 1 and 2). Literature in the psychology often discusses the possibility of the backfire especially when the fearful messages are not accompanied by the efficacy statements (Tannernbaum et al, 2015). The efficacy statements mean the solutions which eliminate or mitigate the fearful events. Although our intervention clearly provides the solution; the vaccine take-up, women who were offered the lowest cash incentives might have had the low self-efficacy due to the budget constraints, in other words, they could not afford going to receive the vaccine at the health clinic. Thislow self-efficacy might have led to the denial.

The last possibility is the low level of understanding about the purpose of the intervention. However, Appendix 2 shows that the education level of women without experiences of the tetanus vaccination is actually higher than women with experiences. Thus, this hypothesis of the lack of understanding of the efficacy statements is less likely to apply in our study.

3 Conclusion

This paper examines the effect of salient information of the disease severity on the tetanus vaccine take-up among women of childbearing age in rural northeastern Nigeria.

We find the differential effect of salient information through the scared-straight intervention by previous experiences of tetanus vaccination among respondents. While the vaccine take-up was not affected by the salient information among women with experiences of tetanus vaccination, the scared-straight intervention decreased the likelihood of the vaccine take-up among women who had never received the tetanus vaccination.

This backfire effect of the scared-straight intervention is not explained by the changes in risk perceptions and fear level because this salient information intervention increased the risk

perceptions of tetanus as well as did it induce emotional response such as stated fear and the increase in the heart rate among all the respondents, regardless of their experiences of vaccination.

The potential reason of this backfire effect is denial. Our results suggests that the salient information about the disease severity using the fear appeals backfired because the recipients of the information responded to the intervention by denying the information, especially among respondents who have the low self-efficacy. We do not recommend the use of the scared-straight tactic to aim for the improved take-up of vaccination among our target; women who never had experiences of vaccination.

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Table 1: Balance tests

Sample:	Total (N=2482)			Never received tetanus vaccine before (N=1493)			Received tetanus vaccine before (N=989)		
	Scared-straight flipcharts (1)	Control flipcharts (2)	Difference (p=value) (3)	Scared-straight flipcharts (4)	Control flipcharts (5)	Difference (p=value) (6)	Scared-straight flipcharts (7)	Control flipcharts (8)	Difference (p=value) (9)
Baseline characteristics									
Age	25.303	25.018	0.312	24.605	24.398	0.560	26.580	25.849	0.890
Muslim	0.504	0.491	0.358	0.522	0.494	0.114	0.489	0.484	0.756
No Education	0.492	0.479	0.503	0.476	0.484	0.762	0.513	0.473	0.150
Primary school	0.254	0.233	0.195	0.254	0.214	0.118	0.253	0.263	0.717
Secondary school or more	0.254	0.286	0.080	0.270	0.298	0.273	0.235	0.264	0.256
Has paid work	0.439	0.433	0.771	0.402	0.403	0.979	0.493	0.479	0.663
Earning per capita per day	6074.444	5784.002	0.389	6765.093	6352.046	0.330	5077.173	4906.124	0.667
Not married	0.149	0.155	0.646	0.197	0.201	0.776	0.066	0.089	0.215
Pregnant	0.195	0.173	0.232	0.167	0.173	0.770	0.237	0.172	0.024
Have children	0.752	0.77	0.414	0.663	0.681	0.492	0.888	0.904	0.506
Ever used clinic	0.727	0.72	0.714	0.669	0.663	0.849	0.810	0.808	0.920
Distance to health clinic (km)	1.69	1.717	0.161	1.713	1.741	0.275	1.665	1.676	0.676
Transportation costs (both way)	120.971	124.776	0.554	129.453	133.091	0.690	111.429	110.674	0.941
Opportunity costs (both way)	4.207	4.005	0.713	3.948	4.029	0.926	4.644	3.943	0.305
Received tetanus vaccine before	0.402	0.397	0.840	0.000	0.000		1.000	1.000	
Perception									
Likely to contract tetanus	0.397	0.37	0.216	0.347	0.328	0.491	0.459	0.439	0.527
Number of people die of tetanus (0-100)	29.403	30.494	0.178	28.527	29.64	0.298	31.27	31.53	0.859
Worried about tetanus	0.380	0.344	0.075	0.287	0.263	0.365	0.513	0.471	0.209
Tetanus is bad	0.449	0.427	0.216	0.383	0.372	0.675	0.548	0.51	0.237
Important to protect from tetanus	0.512	0.487	0.051	0.443	0.409	0.122	0.631	0.598	0.271
Vaccine efficacy	21.574	22.567	0.302	19.732	21.525	0.133	24.974	23.858	0.415
Heart rate	87.714	86.427	0.075	87.068	85.915	0.218	88.566	87.269	0.204

Notes: These are based on the analysis sample of 2,482 women. "Likely to contract tetanus" is a binary variable; "Number of people who die of tetanus" is the number of people out of 100; "Very worried about tetanus", "Tetanus is very bad", and "Very important to be protected from tetanus" are binary variables. "Vaccine efficacy" is the difference between the hypothetical number of unvaccinated people whom each respondent thinks get tetanus and the number of vaccinated people who get tetanus (range: -100 to 100). The estimates are with village fixed effects, with clustered standard error (village-level).

Table 2: Differential Priming Effect by Vaccine Experience

	Received Vaccine		
	(1)	(2)	(3)
Scared-straight flipcharts	-0.058**	-0.061***	-0.039*
	(0.024)	(0.022)	(0.020)
Received vaccine before	-0.093***	-0.064**	-0.013
	(0.032)	(0.030)	(0.027)
Scared-straight * Received vaccine before	0.075*	0.077*	0.031
	(0.044)	(0.042)	(0.039)
N	2482	2482	2482
r2	0.067	0.057	0.024
t-test (Scared-straight + Scared-straight * Received vaccine before = 0)	0.632	0.637	0.815
Mean of dependent var under control	0.778	0.778	0.778
Covariates	X	X	X
Health Facility Fixed Effects		X	
Village Fixed Effects			X

Notes: These are based on the analysis sample of 2,482 women. Robust standard errors clustered by villages (80 villages) are in parentheses. Covariates are Vaccine CCT (control flipcharts), Clinic CCT, woman's age, age squared, religion (Muslim or not), highest education attained, marital status, pregnancy status, whether she has a child, whether she has a paid work, distance to the health clinic, and past utilization of the assigned health clinic. Control mean of dependent variable is the mean under control flipcharts and Received vaccine before=0.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Differential Priming Effect on Risk Perceptions

	Likely to contract tetanus	Number of people die of tetanus (0-100)	Worried about tetanus	Tetanus is bad	Important to protect from tetanus	Vaccine efficacy
Panel A: Village FE	(1)	(2)	(3)	(4)	(5)	(6)
Scared-straight flipcharts	0.039	3.562**	0.151***	0.154***	0.125***	0.082
	(0.027)	(1.709)	(0.037)	(0.034)	(0.034)	(1.605)
Received vaccine before	-0.020	0.230	0.134***	0.145***	0.148***	3.981*
	(0.045)	(2.322)	(0.037)	(0.034)	(0.032)	(2.254)
Scared-straight * Received vaccine before	-0.058	-2.527	-0.017	-0.041	-0.051	-2.461
	(0.043)	(2.205)	(0.050)	(0.043)	(0.038)	(2.843)
N	2283	2280	2283	2283	2283	2278
r2	0.095	0.091	0.147	0.112	0.121	0.112
t-test (Scared-straight + Scared-straight * Received vaccine before = 0)	0.506	0.461	0.001	0.001	0.013	0.317
Village FE	X	X	X	X	X	X
Panel B: Health Facility FE	(1)	(2)	(3)	(4)	(5)	(6)
Scared-straight flipcharts	0.040	1.826	0.154***	0.159***	0.124***	-1.332
	(0.028)	(1.740)	(0.038)	(0.035)	(0.034)	(1.795)
Received vaccine before	-0.030	2.549	0.158***	0.167***	0.177***	5.255**
	(0.048)	(2.201)	(0.035)	(0.031)	(0.028)	(2.271)
Scared-straight * Received vaccine before	-0.086*	-0.810	-0.022	-0.050	-0.063*	-1.977
	(0.045)	(2.374)	(0.049)	(0.045)	(0.034)	(3.026)
N	2283	2280	2283	2283	2283	2278
r2	0.128	0.124	0.175	0.150	0.154	0.144
t-test (Scared-straight + Scared-straight * Received vaccine before = 0)	0.180	0.520	0.000	0.001	0.014	0.187
Health Facility FE	X	X	X	X	X	X
Covariates	X	X	X	X	X	X
Mean of dependent var under control	0.448	36.534	0.486	0.568	0.664	28.975

Notes: These are based on the analysis sample of 2,482 women. Missing obeservations in each column is due to missing values and invalid numbers in the dependent variable. Robust standard errors clustered by villages (80 villages) are in parentheses. Covariates are Vaccine CCT (control flipcharts), Clinic CCT, woman's age, age squared, religion (Muslim or not), highest education attained, marital status, pregnancy status, whether she has a child, whether she has a paid work, distance to the health clinic, and past utilization of the assigned health clinic. Control mean of dependent variable is the mean under control flipcharts and Received vaccine before=0.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Emotional Responses to Flipcharts

Dependent variables:	Flipcharts made me feel			
	Frightened	Tense	Nervous	Heart rate
Panel A: Village FE	(1)	(2)	(3)	(4)
Scared-straight flipcharts	0.299***	0.321***	0.303***	4.691***
	(0.037)	(0.029)	(0.037)	(0.828)
Received vaccine before	0.035	0.045	-0.026	-0.611
	(0.042)	(0.041)	(0.036)	(0.715)
Scared-straight * Received vaccine before	0.075	0.109**	0.125**	3.801***
	(0.058)	(0.052)	(0.053)	(1.088)
N	2467	2467	2465	2091
r2	0.127	0.146	0.146	0.411
Village FE	X	X	X	X
Panel B: Health Facility FE	(1)	(2)	(3)	(4)
Scared-straight flipcharts	0.305***	0.332***	0.328***	4.672***
	(0.037)	(0.029)	(0.036)	(0.953)
Received vaccine before	0.016	0.030	-0.038	-0.232
	(0.043)	(0.039)	(0.035)	(1.120)
Scared-straight * Received vaccine before	0.067	0.096*	0.114**	4.280***
	(0.061)	(0.050)	(0.052)	(1.388)
N	2467	2467	2465	2174
r2	0.118	0.143	0.154	0.069
Health Facility FE	X	X	X	X
Covariates	X	X	X	X
Mean of dependent var under control	0.287	0.228	0.298	88.235

Notes: These are based on the analysis sample of 2,482 women. Missing obeservations in each column is due to missing values and invalid numbers in the dependent variable. Robust standard errors clustered by villages (80 villages) are in parentheses. All the dependent variables are dummy variables which take 1 if a respondent answers "very much" or "much" to the question: "How did you feel about the flipchart you were just shown? Feel frightened, feel tensed, feel nervous, feel uncomfortable?" after the flipcharts intervention. Covariates are Vaccine CCT (control flipcharts), Clinic CCT, woman's age, age squared, religion (Muslim or not), highest education attained, marital status, pregnancy status, whether she has a child, whether she has a paid work, distance to the health clinic, and past utilization of the assigned health clinic. Control mean of dependent variable is the mean under control flipcharts and Received vaccine before=0. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix 1: Comparison of Flipcharts (Example)

Scared-straight Flipchart	Control Flipchart
Example 1	
	Tetanus
- Tetanus is a very painful disease	- Tetanus is a very painful disease
Example 2	
	
-Tetanus is very dangerous (esp for babies) -Typical symptoms of tetanus (1) Severe pain (2) Muscle spasm	-Tetanus is very dangerous (esp for babies) -Typical symptoms of tetanus (1) Severe pain (2) Muscle spasm

Source: Author's development

Appendix 2: Differences in Characteristics by Vaccine Experience

	Received vaccine before (N=989) (1)	Never received vaccine before (N=1493) (2)	Difference (p=value) (3)
Baseline characteristics			
Age	26.374	24.269	0.000
Muslim	0.507	0.487	0.249
No Education	0.483	0.483	0.994
Primary school	0.267	0.222	0.011
Secondary school or more	0.25	0.293	0.019
Has paid work	0.491	0.399	0.001
Earning per capita per day	5026.37	6438.003	0.010
Not married	0.06	0.215	0.000
Pregnant	0.192	0.171	0.157
Have children	0.926	0.657	0.000
Ever used clinic	0.815	0.661	0.000
Distance to health clinic (km)	1.702	1.713	0.386
Perception			
Likely to contract tetanus	0.438	0.339	0.003
Number of people die of tetanus (0-100)	30.974	29.606	0.351
Worried about tetanus	0.464	0.284	0.000
Tetanus is bad	0.496	0.391	0.016
Important to protect from tetanus	0.583	0.438	0.000
Vaccine efficacy	24.483	20.783	0.077
Heart rate	87.427	86.433	0.133

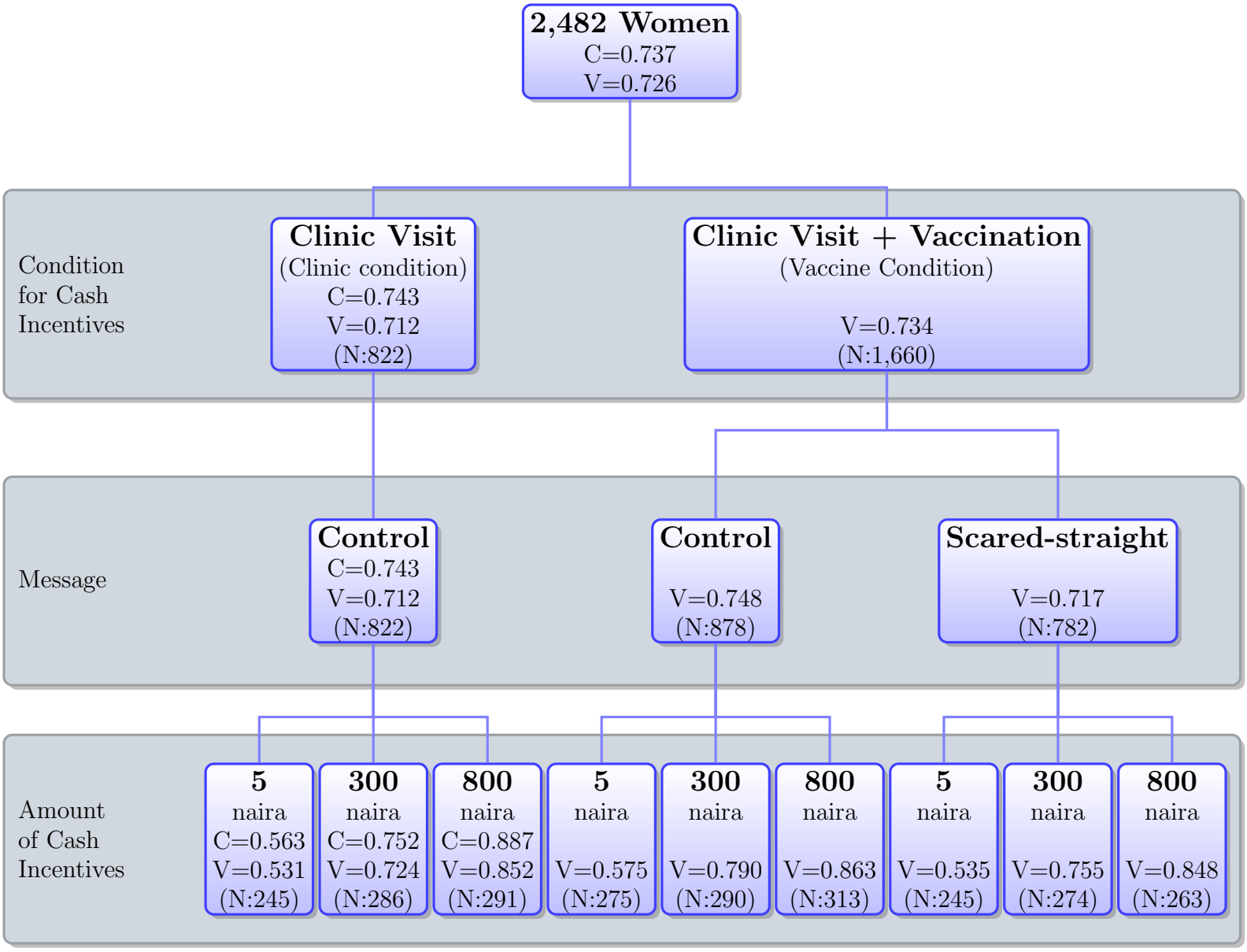
Notes: These are based on the analysis sample of 2,482 women. "Likely to contract tetanus" is a binary variable; "Number of people who die of tetanus" is the number of people out of 100; "Very worried about tetanus", "Tetanus is very bad", and "Very important to be protected from tetanus" are binary variables. "Vaccine efficacy" is the difference between the hypothetical number of unvaccinated people whom each respondent thinks get tetanus and the number of vaccinated people who get tetanus (range: -100 to 100). The estimates are with village fixed effects, with clustered standard error (village-level).

Appendix 3: Differential Priming Effect by Past Vaccine Experience & CCT

Dependent variables:	Received Vaccine			
Sample:	Never received tetanus vaccine		Received tetanus vaccine before	
Panel A: Village FE	(1)	(2)	(3)	(4)
Scared-straight flipcharts	-0.046**	-0.064*	-0.017	0.055
	(0.021)	(0.039)	(0.033)	(0.064)
CCT300		0.187***		0.269***
		(0.043)		(0.052)
CCT800		0.255***		0.330***
		(0.041)		(0.057)
CCT300 * Scared-straight		0.019		-0.086
		(0.059)		(0.083)
CCT800 * Scared-straight		0.054		-0.144*
		(0.047)		(0.080)
N	1493	1493	989	989
r2	0.029	0.130	0.024	0.108
village FE	X	X	X	X
Panel B: Health Facility FE	(1)	(2)	(3)	(4)
Scared-straight flipcharts	-0.062***	-0.107**	0.013	0.058
	(0.022)	(0.041)	(0.034)	(0.066)
CCT300		0.165***		0.248***
		(0.047)		(0.056)
CCT800		0.257***		0.317***
		(0.043)		(0.055)
CCT300 * Scared-straight		0.059		-0.064
		(0.060)		(0.087)
CCT800 * Scared-straight		0.089*		-0.076
		(0.047)		(0.084)
N	1493	1493	989	989
r2	0.057	0.149	0.063	0.127
Health facility FE	X	X	X	X
Covariates	X	X	X	X
Mean of dependent var under control	0.778	0.629	0.706	0.500

Notes: These are based on the analysis sample of 1,493 (columns 1 and 2) and 989 (columns 3 and 4) women. Robust standard errors clustered by villages (80 villages) are in parentheses.Covariates are Vaccine CCT (control flipcharts), Clinic CCT, woman's age, age squared, religion (Muslim or not), highest education attained, marital status, pregnancy status, whether she has a child, whether she has a paid work, distance to the health clinic, and past utilization of the assigned health clinic. Control mean of dependent variable is the mean under control flipcharts and CCT5. * significant at 10%; ** significant at 5%; *** significant at 1%

Online Appendix 1: Research Design



Notes: These are based on the analysis sample of 2,482 women. 150 naira = $1 approximately. C is clinic attendance rate, V is vaccine take-up rate, and N is the number of observations.