

Psychological Barrier to Tetanus-Toxoid Vaccination among Nigerian Women

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ABSTRACT

Objectives: We evaluate psychological barrier to and demand for tetanus-toxoid vaccination among women at childbearing age in rural northern Nigeria.

Methods: In this individual-level randomized controlled trial, we randomize the condition under which women can receive cash incentives among 1,700 women; Clinic condition (N=822) and Vaccine condition (N=878). Women under Clinic condition could receive cash incentives if they visit assigned clinic, while women under Vaccine condition could receive cash incentives if they visit assigned clinic and get vaccinated at the clinic.

Results: 1,268 (74.6%) women visited the clinic (611 [74.3%] of 822 in Clinic condition and 657 [74.8%] of 878 in Vaccine condition), and 1,242 (73.1%) women received the vaccination (585 [71.2%] of 822 in Clinic condition and 657 [74.8%] of 878 in Vaccine condition). There was no statistical difference in clinic attendance between two conditions. Under Clinic condition, 95.7% of women received the vaccination once they visited the clinic, although it was not a requirement for them to receive cash incentives.

Conclusion: Psychological barrier is not a major barrier to vaccination among women in northern Nigeria because there is no need of additional incentive for women to receive vaccination once they visit the clinic.

Keywords: Psychological barrier; Demand; Vaccination; Africa

INTRODUCTION

Tetanus-toxoid vaccination rate is low in Nigeria which is one of the 14 countries not eliminated maternal and neonatal tetanus [1]. We evaluate psychological barrier to, and demand for tetanus-toxoid vaccination among women at childbearing age in rural northern Nigeria. In this individual-level randomized controlled trial, we randomize the condition under which women can receive cash incentives; clinic-visit condition and vaccination condition. Women were eligible for the study if they had not received the tetanus-toxoid vaccination less than 6 months prior to the baseline survey. The total of 1,700 women from 80 villages within catchment areas of 10 health clinics were randomly assigned to the following groups: Clinic condition (n=822) and Vaccine condition (n=878). Women under Clinic condition could receive cash incentives if they visit an assigned clinic, while women under Vaccine condition could receive cash incentives if they visit an assigned clinic and receive the vaccination at the clinic. Overall, 1,268 (74.6%) women visited the clinic (611 [74.3%] of 822 women in Clinic condition and

657 [74.8%] of 878 women in Vaccine condition), and 1,242 (73.1%) women received the vaccination (585 [71.2%] of 822 women in Clinic condition and 657 [74.8%] of 878 women in Vaccine condition). There was no statistical difference in clinic attendance between Clinic and Vaccine condition. Among women under Clinic condition, 95.7% of them received the vaccination once they visited the clinic, although it was not a requirement for them to receive cash incentives. We find that psychological barrier is not a major barrier to vaccination among women in northern Nigeria. There is no need of additional incentive for women to receive vaccination once they visit the clinic, as most of them are willing to receive the vaccine once they are at the clinic. Future work is necessary to find out the major barrier to vaccination.

Maternal and neonatal tetanus (MNT) has been one of the major threats to mothers' and infants' lives. With recent international efforts, however, 45 out of 59 countries which had not eliminated MNT in 1999 achieved the elimination of MNT by 2018. Yet, 14 countries had not eliminated MNT. In 2015

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alone, 34,000 new-borns died of tetanus and there are a significant number of maternal deaths due to tetanus as well [1]. Nigeria, the study site, is one of these 14 countries [1] and tetanus contributes to a high neonatal mortality rate in the country [2].

Tetanus-toxoid vaccination among women at childbearing age is the most effective way to protect both mothers and newborn babies from tetanus. However, the take-up of tetanus vaccine remains low in Nigeria; only 40 percent of births are protected in Nigeria, while the average proportion of infants who are protected against tetanus in countries which have eliminated MNT reaches 86% [3].

There are various potential barriers to vaccination. One major barrier is physical costs to visit health clinics, such as transportation costs and opportunity costs [4]. These physical costs are not specific to vaccination per se, but can be applied to any health service utilization. On the other hand, barriers that are specific to vaccination include psychological factor such as fear of needles, fear of side effects, and distrust against vaccine efficacy. McLenon and Rogers conducted a meta-analysis on the prevalence of fear of needles. They found that needle fear was common [5]. Fear of side effects is one of the most common reasons why women do not take their children for vaccination, according to Nigerians Demographic and Health Survey [6]. The distrust against vaccine efficacy has been well documented in Africa. One of the most famous examples is the polio vaccine boycott that took place in northern Nigeria in 2003, due to the rumor that polio vaccines make women infertile or causes them to contract HIV [7]. Similar incidents opposing vaccination occurred across sub-Saharan Africa [8,9].

This study evaluates the demand for the tetanus-toxoid vaccination and the extent to which psychological barriers prevent women from vaccination. In particular, we compare the clinic attendance among women who are directly incentivized for vaccination and the vaccine take-up among women who are only incentivized to visit the clinic. We found that once women visited the clinic, 95.7% of them received the vaccine, although the vaccination was not incentivized. The result indicates that psychological barrier to vaccination explains only a small part of the low vaccine take-up among women in northern Nigeria. Once they come to the clinic, most of them accept to receive the vaccine without any additional incentives to get vaccinated.

METHODS

Study design

The study was a two-arm individually-randomized controlled trial, facilitated by local Primary Health Care Agency in Jada Local Government in Adamawa State. Eligible women were randomly assigned to one of two conditions under which they could receive the cash incentives; Clinic condition or Vaccine condition¹. Women under Clinic condition could receive the cash incentive if they visited the assigned clinic, while women under Vaccine condition could receive the cash incentive if they visited the assigned clinic and received the tetanus-toxoid vaccination at the clinic.

Study area and sampling

This study was conducted in the Jada local government area of Adamawa state in the northeastern region of Nigeria. The experiment was implemented in March-May 2013. We employed three-stage sampling. We first selected all 10 main health clinics in Jada local government area, except one that was close to another health clinic with a better facility. We then selected 80 villages within the catchment areas of the 10 health clinics in the sample were selected. All villages with more than 10 households within the catchment area of each health clinic were selected, unless the total number of villages in the same catchment area was more than 15; if it exceeded 15, villages farthest from the health clinic were sampled. Lastly, we selected one eligible woman aged 15 to 35 from each household in each of the 80 villages. A woman was eligible if she had not received a tetanus vaccine more than six months prior to the baseline survey. If there was more than one eligible woman in the household, pregnant women were the first priority, followed by a non-pregnant woman who had never received tetanus vaccine. If more than one woman with the same priority was eligible, then we selected the first one in the alphabetical order of their first name. The sample covers 2,530 women in 80 villages in total for a larger study which includes other randomized components such as randomized cash incentives and randomized salient information. For this study to evaluate the psychological factor to and demand for vaccination, we focus on 1,700 women, 822 of which are under Clinic condition and 878 are under Vaccine condition.

Randomization and procedures

Randomization was done at the time of baseline survey via the following procedure. Interviewers visited all the households in each village to find eligible women. In each village, every day, interviewers brought 20 sets of questionnaires. Each questionnaire indicated one of the two conditions (Clinic or Vaccine condition) in the middle page. When starting the baseline interview with each respondent, the interviewer randomly picked one questionnaire out of the 20 sets. In this way, the assignment of the condition is random within villages.

The baseline questionnaire was administered to all women who agreed to participate in the study 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. Immediately after completing the baseline interview, information about tetanus and tetanus-toxoid vaccination was provided to respondents. They were then provided a voucher that indicates the condition (clinic visit vs. vaccination) under which they could receive a certain amount of cash incentives. Respondents could receive the cash at the assigned health clinic if they fulfilled the condition within one week from the baseline survey. The assignment of health clinic for each respondent was determined based on the village where she resided.

Outcomes

The primary outcome was whether respondents visited the clinic to receive the tetanus-toxoid vaccination within one week from

the baseline survey. Among women under Clinic condition, we evaluate the likelihood of clinic visit as well as vaccine take-up. The voucher submission at the clinic as well as the record of the vaccination at the clinic we implemented is used for observing the clinic attendance and the vaccine take-up.

RESULTS

Descriptive statistics

Respondents are on average 25 years old. About half (48.9%) of the sample are Muslim, almost half (48.6 percent) have never received any education, 15.4 percent have never gotten married, 17.1 percent are pregnant, and 77.2 percent have at least one child. Many respondents (43.3 percent) engage in paid work,

including selling agricultural produce, and the average amount of household earnings per capita in the past month is about 5,780 naira (approximately 38.5 US dollars). On average, the distance to the assigned health clinic measured by GPS coordinates is 1.7 kilometers, while the one-way transportation costs to the clinic are around 125 naira.² Overall, the majority of respondents (71.2 percent) had ever visited the assigned health clinic before, and 39.8 percent have received tetanus toxoid vaccination at least once.

The balance of baseline characteristics is checked in Table 1. The results indicate that the randomization performed well: The equality of means between two conditions is not statistically rejected at conventional levels for any variables.

Table 1: Balancing and summary statistics.

Variables	Treatment type		
	Clinic condition (1)	Vaccine condition (2)	Joint significance (p-value) (3)
Age	24.77	25.25	0.164
Muslim	0.502	0.481	0.156
Any education	0.521	0.52	0.798
Marital status = Single	0.157	0.152	0.837
Currently pregnant	0.181	0.165	0.351
Have children	0.756	0.783	0.423
Monthly HH earning per capita (naira)	5974.3	5602.5	0.385
Distance to clinic (km)	1.713	1.72	0.299
Transport to clinic (naira)	119.61	129.72	0.305
Ever used clinic	0.707	0.732	0.411
Received tetanus vaccine before	0.388	0.406	0.664

Notes: These are based on the analysis sample of 1,700 women. Transportation and opportunity costs to clinic are the costs for one-way. Column (3) reports the p-value for the joint significance test for the equality of the means between two arms.

Statistical Analysis

Sample size calculations found that 850 individuals in each arm can detect the treatment effect of 7 percentage points with conservative assumption of standard error of 0.5 with type I error of 0.05 and power of 0.8.

To identify the effect of condition on clinic attendance and vaccine take-up in a regression framework, we estimate:

$$y_{ij} = \alpha + \beta 1Vaccine_condition_{ij} + X'_{ij}\mu + v_{ij} + s_{ij}$$

where y_{ij} is a dummy variable that takes 1 if a woman i in village j visits a clinic, or receives a vaccine; $Vaccine_condition$ is a

dummy variable that takes 1 if the condition for a woman i to receive the cash incentive was Vaccine condition, while the comparison group is Clinic condition. Other covariates included in X are baseline characteristics and behavior such as respondent's age, age squared, religion (Muslim or not), any education attained, marital status (single or married), pregnancy status, whether she has a child, whether she engages in paid work, distance to the health clinic, past utilization of the assigned health clinic, and past tetanus-vaccine experience. In all the empirical analyses in the paper, we also consider specifications without these covariates. All the results are similar to those with the covariates. Because treatment assignments are

random within villages, all the specifications employed in this paper control for village fixed effects (v) and cluster standard errors by village (80 villages in total). Village fixed effects also control for village heterogeneity. As all respondents in the same village are assigned to the same health clinic, village fixed effects also control for clinic heterogeneity, such as supply-side factors.

Demand for vaccination

The proportion of women who visited the clinic and received the vaccination under each condition. Among women under Vaccine condition, 74.8% (N=657) visited the clinic, and all of them (100%) who visited the clinic received the vaccine. Among women under Clinic condition, 74.3% (N=611) visited the clinic, and 585 women (71.7%) received the vaccine. We hypothesized that psychological barriers to vaccination reduce the clinic visit among women under Vaccine condition. But we did not find evidence of psychological barriers (Figure 1).

The proportion of women under each condition, who received the vaccination, provided that they visited the clinic. Because there was no difference in the clinic attendance by the condition, the comparison of the vaccine take-up between two conditions among women who visited the clinic can be considered to capture psychological barriers to vaccination. All of women (100% of 657) received the vaccination under Vaccine condition once they visited the clinic, while 585 (95.7% of 611) women received the vaccination under Clinic condition once they visited the clinic. Note that women under Clinic condition did not have to receive the vaccine to receive a certain amount of cash incentives (Figure 2).

Using the regression specification, (Table 2) shows the effect of Vaccine condition on clinic attendance and vaccine take-up. We found that the condition does not have any significant effect on the clinic attendance (column 1). On the other hand, women under Vaccine condition were 3.4 percentage points more likely to receive the vaccine than women under Clinic condition (column 2).

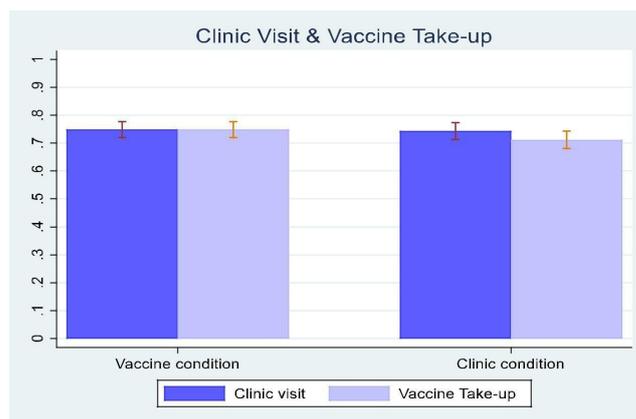


Figure 1: Clinic Attendance and Vaccine Uptake (These are based on the analysis sample of 1,700 women. The rates of clinic attendance and vaccination take-up under two treatment types are depicted along with their 95% confidence intervals).

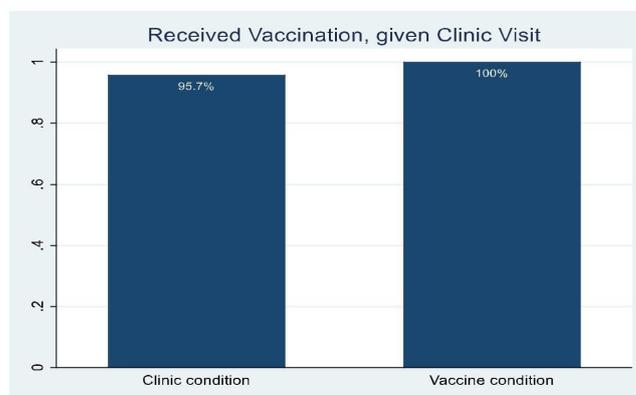


Figure 2: Clinic attendance and vaccine uptake (These are based on the analysis sample of 1,700 women. The rates of vaccination take-up, given clinic visit under two treatment types are depicted).

Table 2: Psychological barrier to vaccination.

Dependent Variables	Attended Clinic (1)	Received Clinic (2)
Vaccine condition	0.003 (0.016)	0.035* (0.019)
Observations	1700	1700
R-squared	0.036	0.029
Control mean of dependent variable	0.743	0.712
Covariates	X	X
Fixed effects by village (80 villages)	X	X

Notes: These are based on the analysis sample of 1,700 women. Robust standard errors clustered by village (80 villages) are in parentheses. Covariates are woman's age, age squared, religion (Muslim or not), any education attained, marital status, pregnancy status, whether she has a child, whether she has a paid work, distance to the health clinic, past utilization of the assigned health clinic, and past tetanus-vaccine experience. Control mean of dependent variable is the mean under Clinic condition. * significant at 10%; ** significant at 5%; *** significant at 1%

Reasons of no vaccination

Complementary, we also asked reasons of no-vaccination among women who never received any type of vaccination before. The breakdown is shown in Table 3. Out of 195 women who never

received any vaccination before, the most common reason for non-vaccination was lack of awareness about vaccination (37% [N=72]). Psychological factors such as fear of vaccine are one of the major barriers to vaccination (17% [N=33]).

Table 3: Reasons for non-vaccination.

Variables	Main reasons respondents have no received any vaccination (N=195)	
	Categorical total	Sub total
Lack of awareness	72	
Transportation to clinic	39	
clinic is far/clinic not available nearby		33
no money for transport		6
No particular reason	34	
Psychological factor	33	
scared of vaccine		18
fear of side effect		5
don't like the vaccine		5
tradition is against vaccine		5
Supply side	9	
supply quality bad		6
short supply of vaccine		3
Misperception	8	
I was healthy (so no need to vaccine)		4
vaccine not necessary		4

Notes: These are based on the sample of 195 women who have never received any vaccination for herself.

DISCUSSION

This study evaluates the psychological barrier to, and the demand for tetanus-toxoid vaccination at the clinic among women at childbearing age in northern Nigeria. To evaluate the psychological barrier to vaccination, we randomly assign the condition (Clinic visit vs Vaccination at the clinic) under which women can receive cash incentives. The difference in the clinic attendance between these two conditions reveal the psychological barrier to vaccination because all the respondents regardless of the treatment arm face the identical physical costs to visit the health clinic, and the only difference between two conditions is whether respondents have to receive the vaccine to be eligible for cash incentives once they are at the clinic. If none of the respondents has any psychological barrier to vaccination, the clinic attendance should be identical between two

conditions. If, on the other hand, some of the respondents have psychological barrier, the clinic attendance should be lower among women under Vaccine condition than under Clinic attendance.

We found that the clinic attendance was statistically the same between two conditions. This result indicates that psychological barrier is not a major barrier to vaccination among women. Furthermore, 95.7% of women who visited the clinic under Clinic condition received the vaccination although it was not required for them to receive the vaccination. Once they visit the clinic, there is high demand for the vaccination. In other words, there is no need of additional incentives for vaccination among women who are at the clinic.

We also collected the information on the perceived barrier to vaccination. About 17% of women who never received any

vaccination claimed to have psychological barriers. However, it is difficult to generalize this result due to the small sample size.

There is a major limitation in this study; not everyone visited the clinic under Clinic condition. It is possible that only women under Clinic condition who do not have psychological barrier to vaccination visited the clinic, and thus almost all of them received the vaccination. If there is this selection bias to visit the health clinic, our finding of high demand for the vaccination conditioned upon the clinic visit is difficult to generalize.

CONCLUSION

Women have high demand for the vaccination once they visit the health clinic. We did not observe psychological factors as major barriers to vaccination. Further study is necessary to evaluate effective way to increase the vaccination. It might be possible to achieve the high vaccination rate if we offer the vaccination on the same day when women come to the clinic for other purposes.

HUMAN SUBJECTS APPROVAL STATEMENT

The study was approved from University of Michigan institutional review board (IRB) (HUM00063832). Oral informed consents were obtained from all the respondents.

CONFLICT OF INTEREST STATEMENT

The author certifies that they have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

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