

CHAPTER 7

Interaction effects of social group affiliation with programme factors on immunization coverage

Introduction

In the preceding analysis the effects of social group affiliation (caste/tribe) on coverage of specific vaccinations (DPT3 and measles) and immunization status were examined after controlling the effects of modifying factors (socio-economic and demographic characteristics which include, residence, household structure, household standard of living index, parents education, mothers work status, sex of child, birth order of child) and cues to action (programme factors which includes, exposure to electronic media, place of delivery and access to health facility). It was found that the SC and ST children were significantly less likely to receive specific vaccinations (DPT3 and measles) and full immunization than that of OC children. However, previous studies show significant interaction effect of different predictors on childhood immunization (Jacinta Bronte Tinkew and Gordon Dejong, 2005; Babalola and Lawan, 2009). Therefore, the observed relationship between the social groups and full immunization either may not be of the same order or may not be even in the same direction at each level of predictor variables. Also results from the preceding chapter (Model 2 of Table 6.2.1 -6.2.4) show that the association between caste/tribe and coverage of immunization (DPT3, measles and full immunization) was attributed in part to programme exposure factors and with the inclusion of other socio-economic and programme factors (Model 4 of Table 6.2.1 -6.2.4) resulting in significant differences in the predictive effect of caste/tribe on full immunization.

This is in agreement with the Health Belief Model (HBM) conceptual framework which proposes the effect of modifying factors which also have some association with factors which act as catalyst to take a positive action for preventive health care. In this line, health service coverage theory of Tanahashi (1978) argues about the effect of four coverage factors (availability, accessibility, affordability and adoptability) for utilization of health care services among target population. Therefore, in order to see the nature of interaction effect of these programme factors for say, cues to action variables, it is

desirable to estimate the effects for various combinations of categorized explanatory variables, and to compare the variables at different levels with another. Therefore, an attempt has been made in this chapter to assess the interaction effects of social group affiliation (caste/tribe) and three cues to action variables (programme exposure factors which include, mothers' exposure to electronic media, place of delivery and mothers access to health facility index) on the coverage of full immunization among children aged 15-59 months in the states.

Analysis of interaction effects: Social group affiliation (Caste/tribe) by programme (cues to action) factors and immunization

In Chapters 5 and 6, it was observed that the direction and level of childhood full immunization was similar among children of SC and ST and similarly between OBC and OCs. Therefore, to examine the interaction effects with the programme factors in this chapter, the caste/tribe variable is put into two categories as SC/ST and non-SC/ST (which includes OBC and OC). The categories are made in this way because in the case of interaction, analysis by caste/tribe and programme exposure variables is not appropriate since the number of cases in each category will become very small. For example, the variable 'caste/tribe X access to health facility index' yields $4 \times 3 = 12$ categories, which includes four categories of caste (SC, ST, OBC and OC) and three categories of access to health facility index (low, medium and high). Hence, the interaction effects are examined with only two categories of caste/tribe, (SCs/STs and non-SCs/STs) and separately for two categories of exposure to electronic media (exposed and not-exposed), the place of delivery (institutional and non-institutional) and three categories of access to health facility index (low, medium and high). Accordingly, following three new variables with combinations of caste/tribe and three programme variables (exposure to electronic media, place of delivery and access to health facility) have been created and used for the analysis. They are:

1. Caste/tribe X exposure to electronic media: Categorized into $2 \times 2 = 4$ categories as SC/ST-exposed; SC/ST-not exposed; Non-SC/ST-exposed; Non-SC/ST-not exposed;
2. Caste/tribe X place of delivery: Categorized into $2 \times 2 = 4$ categories as SC/ST-Institutional delivery; SC/ST-home delivery; Non-SC/ST-Institutional; Non-SC/ST-home delivery;

3. Caste/tribe X access to health facility index: Categorised into $2 \times 3 = 6$ categories as SC/ST-low access; SC/ST-medium access; SC/ST-high access; Non-SC/ST-low access; Non-SC/ST-medium access; and Non-SC/ST-high access.

Characteristics of interaction variables

For better understanding of interaction effects between social group affiliation (caste/tribe) and programme factors (cues to action variables) on child immunization, it is necessary to profile the (exposure) characteristics of mothers of children aged 15-59 months across the three states. Table 7.1 presents the percentage distribution of mothers of children aged 12-59 months along with coverage status of full immunization, according to caste/tribe interaction with three programme variables (exposure to electronic media, place of delivery and access to health facility of mothers) in Rajasthan, Odisha and Madhya Pradesh. In Chapter 4, Section 1, it was observed that exposure to electronic media (TV and Radio programme), home deliveries and access to health facility were less among children of ST and SC mothers than OC.

Table 7.1 also reveals significant social group differences with the three programme characteristics in the states, and large proportion of non-SC/ST mothers had delivered in institutions, were exposed to electronic media, and had high/medium access to health facility, compared with counterparts, SC/ST mothers in all the three states. For instance, only 13-27 per cent of SC/ST mothers were exposed to electronic media compared 32-42 per cent of non-SC/ST mothers in the three states. Similarly, mothers' access to health facility and institutional deliveries were also less among SC/STs as compare with non-SC/ST mothers. In the three States, six to nine per cent of SC/ST mothers compared with 20-27 per cent of non-SC/ST mothers were delivered in institutions; and 10-11 per cent of SC/ST mothers compared with 22-23 per cent of non-SC/ST mothers have reported higher access to health care facility. However, large proportion of non-SC/ST mothers in Rajasthan and Madhya Pradesh (43 and 38% respectively) and SC/ST mothers in Odisha (37%) delivered in non-institutions.

Interaction effects of social groups and programme variables on child immunization: Gross differentials

Overall about half the children aged 12–59 months (46 and 47 per cent respectively) in Odisha and Madhya Pradesh and 27 per cent in Rajasthan were reported fully immunized. In Chapter 4 social group differences were observed in the coverage of

specific vaccinations (DPT3 and measles) and full immunization, and the coverage of specific vaccinations and full immunization were much less among the SC and ST children as compared with OC children in the three states. It was observed in Chapter 6 that the coverage of specific vaccinations (DPT 3 and measles) and full immunization was positively associated with the three programme variables viz., mothers exposed to (electronic) media, delivered in institutions and having high/medium access to health facility (index) than their counterparts, i.e., mothers who have delivered at home, who do not have exposed to media and low access to health facility.

Results from the bivariate analysis of interaction effects of social group affiliation (caste/tribe) and the three programme exposure variables on child immunization (Table 7.1) also show similar results. Though the SC/ST children show lower coverage of full immunization in the previous analysis (Chapters 5 and 6), a clear distinction is observed between SC/ST and non-SC/ST children in interaction with programme factors (cues to action variables) on coverage of full immunization. Irrespective of caste/tribe affiliation in all the three states, higher coverage of full immunization observed among children of mothers who were exposed to electronic media programme, delivered in institutions or had medium/high access to health facility compared with their counterparts who were not exposed to media, delivered at home and low access to health facility. For instance, in Rajasthan, there is virtually no difference in the coverage of full immunization between non-SC/ST and SC/ST children of mothers who were not exposed to electronic media or delivered at home, and small differences (9 and 12 per cent respectively) observed in Madhya Pradesh. Similarly, in Rajasthan and Madhya Pradesh, significant differences are observed in the coverage of full immunization between non-SC/ST and SC/ST children whose mothers were exposed to media (16 and 21 per cent respectively) and delivered at institutions (23 and 18 per cent respectively). At the low levels of mothers' access to health facility in Rajasthan and Madhya Pradesh states, the difference in the coverage of full immunization between SC/ST and non-SC/ST children was small (6 and 12 per cent respectively) compared with the difference at the high levels of mothers' access to health facility (14 and 17 per cent respectively). Thus, the results clearly show the existence of strong interaction effect for 'caste and exposure to media', 'caste and place of delivery', and 'caste and access to facility' on full immunization in Rajasthan and Madhya Pradesh.

While in Odisha, difference in the coverage of full immunization between SC/ST and non-SC/ST children whose mothers were not exposed to media or delivered at home were more (20 and 16 per cent respectively) than to their counterparts, non-SC/ST and SC/ST children whose mothers were exposed to media and delivered at institutions were (11 and 4 per cent respectively). At the low/high levels of mothers' access to health facility, 10 per cent difference observed in the coverage of full immunization between SC/ST and non-SC/ST children. These findings show the existence of some interaction effect between social group affiliation and programme factors in Odisha.

In short, though SC/STs have lower coverage of full immunization in the states, these findings are in accordance with the hypothesized relationship between '*caste and exposure to media*', '*caste and place of delivery*', and '*caste and access to facility*' on childhood immunization. Thus, from the above findings a clear interaction effect of caste/tribe group and three programme variables is observed. Therefore, it is imperative to see the net effect of these interacting variables on coverage of full immunization after controlling for all other factors. Tables 7.2-7.4 present the net effects of '*social group affiliation (caste/tribe) and exposure to media*', '*social group affiliation and place of delivery*', and '*social group affiliation and access to facility*' on childhood immunization after controlling for all other modifying and cues to action variables within four models in the three states.

Net effects of social group interaction with programme exposure variables on child immunization

Previous bivariate analysis shows clear existence of interaction effects of social group affiliation and programme exposure factors ('*caste and access to facility*', '*caste and exposure to media*', and '*caste and place of delivery*') on full vaccination. However, these differences are 'unadjusted' without controlling other socio-economic, demographic and each of the other programme exposure variables and such association confounds the differentials observed in bivariate analysis. Therefore, there is a need to assess the net effect of each of the caste/tribe interaction with programme variables after statistically controlling other variables. To this end, to access and quantify the net effect these three new variables the full immunization, independent of other background characteristics, multivariate logistic regression analysis is carried out with four models (Models 1-4).

In considering all the variables in one model, it is difficult to determine the relative importance of socio-economic, demographic and programme related variables. Therefore, as in the previous analysis (Chapter 6, Section 2), here also in Model 1 the effect of each interaction variable on full immunization is accessed separately without controlling any of the other independent variables. In Model 2 the other two programme factors/variables are introduced. It is possible that at least some differentials in child immunization are attributable to differences in the socio-economic and demographic characteristics of the social groups. Therefore, in Model 3 socio-economic and demographic variables are used as control variables in the place of two other programme variables. Finally, all the variables included in Model 4 (Model 4=Model 1+Model 2+Model 3).

It should be noted here that caste/tribe and programme variables are categorized, and only one interaction is examined at a time. Inclusion of two interaction variables in a single analysis brings in multicollinearity. For example, if ‘caste/tribe and exposure to media’ and ‘caste/tribe and place of delivery’ are included in a single multivariate analysis, the matrix becomes singular and hence, both cannot be examined in one analysis. Therefore, three separate analyses are carried out for each of the (three) interaction variables with four models (Models 1–4). Since all the explanatory variables are categorized, the results are given in the form of odds ratios (with reference to a specified category for each variable), and results are presented in Tables 7.2 to 7.4. Briefly the models with specification used for analysis of interaction effect of social group affiliation (caste/tribe) and three programme variables on child immunization are as follows:

1. *Analysis of interaction effect of social group affiliation (caste/tribe) and exposure to electronic media (watch TV and listen to radio programmes) on full immunization.*
 - a. Model 1: Caste/tribe by exposure to electronic media (without any control variables)
 - b. Model 2: Model 1 + cues to action variables (other two programme factors which include place of delivery and access to health facility index), as explanatory variables.
 - c. Model 3: Model 1 + modifying factors (i.e. other socio-economic and demographic variables which include residence, household structure, household standard of living, fathers’ education, mothers’ education,

mothers' work status, mother's age at the time of child birth, child's birth order and sex of the child), as explanatory variables.

- d. Model 4: Model 1 + Model 2 + Model 3. (i.e., Caste/tribe by exposure to electronic media along with the two other programme factors and nine modifying factors) as explanatory variables.
2. *Analysis of interaction effect of social group affiliation (caste/tribe) and place of delivery on childhood full immunization.*
- a. Model 1: Caste/tribe by place of delivery (without any control variables).
 - b. Model 2: Model 1 + cues to action variables (other two programme factors which include exposure to media and access to health facility index) as explanatory variables.
 - c. Model 3: Model 1 + modifying factors (i.e., other socio-economic and demographic variables which include residence, household structure, household standard of living, fathers' education, mothers' education, mothers' work status, mother's age at the time of child birth, child's birth order and sex of the child) as explanatory variables.
 - d. Model 4: Model 1 + Model 2 + Model 3. (i.e., caste/tribe by place of delivery along with the two other cues to action factors and nine modifying factors) as explanatory variables.
3. *Analysis of interaction effect of social group affiliation (caste/tribe) and access to health facility (index) on childhood full immunization.*

Model 1: Caste/tribe by access to health facility (index) (without any control variables).

Model 2: Model 1 + cues to action variables (other two programme factors, which include exposure to media and place of delivery) as explanatory variables.

Model 3: Model 1 + modifying factors (i.e. other socio-economic and demographic variables, which include residence, household structure, household standard of living, fathers' education, mothers' education, mothers' work status, mother's age at the time of child birth, child's birth order and sex of the child) as explanatory variables.

Model 4: Model 4: Model 1 + Model 2 + Model 3. (i.e., Caste/tribe by access to health facility index, along with two programme factors and other nine modifying factors) as explanatory variables.

Net effects of social group affiliation and exposure to media interaction on full immunization

Table 7.2 presents the results of multiple logistic regression analysis estimating the effect of ‘social group affiliation (caste/tribe) and exposure to electronic media (watch TV and listen to radio programmes)’ interaction on the coverage of full immunization among children aged 12-59 months, after controlling other background characteristics, within four models in Rajasthan, Odisha and Madhya Pradesh. Non-SC/ST children whose mothers were exposed to media have been considered as the reference category for the multivariate analysis.

As mentioned earlier, only ‘Caste/tribe and exposure to media’ interaction variable is used as a baseline model (Model 1). The unadjusted results shows that both SC/ST and non-SC/ST children whose mothers were not exposed to media (in the three states) and SC/ST children whose mothers were exposed to media (in Rajasthan and Madhya Pradesh) were significantly less likely to be fully immunized, as compared with the reference category (i.e., non-SC/ST children whose mothers were exposed to media. For instance, in Rajasthan and Madhya Pradesh, non-SC/ST and SC/ST children whose mothers were not exposed to media were 80 and 72 per cent (ORs for Non-SC/ST = 0.198 and 0.284 respectively); 79 and 81 per cent (ORs for SC/ST = 0.211 and 0.190 respectively) less likely to be fully immunized, as compared with the reference category. On the other hand, SC/ST children whose mothers were exposed to media were 46 and 58 per cent less likely (OR=0.536 and 0.638 respectively) to be fully immunized, as compared with the reference category. Whereas in Odisha, SC/ST and non-SC/ST children whose mothers were not exposed to media were 29 and 70 per cent (OR=0.710 and 0.298 for SC/ST and non-SC/STs respectively) less likely to be fully immunized as compared with the reference category. Similarly, SC/ST children whose mothers were exposed to media were 36 per cent less likely to be fully immunized (OR=0.638). Albeit, SC/ST’s children in both categories (whose mothers were exposed and not exposed to media) exhibit lower probabilities, a noticeable effect of exposure to media on full immunization is observed (Model 1, Table 7.2).

In Model 2, along with the ‘social group affiliation and exposure to media’ interaction variable (Model 1), other two cues to action variables (programme factors, viz., place of delivery and mother’s access to health facility) are introduced. As in Model

1, results from Model 2 show a significant two-way interaction effect on the coverage of full immunization in the states. Specifically, Model 2 shows that both SC/ST and non-SC/ST children, whose mothers were not exposed to media, and SC/ST children whose mothers were exposed to media, were significantly less likely to be fully immunized, as compared with the reference category (non-SC/ST children whose mothers were exposed to media). For instance, as compared with the reference category, SC/ST and non-SC/ST children whose mothers were not exposed to media were 64 to 73 per cent (ORs for SC/ST children = 0.272, 0.339 and 0.358 in f Madhya Pradesh, Rajasthan and Odisha respectively), 68 and 63 per cent less likely (OR=0.322 and 0.369 in Rajasthan and Madhya Pradesh respectively) to be fully immunized. On the other hand, SC/ST children whose mothers were exposed to media were 27, 39 and 47 per cent less likely (OR=0.536, 0.727 and 0.530 in Rajasthan, Odisha, and Madhya Pradesh respectively) to be fully immunized, as compared with the reference category. Moreover, in comparison with Model 1, the likelihood of full immunization in Model 2 increased further among both SC/ST and non-SC/ST children whose mothers were not exposed to media, and SC/ST children whose mothers exposed to media in the three states. Among other two programme factors, place of delivery showed significant effect in the three states and mothers access to health facility index in Rajasthan and Madhya Pradesh (Model 2, Table 7.2).

In Model 3, along with ‘social group affiliation and exposure to media’ interaction variable, other modifying factors (nine household and individual level socio-economic and demographic characteristics) are introduced in the place of programme factors (cues to action variables). Results from Model 3 show that SC/ST children (in all the three states) and non-SC/ST children (in Rajasthan and Madhya Pradesh) whose mothers were not exposed to media remain statistically significant and less likely to be fully immunized, as compared with the reference category. SC/ST children whose mothers were exposed to media (in Madhya Pradesh) were also less likely to be immunized. As compared with the reference category, SC/ST children (in all three states) and non-SC/ST children (in Rajasthan and Madhya Pradesh) whose mothers not exposed to media were 40-47 per cent (ORs for SC/STs = 0.605, 0.570 and 0.531 in Rajasthan, Odisha and Madhya Pradesh, respectively); and 35 and 55 per cent (ORs for Non-SC/STs=0.452 and 0.654, in Rajasthan and Madhya Pradesh, respectively) less likely to be fully immunized. In Madhya Pradesh, SC/ST children whose mothers exposed to media were 31 per cent

less likely (OR=0.694) to be fully immunized, as compared with the reference category. Moreover between Models 2 and 3, the likelihood of children to be fully immunized increased markedly in the states (Model 3, Table 7.2).

Finally in Model 4 (full model) along with the ‘social group affiliation and exposure to media’ interaction variable (Model 1), variables from both Models 2 and 3 included to assess the combined net effect of interaction variable simultaneously controlling for other background characteristics, in the states. Results from the Model 4 were consistent with those observed in the Models 1 to 3 and ‘social group affiliation and exposure to media’ interaction remains significant. As compared with the reference category (non-SC/ST children whose mothers were exposed to media), the probabilities of child being fully immunized were less among SC/ST and non-SC/ST children whose mothers were not exposed to media (in the three states), and among SC/ST children whose mothers were exposed to media in Madhya Pradesh. For instance, as compared with the reference category, SC/ST children whose mothers were not exposed to media were 34-45 per cent less likely (OR=0.659, 0.567 and 0.546 in Rajasthan, Odisha and Madhya Pradesh respectively) to be fully immunized in the three states. Similarly, in Rajasthan and Madhya Pradesh, non-SC/ST children whose mothers were not exposed to media were 50 and 34 per cent less likely (OR=0.501 and 0.660 respectively) to be fully immunized than the reference category. On the other hand, SC/ST children whose mothers were exposed to media in Madhya Pradesh were 28 per cent less likely (OR=0.722) to be fully immunized, as compared with the reference category (Model 4, Table 7.2).

Moreover between Models 1 and 4, the likelihood of children to be fully immunized increased markedly. For instance, between Models 1 and 4, the odds of receiving full immunization among SC/ST children whose mothers were not exposed to media increased from 0.211 to 0.659 in Rajasthan, from 0.298 to 0.567 in Odisha, and from 0.190 to 0.546 in the states of Madhya Pradesh. Thus the difference in full immunization between SC/ST and non-SC/ST children whose mothers were not exposed to media is wider and the gap narrows with the exposure. These results show the existence of interaction effect between caste and exposure to media.

Besides, ‘social group affiliation and exposure to media’ interaction variable, mother’s education (in all the three states); fathers education, mothers age at the time of

child birth, birth order and place of delivery (in Rajasthan and Madhya Pradesh); household standard of living [index] (in Odisha and Madhya Pradesh), and residence and household structure in Madhya Pradesh and Odisha respectively were found to be other significant predictors and social determinants of coverage of full immunization. Children of mothers with secondary or higher level of education (in the three states), urban children (in Madhya Pradesh) and children from joint families (in Odisha) received full immunization than their counterparts born to illiterate mothers, rural children and children from nuclear families. Moreover, children born to fathers of secondary or higher level of education, children with lower (with first or second) birth orders, and children born at institutions (in Rajasthan and Madhya Pradesh only), children from high/medium household standard of living (in Odisha and Madhya Pradesh) are more likely to be fully immunized than their counterparts of illiterate fathers, children with higher birth orders, children born at home and children from low household standard.

Similar set of social determinants is observed in the other analysis of interactions effects also ('social group affiliation and place of delivery' and 'social group affiliation and access to health facility.' Therefore, in the next analysis, more emphasis is laid on the interactions between social groups and the other two cues to action variables and discussed in detail. Therefore, the other significant predictors of social determinants from the models are not discussed.

Net effects of social group affiliation and place of delivery interaction on full immunization

Table 7.3 presents the results of multiple logistic regression analysis estimating the effect of 'social group affiliation and place of delivery' interaction on the coverage of childhood immunization, after controlling other background characteristics and programme factors in the three states. Non-SC/ST children born in institutions/health facilities (whose mothers delivered in health facilities/institutions) was considered as the reference category for the multivariate analysis.

Model 1 contains only 'Caste/tribe and place of delivery' interaction variable to assess the direct and independent effect of interaction on the coverage of full immunization in the three states. The unadjusted results (Model 1) show that place of delivery (home) has significant negative effect on the coverage of full immunization in the states, and as compared with the reference category (i.e., non-SC/ST children born in

health facilities/institution), both SC/ST and non-SC/ST children born at home (in the three states); and SC/ST children born in health facilities/institutions (in Rajasthan and Madhya Pradesh) were significantly less likely to be fully immunized. For instance, in Rajasthan and Madhya Pradesh, SC/ST and non-SC/ST children born at home were 79 and 84 per cent (OR=0.211 and 0.163 for SC/STs in Rajasthan and Madhya Pradesh, respectively), 79 and 73 per cent (OR=0.210 and 0.273 for non-SC/STs in Rajasthan and Madhya Pradesh respectively) less likely to be fully immunized as compared with non-SC/ST children born in health facilities (the reference category). Moreover, SC/ST children who were born in health facilities were also 62 and 55 per cent less likely (OR=0.378 and 0.446 in Rajasthan and Madhya Pradesh respectively) to be fully immunized, as compared with the reference category. While in Odisha, SC/ST and non-SC/ST children born at home had 61 and 26 per cent lower likelihood (OR=0.385 and 0.741 respectively) of receiving full immunization than the reference category (non-SC/ST children born in health facility/institutions). Thus, both SC/ST and non-SC/ST children born at home exhibit lower probabilities of receiving full immunization in the states (Model 1, Table 7.3).

In Model 2, two cues to action variables (programme factors such as mother's exposure to electronic media and access to health facility) are introduced, in addition to Model 1 (interaction) variable. As in Model 1, results from Model 2 show a significant two-way interaction effect of 'caste/tribe and place of delivery' on the coverage of full immunization, SC/ST (in all three states) and non-SC/ST children born at home (in Rajasthan and Madhya Pradesh) were less likely to be fully immunized, as compared with the reference category non-SC/ST children born in health facility. However in Model 2, SC/ST children born in health facilities/ institutions lost significance in Odisha. Further, in comparison with the Model 1, the likelihood of full immunization in Model 2 increased further among both SC/ST and non-SC/ST children born at home, and non-SC/ST children born in institutions. Both cues to action variables – mother's exposure to electronic media (in all the three states) and mother's access to health facility index (in Rajasthan and Madhya Pradesh) show significant positive effect on the coverage of full immunization (Model 2, Table 7.3).

In Model 3, along with interaction variable of Model 1, nine other modifying factors (household and individual level socio-economic and demographic characteristics)

are introduced in the place of cues to action variables (programme factors). With inclusion of modifying factors within Model 1, marked increase in the probability of a child to be fully immunized is observed, and SC/ST children (in the three states) and non-SC/ST children born at home (in Rajasthan and Madhya Pradesh) remain statistically significant, and less likely to be fully immunized, as compared with the reference category. However in Model 3, SC/ST children born in health facilities/institutions lost significance in Rajasthan. Among the modifying variables, household standard of living (index), and mother's education (in the three states); residence and household structure (in Odisha and Madhya Pradesh) father's education, mother's age at the time of child birth and birth order (in Rajasthan and Madhya Pradesh) show significant effect on the coverage of full immunization. Sex of the child does not show any significance on the coverage of immunization in the states (Model 3, Table 7.3).

Finally, in the Model 4 (full model) variables from Models 1-3 are included simultaneously to assess the combined net effect of 'social group affiliation and place of delivery' interaction variable in the states. Results from Model 4 were consistent with those observed in the Models 1 to 3 and 'social group affiliation and place of delivery' interaction variable remains a significant predictor of full immunization in the states. The significant interactions reveal that after controlling for modifying and cues to action factors, SC/ST children born at home were 26, 39 and 53 per cent less likely to be fully immunized as compared with the reference category (non-SC/ST children born in health facility) in Odisha, Rajasthan and Madhya Pradesh, respectively. Similarly, non-SC/ST children born at home (51 and 42 per cent in Rajasthan and Madhya Pradesh respectively) and SC/ST children born in health facility (37 per cent in Madhya Pradesh) were less likely to be fully immunized as compared with the reference category – non-SC/ST children born in health facility (Model 4, Table 7.3).

Moreover in comparison with Model 1, the likelihood of fully immunized among SC/ST children born at home in Model 4 increased further markedly in the states (from 0.211 to 0.605 in Rajasthan, from 0.385 to 0.738 in Odisha, and from 0.163 to 0.468 in Madhya Pradesh) as compared with the reference category (non-SC/ST children born in health facilities). In addition, the odds of fully immunized among non-SC/ST children born at home increases remarkably between Model 1 and 4 in Rajasthan and Madhya Pradesh (from 0.210 to 0.486, and from 0.273 to 0.576 in Rajasthan and Madhya Pradesh

respectively) and among SC/ST children born in health facilities in Madhya Pradesh (from 0.446 to 0.628 between models 1-4 respectively). Thus, the results show the existence of (some) interaction effect between ‘social group affiliation and place of delivery’ on coverage of childhood full immunization. Moreover, findings that children born at home were less likely to be vaccinated than children born at a health unit point to the need for community focused approaches to achieve full immunization. Furthermore, above findings indicate that irrespective of social group affiliation, if the service delivery (health facility/institutional delivery) in the community increases, the probability of a child to be fully immunized will also increase and differences between social groups (SC/ST and non-SC/STs) may be reduced or disappear with increase in service delivery. Generally mothers who deliver at hospitals or clinics are more likely to immunize their children than mothers who deliver at home.

Net effects of social group affiliation and level of access to health facility interaction on full immunization

Table 7.4 provides the estimated effects of interaction between ‘social group affiliation (caste/tribe) and within different levels of access to health facility (index)’ on full immunization in the states, after controlling for other modifying factors and cues to action (socio-economic, demographic and programme) factors using multiple logistic regression analysis. Non-SC/ST children whose mothers have higher access to health facility were considered as the reference category for the multivariate analysis.

As like ‘caste/tribe and exposure to media’, and ‘Caste/tribe and place of delivery’ interaction effects, mother’s access to health facility (own health care) also shows a positive effect on the coverage of full immunization across social groups in the states. Irrespective of caste/tribe affiliation, with increase in access to health facility, the coverage of full immunization increased. However, the tempo of increase in the coverage of full immunization was higher among non-SC/ST children than SC/ST children across the states. As compared with the reference category (i.e., non-SC/ST children whose mothers had higher access to health facility), SC/ST children whose mothers had low/medium/high access (in all the three states) and non-SC/ST children whose mothers had low/medium access (in Rajasthan and Madhya Pradesh) were significantly less likely to be fully immunized (Model 1, Table 7.4).

The unadjusted results (Model 1), which are the direct effects (unadjusted) of interaction between caste/tribe and within different levels of mothers access to health facility on full immunization in the three states show that at the low/medium levels of mothers access to health facility, lower coverage of full immunization observed among both SC/ST and non-SC/ST children, and the differences between them also small. For instance, in Rajasthan and Madhya Pradesh, SC/ST children whose mothers have higher access to health facility were 43 and 51 per cent less likely to be fully immunized (OR=0.572 and 0.494 in Rajasthan and Madhya Pradesh respectively) as compared with the reference category. On the other hand, in Rajasthan, at the low and medium levels of mothers access to health facility, SC/ST children were 84 and 78 per cent (OR=0.162 and 0.218 at low and medium levels of access respectively) and non-SC/ST children were 74 per cent each (OR= 0.258 each, at low and medium levels of access) less likely to be fully immunized, as compared with the reference category. Similarly, at the low and medium levels of mothers access to health facility in Madhya Pradesh, SC/ST children were 73 and 72 per cent (OR=0.275 and 0.283 at low and medium levels of access respectively); and non-SC/ST children were 55 and 36 per cent (OR= 0.454 and 0.644 at low and medium access respectively) less likely to be fully immunized as compared with the reference category. While in Odisha, SC/ST children were 53, 55 and 33 per cent less likely to be fully immunized at low, medium and high levels of mother's access to health facility (OR=0.472, 0.450 and 0.669 respectively) than the reference category (non-SC/ST children born in health facility/institutions). Thus, SC/ST and non-SC/ST children both exhibit lower probabilities of receiving the full immunization at low and medium levels of mother's access to health facility in the states (Model 1, Table 7.4).

As like in Model 1, results from Model 2 (Model 1 + two cues to action variables – mother's exposure to electronic media and place of delivery) also show a significant interaction effect of 'caste/tribe and place of delivery' on the coverage of full immunization in the three states. From Model 2, it can be seen that at the low and medium levels of mothers access to health facility, SC/ST children (70 and 65 per cent in Rajasthan; 39 and 41 per cent in Odisha; and 53 per cent each in Madhya Pradesh at low and medium levels, respectively) and non-SC/ST children (55 and 67 per cent in Rajasthan; 27 and 21 per cent in Madhya Pradesh at low and medium levels of access respectively) were less likely to be fully immunized as compared with the reference category.

Moreover, in comparison with the Model 1, the likelihood of full immunization in Model 2 increased further among both SC/ST and non-SC/ST children whose mothers have low/medium access to health facility. However in Model 2, SC/ST children whose mothers had higher access to health facility lost significance and become insignificant in Rajasthan and Odisha. Both cues to action variables – mother’s exposure to electronic media and place of delivery (in all the three states) have shown significant effect on the coverage of full immunization (Model 2, Table 7.4).

Model 3 (Model 1 + Modifying factors) assesses the ‘social group affiliation and access to health facility index’ interaction effects within different levels along with household and individual level socio-economic and demographic characteristics (other modifying factors) on full immunization in the three states. A clear interaction effect of ‘caste/tribe within different levels of access to health facility’ on full immunization is observed as in earlier Models 1-2. Results from Model 3 show that as compared with the reference category, SC/ST children (in all the three states) and non-SC/ST children (in Rajasthan and Madhya Pradesh) whose mothers had low and medium levels of access to health facility remain statistically significant and less likely to be fully immunized, after controlling for modifying factors. For instance, in Rajasthan and Madhya Pradesh, SC/ST children whose mothers had low and medium access to health facility were 58 and 50 per cent and 30 and 34 per cent less likely (for low and medium access, OR=0.418 and 0.503, and 0.696 and 0.659, in Rajasthan and Madhya Pradesh respectively) to be fully immunized as compared with the reference category. Similarly, non-SC/ST children whose mothers with low and medium access to health facility in Rajasthan were 51 and 62 per cent less likely (OR=0.494 and 0.376 respectively) to be fully immunized as compared with the reference category. Moreover, with the inclusion of other modifying factors in Model 3, the probability of SC/ST children whose mothers had low and medium access to health facility to be fully immunized increased noticeably (as compared with Model 1 and 2) in all the three states; and small increase among non-SC/ST children whose mothers had low and medium access to health facility in Rajasthan. On the other hand, in Madhya Pradesh, non-SC/ST children whose mothers had low and medium access to health facility lost significance become insignificant (Model 3, Table 7.4)

Among the modifying variables, household standard of living (index), mother’s education, mother’s exposure to electronic media and place of delivery (in all the three

states) father's education, mother's age at the time of child birth, and birth order (in Rajasthan and Madhya Pradesh) work status (in Rajasthan), household structure (in Odisha), residence (in Madhya Pradesh) show significant effect on the coverage of full immunization from the model. Sex of the child does not show any significance on coverage of immunization in the states.

In the full model (Model 4), variables from Models 1-3 are included simultaneously to assess the net effect of interaction variable on full immunization. As observed in Model 3, results in Model 4 also show that SC/ST (in all the three states) and non-SC/ST children (in Rajasthan) of mothers with low and medium levels of access to health facility, and SC/ST children of mothers with higher access to health facility (in Madhya Pradesh) remain statistically significant and less likely to be fully immunized after controlling for modifying factors. For instance, SC/ST children having mothers with low and medium access to health facility in Rajasthan were 48 and 57 per cent, and in Madhya Pradesh 26 and 30 per cent less likely (OR= for low and medium access, 0.433 and 0.524 and 0.737 and 0.698 in Rajasthan and Madhya Pradesh respectively) to be fully immunized as compared with the reference category. Similarly, in Madhya Pradesh, SC/ST children of mothers with higher access to health facility were 25 per cent less likely to be fully immunized as compared with the reference category. Though in some of interaction categories, the level of significance is diluted or resolved, there are marked differences in odds ratios between SC/ST and non-SC/ST children. In Odisha, interactions between social groups and access to health facility completely dissolved their level of significance.

Moreover between Models 1 and 4, the likelihood of children to be fully immunized increased further remarkably in the states. For instance, between Models 1 and 4, among SC/ST children whose mothers had low and medium access to health facility, the odds ratios increased from 0.162 to 0.433 and 0.218 to 0.524, respectively in Rajasthan; and from 0.275 to 0.737 and 0.283 to 0.698, respectively in Madhya Pradesh. Similarly between Models 1 and 4, among non-SC/ST children of mothers who had low and medium access to health facility the odds ratios increased from 0.258 to 0.529 and 0.258 to 0.374 respectively in Rajasthan. Thus, the results show the existence of strong interaction effect between 'social group affiliation and different levels of access to health facility (index)' on the coverage of childhood full immunization (Model 4, Table 7.4).

In short, results from both the bivariate and multivariate analysis show the existence of significant interaction effect between household social group affiliation and cues to action variables (programme factors) on coverage of full immunization in the states. From the above analysis lower coverage of full immunization is observed among both SC/ST and non-SC/ST children whose mothers were not exposed to media or delivered at home, or low and medium access to health facility in the states. On the other hand, with the introduction of programme factors, i.e., exposure to electronic media or delivery at institutions or higher access to health facility, the coverage of full immunization increases and that had increases coverage gap (full immunization) between SC/ST and Non-SC/ST children. Thus, the results show the existence of strong interaction between social group affiliation and programme exposure factors (cues to action variables).

Apart from positive impact of programme variables on coverage of full immunization, SC/ST children had significantly lower coverage of full immunization than non-SC/ST children. This directly indicates significant influence of social group affiliation on coverage of full immunization. For instance, the interaction effects between social group affiliation and exposure to media, and place of delivery show that for both SC/ST and non-SC/ST children whose mothers were not exposed to media or delivered at home, there was not only lower coverage of full immunization but virtually no difference in the coverage of full immunization between them in the states, after controlling other modifying and cues to action variables. On the other hand, the coverage of full immunization is high among both SC/ST and non-SC/ST children of whose mothers were exposed to media and delivered in institutions and the differences between them were also increases. Thus, coverage of full immunization was associated more closely with the programme factors, while social group affiliation of household really has some independent effect.

The results shows the existence of strong interaction effects ‘social group affiliation and exposure to media’, and ‘social group affiliation and place of delivery’ and ‘social group affiliation and access to health facility’ on full immunization in the states. From the analysis, there is clear evidence of impact of exposure to mass media, institutional delivery and higher accessibility of health facility on childhood

immunization across the social groups. These programme factors create favourable demand for immunization services, particularly among SC's and ST's.

Chapter 8 contains Summary and conclusions. It summarises all the findings of the study and gives a precise picture about child immunization coverage among children of SCs/STs in the selected states of India.

Table 7.1. Percentage distribution of children, and children aged 15-59 months fully immunized, according to interaction with social group affiliation (caste/tribe) and program factors (exposure to media, mothers place of delivery and access of health facility) in Rajasthan, Odisha and Madhya Pradesh

Caste/tribe interaction with program variables	Characteristics (%)			Fully immunized (%)		
	Rajasthan	Odisha	Madhya Pradesh	Rajasthan	Odisha	Madhya Pradesh
Caste/tribe by exposure to electronic media						
SC/ST-No exposure	22.1	17.9	22.7	15.1	27.4	26.4
Non-SC/ST- No exposure	32.4	12.6	22.5	14.4	47.0	34.9
SC/ST-Exposed	13.4	27.4	19.8	31.2	44.6	44.4
Non-SC/ST- Exposed	32.1	42.0	35.0	45.9	55.6	65.4
Caste/tribe and place of delivery						
SC/ST-Home delivery	27.8	36.8	36.0	18.9	34.2	31.1
Non-SC/ST-Home	43.0	27.3	37.8	18.9	49.7	43.1
SC/ST-Institutional	7.8	8.5	6.5	29.5	53.1	55.2
Non-SC/ST-Institutional	21.5	27.4	19.7	52.5	57.5	73.4
Caste/tribe by access to health facility (Index)						
SC/ST-Low	13.3	18.9	16.6	13.4	36.1	31.3
Non-SC/ST-Low	19.9	14.4	16.7	19.8	47.9	43.0
SC/ST-Medium	11.7	15.1	15.7	17.3	35.0	31.9
Non-SC/ST-Medium	21.8	18.4	17.7	19.8	57.8	51.7
SC/ST-High	10.6	11.4	10.1	35.3	44.4	45.0
Non-SC/ST-High	22.8	21.8	23.1	48.9	54.5	62.4
Total (%)	100.0	100.0	100.0	26.9	46.6	45.5
Total N	1519	1363	2520	1519	1363	2520

Data source: IIPS and ORC Macro, 2005-06, NFHS-3, Rajasthan, Odisha and Madhya Pradesh.

Table 7.2. Results of the multiple logistic regression analysis on full immunization with Caste/tribe and exposure to media interactions, along with select other background characteristics and programme factors in Rajasthan, Odisha and Madhya Pradesh

Characteristics	Reference category	Rajasthan (N=1519)				Odisha (N=1366)				Madhya Pradesh (N=2520)			
		Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Caste/tribe by exposure to media	Non-SC/ST-Exposed												
	SC/ST-Exposed	0.536***	0.615***	0.819	0.836	0.638***	0.727**	0.960	0.973	0.423***	0.530***	0.694***	0.722**
	Non-SC/ST-No	0.198***	0.322***	0.452***	0.501***	0.710*	0.756	1.053	1.039	0.284***	0.369***	0.654***	0.660***
	SC/ST-No	0.211***	0.339***	0.605**	0.659*	0.298***	0.358***	0.570***	0.567***	0.190***	0.272***	0.531***	0.546***
Residence	Rural												
	Urban			1.323*	0.889			0.742*	0.750			2.014***	1.761***
Household structure	Nuclear												
	Joint family			0.909	0.929			1.373***	1.390***			0.900	0.903
Standard of living	Low												
	Medium			1.200	1.173			1.659***	1.641***			1.052	1.048
	High			1.419*	1.201			2.223***	2.166***			2.328***	2.184***
Mothers' education	Illiterate												
	Primary			1.104	1.100			1.204	1.163			1.299**	1.267*
	Secondary+			2.261***	2.071***			1.627***	1.579**			2.032***	1.919***
Fathers' education	Illiterate												
	Primary			0.824	0.877			0.984	0.980			1.355**	1.319**
	Secondary+			1.467**	1.411*			0.963	0.955			1.344**	1.288**
Mothers' work status	Working												
	Not working			1.583***	1.641***			0.971	0.980			1.059	1.043
Mother's age at the time of child birth				1.409***	1.336***			0.966	0.956			1.189**	1.171**
Birth order	3+												
	1			2.160***	1.949***			1.187	1.156			1.542***	1.409**
	2			1.830***	1.786***			0.967	0.954			1.484***	1.430***
Sex of the child	Female												
	Male			0.996	0.971			1.175	1.171			0.970	0.942
Place of delivery	Home												
	Institution			2.175***	1.674***			1.437***	1.119			2.590***	1.596***
Access to health facility (Index)	Low												
	Medium			0.855	0.840			1.227	1.188			1.028	0.995
	High			2.299***	2.036***			1.187	1.004			1.327**	1.064

Note: Level of significance *** p≤0.010; ** p≤0.050; * p≤0.100; Model specifications: Model 1: Interaction variable without any controls; Model 2: Model 1+ Two other program variables; Model 3: Model 2 + Other modifying variables; Model 4: Model 1+Model 2+ Model 3.

Data source: IIPS and ORC Macro, 2005-06, NFHS-3, Rajasthan, Odisha and Madhya Pradesh.

Table 7.3. Results of the multiple logistic regression analysis on full immunization with Caste/tribe and place of delivery interactions, along with select other background characteristics and programme factors in Rajasthan, Odisha and Madhya Pradesh

Characteristics	Reference category	Rajasthan (N=1519)				Odisha (N=1366)				Madhya Pradesh (N=2520)			
		Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Caste/tribe and place of delivery	Non-SC/ST-Institution												
	SC/ST-Institution	0.378***	0.462***	0.718	0.696	0.836	0.854	1.147	1.127	0.446***	0.499***	0.629**	0.628**
	SC/ST-Home	0.211***	0.359***	0.588***	0.605**	0.385***	0.451***	0.734*	0.738*	0.163***	0.229***	0.471***	0.468***
	Non-SC/ST-Home	0.210***	0.354***	0.455***	0.486***	0.741**	0.800	1.030	1.038	0.273***	0.352***	0.574***	0.576***
Residence	Rural												
	Urban			1.189	0.853			0.734*	0.744*			1.940***	1.766***
Household structure	Nuclear												
	Joint family			0.838	0.933			1.347**	1.366**			0.894	0.904
Standard of living (Index)	Low												
	Medium			1.285	1.140			1.698***	1.640***			1.089	1.051
	High			1.737***	1.213			2.250***	2.153***			2.444***	2.190***
Mothers' education	Illiterate												
	Primary			1.192	1.098			1.204	1.157			1.323**	1.262*
	Secondary+			2.447***	2.075***			1.624***	1.562**			2.102***	1.922***
Fathers' education	Illiterate												
	Primary			0.920	0.859			1.009	0.996			1.382**	1.331**
	Secondary+			1.543**	1.382*			0.996	0.962			1.352**	1.288**
Mother's work status	Working												
	Not working			1.577***	1.604***			0.984	0.984			1.059	1.043
Mother's age at the time of child birth	Continuous												
	3+			1.365***	1.335***			0.953	0.951			1.175**	1.173**
Birth order	3+												
	1			1.968***	1.959***			1.148	1.142			1.427**	1.419**
	2			1.813***	1.788***			0.964	0.959			1.438***	1.439***
Sex of the child	Female												
	Male			0.964	0.962			1.171	1.185			0.950	0.945
Exposure to electronic media	Not exposed												
	Exposed			2.497***	1.680***			1.624***	1.282*			2.341***	1.422***
Access to health facility (Index)	Low access												
	Medium			0.865	0.852			1.218	1.181			1.041	0.999
	High			2.296***	2.048***			1.178	1.003			1.349***	1.073

Note: Level of significance *** p≤0.010; ** p≤0.050; * p≤0.100

Data source: IIPS and ORC Macro, 2005-06, NFHS-3, Rajasthan, Odisha and Madhya Pradesh.

Table 7.4. Results of the multiple logistic regression analysis on full immunization with Caste/tribe and access to health facility (index) interactions, along with other background characteristics and programme factors in Rajasthan, Odisha and Madhya Pradesh

Characteristics	Reference category	Rajasthan (N=1519)				Odisha (N=1366)				Madhya Pradesh (N=2520)			
		Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Caste/tribe and access to health facility (Index)	Non-SC/ST-High access												
	SC/ST-Low	0.162***	0.297***	0.418***	0.433***	0.472***	0.614***	0.970	0.965	0.275***	0.465***	0.696**	0.737**
	SC/ST-Medium	0.218***	0.354***	0.503***	0.524**	0.450***	0.593***	0.833	0.849	0.283***	0.466***	0.659***	0.698**
	SC/ST-High	0.572***	0.717	0.999	1.001	0.669**	0.782	1.033	1.030	0.494***	0.613***	0.729*	0.746*
	Non-SC/ST-Low	0.258***	0.451***	0.494***	0.529***	0.769	0.840	0.999	0.978	0.454***	0.729**	0.814	0.897
	Non-SC/ST-Medium	0.258***	0.333***	0.376***	0.374***	1.146	1.269	1.533**	1.114	0.644***	0.787*	0.935	0.944
Residence	Rural												
	Urban			1.136	0.861			0.797	0.768			2.137***	1.767***
Household structure	Nuclear												
	Joint family			0.925	0.923			1.371***	1.394***			0.906	0.906
Standard of living (Index)	Low												
	Medium			1.218	1.134			1.711***	1.648***			1.062	1.046
	High			1.538**	1.207			2.271***	2.100***			2.477***	2.197***
Mother's education	Illiterate												
	Primary			1.238	1.118			1.256	1.201			1.363***	1.271*
	Secondary+			2.717***	2.117***			1.698***	1.615**			2.217***	1.928***
Fathers' education	Illiterate												
	Primary			0.930	0.854			1.008	0.993			1.412***	1.315**
	Secondary+			1.519**	1.396*			0.978	0.943			1.406***	1.285**
Mothers' work status	Working												
	Not working			1.612***	1.621***			1.004	0.993			1.074	1.042
Mother's age at the time of child birth	Continuous			1.325**	1.344***			0.960	0.955			1.189**	1.170**
Birth order	3+												
	1			2.170***	1.978***			1.232	1.172			1.541***	1.409**
	2			1.834***	1.800***			0.991	0.969			1.472***	1.430***
Sex of the child	Female												
	Male			0.984	0.963			1.166	1.183			0.972	0.941
Exposure to electronic media	Not exposed												
	Exposed		2.587***		1.713***		1.633***		1.522**		2.342***		1.419***
Place of delivery	Home												
	Institutional		2.233***		1.716***		1.438***		1.282*		2.608***		1.596***

Note: Level of significance * p≤0.010; ** p≤0.050; * p≤0.100

Data source: IIPS and ORC Macro, 2005-06, NFHS-3, Rajasthan, Odisha and Madhya Pradesh.