











result of the recent introduction of the second dose, some parents still believe that immunization is limited to 9 months of age in Burkina Faso. Mothers resume their daily activities as their children gain some motor autonomy after one year of age. Immunization after this period is no longer a priority or they forget about it because of their busy lives.

A total of 125 children in this study did not receive a dose in the second year of life. The most common reasons reported by mothers were, in descending order, forgetting to immunize the child, lack of time to get to the health facility, and lengthy waiting time for immunization. In the 2020 Burkina Faso Immunization Coverage Survey, the reasons for not immunizing were classified into three categories for children aged 24 to 35 months. The top ranking was the lack of information with 55% of the reasons, the second was barriers (insecurity; busy mother/caregiver; covid-19 epidemic, and long distance to immunization services) with 27% and the third was lack of motivation with 12% [15]. In our context, failure to immunize children is not related to carelessness but rather to parents' lack of information and the constraints they face in fully immunizing their children. The time that elapses between the MR1 and MR2 immunization is quite long enough for a mother to remember her child's immunization date. In addition to forgetting the date, at 15 months of age, the child becomes increasingly independent and the mother returns to full-time activities after extended months of missed and irregular work. Since vaccination hours and working hours are the same, it is difficult for a working mother to wait for long periods in a health facility to immunize her child. Hence the interest in setting up strategies to remind mothers of the timing of their children's immunization and to involve men in the process of immunizing their children. In Tanzania, unawareness of the 15-18 months contact, unwillingness to open a vial for a few children, and lengthy waiting time were significantly associated with failure to immunize with MR2 [11]. Multiparous mothers were more likely to have their children immunized in the second year of life than primiparous mothers. Very often, multiparous mothers have already been in contact with immunization services, are more familiar with the immunization schedule, and know the benefits of immunization. Unlike young mothers who are in their first contact with immunization services and have to be educated about everything.

For health workers, the potential reason for not immunizing in the second year of life is the limited number of children required before a 10-dose vial can be opened, in addition to vaccine shortages. Results from other studies in Burkina Faso, sub-Saharan Africa, and Cambodia corroborate our findings [7]–[9], [17]. The recommended vaccine wastage rate is an EPI performance indicator set at 25%. Thus, opening a 10-dose vial of measles-rubella vaccine or meningococcal A vaccine for one or two children is a huge waste and decreases

the performance of the health facility. During a qualitative study conducted in Burkina Faso in 2018, a health worker said, «If it is one child or two children, you cannot open the 10-dose vial. A minimum of 5 children must be gathered to open it. However, if we only have 2 or 3 children attending a vaccination session, then we ask the mother to come back the following week, and that discourages them. In the same study, a district EPI manager said: "Imagine that I have 3 children for MR1 and 2 for MR2, for a total of 5 children. The minimum number of children required to open my 10-dose MR vial is met. On the other hand, it is not enough to open the MCVA vial as I only have 2 eligible children. Opening and administering 2 doses will result in a waste of 8 doses. Under such a situation, what should be done to minimize the wastage?" [9]. Reducing the number of doses per vial would reduce wastage and motivate healthcare providers to administer more doses at immunization sessions. In a study conducted in Zambia and released in 2020, health facilities were selected to receive 5-dose vials of measles vaccine for an assessment of the impact on immunization coverage compared to health facilities using 10-dose vials. The findings show an intervention effect of 5 percentage points for the first dose and an effect of 3.5 percentage points for the second dose. The wastage rate was 16.2% in facilities using 5-dose vials and 30.5% in those using 10-dose vials [8].

### Limitations of the study

Our sample included only two health districts in the central region. Thus, the Central Region is not representative of Burkina Faso, which has 13 health regions.

In addition, data collection took place during the rainy period. In rural and semi-urban areas, families were busy with rural activities. Some mothers were not available.

Some data on children's immunization status were collected based on the mother's recall and not based on the immunization record. Recall biases may influence raw immunization coverage.

### Conclusion

Not remembering to immunize a child, not having enough time to get to the health facility, waiting a long time for immunization sessions, and being a primiparous are community factors associated with poor immunization coverage in the second year of life. At the health system level, other than vaccine shortages, insufficient numbers of children to open a 10-dose vial, illness of the child on the day of immunization, and coming to the health facility outside of immunization days are the major factors associated with poor immunization coverage.

Targeted interventions are needed to address these contributing factors to poor immunization coverage. A needs

assessment study of the community and of the health facilities that are involved in immunization activities to strengthen the immunization of children in the second year of life would be useful.

## Conflicts of Interest

The authors declare no conflicts of interest

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