MISSED OPPORTUNITIES FOR VACCINATION ASSESSMENT REPORT:

findings, lessons learned and experiences from a high-performing middle-income country


MOV
Missed Opportunities
for Vaccination


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World Health
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Control and Prevention

CONTENTS

ACRONYMS

AEFI	adverse event following immunization
ANC	antenatal care
BCG	bacille Calmette-Guerin vaccine
CDC	US Centers for Disease Control and Prevention
DTaP-Hib-IPV+HBV	diphtheria, tetanus, acellular pertussis, Haemophilus Influenzae type B, inactivated polio vaccine, hepatitis B vaccine
DTP	diphtheria, tetanus and pertussis vaccine
EPI	Expanded Programme on Immunization
FGD	focus group discussion
HBV	hepatitis B vaccine
IDI	in-depth interview
IMCI	Integrated Management of Childhood Illnesses
IPV	inactivated polio vaccine
JOD	Jordanian Dinar
JSI	John Snow International
KAP	knowledge, attitude and practices
MCH	maternal and child health
MCV	measles-containing vaccine
MMR	measles, mumps, rubella vaccine
MNTE	Maternal and Neonatal Tetanus Elimination
MOH	Ministry of Health
MOV	missed opportunity for vaccination
NA	not available
ODK	OpenDataKit
OPD	outpatient department
OPV	oral polio vaccine
RV	rotavirus
SD	standard deviation
SMS	short message service
STI	sexually transmitted infection
TB	tuberculosis
Td	tetanus and diphtheria vaccine
TTCV	tetanus toxoid-containing vaccine
UNICEF	United Nations Children's Fund
USD	US Dollar
VPD	vaccine-preventable disease
WCBA	women of childbearing age
WHO	World Health Organization

EXECUTIVE SUMMARY

INTRODUCTION:

Missed opportunities for vaccination (MOV) can occur when an individual, who is eligible for vaccination, makes contact with health services but does not receive all eligible vaccinations. Reducing MOV can improve the equality of coverage and timeliness of vaccination, increase operational efficiency and satisfaction and minimize unnecessary costs to caregivers and households, particularly the disadvantaged. Jordan, a high-performing middle-income country, assessed the magnitude and types of MOV in order to reduce MOV among children and women of child-bearing age (WCBA).

METHODS:

We assessed the magnitude and type of MOV in Jordan among children aged under 2 years and WCBA aged 15–49 with documented vaccination records. We also identified the characteristics associated with a MOV occurrence, estimated the economic cost to households of a visit to a healthcare facility, and identified strategies to reduce MOV. In November 2017, we sampled 20 Expanded Programme on Immunization (EPI, or childhood vaccination) clinics and 13 maternal and child health (MCH) clinics in four of the twelve governorates in Jordan (Amman, Irbid, Ma'an and Mafraq). In these clinics, we conducted exit interviews with caregivers of children aged under 2 years and WCBA, so we could assess their experience and knowledge of childhood vaccines and vaccines during pregnancy (e.g. tetanus toxoid- containing vaccines (TTCV)) and their views on the quality of care received. We also interviewed healthcare providers at EPI and MCH clinics about their vaccination knowledge, including knowledge of vaccine contraindications and perceived reasons for MOV. We also held 72 focus-group discussions and in-depth interviews with caregivers and healthcare providers. Finally, we hosted a two-day brainstorming session in March 2018 with the Ministry of Health, and representatives and decision-makers from all districts, to validate our preliminary findings and discuss strategies to improve immunization services.

RESULTS:

MOV prevalence among eligible children aged under 2 years was 36 per cent (102 children in total). Higher MOV prevalence was estimated among children attending a clinic for a non-vaccination visit (65 per cent), children who did not possess a vaccination card at the time of interview (63 per cent), children of caregivers with no formal education (47 per cent), children of caregivers employed as laborers or employees (40 per cent), and older children (37 per cent among those aged 12–24 months versus 25 per cent for those aged 0–11 months).

On average, the cost of a visit to a clinic for those experiencing MOV was JOD 2.93 (4.13 US$). Almost every income category of caregivers experiencing MOV faced higher costs on average. Among WCBA, MOV could not be estimated because only 9 per cent had documented vaccination information even though 87 per cent recalled receipt of TTCV in school.

In general, caregivers reported positive experiences with vaccination and other healthcare services, including waiting times, awareness of the date of their next visit, access to clinics, and a friendly service. Caregivers' suggestions for improvement included the need to provide daily vaccination services and adapt opening hours to caregivers' work schedules, and to reduce crowding and increase staffing at healthcare centers. Caregivers also expressed a desire for better education about side effects following vaccination and how to respond.

Healthcare providers highlighted additional challenges that may result in MOV, including occasional vaccine stockouts, caregivers not bringing vaccination cards to every visit, and husbands either not fully supportive of vaccinations or of their wife traveling unaccompanied to the healthcare facility. Caregivers and healthcare providers both expressed concern about vaccinating an ill child, and a high proportion of providers had sub-optimal knowledge about vaccine contraindications and adverse events following immunization (AEFI). Providers were highly aware of TTCV, but only 43 per cent could recall the correct contraindications. Providers also indicated that children coming to the clinic for a non-vaccination visit were often not screened for their vaccination status: this was compounded by a perception that caregivers frequently do not bring the card to such visits.

CONCLUSIONS:

Strategies to strengthen the quality of immunization services, increase operational efficiency and satisfaction, and reduce MOV, particularly in the disadvantaged households, include the following: updating the national EPI policy; enhancing coordination and communication among various units in healthcare facilities; improving provider and caregiver knowledge of AEFI and vaccine contraindications; ensuring caregivers and WCBA know to bring the vaccination card to every visit (including non-vaccination visits); improving WCBA receipt and retention of a TTCV health card; and increasing the frequency and hours for clinics where vaccines are administered.

The findings of this assessment and proposed strategies may pertain to middle-income and Gavi transitioning countries that have high-performing immunization programs and systems. Undertaking and scaling up improvement strategies, with particular focus on equity and disadvantaged households, will require evidence-based advocacy and political will in individual countries. In this effort, UN and development partners, academia and civil society are encouraged to coordinate and support countries and immunization programs in generating evidence, influencing policies, mobilizing domestic resources, and providing technical and operational assistance.

ACKNOWLEDGEMENT:

This assessment would not have been possible without the leadership of the Jordan Ministry of Health, particularly Dr. Kamil AbuSell, national immunization manager and Dr. Nabil Qasim, national deputy immunization manager. UNICEF Middle East and North Africa (MENA) Regional Office (Nahad Sadr-Azodi), Headquarters Programme Division (Ulla Griffiths) and Jordan Country Office (Rami Hijazeen, Mohammad Amiri, Manal Tahtamouni) initiated this project in close technical collaboration with the World Health Organization (WHO) (Ikechukwu Udo Ogbuanu, Laura Nic Lochlainn, Lora Alsawalha) and US Centers for Disease Control and Prevention (Aaron Wallace, Zunera Gilani). Our sincere gratitude is extended to the 45 governorate supervisors and assessors and colleagues from Medair and Global Health Development who provided excellent support in interviewing participants, collecting data, and providing information technology and logistics support.

MOV ASSESSMENT IN CONTEXT:

This is the first MOV assessment undertaken in the MENA region and in a middle-income country using the revised 2015 WHO MOV strategy. It is also the first time a MOV assessment has included data collection on TTCV coverage among WCBA and the cost implications of healthcare visits for caregivers.

INTRODUCTION

As early as 1983, the Expanded Programme on Immunization (EPI) recommended using every healthcare sector encounter as an opportunity to vaccinate all eligible individuals whether they present for vaccination or other healthcare services. During these encounters, if an individual does not receive all the vaccinations for which they are eligible, a missed opportunity for vaccination (MOV) has occurred. MOV can occur in two major settings: 1) during visits for immunization and other preventive services (e.g. growth monitoring, nutrition assessments, oral rehydration training sessions, etc.), and 2) during visits for therapeutic services.

There are several benefits to reducing MOV. From a disease reduction standpoint, reducing MOV has the potential to improve the coverage equality and timeliness of vaccination, particularly when the availability and use of healthcare services are high. When the availability and use of healthcare services are low, immunizing at any healthcare contact is important because the risk of vaccine-preventable diseases is likely to be high in these settings. From an operational standpoint, addressing MOV has the potential to reduce the number of visits to healthcare facilities, which can increase satisfaction and minimize costs to both the households, particularly the disadvantaged, by reducing the number of return visits required and to the healthcare sector by reducing workload pressures.

Several MOV assessments were conducted throughout the 1980s and 1990s, and were summarized in a WHO-commissioned global review. This estimated MOV to be at 30 per cent among children and women[1] . WHO, in collaboration with JSI, CDC, UNICEF and other immunization partners, subsequently updated and piloted the global guidelines for conducting a MOV assessment.

In 2016, Jordan's estimated vaccination coverage for the third dose of diphtheria, tetanus and pertussis (DTP3) and second dose of measles-contacting vaccine (MCV2) was 98 per cent and 99 per cent, respectively[2]. Although high, this coverage may conceal other issues related to the inequalities and timeliness of vaccination. Similarly, despite the high vaccination coverage for DPT3 among children, the proportion of women of childbearing age (WCBA) who received their second and subsequent tetanus toxoid-containing vaccines (TTCV) (TT2+) was 30 per cent[3]. The aim of this MOV assessment in Jordan was therefore to highlight opportunities to reduce coverage disparities and increase the efficiency of vaccine delivery to both children and WCBA.

The objectives of this MOV assessment were to:

- Document the type and magnitude of MOV in children under 2 years of age and WCBA aged 15–49;
- Identify the characteristics associated with MOV in children under 2 years of age and WCBA aged 15–49;
- Explore what can be adjusted or done differently to reduce MOV and improve vaccination coverage and equity; and
- Estimate the costs to households of a visit to a healthcare facility.

1 SS Hutchins et al. Studies of missed opportunities for immunization in developing and industrialized countries. Bull WHO, 1993; 71(5):549–560

2 WHO/UNICEF. WHO and UNICEF estimates of immunization coverage: 2016 revision. https://data.unicef.org/wp-content/uploads/country_profiles/Jordan/immunization_country_profiles/immunization_jor.pdf

3 Maternal and Neonatal Tetanus Elimination (MNTE) [website] Geneva: World Health Organization.http://www.who.int/immunization/diseases/MNTE_initiative/en/index3.html

METHODS

DEFINITIONS

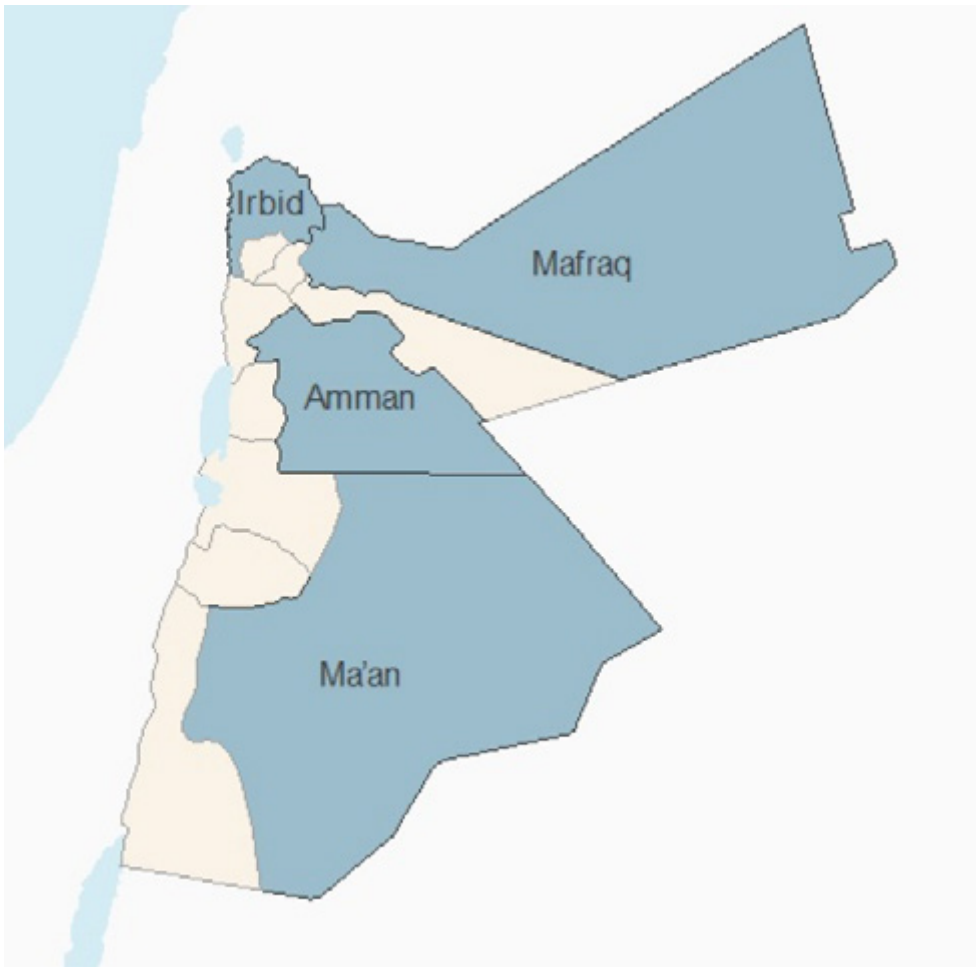
A MOV was defined as any contact with healthcare services by a child or WCBA who was eligible for vaccination (i.e., unvaccinated, partially vaccinated, or not up-to-date, and free of contraindications to vaccination), which did not result in the individual receiving all the vaccine doses for which he or she was eligible. A caregiver was defined as a person aged ≥15 years with responsibility for a child under 2 years of age at the healthcare facilities they had visited on the day of the survey. An EPI clinic was defined as a unit within a healthcare facility where childhood vaccinations are routinely provided, and a maternal child health (MCH) clinic as a unit within a healthcare facility where children receive healthcare and WCBA receive reproductive health services, including TTCV vaccinations.

To calculate the financial cost of visiting a healthcare facility, we estimated the opportunity and transport costs. Opportunity costs are those costs incurred by a caregiver as a result of visiting a healthcare facility and so not working, for example, lost wages. Transport costs were costs needed to travel to and from the healthcare facility.

SAMPLING

The administrative regions we studied were sampled to provide a spread of socio-economic status, geographical (north, central and southern Jordan) and residential (urban and rural) locations and population size. We aimed to sample 15 EPI clinics and 30 MCH clinics in four of the 12 districts in Jordan (Figure 1).

Figure 1: Location of missed opportunities for vaccination (MOV) assessments



In each clinic we visited, a target was set for each team to conduct 10 caregiver interviews, 10 WCBA interviews and 10 knowledge, attitude and practices (KAP) questionnaires with providers. One in-depth interview (IDI) was conducted with a key informant (senior member of staff or healthcare administrator) for each healthcare facility. We also set a target to conduct 15 focus-group discussions (FGDs) with mothers/caregivers and 15 FGDs with providers (Table 1).

Table 1: Overview of fieldwork activities

Activity	Target	(%) Achieved
Child exit interviews(with caregivers)	450	428 (95%)
WCBA exit interviews	450	465 (>100%)
MCH and EPI provider knowledge, attitudes and practices (KAPs)	450	432 (96%)
FGD – caregivers	15	13 (87%)
FGD – healthcare providers	15	13 (87%)
IDI	45	40 (89%)

DATA COLLECTION

Data collection teams were trained from 7 to 9 November 2017 on the background of MOV and the methodology for this assessment. They were trained to use the data collection tool, which was an Android tablet installed with open-source software OpenDataKit (ODK). The teams piloted the data collection tool before conducting the assessment between 11 and 14 November 2017. All caregivers, WCBA and healthcare providers gave verbal consent to participate.

QUANTITATIVE DATA COLLECTION

The MOV assessment among children <24 months of age and WCBA consisted of caregiver interviews at EPI clinics, provider interviews at EPI clinics, WCBA interviews at EPI and MCH clinics, provider interviews at MCH clinics, vaccination record reviews, separate focus group discussions (FGDs) with caregivers and WCBA, and in-depth interviews (IDIs) with key informants.

Data collection for the MOV assessment among children

At each healthcare facility, teams interviewed caregivers as they exited, regardless of their reason for visiting. Caregivers were pre-screened for the age eligibility of the child in their care. Interview questions probed socio-demographic information, knowledge of vaccination schedules, sources of vaccination information, reported experiences of being turned away for the child's vaccination, health card ownership, reasons for any missed vaccinations, and perceptions of the quality of vaccination services. Vaccination records for each interview were extracted from vaccination cards or facility registers (paper or electronic) and entered into the tablets. A photo of the vaccination card was also taken for data validation purposes.

To estimate the cost of visiting a healthcare facility, caregivers were asked what type of transport they used, the cost and time needed to get to the clinic, their monthly income range and employment type, what medical costs they had incurred during their most recent visit, any childcare costs incurred during the visit, and how much time they had spent at the facility.

Healthcare providers were interviewed about their vaccination KAP related to childhood vaccinations and MOV.

Data collection for the MOV assessment among WCBA

Teams interviewed WCBA as they left the healthcare facility, regardless of their reason for visiting. WCBA were pre-screened for age eligibility before taking part. Interview questions explored socio-demographic information, knowledge of WCBA vaccination schedules, sources of WCBA vaccination information, experiences of being turned away for vaccination, vaccination card ownership, reasons for any missed WCBA vaccinations, and perceptions of the quality of WCBA vaccination services.

To estimate the cost of visiting the facility, we asked WCBA which type of transport they used and what the costs were, their monthly income range, medical costs incurred during their most recent visit, any childcare costs incurred during the visit, and how much time they had spent at the facility.

Providers at EPI clinic and MCH clinics were also interviewed about MOV among WCBA.

QUALITATIVE DATA COLLECTION

On the final day of the assessment, the survey teams conducted FGDs and IDIs at healthcare facilities. They interviewed caregivers in the morning and providers in the afternoon. Discussion topics included vaccination services, vaccine compliance, MOV and integration. The questions were open-ended to allow participants flexibility in responding.

DATA ANALYSIS

QUALITATIVE DATA ANALYSIS

For quantitative data analysis, we calculated the frequencies or means for each indicator collected in the interviews with caregivers, WCBA, and providers. Children aged >24 months and WCBA aged <15 years or >49 years were excluded from the analysis. All quantitative analyses were conducted using Stata 14 software.[4]

Records that did not include the respondent's vaccination record or date of birth were excluded from the analysis. To determine when respondents had experienced a MOV, we used the Jordanian vaccination schedule and eligibility criteria for vaccinations (Table 2 (child) and Table 3 (WCBA)) and vaccination contraindications. We also considered the age cut-off for receipt of vaccinations when determining MOV among children <24 months of age, e.g. rotavirus (RV) and single-antigen measles vaccine. Records for respondents who were due at least one vaccination on the day of the interview were included in the calculation of MOV, while respondents with a valid contraindication for vaccination were excluded. The contraindications, as defined by the Jordanian Ministry of Health, were:

- The doctor/nurse said the child/WCBA could not be vaccinated because s/he was sick;
- Major illness requiring admission, such as severe pneumonia or severe malaria;
- Child/WCBA taking cancer medication or cortisone;
- Child/WCBA has HIV or AIDS; and/or
- The last time the child/WCBA was vaccinated, s/he became ill or had an adverse reaction

Thus, all eligible respondents without a valid contraindication and who did not receive all the doses for which they were due on the day of the interview were considered to have experienced a MOV. Note that respondents who were due for more than one dose in a multi-dose series (for instance, a child due for OPV2 and OPV3 within the OPV four-dose series) and who received one of these doses were not considered to have experienced a MOV for that antigen.

4 StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

Table 2: Jordanian child vaccination schedule

Age	Recommended Vaccines		
1st contact	BCG		
2 months	DTaP-Hib-IPV+HBV		RV1*
3 months	DTaP-Hib-IPV+HBV	OPV1	RV2**
4 months	DTaP-Hib-IPV+HBV	OPV2	RV3**
9 months	Measles***	OPV3	
12 months	MMR1		
18 months	DTP	OPV4	MMR2
6 Years (First Grade)	Td	OPV5	check for MMR
16 Years (Tenth Grade)	Td		check for MMR

*children no longer eligible for RV1 after 120 days of age

**children no longer eligible for RV2 or RV3 after 240 days of age

***children no longer eligible for single antigen measles after 1 year of age

Jordan's TTCV vaccination schedule for WCBA is shown in Table 3 (below). The timing of TTCV doses was considered when determining MOVs for WCBA.

Table 3: Jordanian TTCV vaccination schedule for women of childbearing age

Dose	When given		
TT1	At first contact	or	At first contact or at 1st pregnancy
TT2	At least 4 weeks after TT1		
TT3	At least 6 months after TT2	or	during second pregnancy
TT4	At least 1 year after TT3	or	during third pregnancy
TT5	At least 1 year after TT4	or	during fourth pregnancy

CALCULATION OF COSTS TO HOUSEHOLDS

We estimated the costs to households of a visit to a healthcare facility in Jordanian Dinar (JOD) as follows:

- We calculated the opportunity cost (i.e., wages lost due to time spent at the clinic) by multiplying the mid-point of an individual's reported income range (calculated in per-minute increments) by the assumed length of the visit (60 minutes);
- We added to this transport costs to and from the healthcare facility; and
- We calculated the opportunity cost of time spent travelling by multiplying the mid-point of an individual's reported income range (calculated in per-minute increments) by the reported time it took to travel to and from the healthcare facility.

We also calculated the mean cost of a visit across all surveyed caregivers or WCBA, and repeated our calculations using the Jordanian reported minimum wage for housewives without employment income[5].

QUALITATIVE DATA ANALYSIS

For qualitative data analysis, we used a thematic approach. The purpose of this approach was to condense raw text data from the FGDs and IDIs into a summary format by developing themes that reflected recurrent patterns in participants' reported experiences. We summarized information across all caregiver or provider FGDs/IDIs by question, identified key themes that arose under each major topic area, and then coded each FGD/IDI. Key themes were summarized under the following major topic areas:

- general attitudes and experiences with vaccination;
- MOV-specific attitudes and experiences; and
- suggestions for strategies to reduce MOV.

We also collected spoken testimony, and present some examples in this report to illustrate the essence of particular themes.

Finally, a two-day brainstorming session was held in March 2018 with the Minister of Health and representatives and decision-makers from all administrative regions to validate the preliminary findings and discuss options for improvement.

5 https://www.nordeatrade.com/se/explore-new-market/jordan/work-conditions

RESULTS

Our data collection teams visited 14 EPI clinics and 29 MCH clinics in four administrative regions (Amman, Irbid, Mafraq and Ma'an) (Figure 1 above). Data collectors interviewed 428 caregivers, 465 WCBA (273 at EPI clinics and 192 at MCH clinics), and 432 providers. Across all clinics, 13 FGDs among caregivers, 13 FGDs among providers, and 40 IDIs among key informants in health-care facilities were conducted. Vaccination cards were available for 86 per cent of children aged <24 months (369/428) and among 9 per cent of WCBA (44/465).

CAREGIVER AND CHILD DEMOGRAPHICS

Nearly all caregivers surveyed were mothers (n=398; 93 per cent). Most were literate (n=401; 94 per cent), with 41 per cent having completed secondary school (n=175) and 37 per cent having more than a secondary school education (n=156). Eighty per cent (n=342) of caregivers described themselves as housewives (Supplementary Table 1 in the Annex). Of the 428 children interviewed, 427 had a valid date of birth and were <24 months of age. Table 4 (below) shows that 52 per cent of children were male and 80 per cent were aged 0–11 months. Most children were brought to a healthcare facility for vaccination (n=292; 68 per cent) and 26 per cent (n=112) were brought for medical consultation.

Table 4: Characteristics of surveyed children < 24 months old (n=427)

	N	%
Sex		
Male	224	52.46
Female	203	47.54
Age		
<2 months	87	20.37
2 - <3 months	39	9.13
3 - < 4 months	53	12.41
4- < 9 months	88	20.61
9 - <12 months	73	17.10
12 - < 18 months	45	10.54
18+ months	42	9.84
Reason brought to facility		
For medical consultation (child is sick)	112	26.23
For vaccination	291	68.15
Healthy child visit or growth/development check-up	37	8.67
Child is only accompanying (not for treatment, vaccination)	27	6.32
Hospitalization (child was admitted or is still on admission)	0	0.00
Other	0	0.00

WCBA DEMOGRAPHICS

Approximately half (46 per cent) of the WCBA interviewed were aged 20–29 years, while 37 per cent were 30–39 years old. Most WCBA surveyed (82 per cent) were not pregnant at the time of the interview. A majority of WCBA were highly educated, with a third having completed post-secondary education and 44 per cent with secondary school education. A large majority (79 per cent) were employed as housewives, followed by 16 per cent as laborers or employees. One-third of the WCBA interviewed presented at the facility for a therapeutic care consultation, followed by 23 per cent for a maternal–child healthcare visit, 14 per cent for their own vaccination, and 14 per cent accompanying someone else for vaccination (Supplementary Table 2 in the Annex).

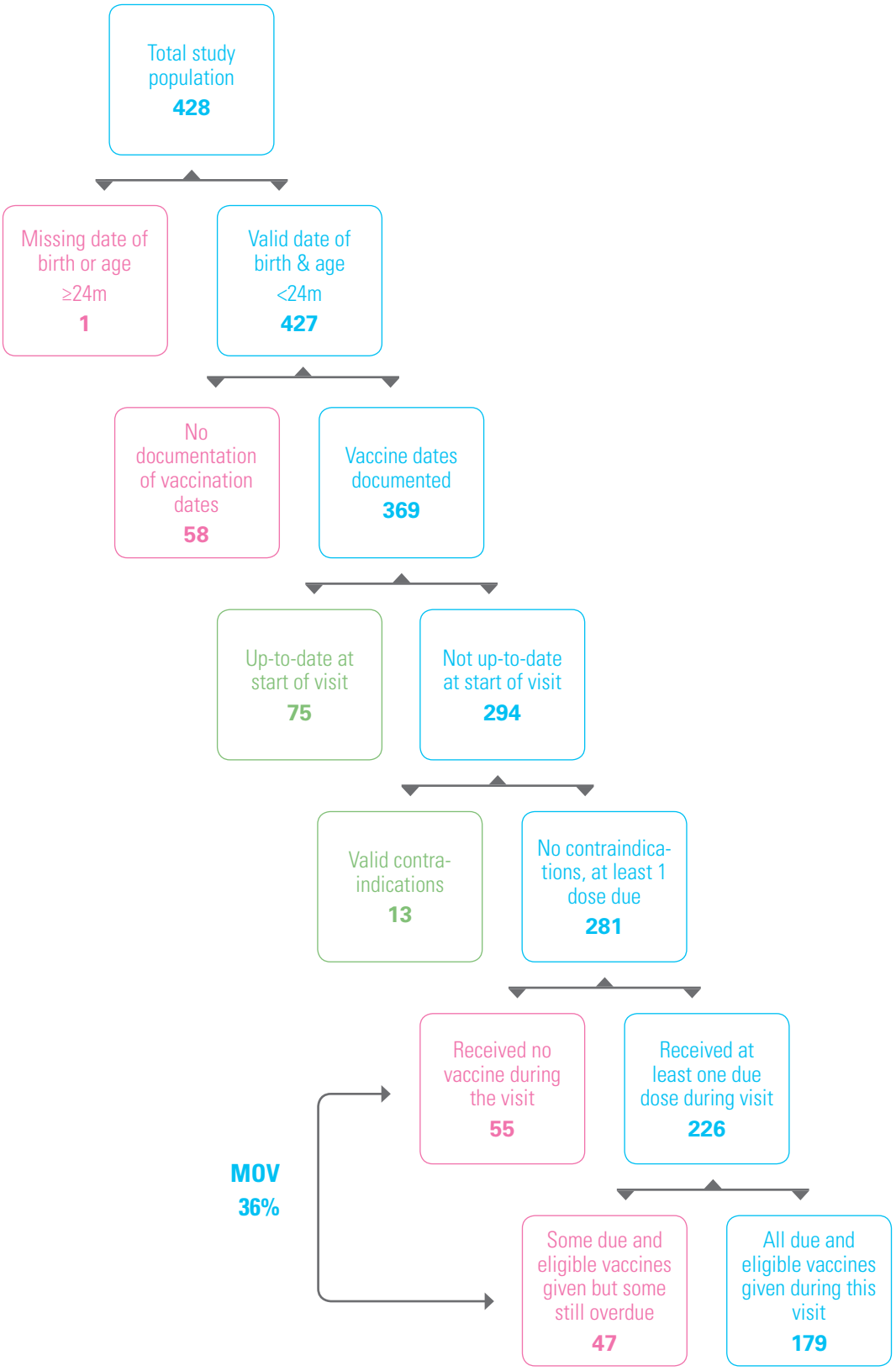
PROVIDER DEMOGRAPHICS

More than three-quarters (78 per cent) of providers interviewed were female and 45 per cent were aged between 30 and 39. Just over one-third (37 per cent) were nurses and 16 per cent were doctors; the remainder were a mix of other healthcare provider types working in a variety of units (Supplementary Table 3).

MOV AMONG CHILDREN UNDER TWO YEARS OLD

Fifty-eight (14 per cent) of children (through their caregivers) interviewed did not have documentation of their vaccination dates. At the start of their visit, 20 per cent of children (n=75) were already up-to-date with their vaccinations. Among the 294 children who were not, 13 met the criteria for contraindications to vaccination, while 281 were due at least one dose of vaccine. Of these 281 children, 226 received at least one due dose during the visit, while 55 received no vaccine during their visit. Among these 226 children, 179 received all due and eligible vaccines and 47 received some due and eligible vaccines during their visit. **Overall, 102/281 (36 per cent) of children <24 months had a MOV on the day of the interview (Figure 2).**

Figure 2: Health facility-based flow-chart for determining missed opportunities for vaccination (MOV) among surveyed children < 24 months old



OPV1 was the most frequently missed vaccination dose (n=30; 29 per cent), followed by OPV3 (n=23; 23 per cent) and the first dose of pentavalent/hexavalent vaccine (n=19; 19 per cent) (Table 5).

Table 5: Vaccinations due for children < 24 months old with a missed opportunity for vaccination (n=102)

	N	%
BCG	8	7.84
OPV1	30	29.41
OPV2	7	6.86
OPV3	23	22.55
OPV4	9	8.82
Penta/Hexa1	19	18.63
Penta/Hexa2	11	10.78
Penta/Hexa3	11	10.78
Rota1	10	9.80
Rota2	12	11.76
Rota3	2	1.96
Single antigen measles	11	10.78
MMR1	8	7.84
MMR2	1	0.98
DTP	7	6.86

Among the 238 children that were at the facility for a vaccination visit and were eligible for at least one due dose, 61 (26 per cent) had a MOV. About two-thirds (65 per cent) of the 75 children that were at the facility for a non-vaccination visit (including medical consultation, check-up, or child accompanying adult) experienced a MOV (Table 6).

Table 6: Missed opportunities for vaccination among children < 24 months old by reason for visit*

		Child-based MOV		
	Children with documented vaccination dates	No. of children with 1+ eligible doses due	Proportion of children with 1+ missed opportunities for vaccination	
	n	n	n	%
Vaccination visit	276	238	61	25.63
Non-vaccination visits				
• Medical consultation	80	46	33	71.74
• Healthy child visit or check-up	31	21	9	42.86
• Child is accompanying adult	20	8	7	87.5
Non-vaccination visit total	232	75	49	65.33
Total	369	282	102	
*Multiple responses allowed				

There was no gender difference among children experiencing a MOV. However, older children were more likely to experience a MOV than younger children (37 per cent of children aged 12–24 months versus 25 per cent aged 0–11 months experienced a MOV). Children of caregivers with no formal education were more likely to experience a MOV (n=19, 47 per cent) compared with children of caregivers with primary or secondary education (range: 8–9 per cent). A slightly higher proportion of children of caregivers who were laborer or employees experienced a MOV (40 per cent) compared with children whose caregivers were housewives (26 per cent). Children who did not possess a vaccination card during the visit were also more likely to experience a MOV (63 per cent) compared with those who brought a vaccination card to the clinic (24 per cent). Supplementary Table 4 has a full breakdown of these figures.

CAREGIVER-REPORTED EXPERIENCES WITH VACCINATION SERVICES

Quantitative results

As a first step for determining vaccination eligibility, 66 per cent of caregivers were asked by providers for the child's vaccination card during the facility visit. Among those not asked for the card, 87 per cent were also not asked about the child's vaccination status. Also, among caregivers who reported that their child had been due for a vaccination dose on the day of the interview but had not received it, approximately one-third (34 per cent) indicated that the provider did not refer them (Supplementary Table 5).

During the visit, caregivers generally reported short waiting times, with nearly 70 per cent indicating waiting times of under 15 minutes (n=185; 69 per cent) (Supplementary Table 6).

Most caregivers were informed by staff about the vaccines their child had received (n=176; 66 per cent). Among caregivers whose child received vaccination services on the day of the interview, 92 per cent indicated that providers had told them the date of their next vaccination appointment. Most (89 per cent) had the date of the next appointment written down, and most (84 per cent) received information about reactions or side effects (Supplementary Table 6 in Annex).

Supplementary Table 6 also indicates that most caregivers (90 per cent) attending for vaccination services reported being satisfied with the services provided and most (73 per cent) were also satisfied with the immediate attention and friendly treatment by providers (82 per cent). However, some caregivers were not satisfied by long waiting times for vaccination (64 per cent), discourteous staff (50 per cent), and a lack of explanation about the vaccinations their child had received (50 per cent). When questioned about their knowledge of vaccination, only 60 per cent of caregivers felt they knew what vaccines their child needed, and of these, 92 per cent knew when these vaccines should be given (Supplementary Table 7; Supplementary Table 8 shows caregivers' knowledge about vaccination cards and vaccines).

Qualitative results

During FGDs among caregivers, the following MOV-related themes emerged:

- provider–patient interactions;
- efficiency of service delivery;
- vaccination confidence; and
- barriers to vaccination barriers.

In discussions, caregivers reported overall satisfaction with healthcare services, particularly vaccination services. Several caregivers mentioned that services were delivered quickly and that they were treated well during their interactions with healthcare providers. However, some caregivers reported dissatisfaction with longer than expected waiting times and suboptimal quality of service delivery. These included lack of providers, insufficient space when waiting for services in the clinic, and lack of daily availability of vaccination services, which was thought to lead to inefficient delivery of vaccinations. In one FGD, caregivers mentioned the following challenges to the efficient delivery of healthcare services:

"Computer systems delay services. It takes a long time to register information in the card, record, mother's card, and computer. There is a need to increase health staff as there are only two nurses and we have to wait a long time since they have many tasks they must do." – FGD, Amman

Several caregivers also reported concerns about fever following vaccination and insufficient information being provided on how to handle adverse events following immunization (AEFI). This reinforced the quantitative findings.

Caregivers noted a number of barriers that could preclude them from completing the national childhood vaccination schedule. These included the distance from home to the clinic, insufficient funds to pay for transport, lack of caregiver awareness of the need to return for vaccination, husbands not fully supportive of childhood vaccination, conflicts with caregivers' work schedule, vaccine stockouts, and lost health cards.

CAREGIVER-REPORTED EXPERIENCES WITH MOV AMONG CHILDREN

Quantitative results

When questioned about their experience and awareness of vaccination, a small minority (12 per cent) of caregivers indicated that they had requested vaccination services for their child in the past and had been refused. Among these respondents, the reasons given for being turned away included (Supplementary Table 9):

- 40 per cent (n=21) – medical professional said the vaccination could not be done because the child was sick;
- 17 per cent (n=9) – no vaccines or related materials available at the healthcare facility; and
- 15 per cent (n=8) – not a vaccination day at the healthcare facility.

The caregivers of the 160 children who were due for vaccination on the day of the survey but did not receive it gave several reasons for this outcome (Supplementary Table 10). These included:

- (n=30) – provider said child was ineligible for vaccination that day;
- (n=24) – lack of vaccination on that day; and
- (n=19) – provider said child was sick and so could not be vaccinated.

Qualitative results

The qualitative findings generally reinforced the findings from the caregiver survey, while also indicating additional reasons why MOV occur. During their FGDs, caregivers reported several provider-based reasons for MOV. These related to provider–patient interactions and vaccination barriers:

- lack of providers to screen for, and provide, missed vaccinations;
- lack of daily vaccination sessions;
- provider concern about wasting measles and BCG vaccines and so only vaccinating a small number of children;
- turning away a child considered too ill for vaccination;
- reported maltreatment of the caregiver by the provider; and
- caregivers being turned away because they did not have the child's vaccination card.

In one FGD, the following vaccination barrier was noted:

"Providers should treat mothers and children in a friendly way and use smiles instead of getting angry." – FGD, Hwara.

In their FGDs, caregivers also reported several reasons for MOV that affected caregivers' confidence and so acted as barriers:

- caregivers' concern about vaccinating an ill child;
- side effects following vaccination;
- lack of caregiver awareness that they could ask about vaccination while at the facility for a non-vaccination appointment;
- husbands refusing to allow the child to receive a missed vaccination; and
- not having the vaccination card with them.

PROVIDER-REPORTED CHILDHOOD VACCINATION KNOWLEDGE, ATTITUDES AND PRACTICES

Quantitative results

Providers who indicated they were primarily employed for EPI services (n=35) had high awareness of the vaccines that healthy children should receive (range: 97–100 per cent; Supplementary Table 11). However, only two-thirds of these 35 providers knew the correct contraindications for polio vaccination (Supplementary Table 12). Nearly all (range by vaccine: 94–100 per cent) were correctly aware of the recommended minimum age to administer measles-containing vaccines. Forty per cent believed that their knowledge of vaccination for children was insufficient or outdated (Supplementary Table 12, and Supplementary Table 13 for further information about healthcare worker practices towards the vaccination of WCBA).

Of the 432 providers interviewed across all services, 46 per cent expressed concern about AEFI (Supplementary Table 14).

Qualitative results

In their FGDs and IDIs, healthcare providers and key informants reported that caregivers were generally highly compliant with the national vaccination schedule. They noted that the key barriers to high vaccination compliance were:

- travelling distance from healthcare facilities;
- inability to attend vaccination services due to work schedules;
- caregiver concerns about vaccinating a sick child;
- husbands who were unsupportive of their child getting vaccinated due to lack of confidence in the vaccine and/or refusal to let wives travel to the health centre alone; and
- long waiting times.

Respondents suggested there was a need to bring in remind–recall interventions for caregivers, such as SMS reminders or phone calls, as well as household visits to caregivers of children who have defaulted for vaccination.

PROVIDER-REPORTED MOV AMONG CHILDREN

Qualitative results

In their FGDs and IDIs, providers gave multiple reasons for MOV which generally fell into the vaccination barriers theme. Those most commonly cited were:

- provider uncertainty about the correct contraindications for vaccination;
- lack of review of the child's vaccination card, or lack of a vaccination card altogether; and
- fathers who refused vaccination for the child.

Where the vaccination card was not presented, providers could not determine whether the child was eligible for vaccination:

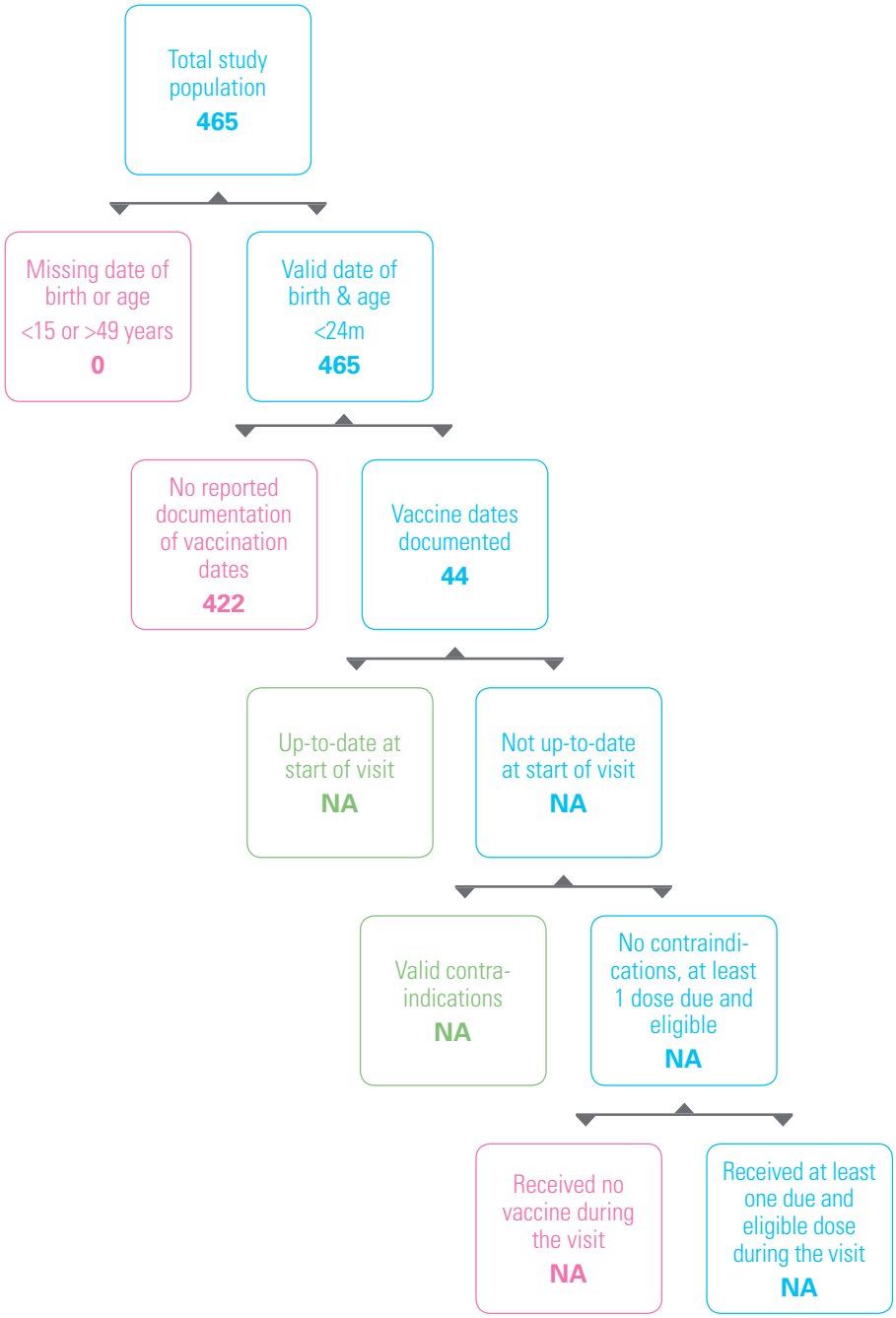
"There are not any records for the child's vaccination status except for the vaccination card, so the doctors do not have sufficient knowledge of vaccines...advise the mother of the importance of bringing the vaccination card each time she visits the center." – Doctor, Abu Nussair

MOV AMONG WOMEN OF CHILDBEARING AGE

MISSED OPPORTUNITIES FOR VACCINATION AMONG WCBA

A full estimation of the proportion of WCBA with a MOV was not feasible, as only 9 per cent (n=44) of the 465 WCBA surveyed had documented information available regarding TTCV vaccination (Figure 3).

Figure 3: Health-facility-based flow-chart for determining MOV for tetanus toxoid (TT) among WCBA



Additionally, among these 44 women, data were incomplete and did not allow us to determine how many were up-to-date with their vaccines and how many had received vaccine doses that were due on the day of the interview.

WCBA VACCINATION STATUS

A total of 87 per cent of WCBA (n=406) reported receiving school-based TTCV by recall. Of these, 76 per cent (n=308) recalled the number of doses they had received. A majority received either one (31 per cent) or two (43 per cent) TTCV doses, and 19 per cent recalled receipt of three TTCV doses in school. During pregnancy, 44 per cent of WCBA (n=205) indicated they had received a TTCV dose (Supplementary Table 15).

Vaccine verification by card was limited, as only 35 per cent of women indicated they owned an adult TTCV card and only 10 per cent indicated they were in possession of the card at the interview (Supplementary Table 16). However, using both health cards and healthcare facilities' registers, we found that there was complete information for a total of 44 WCBA regarding their TTCV status. Of these, 89 per cent indicated receiving one TTCV dose, 61 per cent indicated receiving two TTCV doses, 27 per cent indicated receiving three TTCV doses, 9 per cent indicated receiving four TTCV doses, and 2 per cent indicated receiving five TTCV doses (Table 7 below).

Table 7: Receipt of adult tetanus vaccination by vaccination card or register among women of childbearing age (n=44)

Dose	N	%
TTCV1	39	88.64
TTCV2	27	61.36
TTCV3	12	27.27
TTCV4	4	9.09
TTCV5	1	2.27

WCBA EXPERIENCES REGARDING VACCINATION

Only 4 per cent (n=18) of WCBA said they had been refused TTCV on previous visits. Reasons given for refusal included lack of a vaccination card (n=3), or the provider refusing to administer the vaccine because the woman was sick (n=3) (Supplementary Table 15).

Thirteen women had received TTCV vaccination on the day of the interview (Supplementary Table 17). Among the 389 women who indicated they were not vaccinated on the day of their visit, 55 gave reasons related to providers:

- (n=41) – the doctor/nurse said the WCBA was already completely vaccinated; and
- (n=10) – the doctor/nurse said the WCBA could not be vaccinated because they were sick.

Eight WCBA provided a reason related to a medical condition, with all but one reporting minor illness. For the 323 WCBA who were not vaccinated on the day of their visit, the majority reported that vaccination was not the purpose of the visit (n=197) or that they were already fully vaccinated (n=43) (Supplementary Table 17).

PROVIDER WCBA VACCINATION KNOWLEDGE, ATTITUDES AND PRACTICES

Supplementary Table 12 indicates that a large majority of providers knew that TTCV vaccine should be provided to WCBA (n=315; 79 per cent) and that 94 per cent knew the schedule for WCBA TTCV vaccination (n=373). Only 43 per cent (n=171) of MCH or other types of provider knew the contraindications to being vaccinated with TTCV, but 60 per cent of all 432 providers surveyed (n=260) knew the absolute contraindications for any vaccine. A large majority (64 per cent) of providers believed that their knowledge of vaccination for WCBA was insufficient or outdated. Across the 397 MCH or other types of provider, more than half (n=254; 64 per cent) believed that their knowledge of WCBA vaccinations was insufficient or outdated.

HEALTH FACILITY VISIT COST ANALYSIS

On average, the cost of a visit to a clinic for those experiencing MOV was JOD 2.93 (4.13 US$). Almost every income category of caregivers experiencing MOV faced higher costs on average. Across all surveyed caregivers, including those experiencing MOV, the mean economic cost of a healthcare facility visit was JOD 2.69 (3.79 US$). According to the Arab Trade Union[6], the Jordanian minimum wage is estimated at around JOD 220 (equivalent to around USE 310) per month. An average of 39 per cent of the healthcare facility visit was composed of transport costs, with the remaining 61 per cent comprising the respective opportunity costs of the visit itself (49 per cent) and travelling time (12 per cent). The majority of caregivers used vehicles for transport (63 per cent) or walked (28 per cent), and 81 per cent of caregivers had <15-minute transit time to the healthcare facility (Supplementary Table 1). The cost of a visit exhibited a general upward trend as the caregiver income category increased (Supplementary Table 18).

Across all surveyed WCBA, the mean economic cost of a visit was JOD 2.15 (3.03 US$). An average of 44 per cent of the cost of the visit comprised transport costs and the remainder was composed of the respective opportunity costs of the visit (46 per cent) and travel time (11 per cent). Again, most WCBA used vehicles for transport (54 per cent) or walked (34 per cent), and 76 per cent of WCBA had <15-minute transit time to the healthcare facility. The majority of WCBA were housewives (79 per cent) and 49 per cent had no monthly income (Supplementary Table 2). The cost of a visit exhibited a general upward trend as the WCBA income category increased (Supplementary Table 18).

INTERVENTIONS TO REDUCE MOVS

STRATEGIES SUGGESTED TO REDUCE MOVS AMONG CHILDREN

During the survey, the most frequent suggestions caregivers gave to improve vaccination services were:

- hiring more healthcare providers who vaccinate (30 per cent);
- lengthening hours and days when vaccinations are provided (22 per cent);
- reducing waiting times (19 per cent); and
- ensuring free vaccinations (19 per cent).

6 http://www.arabtradeunion.org/en/content/jordan-government-decides-raise-minimum-wage

In their FGDs, caregivers suggested multiple strategies to reduce MOV. Several mentioned how important it is that they be reminded to keep the vaccination card safe and to bring it to every visit. They also suggested that providers deliver daily vaccination sessions for all vaccines, including for BCG and measles.

Healthcare providers suggested:

- assigning a staff member in the healthcare facility to screen children routinely for vaccination;
- educating caregivers to bring vaccination cards to all visits to clinics (not just visits for vaccination services);
- training providers to check vaccination cards for all childhood visits;
- improving the adequacy and accuracy of information on children's vaccination status in clinical records;
- ensuring vaccine stockouts do not occur;
- assessing the feasibility of increasing the number of weekly vaccination sessions, and offering BCG and measles vaccines more frequently;
- upgrading computer systems to automatically identify children eligible for a missed vaccination on any visit;
- routing children through the maternity and childhood section of a clinic first for a vaccination screening prior to therapeutic visit; and
- communicating more clearly the schedule for vaccination visits through outreach, posters, leaflets etc.

STRATEGIES SUGGESTED TO REDUCE MOVS AMONG WCBA

The most frequent suggestions provided by WCBA to improve vaccination services were:

- providing WCBA with information about the vaccines being given, the diseases they prevent, and the reactions they produce (n=157; 34 per cent);
- hiring more vaccination personnel (n=114; 25 per cent);
- not limiting hours and days during which vaccination services are available (n=87; 19 per cent); and
- reducing waiting times (n=86; 18 per cent).

Supplementary Table 19 details these responses. WCBA also mentioned the need to develop a WCBA vaccination card to screen for missed vaccinations, and many WCBA suggested staffing a gynecologist at the MCH clinic to allow for WCBA vaccinations at these clinics.

DISCUSSION AND CONCLUSIONS

In this assessment, we found that among the 282 children aged <24 months, without contraindications and due at least one vaccine dose, 36 per cent (102 children in total) had a MOV during their visit to the healthcare facility. Higher MOV prevalence was seen among children who attended clinic for a non-vaccination visit, older children, children of caregivers employed as laborers, and children who did not possess a vaccination card at the interview visit. MOV was most common for the OPV, in particular OPV1 and OPV3 doses, which together comprised nearly a third of the identified MOV. Reducing MOV can minimize the economic burden of a return visit, particularly for disadvantaged households experiencing MOV, estimated at approximately JOD 2.93, or more than 1 per cent of the monthly minimum wage income in Jordan.

Knowledge regarding vaccinations was high among caregivers, WCBA and healthcare providers. However, all respondents acknowledged a need for more education regarding immunization, particularly for AEFI and vaccine contraindications. Caregivers indicated that MOV can occur due to concerns about vaccine safety and potential AEFI, and expressed a desire to improve their knowledge about such topics through education. Both caregivers and providers were concerned about vaccinating a sick child, and a high proportion of providers had suboptimal knowledge of vaccine contraindications for both childhood and WCBA vaccinations, indicating an opportunity to improve provider knowledge about a potential barrier to reducing MOV.

Providers and caregivers both mentioned the importance of the vaccination card, and one conclusion is that the value of vaccine documentation should be strongly emphasized among providers and caregivers alike. Interventions that improve both card security and retention and help ensure that households bring vaccination cards to all types of healthcare facility visits can reduce MOV.

Opportunities to strengthen healthcare and immunization systems, increase coverage equality and satisfaction and reduce MOV in Jordan could include:

- improving provider knowledge of AEFI and vaccine contraindications;
- ensuring that caregivers and WCBA know to bring the card to every visit to a clinic;
- improving WCBA retention of a TTCV health card; and
- increasing the frequency and hours for vaccination sessions.

Beyond these suggested strategies, several action points were developed in two workshops held in November 2017 and March 2018. During the March workshop, the following priority areas were identified to address MOV in Jordan:

- Update national policy to include specific guidance on MOV and possible consideration for means-tested conditional cash transfer;
- Train and orient healthcare workers about vaccination to improve their knowledge and increase awareness about vaccination among caregivers and WCBA; and
- Coordinate and mainstream EPI activities within all healthcare facilities, including non-vaccination points.

Table 8 below details the workplan for achieving these aims, and Supplementary Table 20 shows the algorithm adopted for missed opportunities for vaccination.

Table 8: Workplan for addressing missed opportunities for vaccination

Main issues identified	Proposed interventions	Timeline for completion	Responsible person/organization
Healthcare workers	Situation analysis	6 months	Ministry of Health
	Healthcare worker training		
	Internal rotation of medical staff		
	Equitable distribution of staff		
	Healthcare center manager involvement		
	Increase awareness among healthcare worker		
	Motivation		
Policy level	Establish a committee to develop policies about missed opportunities for vaccination	3 months	Ministry of Health
	Implementation of policies	1 year	
	Monitoring and evaluation	1 year	
	Release new evidence of missed opportunities for vaccination	6 months	
Caregiver level	Design leaflets or guideline papers	3 months	Ministry of Health
	Work in coordination with Directorate of Health Education	1 year	Ministry of Health
	Activate social local committee to increase awareness in population	3 months	Local governorate
	Use social media to send messages about missed opportunities for vaccination	3 months	Ministry of Communication

The findings should be interpreted with caution as this assessment is not a randomized study; however, great attention was paid to designing the methodology and the selection of governorates and sites in close consultation with government representatives. Also, as mentioned already, the findings for the WCBA TT MOV were not conclusive given the lack of available documentation.

Nevertheless, the findings of this assessment and proposed interventions can guide and inform high-performing immunization programs and systems and countries with varying socioeconomic status, including those transitioning out of Gavi support. Undertaking and scaling up improvement strategies, with particular focus on equity and disadvantaged households, will require evidence-based advocacy and political will in individual countries. In this effort, UN and development partners, academia and civil society are encouraged to coordinate and support countries and immunization programs in generating evidence, influencing policies, mobilizing domestic resources, and providing technical and operational assistance.

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ANNEX: SUPPLEMENTARY TABLES

Supplementary Table 1: Characteristics of caregivers of surveyed children < 24 months old (n=427)

	N	%
Relationship to child		
Mother	398	93.21
Father	15	3.51
Grandparent	9	2.11
Uncle/aunt	5	1.17
Brother/sister	0	0
Other	0	0
Can you read and write?		
Yes	401	93.91
No	26	6.09
Education		
No formal education	23	5.39
Did not complete primary (less than 6 years)	12	2.81
Completed primary	61	14.29
Completed secondary school	175	40.98
More than secondary	156	36.53
Occupation		
Housewife (work is housekeeping)	342	80.09
Employee or laborer	59	13.82
Farming	0	0.00
Self-employed	6	1.41
Boss or employer	0	0.00
Teacher	9	2.11
Student	0	0.00
Other	11	2.58
What would you be doing if you were not at the health facility today? Check all that apply		
At home doing chores	388	90.87
Unpaid work elsewhere	5	1.17
Paid work	33	7.73
Other	2	0.47

Table 1 'cont: Characteristics of caregivers of surveyed children < 24 months old (n=427)

What is your average personal monthly income?		
No income	176	41.22
Between 1500 and 3000 JOD	2	0.47
Between 200 and 400 JOD	141	33.02
Between 400 and 700 JOD	57	13.35
Between 700 and 1000 JOD	6	1.41
Less than 200 JOD	45	10.54

By what means of transportation do you usually come to this facility?		
Walk	119	27.87
Bicycle	0	0.00
Motorcycle	0	0.00
Car	270	63.23
Bus	33	7.73
Taxi	5	1.17

If you paid for transportation (round trip) to reach the facility, how much did you pay?	
Avg	0.99 JOD
SD	1.74 JOD

How long does it take you to reach the facility?		
0 to 15 mins	344	80.56
15 to 30 mins	68	15.93
30 to 45 mins	10	2.34
45 to 60 mins	3	0.70
60 to 120 mins	1	0.23
150 mins	1	0.23

Did you use a private car to get here?		
Yes	163	38.17
No	264	61.83

Table 1 'cont: Characteristics of caregivers of surveyed children < 24 months old (n=427)

In your home, who primarily makes the decision to vaccinate the children		
Husband or spouse	15	3.51
Mother (response says "self"	160	37.47
Other relatives	1	0.23
Consensus of self and husband or partner	51	11.94
Other	2	0.47
Parents	198	46.37

Supplementary Table 2: Characteristics of surveyed women of childbearing age (n=465)

	N	%
Why did you attend this health care facility today?		
For antenatal care	35	7.53
Other curative care consultation	155	33.33
For vaccination	66	14.19
Other preventive care check-up	18	3.87
Accompanying someone else (not for treatment, vaccination)	67	14.41
Hospitalization	1	0.22
For MCH visit	108	23.23
For EPI visit	13	2.80
Other	24	5.16
Vaccination of child	18	3.87
Family planning	6	1.29
Are you pregnant?		
Yes	75	16.13
No	380	81.72
Not sure	10	2.15
Age in years		
15-19	27	5.81
20-29	213	45.81
30-39	171	36.77
40-48	54	11.61

Table 2 'cont: Characteristics of surveyed women of childbearing age (n=465)

Can you read and write		
Yes	437	93.98
No	28	6.02
Level of formal education		
No formal education	18	3.87
Did not complete primary (less than 6 years)	10	2.15
Completed primary	79	16.99
Completed secondary school	203	43.66
More than secondary	155	33.33
Occupation		
Housewife (work is housekeeping)	369	79.35
Employee or laborer	76	16.34
Farming	1	0.22
Self-employed	3	0.65
Boss or employer	0	0.00
Teacher	6	1.29
Student	6	1.29
Other	4	0.86
If formally or informally working, what is your personal average monthly income?		
Between 1500 and 3000 JOD	2	0.43
Between 200 and 400 JOD	152	32.69
Between 400 and 700 JOD	30	6.45
Between 700 and 1000 JOD	5	1.08
Less than 200 JOD	47	10.11
More than 3000 JOD	1	0.22
No income	228	49.03

Table 2 'cont: Characteristics of surveyed women of childbearing age (n=465)

By what means of transportation do you usually come to this facility?		
Walk	158	33.98
Bicycle	0	0
Motorcycle	0	0
Car	250	53.76
Bus	54	11.61
Taxi	3	0.65
How long did it take you to get here		
0 to 15 mins	352	75.70
15 to 30 mins	93	20.00
30 to 45 mins	11	2.37
45 to 60 mins	5	1.08
60 to 120 mins	2	0.43
Longer specified (180 mins)	1	0.22
More than 120 mins	1	0.22
Did you use a private car to get here?		
Yes	137	29.46
No	328	70.54
In your home, who primarily makes the decision about whether you should receive TT vaccination?		
Self	333	71.61
Parents	37	7.96
Husband/spouse	44	9.46
Other relatives	0	0
Consensus of self and husband/partner	51	10.97
Other	0	0

Supplementary Table 3: Characteristics of surveyed healthcare workers (n=432)

	N	%
Sex		
Male	95	21.99
Female	337	78.01
Age		
Under 20 years	0	0.00
20-29	102	23.61
30-39	194	44.91
40-49	112	25.93
50 or over	24	5.56
Professional Training		
Doctor	70	16.20
Nurse	158	36.57
Clinical Officer	10	2.31
Public Health Officer	3	0.69
Other	55	12.73
Medical Records	26	6.02
Laboratory	18	4.17
Pharmacy/Pharmaceuticals	33	7.64
Accounting	24	5.56
Legal	10	2.31
Perinatal Care	17	3.94
Dental	8	1.85
Area (or department) in which you predominantly work		
In-patient Department (in the admission wards)	7	1.62
General Out-Patient (OPD)	37	8.56
Emergency Department	67	15.51
Immunization, preventive medicine and epidemiology	16	3.70
Nutrition	1	0.23
IMCI (Integrated Management of Childhood Illnesses)	7	1.62
Dental/Oral Unit	51	11.81
Family Planning and STI	22	5.09
Ante-Natal Clinic (ANC)	13	3.01

Table 3 'cont: Characteristics of surveyed healthcare workers (n=432)

Other	43	9.95
Medical Records	26	6.02
Laboratory	20	4.63
Pharmacy	29	6.71
Accounting	21	4.86
General Medicine	9	2.08
Maternal Care/Childhood Care/Obstetrics	48	11.11
First Health Center	15	3.47

For how long have you been working in this profession? (months)		
Avg	132.00	
SD	94.70	

During your basic training in nursing, midwifery or medical school, were you trained in the control of VPDs?		
Yes	258	59.72
No	174	40.28

Since your basic training, have you received training or participated in courses on vaccination or control of VPDs?		
Yes	163	37.73
No	269	62.27

If yes, when were you last trained? (n=163)		
<1 year ago	66	40.49
1-2 years ago	23	14.11
2-3 years ago	29	17.79
>4 years ago	45	27.61

Do you work in the area of immunization or provide vaccines as part of your job?		
Yes	125	28.94
No	307	71.06

Supplementary Table 4: Missed opportunities for vaccination by child < 24 months and caregiver factors

	Total	MOV (n)	%
Sex of child			
Male	196	58	29.59
Female	173	44	25.43
Age of child			
<2 months	67	0	0
2 - < 3 months	39	9	23.08
3 - < 4 months	51	19	37.25
4 - < 9 months	78	24	30.77
9 - < 12 months	59	22	37.29
12 - < 18 months	39	12	30.77
18 - < 24 months	36	16	44.44
Caregiver educational level			
No formal education	19	9	47.37
Did not complete primary (less than 6 years)	11	1	9.09
Completed primary	56	15	26.79
Completed secondary school	146	38	26.03
More than secondary	137	39	28.47
Caregiver Occupation			
Housewife (work is housekeeping)	299	77	25.75
Employee or laborer	50	20	40.0
Farming	0	0	0
Self-employed	5	0	0
Boss or employer	0	0	0
Teacher	9	2	22.22
Student	0	0	0
Other	6	3	50.0
Vaccination card available			
Yes, and I have it with me	337	82	24.33
Yes, but I do not have it with me	32	20	62.5
No	0	0	0
Total	369	102	27.64

Supplementary Table 5: Feedback about vaccination on the day of survey among caregivers of children < 24 months old (n=427)

	N	%
During today's visit, did the personnel/staff ask you for the child's vaccination card?		
Yes	280	65.57
No	147	34.43
If no, did they ask for the vaccination status of the child? (n=147)		
Yes	19	12.93
No	128	87.07
Was your child vaccinated here today?		
Yes	267	62.53
No	160	37.47
If your child was eligible for vaccination but was not vaccinated today, did the health worker refer you to or inform you where you can receive the missing vaccine doses?		
Yes	283	66.28
No	144	33.72

Supplementary Table 6: Feedback about the quality of vaccination service delivery from caregivers of surveyed children < 24 months old who were vaccinated on the day of the survey (n=267)

	N	%
How long did you wait today for your child to be vaccinated?		
0 to 15 mins	185	69.29
15 to 30 mins	47	17.60
30 to 45 mins	8	3.00
45 to 60 mins	15	5.62
60 to 120 mins	12	4.49
Did they tell you today what vaccines they gave the child?		
Yes	176	65.92
No	91	34.08
Today, did they tell you the date of the next vaccination appointment?		
Yes	245	91.76
No	22	8.24

Table 6 'cont: Feedback about the quality of vaccination service delivery from caregivers of surveyed children < 24 months old who were vaccinated on the day of the survey (n=267)

Today, did they write down for you the date of the next vaccination appointment?		
Yes	238	89.14
No	29	10.86

Did you receive information today on the reactions or side effects that can occur following vaccination?		
Yes	225	84.27
No	42	15.73

If so, what did they mention? (choose all that apply)		
Pain at injection site	92	40.89
Fever	171	76.00
Rash	11	4.89
Diarrhea	6	2.67
Vomiting	1	0.44
Other	30	13.33

Did you receive information today on what you should do if the child has reactions or side effects to the vaccine?		
Yes	214	80.15
No	53	19.85

Are you satisfied with the service provided today?		
Yes	239	89.51
No	28	10.49

Why were you satisfied with the service?		
Immediate attention	175	73.22
Friendly treatment by staff	197	82.43
No charge for service	121	50.63
The necessary vaccines and supplies were available	110	46.03
Other	8	3.35

Why were you NOT satisfied?		
Had to wait a long time	18	64.29
The staff was discourteous	14	50.0
The language that the health workers use is not clear	4	14.29
They did not explain what vaccines they had given the child	14	50.0
The necessary vaccines or supplies were not available	0	0.00
Other	4	14.29

Supplementary Table 7: Knowledge about the reasons to vaccinate among caregivers of surveyed children < 24 months old (n=427)

	N	%
Could you tell me the purpose of vaccines?		
To prevent diseases	400	93.68
So children will grow up healthy	140	32.79
To cure/heal diseases	125	29.27
They don't do any good	1	0.23
What suggestions do you have to improve vaccination services?	10	2.34
Other	0	0
Do you think your child could get diseases if you don't vaccinate him/her?		
Yes	396	92.74
No	31	7.26
What suggestions do you have to improve vaccination services?		
None	163	38.17
There should be more vaccination personnel	126	29.51
Hours and days when vaccination services are available should not be limited	95	22.25
There should be less of a wait	82	19.20
Vaccination should remain free	83	19.44
They should provide information on the vaccines that are being given, on the diseases	61	14.29
Vaccines should always be in stock	45	10.54
The treatment of the public, and of the children being vaccinated, should be friendlier	37	8.67
More outreach services	30	7.03
Other	37	8.67
Don't know	4	0.94

Supplementary Table 8: Knowledge about vaccination cards and vaccines among caregivers of surveyed children < 24 months old

	N	%
Does your child have a vaccination card? (n=427)		
Yes, and I have it with me	340	79.63
Yes, but I do not have it with me	68	15.93
No	19	4.45
Could you tell us why you do not have the vaccination card with you today? (n=68)		
It is at the nursery school/day care center	3	4.41
I left it at home (because I forgot to bring it)	8	11.76
I left it home (because I didn't know it was important to bring it along)	17	25
I lost it	2	2.94
The card has been damaged	1	1.47
I have never been given one	0	0
Because vaccination was not the reason for this visit	37	54.41
Other	0	0
Why, according to the caregiver, does the child not have a vaccination card? (n=19)		
I lost it	0	0
I have never been given one	9	47.37
I don't know	2	10.53
Other	8	42.11
Have you ever lost a vaccination card for this child? (n=340)		
Yes	23	6.76
No	317	93.24
If yes, did you encounter difficulty getting the vaccination card replaced? (n=2)		
Yes	0	0
No	2	100

Table 8 'cont: Knowledge about vaccination cards and vaccines among caregivers of surveyed children < 24 months old

Could you tell me what purpose the vaccination card serves? (n=326)		
To know what vaccines the child has had and which ones are missing	243	74.54
Birth certificate and/or identification	46	14.11
Overall health record and growth monitoring	69	21.17
Record and remind for return visit dates	161	49.39
Don't Know/No Response	9	2.76
For school purposes	29	8.90
Other	1	0.03

Supplementary Table 9: Caregivers' experience and awareness of vaccination (n=427)

Have you heard or seen messages on vaccination in the last one month?		
Yes	105	24.59
No	322	75.41

Where/how did you hear or see the message?		
Radio	20	19.05
Television	67	63.81
Newspaper	7	6.67
Healthcare facility	37	35.24
Telephone message	2	1.90
Facebook or internet	23	21.90
Children's school	5	4.76
Place of worship	3	2.86
During home visit by healthcare workers/healthcare outreach	2	1.90
Community meetings	3	2.86
Friend or family member	4	3.81
Other	1	0.95

Do you feel that you know the vaccines your child needs?		
Yes	257	60.19
No	101	23.65
Not sure	69	16.16

Table 9 'cont: Caregivers' experience and awareness of vaccination (n=427)

If yes, do you feel that you know WHEN the vaccines should be given? (n=257)		
Yes	237	92.22
No	5	1.95
Not sure	15	5.84

Has this child ever been vaccinated?		
Yes	340	79.63
No	87	20.37

If no, why not (n=87)		
The necessary vaccines or supplies were not available	3	3.45
I am not in favour of vaccination	0	0
My husband/the decision maker is not in favour of vaccination	0	0
I have not visited the healthcare facility on a vaccination day	4	4.6
I did not know that the child was eligible to be vaccinated	5	5.75
Other	65	74.71
Child sickness	10	11.49

Have you ever requested vaccination service for this child and been refused?		
Yes	52	12.18
No	374	87.59
It was not a vaccination day	1	0.23

If so, why didn't they vaccinate the child? (n=52)		
The doctor or nurse said it couldn't be done because the child was sick	21	40.38
There were no vaccines, or there were no syringes or some other supply needed for vaccination	9	17.31
It was not a vaccination day	8	15.38
The vaccination area was closed	0	0
The person in charge of vaccination was not there	1	1.92
We didn't have the vaccination card	1	1.92
The hours for vaccination are limited	2	3.85
Other	10	19.23

Supplementary Table 10: Reasons for children < 24 months old not being vaccinated on the day of survey (n=160)

Why was your child not vaccinated today?		
The doctor/nurse said that the child was not eligible for vaccination today	30	18.75
The health worker who saw us did not tell me about vaccinating the child today	7	4.38
The doctor/nurse said that the child could not be vaccinated because s/he was sick	19	11.88
None of the above	104	65.00

If because of illness, what type of disease or treatment did the child receive today? (n=19)		
Minor illness such as mild fever, cold, cough, or diarrhea	17	89.47
Other illness such as intestinal parasitosis, malnutrition, anemia, dehydration, urinary tract infection	1	5.26
Other	1	5.26
The last time the child was vaccinated, he/she got sick or had a reaction	10	6.25
My religion doesn't permit vaccination or I don't believe in vaccines	0	0
Vaccination was not the purpose of this visit	71	44.38
This child is already fully vaccinated for his/her age	19	11.88
I don't trust the health workers/the vaccines in this health facility	0	0
I forgot to take my child to the vaccination area	0	0
I didn't have time today to wait for vaccination	1	0.63
Other	16	10.00
None of the above	43	26.88

There were no vaccines in the health facility today	2	1.25
There were no syringes or other vaccination supplies	1	0.63
Today is not a vaccination day in this health facility	24	15.00
The vaccination area was closed	0	0.00
The person in charge of vaccinations was not there	2	1.25
There would have been a long wait	4	2.50
The staff treated us badly	0	0.00
Other	20	12.50
None of the above	107	66.88

Supplementary Table 11: Healthcare worker practices towards the Expanded Programme on Immunization (n=35)

	N	%
A female infant comes to the clinic today. She is aged 3 months. She has a documented history of one dose of BCG administered at birth. The mother seeks service to assess the child's growth and development. What vaccines would you give the child today?		
None	3	8.57
Only Polio (OPV)	1	2.86
Only Hexa	7	20
Measles vaccine	0	0
Hexavalent vaccine, OPV and Rotavirus	24	68.57
Don't know	0	0
An infant aged 6 months with documented history of one dose of BCG, two doses of hexavalent vaccine, two doses of RV and polio vaccines. The last doses of vaccines were given when the child was 4 mo. old. According to the mother, the child experienced fever and seizure one month ago and is now receiving medical treatment. Following EPI guidelines, what vaccines would you give her?		
I would not vaccinate her	15	42.86
Only polio vaccine and I would refer her to a specialist	2	5.71
DTaP-Hib-IPV	1	2.86
OPV, Hexavalent vaccine and RV	15	42.86
Don't know	2	5.71
Are vaccination services offered every day at this facility?		
Yes, for all antigens	26	74.29
Yes, services are offered but not for all antigens	5	14.29
No, certain days are scheduled as immunization days	4	11.43
Today, you vaccinate a child aged 2 months with the first doses of Hexavalent vaccine and rotavirus vaccines. After telling her parents which vaccines she received, what other information and recommendations would you provide her caregivers?		
The child may experience a bit of fever, diarrhea, or discomfort following vaccination	10	33.33
The symptoms above generally do not require treatment; however, in the case of fever, the child should be lightly dressed and should NEVER stop breastfeeding	2	6.67
The parent should return to the health center if these symptoms persist so that the so that the child may be seen by a doctor	2	6.67
All of the above	16	53.33
None of the above	3	10
Total	30	

Table 11 'cont: Healthcare worker practices towards the Expanded Programme on Immunization (n=35)

What could be done to follow up on vaccination of children after hospitalization or outpatient treatment for a chronic condition?		
Coordinate with clinical areas, inpatient and emergency departments in hospitals, so that they can review the child's vaccination card	21	70
Send patients whose physicians consider them eligible for vaccination to the immunization unit so that they can be vaccinated before leaving the hospital	13	43.33
In hospitals, a health worker in the immunization unit could visit inpatient departments to review the medical records of children who will be discharged that day, thereby identifying children to start or complete the vaccination schedule	1	3.33
All of the above	6	20
None of the above	0	0

At 8:00 AM, you prepare a vaccination cold box for the morning shift at the health facility. You place two vials of 10 doses of measles vaccine in the cold boxes. At 3:00 pm, a mother requests that her 11 month old child receive one dose of measles vaccine. The child has not yet received measles vaccine but has received other vaccines for children aged < 1 year. The child has no contraindications. Only two doses from the first vial have been administered since 8:30am, when the first dose was given. Which of the two vaccine vials in the cold box would you use to vaccinate this child? (n=30)		
I would use the first open vial to prevent vaccine wastage	16	53.33
I would tell the mother to return the next day, since I cannot open a new vaccine vial and	3	10
I would open the second vial of measles vaccine to immunize the girl	10	33.33
I would recommend that the mother take the child to another health center to be vaccinated	0	0
None of the above	1	3.33

What instructions do you USUALLY give to mothers or caregivers the first time you issue them a new vaccination card? (n=30)		
Keep the card safe	26	86.67
Bring this card to all visits to the health facility	28	93.33
Bring this card only when you come for vaccinations	15	50.00
No instructions are given	0	0.00
Others: Specify: _____	0	0.00

What do you do for a mother or caregiver that forgot the vaccination card at home? (n=30)		
I do not vaccinate and ask her to return with card next time	6	20
I issue a new card, vaccinate and record today's vaccinations in the new card and in the register	4	13.33
I issue a new card, vaccinate and record old vaccinations from the register	6	20
I issue a temporary card, vaccinate, record in register, and ask them to bring the old card for next visit	7	23.33
I will vaccinate without the replacing card, but I will document in register only	7	23.33
Other: Specify: _____	0	0

Table 11 'cont: Healthcare worker practices towards the Expanded Programme on Immunization (n=35)

If a mother or caregiver reports that the child's card has been lost or damaged, what do you usually do? (n=30)		
I issue a new card and record all future vaccines in the new card	2	6.67
I issue a new card and transcribe all previous vaccines from register	26	86.67
I issue a new card and ask woman to tell me of all previous vaccinations so I can write them down	2	6.67
Vaccinate without replacing card, document in register only	0	0
Other: Specify: _____	0	0

Today, I have enough vials of vaccines for all patients who seek immunization services (n=30)		
Agree	30	100
Disagree	0	0

Today, I have all the materials that I need to vaccinate patients who seek immunization (including syringes, recording sheets, vaccination cards, and other materials) (n=30)		
Agree	30	100
Disagree	0	0

There is sufficient staff offering immunization services at this facility (n=30)		
Agree	18	60
Disagree	12	40

What should be done if you notice that there are children with delayed or missed vaccines in the vaccine registry? (n=30)		
Make a weekly list of children with incomplete schedules	21	70.0
Contact parents or guardians by telephone, email, or any other means of communication to remind them to vaccinate their children	13	43.33
Make home visits to encourage the family to complete the child's vaccination schedule communication to remind them to vaccinate their children	1	3.33
All of the above	6	20.0
None of the above	0	0

Supplementary Table 12: Knowledge of vaccination among healthcare workers surveyed

	N	%
Vaccines that healthy women of childbearing age should receive include: (n=397)		
TT	315	79.35
Influenza	58	14.61
I don't know	67	16.88
Vaccines that healthy children should receive include: (n=35)		
BCG	35	100
measles	34	97.14
DtaP-Hib-IPV	34	97.14
OPV	34	97.14
Rotavirus	34	97.14
MMR	34	97.14
HBV	34	97.14
I don't know	0	0
Contraindications against being vaccinated with TT vaccine include: (n=397)		
Pregnancy	47	11.84
Allergic hypersensitivity	182	45.84
Mild malnutrition	17	4.28
Mild diarrhea	23	5.79
None of the above	171	43.07
Contraindications against being vaccinated with polio vaccine include: (n=35)		
Breastfeeding	0	0
Axillary or rectal temperature of 37.5 C	10	28.57
Mild malnutrition	1	2.86
Mild diarrhea	8	22.86
None of the above	23	65.71
Age hexavalent vaccine should be administered (n=35)		
3, 4, and 5 months	24	68.57
3, 4, 5, and 18 months	11	31.43

Table 12 'cont: Knowledge of vaccination among healthcare workers surveyed

Age tetanus toxoid vaccine should be administered (n=397)		
first contact with WCBA	373	93.95
yearly	24	6.05
Age influenza vaccine should be administered (n=397)		
first contact with WCBA	28	7.05
yearly	369	92.95
Age BCG should be administered (n=35)		
Birth	35	100
Age OPV should be administered (n=35)		
12 months and 18 months	1	2.86
3, 4 and 5 months	10	28.57
9 months	1	2.86
3, 4, 5 and 18 months	23	65.71
Age single antigen measles vaccine should be administered (n=35)		
12 months and 18 months	2	5.71
9 months	33	94.29
Age MMR vaccine should be administered (n=35)		
12 and 18 months	35	100
Vaccine-preventable diseases (VPDs) in the process of eradication or elimination include: (n=432)		
TB	232	53.70
Whooping cough	182	42.13
Poliomyelitis and measles	384	88.89
Diarrhea	77	17.82
None of the above	20	4.63
Absolute contraindications against ANY vaccine include: (n=432)		
Local reaction to previous dose	133	30.79
Light fever	133	30.79
Seizures under medical treatment	192	44.44
Pneumonia or other serious diseases	260	60.19
None of the above	61	14.12

Table 12 'cont: Knowledge of vaccination among healthcare workers surveyed

My knowledge of vaccines and vaccination for WCBA is insufficient or outdated (n=397)		
Agree	254	63.98
Disagree	143	36.02
My knowledge of vaccines and vaccination for children is insufficient or outdated (n=35)		
Agree	14	40
Disagree	21	60

Supplementary Table 13: Healthcare worker practices towards vaccination of women of childbearing age

	N	%
Are TT vaccination services offered every day at this facility? (n=397)		
Yes	283	71.28
No, certain days are scheduled as immunization days	114	28.72
Do you work in the area of immunization or provide vaccines as part of your job? (n=432)		
Yes	125	28.94
No	307	71.06
Under what circumstances would you tell the WCBA what vaccine you are administering AND provide advice regarding what to do in case the WCBA experiences an adverse reaction following immunization? (n=95)		
Only if the vaccine administered could produce a severe reaction	13	13.68
Only when they requests this information	10	10.53
Never, since this information can be counterproductive and discourage participation in the immunization program	1	1.05
Always, regardless of the vaccine used and type of reaction that might be expected	64	67.37
The probability that an adverse event related to vaccination is so low that I would rarely have to provide this information	7	7.37
Under what circumstances would you tell the parent what vaccines you are administering AND provide advice regarding what to do in case the child experiences an adverse reaction following immunization? (n=30)		
If the vaccine administered could produce a severe reaction	8	26.67
When the parent or guardian requests this information	3	10.0
Never, since this information can be counterproductive and discourage participation in the immunization programme	1	3.33
Always, regardless of the vaccine used and type of reaction that might be expected	18	60.0

Table 13 'cont: Healthcare worker practices towards vaccination of women of childbearing age

Today, you vaccinate a woman aged 25 with the first dose of TT vaccine. After telling her which vaccine she received, what other information and recommendations would you provide her? (n=95)		
The WCBA may experience a bit of discomfort following vaccination	29	30.53
The symptoms above generally do not require treatment	11	11.58
The WCBA should return to the health center if these symptoms persist so that the child may be seen by a doctor	15	15.79
All of the above	40	42.11
None of the above	13	13.68

What should be done if you notice that there are WCBA with delayed or missed vaccines in the vaccine registry? (n=95)		
Make a weekly list of WCBA with incomplete schedules	38	40.00
Contact WCBA via email, sms or phone with	29	30.53
Make home visits to encourage the WCBA to complete vaccination schedule	9	9.47
All of the above	18	18.95
None of the above	25	26.32

What instructions do you USUALLY give to WCBA the first time you issue them a new vaccination card? (n=95)		
Keep the card safe	76	80.00
Bring this card to all visits to the health facility	79	83.16
Bring this card only when you come for vaccinations	33	34.74
No instructions are given	3	3.16
Others: Specify: _____	3	3.16

What instructions do you USUALLY give to parents the first time you issue them a new vaccination card? (n=69)		
Keep the card safe	26	86.67
Bring this card to all visits to the health facility	28	93.33
Bring this card only when you come for vaccinations	15	50.00
No instructions are given	0	0.00
Others: Specify: _____	0	0.00

What do you do for a WCBA that forgot the vaccination card at home? (n=95)		
I do not vaccinate and ask her to return with card next time	22	23.16
I issue a new card, vaccinate and record today's vaccinations in the new card and in the register	18	18.95
I issue a new card, vaccinate and record old vaccinations from the register	18	18.95

Table 13 'cont: Healthcare worker practices towards vaccination of women of childbearing age

I issue a temporary card, vaccinate, record in register, and ask them to bring the old card for next visit	16	16.84
I will vaccinate without the replacing card, but I will document in register only	16	16.84
Other: Specify: _____	5	5.26
If a WCBA reports that her card has been lost or damaged, what do you usually do? (n=95)		
I issue a new card and record all future vaccines in the new card	18	18.95
I issue a new card and transcribe all previous vaccines from register	66	69.47
I issue a new card and ask woman to tell me of all previous vaccinations so I can write them down	8	8.42
Vaccinate without replacing card, document in register only	1	1.05
Other: Specify: _____	2	2.11
Today, I have enough vials of TT vaccine for all WCBA who seek vaccination (n=95)		
Agree	91	95.79
Disagree	4	4.21
Today, I have all the materials that I need to vaccinate WCBA who seek immunization (including syringes, recording sheets, vaccination cards, and other materials) (n=95)		
Agree	91	95.79
Disagree	4	4.21
If disagree, what are you lacking? (n=4)		
Syringes	0	0
Recording materials	2	50
Vaccination cards	4	100
Other: Specify: _____	1	25
When the professional in charge of vaccination is unavoidably absent, another health care professional is available to replace him or her (n=125)		
Agree	117	93.60
Disagree	8	6.40
There is sufficient staff offering TT immunization services at this facility (n=95)		
Agree	81	85.26
Disagree	14	14.74

Supplementary Table 14: Attitudes towards vaccination among healthcare workers surveyed

	N	%
In which of the following situations should you inquire about the doses that WCBA have received and those that are missing according to their age? (n=397)		
During an antenatal care visit	175	44.08
Consultation for any illness	39	9.82
When a WCBA is accompanying a child for a vaccination visit	52	13.10
All of the above	165	41.56
From day to day, who should evaluate the vaccination status of children, review vaccination cards, and ensure that children are up to date according to the national schedule? (n=35)		
The child's parents	12	34.29
The health worker responsible for immunization	14	40
Physicians in external consultations, inpatient services, and emergency rooms	2	5.71
All of the above	16	45.71
In which of the following situations should you inquire about the doses that children have received and those that are missing according to their age? (n=35)		
During a child's wellness visit	12	34.29
Consultation for any illness	6	17.14
When a child is accompanying a caregiver during a pre-natal check-up	6	17.14
When a child is accompanying a caregiver visiting a health care facility for any reason	4	11.43
All of the above	19	54.29
Why do you think that some WCBA are not up to date on their vaccination? (n=397)		
WCBAs' negative beliefs related to vaccination	245	61.71
Hours of vaccination incompatible with WCBAs' busy lives	80	20.15
Physicians, nurses, and health workers do not ask about WCBA's vaccination schedules	65	16.37
Physicians, nurses, and health workers do not review WCBA's vaccination records	46	11.59
False contraindications for vaccination by health workers	41	10.33
Distance from vaccination site	88	22.17
All of the above	69	17.38

Table 14 'cont: Attitudes towards vaccination among healthcare workers surveyed

Why do you think that some children are not up to date on their vaccination? (n=35)		
Parents' negative beliefs related to vaccination	27	77.14
Hours of vaccination incompatible with parents' busy lives	9	25.71
Physicians, nurses, and health workers do not ask about children's vaccination schedules	4	11.43
Physicians, nurses, and health workers do not review children's vaccination records	3	8.57
False contraindications for vaccination by health workers	3	8.57
Distance from vaccination site	16	45.71
All of the above	2	5.71

Do you believe that the vaccines administered in private practice vary in quality from those provided by the Ministry of Health? (n=432)		
Yes	61	14.12
No	339	78.47
Don't know	32	7.41

I am very concerned about, and fear, adverse reactions from vaccines (n=432)		
Agree	199	46.06
Disagree	233	53.94

Completing nominal vaccine registries (books/notebooks/vaccination cards) delays the timely vaccination of WCBA (n=397)		
Agree	201	50.63
Disagree	196	49.37

Completing nominal vaccine registries (books/notebooks/vaccination cards) delays the timely vaccination of children (n=35)		
Agree	16	45.71
Disagree	19	54.29

Supplementary Table 15: Knowledge and awareness of vaccination among women of childbearing age (n=465)

Have you heard or seen messages on vaccination in the last one month?		
Yes	102	21.94
No	363	78.06

Where/how did you hear or see the message?		
Radio	20	19.61
Television	74	72.55
Newspaper	11	10.78
Health facility	43	42.16
Telephone message	3	2.94
Facebook or internet	16	15.69
Children's school	3	2.94
Place of worship	0	0
During home visit by health workers/health outreaches	2	1.96
Community meetings	3	2.94
Friend or family member	8	7.84
Neighbor	1	0.98

Do you feel you know the vaccines that you need at this stage of your life?		
Yes	204	43.87
No	207	44.52
Not sure	54	11.61

If yes, do you feel that you know WHEN the vaccines should be given?		
Yes	157	76.96
No	30	14.71
Not sure	17	8.33

Have you ever been vaccinated for either childhood and/or adult vaccines i.e. TT vaccination?		
Yes	377	81.08
No	69	14.84
Unsure	19	4.09

Table 15 'cont: Knowledge and awareness of vaccination among women of childbearing age (n=465)

If no, why not?		
The necessary vaccines or supplies were not available	2	2.27
I am not in favour of vaccination	9	10.23
My husband/the decision maker is not in favour of vaccination	3	3.41
I have not visited the health facility on a vaccination day	10	11.36
I did not know that I was eligible to be vaccinated	51	57.95
Other	13	14.77
	88	
Did you receive any these vaccination(s) in school?		
Yes	406	87.31
No	36	7.74
Don't Know	23	4.95
How many vaccinations did you get? (n=406)		
1	97	31.49
2	132	42.86
3	59	19.16
4	12	3.90
5	4	1.30
6	3	0.97
7	0	0
8	1	0.32
Total that knew number of vaccines received	308	
Unknown	98	
Do you know what these vaccines are for? (n=406)		
Yes, it was for tetanus	245	60.34
Yes, other	33	8.13
I don't know	128	31.53
During your pregnancy/ies, were you given an injection to protect the baby from getting tetanus? (n=406)		
Yes	205	50.49
No	187	46.06
Don't Know	14	3.45

Table 15 'cont: Knowledge and awareness of vaccination among women of childbearing age (n=465)

Have you ever been refused vaccines?		
Yes	18	3.87
No	447	96.13
If refused, why didn't you get vaccinated? (n=18)		
The doctor or nurse said it couldn't be done because I was sick	3	16.67
There were no vaccines, or there were no syringes or some other supply needed for vaccination	1	5.56
It was not a vaccination day	2	11.11
The vaccination area was closed	0	0
The person in charge of vaccination was not there	1	5.56
We didn't have the vaccination card	3	16.67
The hours for vaccination are limited	2	11.11
Other	6	33.33

Supplementary Table 16: Knowledge about use of vaccination cards and vaccines among women of childbearing age

	N	%
Do you have a vaccination card where vaccinations you receive are recorded? (n=465)		
Yes	46	9.89
Yes, but I do not have it with me	117	25.16
No	302	64.95

Could you tell us why you do not have your vaccination card with you today? (n=117)		
I left it at home (because I forgot to bring it)	25	21.37
I left it home (because I didn't know it was important to bring it along)	35	29.91
I lost it	1	0.85
The card has been damaged	1	0.85
I have never been given one	0	0
Because vaccination was not the reason for this visit	50	42.74
Other	5	4.27

Table 16 'cont: Knowledge about use of vaccination cards and vaccines among women of childbearing age

Among those who do not have a vaccination card, why? (n=302)		
I lost it	17	5.63
I have never been given one	163	53.97
I don't know	82	27.15
Other	20	6.62
Seen at private clinic/private doctor (did not follow-up at the center)	20	6.62
Did you encounter difficulty getting the vaccination replaced? (n=18)		
Yes	7	38.89
No	11	61.11

Have you ever lost your TT vaccination card? (n=46)		
Yes	8	17.39
No	38	82.61

Could you tell me what is the purpose of your vaccination card? (n=465)		
To know what vaccines I have received and which ones are missing	290	62.37
Record and remind for return visit dates	242	52.04
Other	11	2.37
Don't Know/No Response	78	16.77
For school purposes	10	2.15

Supplementary Table 17: Feedback about vaccination on the day of survey among women of child-bearing age

	N	%
During today's visit, did the personnel/staff ask you for your vaccination card? (n=465)		
Yes	63	13.55
No	402	86.45
If no, did they ask for, or use another source of data to check your vaccination status? (n=402)		
Yes	19	4.73
No	383	95.27
Did you receive TT vaccine today? (n=402)		
Yes	13	3.23
No	389	96.77
Why were you not vaccinated today?		
The doctor/nurse said that I am completely vaccinated already	41	10.54
The doctor/nurse said that I could not be vaccinated because I am pregnant	4	10.28
The doctor/nurse said that I could not be vaccinated because I am sick	10	2.57
None of the above	334	85.86
Minor illnesses such as mild fever, cold, cough, or diarrhea	7	70.0
Major illnesses requiring admission, such as severe pneumonia or severe malaria	0	0.00
Other illnesses such as intestinal parasitosis, malnutrition, anemia, allergies, dehydration, urinary tract infection	0	0.00
She is taking medications	1	10.0
HIV or AIDS	0	0.00
Pregnant	0	0.00
Other illnesses such as intestinal parasitosis, malnutrition, anemia, allergies, dehydration, urinary tract infection	0	0.00
None of the above	2	20.0
Because the last time I was vaccinated I got sick or had a reaction	7	1.80
My religion doesn't permit vaccination or I don't believe in vaccines	1	0.26
Vaccination was not the purpose of this visit	197	50.64
I am fully vaccinated	43	11.05
I don't trust the health workers/the vaccines in this health facility	1	0.26
I forgot	4	1.03

Table 17 'cont: Feedback about vaccination on the day of survey among women of childbearing age

I didn't have time today to wait for vaccination	5	1.29
I do not believe that vaccines are safe	2	1.06
I do not believe that vaccines are necessary	16	4.11
Other	28	7.20
Lack of knowledge about vaccination	19	4.88
Do not know	10	2.57
None of the above	56	14.40

There were no vaccines in the health facility today	3	0.77
There were no syringes or other vaccination supplies	0	0.00
Today is not a vaccination day in this health facility	26	6.68
The vaccination area was closed	0	0.00
The person in charge of vaccinations was not there	2	0.51
There would have been a long wait	4	1.03
The staff treated us badly	5	1.29
This health care setting does not provide vaccines for women/adults	15	3.86
Does not want to be vaccinated	8	2.06
No knowledge of vaccine/do not know	7	1.80
No one told her	3	0.77
Other	46	11.83
None of the above	270	69.41

If you were eligible for vaccination but were not vaccinated today, did the health worker refer you to or inform you where you can receive the missing vaccine doses?		
Yes	184	39.57
No	281	60.43

Supplementary Table 18: Average cost of healthcare visits for children and women of childbearing age by income level, using Jordan's minimum wage for housewives

	N	Total cost of visit in JOD (SD)	N	Total cost of visit in JOD for those with MOV (SD)
Cost of visit for caregivers of children (total)	*427*	*2.69 (2.16)*	*102*	*2.93 (2.57)*
Caregiver Income				
No income	176	2.40 (2.06)	44	2.51 (2.82)
Less than 200 JOD	45	1.23 (1.11)	10	1.23 (1.38)
Between 200 and 400 JOD	141	2.62 (1.56)	31	2.96 (1.98)
Between 400 and 700 JOD	57	4.22 (2.16)	14	4.92 (2.48)
Between 700 and 1000 JOD	6	4.76 (0.82)	3	5.09(1.16)
Between 1500 and 3000 JOD	2	15.06 (1.90)		
Cost of visit for WCBA (total)	*465*	*2.15 (1.50)*		
WCBA Income				
No income	228	1.91 (1.25)		
Less than 200 JOD	47	0.91 (0.62)		
Between 200 and 400 JOD	152	2.24 (0.92)		
Between 400 and 700 JOD	30	3.46 (1.06)		
Between 700 and 1000 JOD	5	4.93 (0.71)		
Between 1500 and 3000 JOD	2	14.56 (2.61)		
More than 3000 JOD	1	1.15 (---)		

Supplementary Table 19: Reasons to vaccinate women of childbearing age (n=465)

	N	%
Do you think you could get diseases if you don't receive vaccinations?		
Yes	349	75.05
No	116	24.95
What suggestions do you have to improve vaccination services?		
There should be more vaccination personnel	114	24.52
There should be less of a wait	86	18.49
Hours and days when vaccination services are available should not be limited	87	18.71
Vaccination should remain free	76	16.34
The treatment of the public, and of the women being vaccinated, should be friendlier	40	8.60
Vaccines should always be in stock	45	9.68
They should provide information on the vaccines that are being given, on the diseases that they prevent, and on the reactions they produce	157	33.76
More outreach services	67	14.41
Other	20	4.30
None	135	29.03
Don't know	12	2.58

Supplementary Table 20: Missed opportunities for vaccination algorithm

Age in days (and months)	Vaccines needed to be up to date or due	Notes
0 – 30 (< 1 month)	BCG	
31-60 (1 - <2 months)	BCG	
61 – 90 (2 - < 3 months)	BCG penta/hexa1 or penta/hexa2 or penta/hexa3 or DTP rota1 or rota2 or rota3	
91 – 120 (3 - < 4 months)	BCG OPV1 or OPV2 or OPV3 or OPV4 penta/hexa2 or penta/hexa3 or DTP rota2 or rota3	

Table 20 'cont: Missed opportunities for vaccination algorithm

121 – 150 (4 - < 5 months) 151 – 180 (5 - < 6 months) 181 – 210 (6 - < 7 months) 211-240 (7 - < 8 months)	BCG OPV2 or OPV3 or OPV4 penta/hexa3 or DTP rota3	• Children no longer eligible for rota1 once they are past 120 days old
241 – 270 days (8 - < 9 months)	BCG OPV2 or OPV3 or OPV4 penta/hexa3 or DTP	• Children no longer eligible for rota1 once they are past 120 days old • Children no longer eligible for rota2 and rota3 once they are past 240 days old
271–300 days (9 – < 10 months) 301–330 days (10 – < 11 months) 331–365 (11 – < 12 months)	BCG OPV3 or OPV4 penta/hexa3 or DTP MCV or MMR1 or MMR2	• Children no longer eligible for rota1 once they are past 120 days • Children no longer eligible for rota2 and rota3 once they are past 240 days old
366–396 days (12 – < 13 months) 397–427 days (13 – < 14 months) 428–458 days (14 – < 15 months) 459–489 days (15 – < 16 months) 490–520 days (16 – < 17 months) 521–551 days (17 – < 18 months)	BCG OPV3 or OPV4 penta/hexa3 or DTP MCV or MMR1 or MMR2	• Children no longer eligible for rota1 once they are past 120 days • Children no longer eligible for rota2 and rota3 once they are past 240 days old
552–582 days (18 - < 19 months) 19–24 months 583–613 (19 – < 20 months) 614–644 (20 – < 21 months) 645–675 (21 – < 22 months) 676–706 (22 – < 23 months) 707–737 (23 – < 24 months)	BCG DTP OPV4 MMR2 or (MCV and MMR1)	• Children no longer eligible for rota1 once they are past 120 days old • Children no longer eligible for rota2 and rota3 once they are past 240 days old • Children no longer eligible for single antigen measles once they are past 12 months old


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