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Preparing for forecasting and supply planning

Guidance Manual on Forecasting and Supply Planning

for Vaccines and other Immunization Supplies

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Contents

Preparing for forecasting and supply planning

This guidance manual provides an overview of the forecasting and supply planning (FSP) preparatory phase. It covers the key activities that should be completed, including describing the programme, defining scope, collecting and compiling needed FSP data and assumptions, and obtaining required inputs through targeted consultations and/or an FSP workshop. The document is organized into the following sections.

Acronyms

Acronym	Definition
cMYP	Comprehensive multi-year strategic plan
DQA	Data quality assessment
FSP	Forecasting and supply planning
GIS	Geographic information system
LMIS	Logistics management information system
MICS/NICS	Multiple indicator cluster survey/national immunization coverage survey
RED/REC	Reaching every district/reaching every child
SMART	Standardized monitoring and assessment of relief and transitions
UN	United Nations
WHO	World Health Organization
WUENIC	WHO and UNICEF estimates of national infant immunization coverage

Definition of terms

Term	Definition
Buffer	The additional quantity of the stock (other than forecasted consumption) is needed to prevent stock-out, and covering stock required when deliveries are being awaited and other fluctuations in demand. Buffer stock can also be referred to as safety stock.
Consumption	The quantity of product administered to end users over a defined period, including reasonable waste that will be experienced during service delivery for vaccines.
Data triangulation	The process of comparing data points from multiple sources or approaches to improve data analysis results and increase reliability in the targeted output.
Forecasting	The process used to estimate the quantity of doses of each vaccine that will be consumed or utilized for a specific period in the future. This process can be based on observed trends or patterns from adjusted demographic, health services utilization and/or logistics data. The output of this process is the estimated projected consumption.
Forecasting and supply planning (FSP) consultation meetings	Meetings that target individuals with some specific skills and expertise that are not available within the FSP team to obtain required inputs for FSP.
FSP workshop	The platform for reviewing the historical programme and FSP performance, discussion and ratification of the FSP data and assumptions, as well as the final forecast and supply plan. The workshop should include a diverse group of stakeholders involved in programme planning and implementation.
Lead time	The time interval between when an order is placed and when the product is delivered by a supplier to the customer (this can be a store or a health facility).

Term	Definition
Logistics management information system (LMIS)	An organized system for collecting, processing, reporting, and using logistics data for informed decisions.
Maximum and minimum inventory control level	The stock level that must not be exceeded (maximum) and the lowest quantity of stock (minimum) that should be available under normal conditions per supply chain level, as defined by the country's inventory policy. The maximum and minimum inventory levels are usually expressed in time periods (e.g., months).
Microplanning for immunization services	Microplanning is the process that involves an integrated set of activities used to identify priority communities, identify all beneficiaries, plan for vaccine and logistics requirements, including modes of delivery to address barriers, and ensure robust delivery of immunization services. The output of this exercise is a microplan.
Quality data	Data that are accurate, timely, consistent, reliable and complete.
Reporting rate	The proportion of expected reports that were submitted.
Stock on hand	The quantity of available usable stock at a given point in time.
Stock-out	A situation in which no usable product is available for use.
Stock status	A report of available product quantities in stock, in transit or on order. It can also be expressed in time period, e.g., how long stock will last in weeks or months.
Stratified forecasting and supply planning	A vaccine forecasting and supply planning process that uses disaggregated health and logistics data (for subgroups with common properties) to more accurately predict vaccine demand and supply, in order to improve immunization coverage for traditionally underserved populations such as urban poor, remote rural and conflict-affected populations.
Supply planning	The process used to determine when, where and how many doses of each vaccine should be delivered to ensure adequate stock levels are maintained throughout the supply chain based on the forecasted consumption, stock status and inventory policies. The supply planning process estimates the total vaccine requirements.
Wastage	The quantity of vaccines lost for various reasons and never administered to the end user. Vaccine wastage is broadly classified into (1) closed vial wastage (vial has not been opened with wastage due to expiry, heat damage, freezing, breakage and/or missing inventory), and (2) opened vial wastage (wastage that occurs when the vial has been opened). Opened vial wastage is categorized as avoidable (due to errors or accidents made during immunization sessions) and unavoidable (due to discarding unused doses of multidose vials at the end of the immunization session).

Preparatory phase steps

The output of the preparatory phase will serve as input and influence the quality of the forecast and supply plan. The tasks to be completed during the preparatory phase, including estimated time allocation, are briefly discussed below and in more detail in subsequent sections.

#	Task	Description	Estimated time allocation	Responsible
1	Describe programme and define scope	The FSP team should: – Describe programme background, including historical and current coverage performance, service delivery model, supply chain architecture/design, national immunization partners including donors, financing considerations including past and current funding availability, donor funding requirements and timelines, past programme and supply chain challenges, particular political and service delivery environment, etc. – Describe programme targets, priorities for example, vaccine introduction, forecasting period, products being forecasted, and any foreseen programme and policy changes that can affect the supply and demand for vaccines and other immunization supplies	One day	Chairperson/ secretary of the FSP team
2	Collect, clean, adjust, aggregate and analyse FSP data and assumptions	FSP data and assumptions should cover health and supply chain-related data, as summarized in Table 1. All decisions made while completing this step should be documented appropriately, as they will inform discussions during the FSP workshop.	Few days to two weeks	Chairperson/ secretary of the FSP team

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#	Task	Description	Estimated time allocation	Responsible
3	Plan for the FSP consultation meetings and/or workshop	The FSP consultation meetings and/or workshop serves as the platform for the review of historical programme and FSP performance, discussion and ratification of the FSP data and assumptions, and the final forecast and supply. To plan for the consultation meetings the FSP team should: – Articulate the specific objectives of the consultation meetings, including key outputs – Engage the targeted persons and propose a meeting plan – Develop presentations that will inform discussion during the consultation To plan for this workshop, the FSP team should: – Articulate the specific objectives of the workshop, including key outputs – Decide on the type of workshop and participants – Develop the agenda and budget for the workshop – Develop and ensure that invitations are sent to all participants in a timely manner – Confirm the completeness of data, assumptions and analytics, as well as other workshop logistics – Develop presentations and templates that will inform discussion during the workshop	Few days to two weeks	Chairperson/ secretary of the FSP team

The timeline provided is indicative. Countries need to consider their specific context while preparing for FSP.

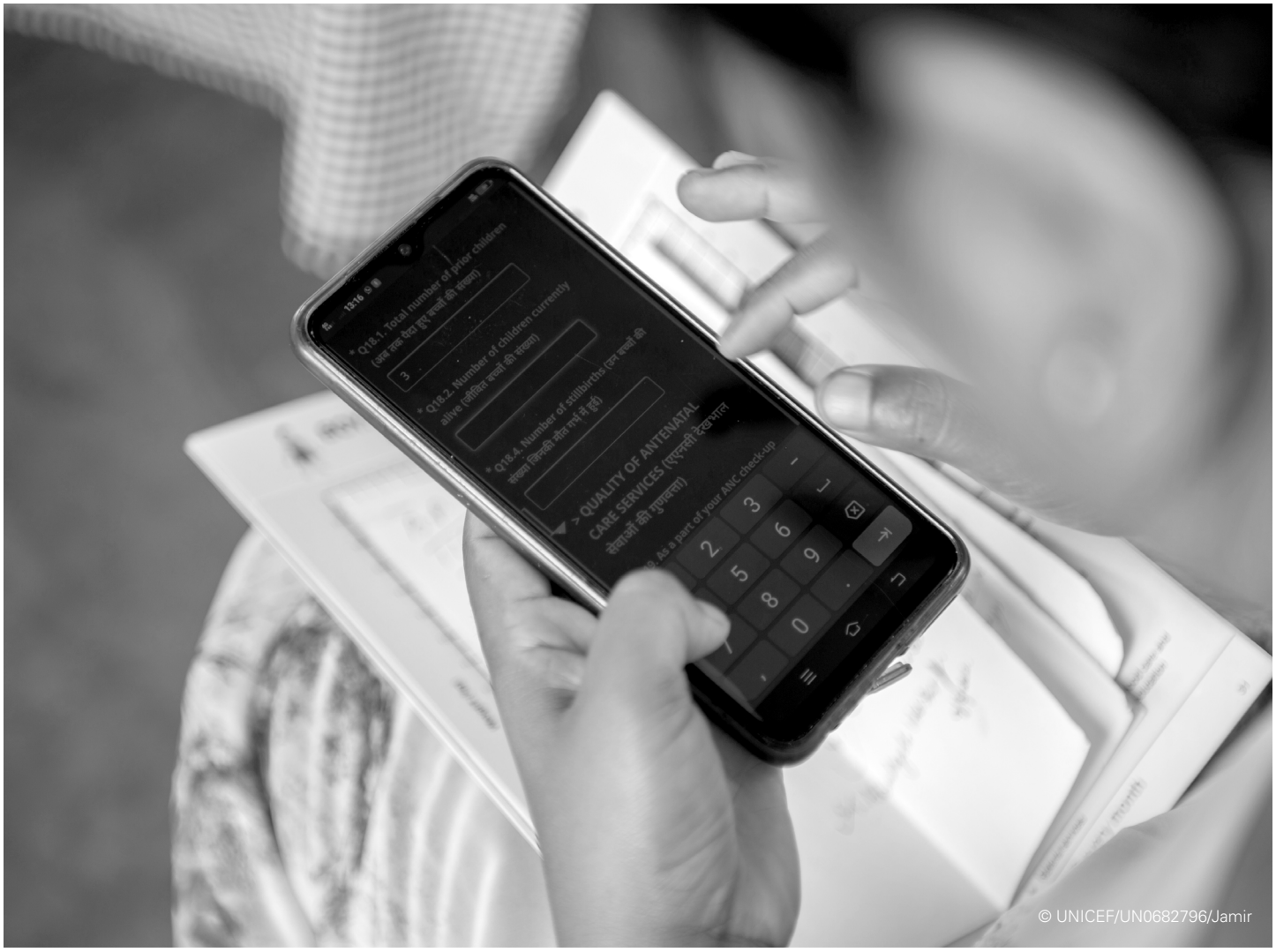
Table 1: FSP data and assumptions

Type of data	#	Data point	Potential source(s)
Programme background data and scope	1.1	**Programme background data**	
	1.1.1	Immunization service delivery model for example description of primary health-care services, community health services, type and distribution of health-care workers and supply chain architecture/ design	Programme strategy documents, key informant interviews
	1.1.2	National immunization partners, including donors	Programme strategy documents, key informant interviews
	1.1.3	Financing considerations, including past and current funding availability, donor funding requirements, and timelines	Budget, donor commitment (decision) letter
	1.1.4	Past programme and supply chain challenges	Supply chain assessment reports, key informant interviews
	1.1.5	Particular political and service delivery environment that can affect immunization service delivery	Programme strategy documents, key informant interviews
	1.1.6	Any foreseen programme and policy changes that can affect the demand and supply for vaccines and other immunization supplies	Programme strategy documents, policy documents, key informant interviews
	1.1.7	Any relevant new products or formulations in the market	Market update reports, key informant interviews
	1.1.8	Seasonality and geographical variation in incidence of specific diseases that may affect demand for vaccine	Programme assessment reports
	1.1.9	Societal and behavioural factors that can affect vaccine uptake, for example HPV vaccine stigma due to misinformation	Epidemiology report, key informant interviews
	1.1.10	Historical coverage	Administrative database, surveys (multiple indicator cluster survey/national immunization coverage survey [MICS/NICS]), standardized monitoring and assessment of relief and transitions (SMART), World Health Organization (WHO) and UNICEF estimates of national infant immunization coverage (WUENIC)
	1.1.11	Historical dropout rate	Administrative database, surveys (MICS/NICS, SMART), WUENIC
	1.2	**Scope**	
	1.2.1	Forecasting period	Programme strategy documents, key informant interviews
	1.2.2	Historical consumption period	Programme strategy documents, key informant interviews
	1.2.3	List of routine immunization antigens	Programme strategy documents
	1.2.4	List of supplementary immunization activities antigen	Programme strategy documents, key informant interviews
	1.2.5	List of antigens for outbreak response	Programme strategy documents, key informant interviews
	1.2.6	List of immunization supplies	Programme strategy documents, key informant interviews
	1.2.7	Vaccine introduction, switch and withdrawal plan	Programme strategy documents, key informant interviews

Type of data	#	Data point	Potential source(s)
Forecasting	2.1	**Demographic**	
	2.1.1	Total population	Population census, United Nations (UN) projection, microplan, geographic information system (GIS) estimate
	2.1.2	Population growth rate	Population census, UN projection, research publications, strategy documents, stakeholders' consensus
	2.1.3	Target population groups	Population census, UN projection, research publications, strategy documents, stakeholders' consensus, campaign plan, zero-dose children report
	2.1.4	Target coverage	Strategy documents, e.g., comprehensive multi-year strategic plan (cMYP), stakeholders' consensus, campaign plan, zero-dose children report
	2.1.5	Target dropout rate	Strategy documents, stakeholders' consensus
	2.1.6	Number of doses per person	Programme/strategy documents, manufacturer
	2.1.7	Wastage rate	Administrative database (LMIS), operational research publication, stakeholders' consensus
	2.2	**Vaccination session:** This forecasting method is to be primarily applied at the health facility or district level. The national level will collate and aggregate lower-level forecasts to obtain the national estimate.	
	2.2.1	Total population	Population census, UN projection, GIS estimate, microplan
	2.2.2	Population growth rate	Population census, UN projection, research publications, strategy documents, stakeholders' consensus
	2.2.3	Target population	Population census, UN projection, GIS estimate, microplan
	2.2.4	Target coverage	Strategy documents, e.g., cMYP, stakeholders' consensus
	2.2.5	Dropout rate	Strategy documents, stakeholders' consensus, reaching every district/reaching every child (RED/REC) books
	2.2.6	Number of doses per person	Programme/strategy documents, manufacturer
	2.2.7	Number of vaccination sessions per period	Programme strategy documents or plans
	2.2.8	Number of weeks per period	Calendar
	2.2.9	Number of weeks an opened multidose vial can be used for subsequent vaccination sessions	Programme policy document, stakeholders' consensus
	2.2.10	Number of doses per vial	Stakeholders' consensus, supplier/manufacturer
	2.2.11	Unopened (closed) vial wastage	Strategy documents, stakeholders' consensus, administrative sources, operational research publication
	2.2.12	Avoidable opened vial wastage	Operational research publication, stakeholders' consensus

Type of data	#	Data point	Potential source(s)
Forecasting	2.3	**Consumption**	
	2.3.1	Historical consumption for the defined review period	Administrative database (LMIS)
	2.3.2	Historical reporting rate for the defined review period	Administrative database (LMIS)
	2.3.3	Historical stock-out days for the defined review period	Administrative database (LMIS)
	2.3.4	Population data	Population census, UN projection, GIS estimate, microplan
	2.3.5	Projected growth rate	Strategy documents, stakeholders' consensus
Supply Planning	3.1	Projected consumption for the remainder of the implementation year	Administrative database (LMIS), FSP report
	3.2	Stock on hand (quantities including expiry dates) as available from the most recent logistics reports	Administrative database (LMIS)
	3.3	Months of stock on hand (expressed as stock on hand divided by average monthly consumption)	Administrative database (LMIS)
	3.4	Shipments in the pipeline (confirmed and unconfirmed orders)	Supply plan, procurement plan
	3.5	Maximum and minimum inventory control level or buffer rates as defined or applied in the national management policy or practice	Programme policy document, supply chain strategy document, supply chain standard operating procedures, stakeholders' consensus
	3.6	Established shipment intervals	Programme strategy document, key informant interviews
	3.7	**Product information**	
	3.7.1	Registration status	National regulatory agency's website or registration status document
	3.7.2	Status on national essential medicines list	National essential medicines list
	3.7.3	Prices	Procurement agent, finance department
	3.7.4	Vial size	Procurement agent/manufacturer
	3.7.5	Number of units per pack size	Procurement agent/manufacturer
	3.8	**Procurement information**	
	3.8.1	Procurement mechanism	Programme strategy document, key informant interviews
	3.8.2	Procurement lead time for each procurement mechanism	Procurement agent
	3.9	**Supplier information**	
	3.9.1	Prices	Supplier
	3.9.2	Packaging information	Supplier
	3.9.3	Lead time	Supplier
	3.9.4	Shipping and handling cost (freight etc.)	Supplier

Type of data	#	Data point	Potential source(s)
Supply Planning	3.10	**Funding information**	
	3.10.1	Funders/sources	Programme strategy document, key informant interviews, donors
	3.10.2	Funding commitment	Budget, donor commitment (decision) letter
	3.10.3	Fund disbursement schedule	Donor commitment (decision) letter
	3.11	**Distribution information**	
	3.11.1	Customs clearance fees including taxes	Programme budget and invoices
	3.11.2	In-country distribution costs	Programme budget and invoices
	3.12	**Storage and other in-country information**	
	3.12.1	In-country storage costs	Programme budget and invoices
	3.12.2	In-country sampling and quality assurance costs	Programme budget and invoices
	3.12.3	Insurance cost	Programme budget and invoices



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Collect, clean, adjust, aggregate and analyse forecasting and supply planning data and assumptions

The key considerations for each subactivity are explained in detail below.

1) Collect FSP data and assumptions

#	Consideration	Description	Guidance
1.1	Collect data and assumptions for all forecasting methods	The team should collect data and assumptions for all forecasting methods	These data and assumptions must be collected from established sources, as defined by the programme. Where the data and assumptions for any forecasting method are unavailable, the programme should put necessary measures in place to ensure they are available for subsequent forecasting period.
1.2	Collect data and assumptions for all administrative and/or supply chain levels	The FSP team should collect data and assumptions up to the lowest administrative and/or supply chain level possible, as this is foundational to equity and accurate estimation of commodity requirements.	
1.3	Consider multiple sources for each data point	The FSP team should consider multiple sources for any given data, as this creates an opportunity for triangulation. For example, historical coverage data may be sourced from administrative reports, WUENIC, and coverage survey reports.	The final decision on which data source to use will depend on the quality and reliability of the data from these different sources, among other considerations.
1.4	Collect historical data and futuristic projections	Where applicable, historical performance and futuristic projections are required. The historical performance could help (1) determine how well the programme has performed in the past (see Chapter 9 'Forecasting and supply planning performance monitoring' for details) and (2) assess how realistic futuristic projections are, and can even inform revisions when considered in combination with other factors that may impact future demand. For example, a review of historical performance can reveal that the best coverage performance over the past five years has been 50%, resulting in the decision that a coverage target of 90% for the forecast year is unrealistic given the planned investments.	When the historical performance is unavailable, the programme should put necessary measures in place to ensure they are available for subsequent FSP period.
1.5	Collect preliminary assumptions when data is unavailable	The FSP team can also work with stakeholders to generate preliminary informed assumptions when the needed data are unavailable.	The preliminary informed assumptions should be discussed and ratified during the FSP consultation meetings and/or workshop.

2) Clean data

As collected data, especially those from administrative sources, may not be error-free, all data should be reviewed for possible errors and cleaned in line with the existing country protocols.

The quality review should establish availability, after which available data should be reviewed for accuracy, completeness, and recency. All observed errors and actions taken, including unresolved issues, should be documented during the quality review process.

Table 2 summarizes common quality issues and recommended actions. The list is, however, not exhaustive, and countries may encounter other issues outside the list. It is the responsibility of the FSP team to work with other stakeholders to decide on a course of action in such situations.

Table 2: Common quality issues and recommended actions

Type of data	Data	Quality issue	Recommended action
Programme performance, targets, and policy	Historical coverage, dropout rate	Administrative coverage may be inaccurate, e.g., ≥100% coverage due to overreporting of numerator or wrong denominator, negative dropout rate	Consider using alternative sources, e.g., WUENIC estimates and survey results. In doing so, the cohort birth year, rather than the year the survey results were released, should be matched with the appropriate administrative year
			Adjust coverage and/ or dropout rate based on verification factor from data quality assessment (DQA)
	Target coverage and dropout rate	May be unrealistic	Revise based on historical trends and interventions that may impact future demand
	Maximum and minimum inventory control level	No formal policy is in place	Work with stakeholders to come up with an informed assumption
Demographic/morbidity	Total population	Population data from some sources, e.g., population census, may be outdated and not available for all administrative levels	Explore triangulation of projected population census data with data from more recent alternative sources, e.g., aggregated microplan
	Population growth rate	Information may not be available for the lower administrative levels	Use the growth rate for the closest upper administrative level, e.g., the state average can be used for all districts
	Target population	Information on the proportion of the population that falls within a certain age group may be unavailable	Use guesstimate

Type of data	Data	Quality issue	Recommended action
Logistics	Consumption	Data may be unavailable or inaccurate	Consider using issues data from the lowest distribution point
			Consider estimating consumption using opening stock, receipts, and stock balance
	Wastage rate (historical)	Data may be unavailable or inaccurate, e.g., 0% or negative wastage rate for multidose vial	Use data from the most recent wastage study
	Wastage rate (future projection)	May not reflect programme implementation reality	Revise based on WHO wastage calculator projection, wastage rate study findings, or most recent administrative data if of good quality
	LMIS reporting rate	Data may be unavailable	Work with stakeholders to produce a guesstimate
	Stock-out days	Data may be unavailable	Work with stakeholders to produce a guesstimate
	Stock on hand	Data may be unavailable or inaccurate	Conduct physical stock count just before the FSP exercise
			Exclude poor-quality data if quality issues are localized to a level of the supply chain that does not hold a significant volume of stock
Services	Number of children immunized	Administrative data may be inaccurate due to overreporting or underreporting	Use the results of DQA to adjust estimates
			Consider other sources for assumptions that require the use of children immunized, e.g., use the WHO wastage calculator for wastage rate
	Number of active immunization sites	Data may be inaccurate	Work with stakeholders to produce a guesstimate
	Vaccination session frequency	Data may be inaccurate	Work with stakeholders to produce a guesstimate

3) Adjust data

Due to service interruption or stock-out, incompleteness, product switch and programmatic changes, the cleaned data may require adjustment before they are used to inform discussions during the FSP consultation meetings/ workshop and/or generate the final forecast. Table 3 shows the possible reasons and formula for adjusting consumption data.

Table 3: Possible reasons and formula for adjusting consumption data

#	Possible reason for adjustment	Formula	Comments
1	Stock-out	$\text{Unadjusted consumption} \times \frac{\text{Review period months (or days)}}{\text{Review period months (or days)} - \text{months (or days) of stock-out}}$	Where feasible, the adjustment should be made at the health facility level.
2	Reporting rate	$\text{Unadjusted consumption} \times \frac{100\%}{\text{Reporting rate}}$ Stratified adjustment based on jurisdiction population can be conducted following the steps listed below (see illustrative example): I. Group health facilities by population served II. Estimate reporting rate for each stratum III. Adjust consumption for each stratum (using the formula above) IV. Pool together estimates across all strata	Where feasible, the adjustment should be calculated by stratification, i.e., based on "high", "medium" and "low" consumption facilities, or by jurisdiction populations, and should be adjusted separately, following which the resulting estimates should be pooled together.
3	Potential decrease in wastage	$\text{Unadjusted consumption} \times (100\% - \%\text{ decrease in consumption})$	This could be due to anticipated improvements in product handling practices, such as improved adherence to multidose vial policy by health-care workers, or product changes, such as a switch to a smaller vial size (number of doses/ vial).
4	Potential increase wastage	$\text{Unadjusted consumption} \times (100\% + \%\text{ increase in consumption})$	This could be due to a switch to a bigger vial size (number of doses/vial).

Notes:

- Multiple adjustments may be required, i.e., the FSP may need to be adjusted based on all four reasons provided in Table 3.
- The third and fourth adjustments described in Table 3 (potential decrease or increase in wastage) are only required for consumption-based forecasting, to ensure that historical trends not expected to extend into the future are duly accounted for.

Illustrative example: Reporting rate adjustment

Consider a hypothetical country with 30 health facilities, 24 of which reported BCG consumption for the month as indicated below.

Table 4: Data for hypothetical country

#	Health facility name	Catchment population	Reported (yes/no)	BCG consumption (doses)
1	A	1,000	Yes	1,800
2	C	800	Yes	1,440
3	N	1,650	Yes	2,970
4	O	1,920	Yes	3,460
5	P	1,800	Yes	3,240
6	Q	1,320	Yes	2,380
7	D	850	No	-
8	Z	2,020	Yes	3,640
9	A1	2,023	Yes	3,650
10	F	980	Yes	1,770
11	G	840	No	-
12	H	650	Yes	1,170
13	I	999	Yes	1,800
14	J	899	No	-
15	K	1,999	Yes	3,600
16	M	1,500	No	-
17	R	1,400	Yes	2,520
18	S	1,450	Yes	2,610
19	T	1,620	Yes	2,920
20	U	2,001	Yes	3,610
21	V	2,500	Yes	4,500
22	E	920	Yes	1,660
23	W	3,000	Yes	5,400
24	X	2,120	No	-
25	Y	2,300	Yes	4,140
26	B	900	Yes	1,620
27	B2	2,400	No	-
28	L	1,200	Yes	2,160
29	C3	2,700	Yes	4,860
30	D4	2,800	Yes	5,040

Calculate adjusted consumption:

1: without stratification
2: with stratification based on the catchment population categorization indicated below

Category	Catchment population
Low	≤1,000
Medium	>1,000, ≤2,000
High	>2,000

Solution 1: Adjusted consumption without stratification

Formula

$$\text{Unadjusted consumption} \times \frac{100\%}{\text{reporting rate}}$$

Unadjusted consumption = sum of all reported consumption = 71, 960 doses

$$\text{Reporting rate} = \frac{\text{Total number of reports received}}{\text{Total number of reports expected}} \times 100\% =$$

$$\frac{24}{30} \times 100\% = 80\%$$

Adjusted consumption =

$$71{,}960 \times \frac{100\%}{80\%} = 89{,}950 \text{ doses}$$

Solution 2: Adjusted consumption with stratification

I. Group health facilities by population served (see the category column in Table 5)
Based on the agreed categorization, there are 10 health facilities each in low, medium and high categories.

II. Estimate reporting rate for each stratum

Formula

$$\text{Reporting rate} = \frac{\text{Total number of reports received}}{\text{Total number of reports expected}} \times 100\%$$

As shown in the table below, the reporting rates for low, medium and high categories are 70 per cent, 90 per cent and 80 per cent respectively.

III. Adjust consumption for each stratum

Formula

$$\text{Unadjusted consumption} \times \frac{100\%}{\text{Reporting rate}}$$

Where unadjusted consumption = sum of all reported consumption for each stratum

Adjusted consumption is 16,086, 28,733 and 43,550 for low, medium and high categories respectively.

IV. Pool together estimates across all strata, i.e., sum of all adjusted consumption for each stratum

Adjusted consumption for the country =
16,086 + 28,733 + 43,550 = 88,369 doses

Table 5: Solution: Adjusted consumption with stratification

#	Health facility name	Catchment population	Category	Reported (yes/no)	BCG consumption (doses)	Reporting rate by stratum	Unadjusted consumption by stratum	Adjusted consumption by stratum	Adjusted consumption for the country
1	H	650	Low	Yes	1,170	70%	11,260	16,086	(16,086 + 28,733 + 43,550) = 88,369
2	C	800	Low	Yes	1,440				
3	G	840	Low	No	-				
4	D	850	Low	No	-				
5	J	899	Low	No	-				
6	B	900	Low	Yes	1,620				
7	E	920	Low	Yes	1,660				
8	F	980	Low	Yes	1,770				
9	I	999	Low	Yes	1,800				
10	A	1,000	Low	Yes	1,800				
11	L	1,200	Medium	Yes	2,160	90%	25,860	28,733	
12	Q	1,320	Medium	Yes	2,380				
13	R	1,400	Medium	Yes	2,520				
14	S	1,450	Medium	Yes	2,610				
15	M	1,500	Medium	No	-				
16	T	1,620	Medium	Yes	2,920				
17	N	1,650	Medium	Yes	2,970				
18	P	1,800	Medium	Yes	3,240				
19	O	1,920	Medium	Yes	3,460				
20	K	1,999	Medium	Yes	3,600				
21	U	2,001	High	Yes	3,610	80%	34,840	43,550	
22	Z	2,020	High	Yes	3,640				
23	A1	2,023	High	Yes	3,650				
24	X	2,120	High	No	-				
25	Y	2,300	High	Yes	4,140				
26	B2	2,400	High	No	-				
27	V	2,500	High	Yes	4,500				
28	C3	2,700	High	Yes	4,860				
29	D4	2,800	High	Yes	5,040				
30	W	3,000	High	Yes	5,400				

Note: There is a difference between the unstratified and stratified adjusted consumption (89,950 doses versus 88,369 doses). Where possible, stratified adjustment should be conducted, as it will be more accurate, given that it considers the variation in the population served by health facilities.

4) Aggregate data

Following data collection, cleaning, quality review and adjustment, the data can then be aggregated in preparation for analysis. The aggregation level will depend on the forecasting approach, i.e., single national forecast versus stratified/disaggregated forecast by region (see the subsections on equity and zero-dose considerations and disaggregated forecasting).

5) Prepare FSP data and assumptions and conduct a preliminary analysis

At this stage, the aggregated data and assumptions are presented in a format that can facilitate discussions at the FSP workshop. This will include conducting a preliminary analysis to show historical programme performance as a means of establishing how realistic programme targets are. The type of analytics can include:

- Coverage and dropout rate trend
- Consumption trend
- Historical forecast and supply plan accuracy

For equity reasons, the analysis should include subnational performance to detect any significant variations.

Considerations for ensuring equity, reaching zero-dose children, and stratified forecasting and supply planning

Equity and zero-dose considerations

The FSP team should consider equity and strategies for reaching zero-dose children, which should be informed by the existing country strategy and/or discussions during the FSP consultations/workshop. The factors discussed below can guide the team's discussion.

- **Variation in subnational coverage and dropout rate:** This is important in establishing the magnitude of inequity and which regions are most affected. The country can set separate targets for different areas based on historical performance and planned interventions with this information. For example, following the review of subnational coverage and discussions on the potential impact of planned interventions, a country may decide on four categories, as shown below, to facilitate stratified forecasting.

Category	Historical coverage	Target coverage
1	≤30%	50%
2	>30 – ≤50%	80%
3	>50 – ≤80%	90%
4	>80%	99%

- Subnational geographical characteristics, including distances to the last distribution point and climate considerations, are equally important.
- **Representativeness of population figures:** One reason for the inability to reach zero-dose children is the lack of their inclusion in the population estimate used for FSP. The FSP team should therefore attempt to establish whether the population estimate considers these children. This could mean triangulating data from the population census with an aggregated microplan or other sources, and making necessary adjustments. Alternatively, the team may want to ascertain whether the buffer stock will be sufficient to accommodate the vaccine requirement of this population. If the buffer stock is considered insufficient, the team may, at this point, decide to increase it for the affected regions, while considering available storage capacity.
- **Seasonal variability in demand:** In some countries' contexts, one reason for poor forecast accuracy is the lack of consideration of possible seasonal variation in demand. Countries should therefore take into account this variation when setting forecasting parameters (e.g., target population, dropout rate) or choosing forecasting approach. For example, this can be important for countries with seasonal cross-border migration (e.g., nomadic pastoralists) or seasonal conditions (e.g., rainy season) that can impact the likelihood of caregivers accessing immunization services at certain periods of the year.

— **Planned interventions**
Planned interventions for addressing the underlying causes of inequitable coverage should also be considered while compiling FSP inputs. For example, the country may decide that a switch to a smaller dose vial or an increase in allowable wastage rate will be the supply-side intervention to address missed opportunities for vaccination due to health workers' reluctance to open a multidose vial in certain regions. In other instances, it could be a change in vaccination session frequency. These interventions have implications for FSP and must be considered while collating data and assumptions.

Stratified forecasting and supply planning

Stratified FSP helps countries develop more accurate forecast and supply plans, and should be considered when there is significant subnational variation in coverage performance. This will involve setting different targets for different regions and deploying targeted interventions that can affect commodity needs. The FSP inputs should be compiled in a format that aligns with the agreed-upon categorization and planned interventions. For example, a country that chooses four categorizations for demographic/wastage factor-based forecasting should have assumptions stratified by categories, as shown below.

	Region One	Region Two	Region Three	Region Four
Target population (TP)	TP_1	TP_2	TP_3	TP_4
Target coverage (TCov)	$TCov_1$	$TCov_2$	$TCov_3$	$TCov_4$
Target dropout rate (TDpr)	$TDpr_1$	$TDpr_2$	$TDpr_3$	$TDpr_4$
Wastage rate (WR)	WR_1	WR_2	WR_3	WR_4
Buffer rate (BR)	BR_1	BR_2	BR_3	BR_4

Plan for the forecasting and supply planning consultation meetings and/or workshop

The last FSP preparatory activity is planning for FSP consultation meetings and/or workshop. The FSP consultation meetings and/or workshop can serve as the platform for (1) reviewing the historical programme and FSP performance, (2) discussion and ratification of data and assumptions, including adjustments where applicable, (3) development of a forecast and supply plan, and (4) development of recommendations to facilitate operationalization and improvement of FSP performance.

Forecasting and supply planning consultation meetings

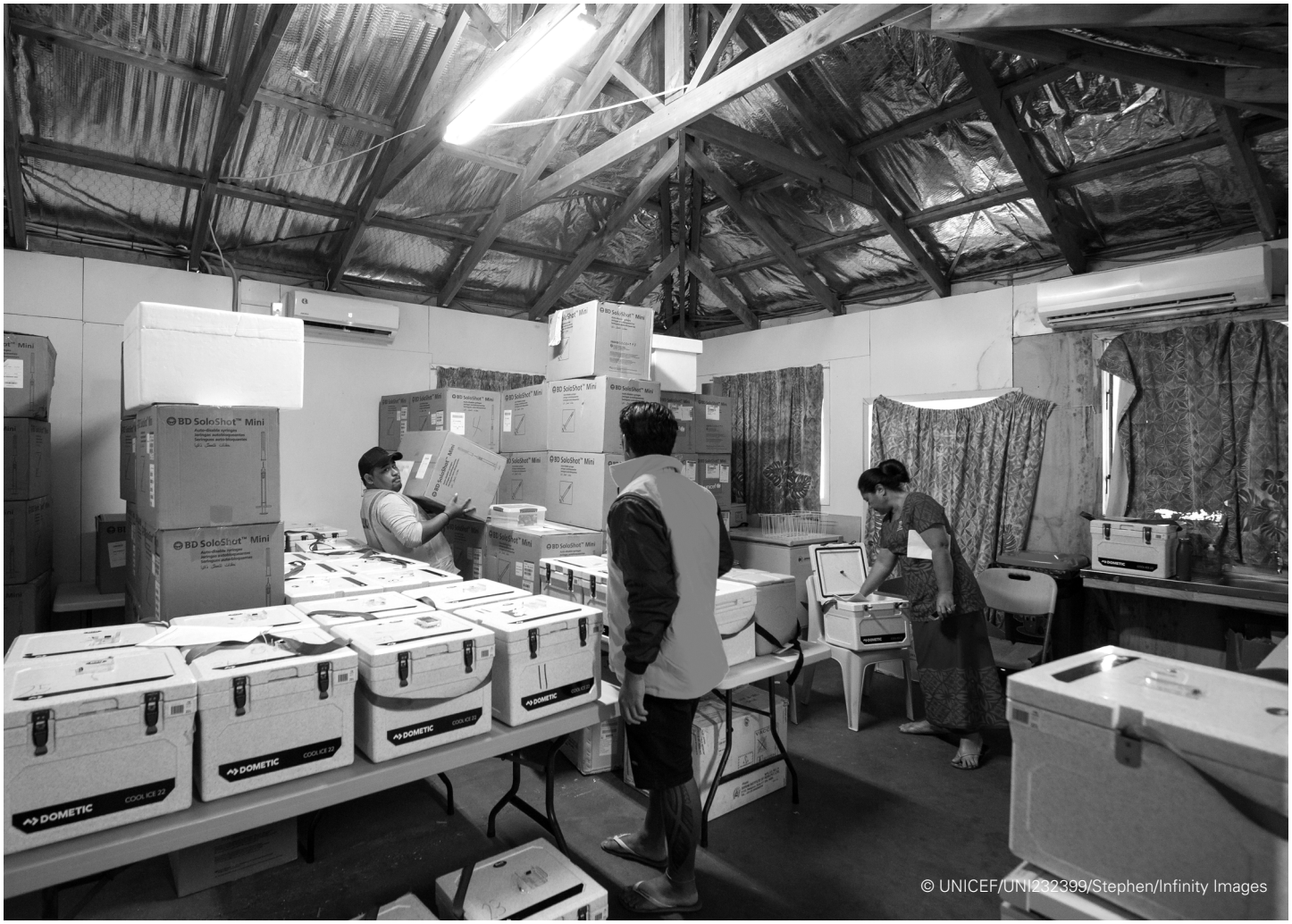
The FSP consultation meetings target individuals with some specific skills and expertise that are not available within the FSP team. To prepare for the FSP consultation meetings, the FSP team should accomplish the following tasks.

#	Task	Description
1	Articulate the specific objectives of the consultation meetings, including key outputs	The specific objectives should be clearly articulated before the consultation meeting. Also, the team should be clear on the key outputs from the consultation.
2	Engage the targeted persons and propose a meeting plan	Efforts should also be made to ensure that the targeted persons are engaged well ahead of time, including proposing possible meeting dates and key discussion points.
3	Develop presentations that will inform discussion during the consultation	Presentations that will inform discussions during the consultation meeting should be developed by the FSP team.

Forecasting and supply planning workshop

In addition, or as an alternative to the consultation meetings, the FSP team can organize an FSP workshop. Participants at this workshop should include a diverse group of stakeholders involved in programme planning and implementation. To prepare for the FSP workshop, the FSP team should accomplish the following tasks.

#	Task	Description
1	Articulate the specific objectives of the workshop, including key outputs	The specific objectives of the FSP workshop should be clearly articulated during the preparatory phase. Also, the team should be clear on the key outputs from the workshop.
2	Decide on the type of workshop and participants	Based on the prevailing situation and available funding, the team should decide whether the FSP workshop will be in-person, virtual or hybrid. Also, the team should develop and finalize a participants list.
3	Develop agenda and budget for the workshop	This should detail the various sessions that will be held, time allotment, facilitator, and key output from each session. The unit responsible for overseeing the activity of the FSP team is expected to review and approve the final copy of the agenda. Where applicable, the team should also develop and obtain approval for the workshop budget.
4	Develop and ensure that invitations are sent to all participants in a timely manner	Invitations for this workshop should be sent out on time, considering the time needed for administrative approval. Efforts should also be made to ensure that the invitations are shared with the appropriate contact point responsible for approving participation. Also, the team should follow up to confirm receipt of the invitation and, more importantly, confirm attendance ahead of the workshop. Apart from clearly stating the date(s) and venue of the workshop, the invitation should also be clear on the roles of invitees during the workshop. An example will be a specific presentation or facilitation role.
5	Confirm completeness of data, assumptions and analytics, as well as other workshop logistics	The FSP team must ensure that the key data, assumptions, and analytics needed for informed discussions are ready ahead of the workshop (see Annex 1). Also, the FSP team should ensure that tools for FSP are in place. All necessary logistics for the workshop, such as venue, presentation aid and refreshment arrangements, should also be confirmed.
6	Develop presentations that will inform discussion during the workshop	Presentations that will inform discussions in the FSP workshop should be developed by the FSP team. Also, templates for reporting and documenting resolutions from the workshop should be created.



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Key takeaways

- **Planning for FSP should be led by the FSP team**, while reporting to the government entity responsible for leadership oversight.
- During the preparatory phase, **the FSP team should prepare data, assumptions and analytics for the FSP workshop/ consultation meetings**.
- **Countries can organize an FSP workshop in addition** to, or as an alternative to, the consultation meetings.
- In collating data and assumptions, the **FSP team should ensure that equity and strategies for reaching zero-dose children are considered**.
- By the time planning for the FSP workshop is completed, **all the inputs needed to make informed decisions during the FSP workshop/consultation meetings should be ready**.

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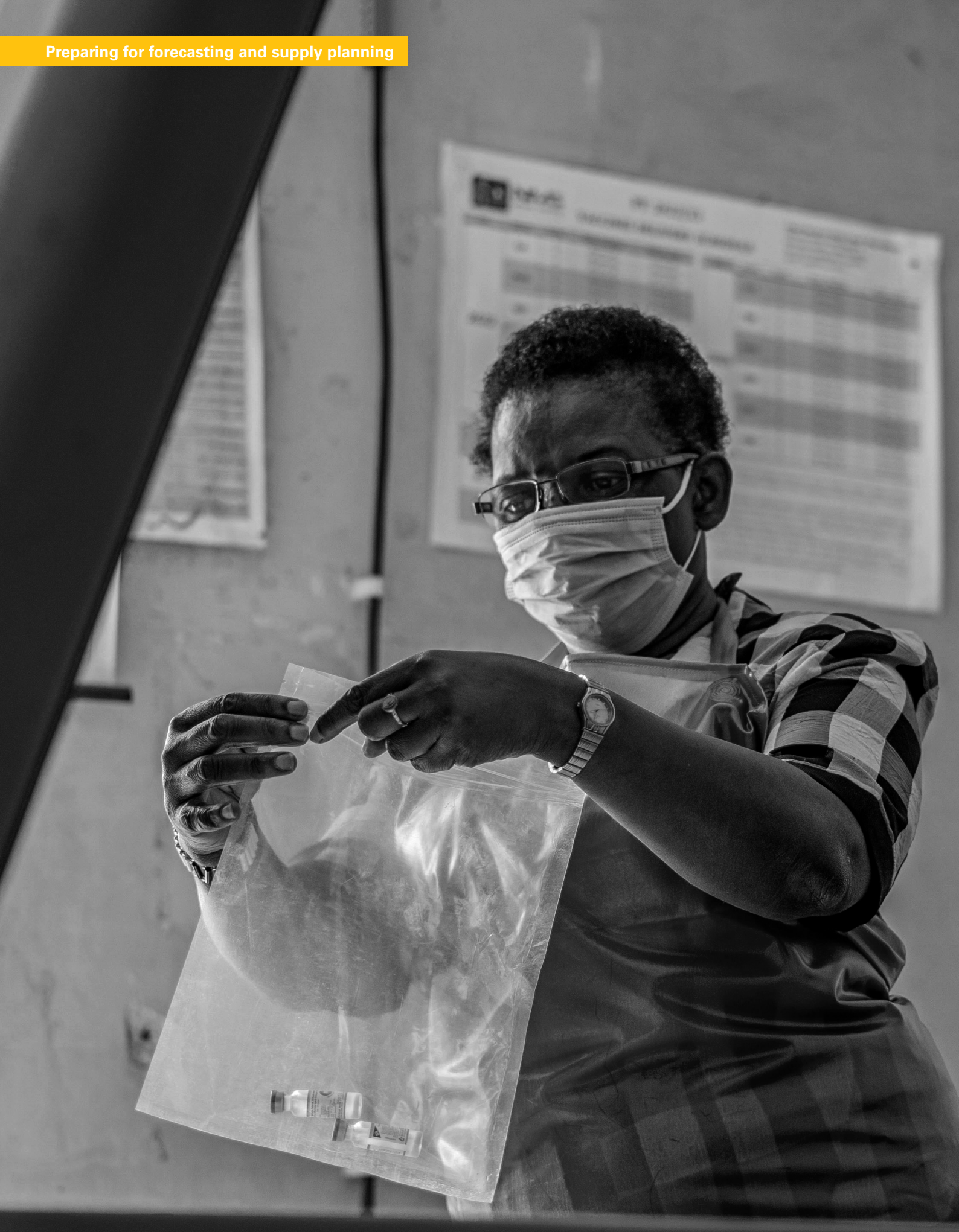
Preparing for forecasting and supply planning



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Annex

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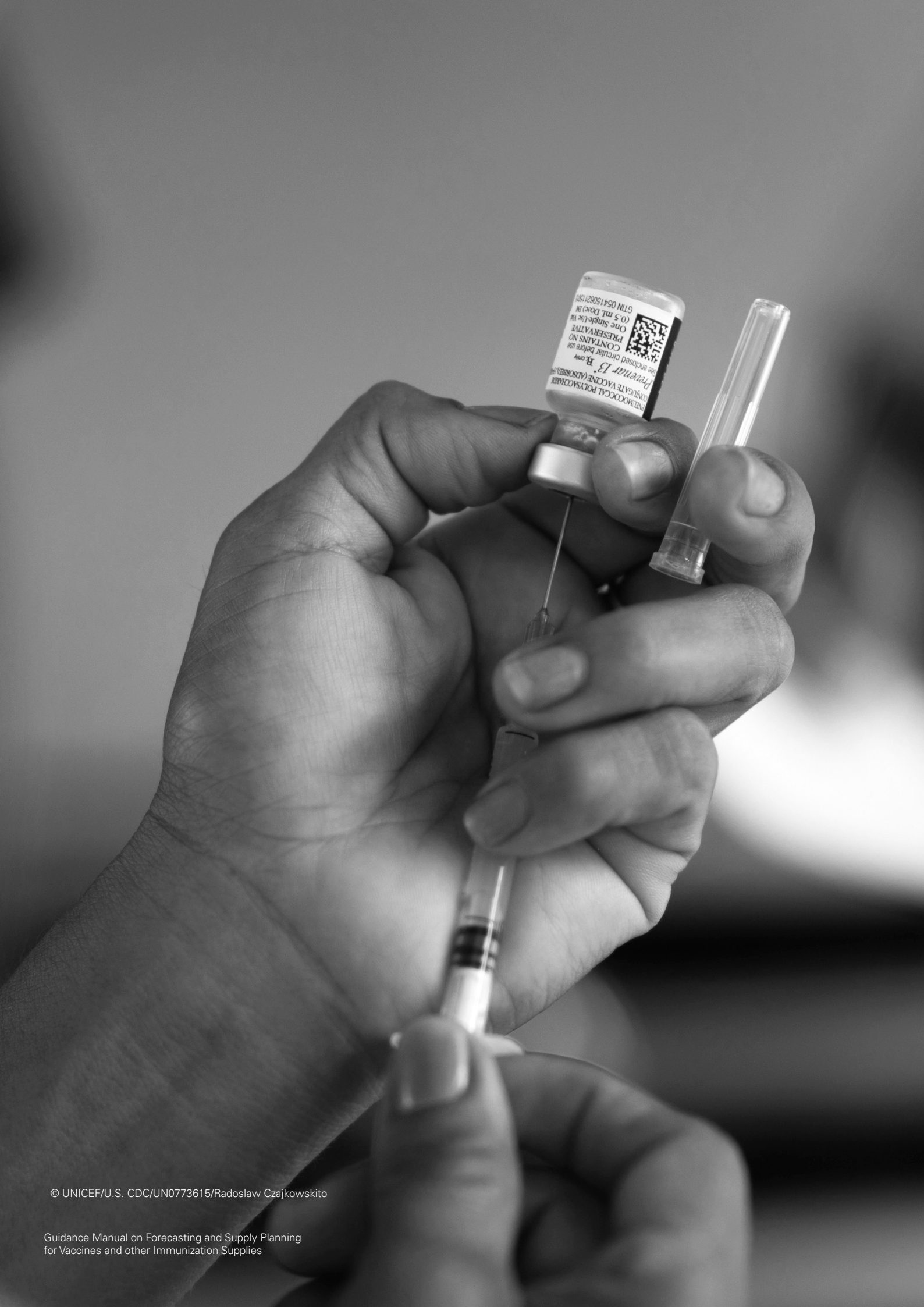
Annex

Annex 1: Key forecasting and supply planning inputs

Forecasting			Supply planning
Demographic	Vaccination session	Consumption	
Target population⁺	Target population	Historical consumption	Stock on hand – quantities, including expiry dates – as available from the most recent logistics reports
Target coverage	Target coverage	Historical reporting rate*	Expected product shipments (stock on order)
Dropout rate	Dropout rate	Historical stock-out days*	Projected consumption for the remainder of the implementation year
Number of doses per person	Number of doses per person	Projected growth rate	Maximum and minimum inventory control level, or buffer rate
Wastage rate	Number of vaccination sessions per period		Established shipment intervals
	Number of weeks per period		Product information: – Registration status – Status on national essential medicines list – Prices – Vial size – Number of units per pack size
	Number of doses per vial		Supplier information and cost: – Product prices – Pack size – Lead time – Shipping and handling cost (such as freight)
	Number of weeks of reuse for opened multidose vial		Funding information: – Funders/sources – Funding commitment – Fund disbursement schedule
	Number of supply chain levels		Procurement mechanism and lead time
	Closed vial wastage		Distribution cost: – Customs clearance fees, including taxes – In-country distribution costs
	Avoidable opened vial wastage		Storage and other in-country costs: – In-country storage costs – In-country sampling and quality assurance (QA) costs – Insurance costs

Note: Some of the data are required for individual products.
⁺ Usually estimated as a percentage of the total population, i.e., the total population multiplied by A% where A% represents the proportion of the total population that is eligible for the vaccine.
* Required for adjustment of historical consumption, where indicated.



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