FIRST FORECASTING EXERCISE FOR THE VERY ESSENTIAL MNCH COMMODITIES PRIORITIZED BY THE DEPARTMENT OF HEALTH GOVERNMENT OF KHYBER PAKHTUNKHWA

2017-18 to 2022-23

Department of Health
Government of Khyber Pakhtunkhwa

This is a living document and will be updated on regular basis as and when required

First Forecasting Exercise for the Very Essential Maternal, Newborn, and Child Health Commodities Prioritized by the Department of Health, Govt. of Khyber Pakhtunkhwa

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ACKNOWLEDGMENTS

With the technical support of United States Agency for International Development (USAID), Global Health Supply Chain Program, Procurement and Supply Management (GHSC-PSM) Project, the Department of Health, Government of Khyber Pakhtunkhwa has developed a province-focused forecast for the MNCH commodities listed in the Very Essential Medicines List (VEML) of Khyber Pakhtunkhwa.

As per the mandate of USAID, GHSC-PSM Project continues to lend its technical expertise to support forecasting and supply planning of MNCH commodities in Khyber Pakhtunkhwa. This forecast is a result of a close coordination between Department of Health and GHSC-PSM Project, hence proving to be a stepping stone towards the capacity building of the human resource of DOH-KP. In addition, it is aimed at the successful transition of all forecasting and supply planning activities to provincial governments which can lead towards the achievement of global supply planning benchmarks.

We would like to express our deepest appreciation to all the relevant public-sector stakeholders, development partners, experts and medical professionals for reviewing, contributing, guiding and supporting the Forecasting of MNCH commodities for Khyber Pakhtunkhwa.

We also wish to appreciate Dr. Muhammad Tariq, Country Director, USAID GHSC-PSM Project, Pakistan for his leadership role and his dedicated team for their devoted efforts and support provided in the formulation of this report.

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ACRONYMS

ANCS	Antenatal corticosteroids
ARI	Acute respiratory infection
PBS	Pakistan Bureau of Statistics
PDHS	Pakistan Demographic and Health Survey
CHX	Chlorhexidine
DHIS	District Health Information System
ECP	Emergency contraceptive pill
EML	Essential Medicines List
VEML	Very Essential Medicines List
EPI	Expanded Program on Immunization
FIGO	Federation of Gynecology and Obstetrics
PWD	Population Welfare Department
TWG	Technical Working Group
GDP	Gross domestic product
GOP	Government of Pakistan
HDI	Human Development Index
ICM	International Confederation of Midwives
IM	Intramuscular
IV	Intravenous
MMR	Maternal mortality rate
MNCH	Maternal, neonatal, and child health
DOH	Department of Health
MWRA	Married women of reproductive age
NGO	Non-governmental organization
ORS	Oral rehydration salts
PE/E	Preeclampsia and eclampsia
PHC	Primary health care center
PPH	Postpartum hemorrhage
UN	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization
WRA	Women of reproductive age

INTRODUCTION

In September 2017, the Department of Health, Khyber Pakhtunkhwa notified the first ever MNCH very essential medicines list for improving access to 22 priority commodities across the maternal, newborn, and child health (MNCH) continuum. Later in December 2017, the first ever Technical Working Group (TWG) on Forecasting and Supply Planning (FASP) was notified. The terms of reference for TWG focused on developing institutional FASP capacity for these commodities; strengthening provincial supply chains; and improving data quality and availability. One of the supply chain areas for these commodities that was identified as particularly weak was forecasting and supply planning. For several of these commodities, the data required to estimate need accurately are unavailable in many countries and national forecasts are based on unsubstantiated assumptions and often on data from past procurements. This is the case for many commodities procured by the MNCH Program, Department of Health (DOH) Khyber Pakhtunkhwa (KP).

The Department of Health (DOH) Khyber Pakhtunkhwa (KP) requested USAID Global Health Supply Chain Program, Procurement and Supply Management (GHSC-PSM) Project, Pakistan, implemented by Chemonics International Inc., to address supply chain management issues related to essential medicines, especially tracer drugs (determined by FASP TWG of the DOH) with maternal, newborn, and child health (MNCH) products, helping the Government of Khyber Pakhtunkhwa and other key provincial stakeholders to improve the security of essential medicines in the province, strengthen the distribution and management information systems in place, and build local capacity to strengthen the health systems. As part of this effort, USAID GHSC-PSM Project has been working with relevant DOH, KP to improve forecasting and supply planning of MNCH commodities.

BACKGROUND

Khyber Pakhtunkhwa is the third most populated province in Pakistan, with a land mass of 74,521 km^2 and a population of 30,523,371. Among those, 83.1% live in rural areas. The population growth rate is 2.89% per annum (PBS) while the province itself accounts for 10% of Pakistan's GDP.
http://www.finance.gov.pk/survey/chapters_17/Economic_Indicators.pdf

Taking into account the current annual population growth rate, the projections suggest that the population of Pakistan will go beyond 300 million by 2050 and the province of KP will contribute almost 80 million to the total. In addition, the fertility rate is considerably higher in rural areas (4.2 births per woman) compared to urban areas (3.2 births per woman). (PDHS 12-13)

PDHS 2012-13 shows that Pakistan has a high infant and child mortality rate. Infant and under-five mortality rates in the past five years were 74 and 89 deaths per 1,000 live births respectively. At these mortality levels, 1 in every 14 Pakistani children die before reaching age 01, and 1 in every 11 does not survive to their 5^{th} birthday.

According to PDHS 2012-13, Neonatal mortality remained unchanged for the last 20 years, whereas infant mortality has decreased by 19 percent and under-five mortality has decreased by 24 percent over the same period.

Deaths of newborns are mainly due to prematurity, asphyxia, and infections. Most of these deaths could have been prevented if newborns had adequate access to resuscitation devices, appropriate umbilical cord care, and timely treatment for sepsis. Substantial presence of acute respiratory infections and diarrhea also contribute to the elevated mortality rates for children.

The current estimated maternal mortality ratio (MMR) is 178 per 100,000 live births (WHO 2015), one of the highest rates in the world. One of the many factors that contribute to maternal mortality is the inadequate use of health services. Fifty-five percent of pregnant women deliver at health facilities, and skilled attendance at birth remains low at 52%. Most of the women die at the time of the birth because of postpartum hemorrhage, eclampsia and other indirect obstetric causes.

As the challenges cited above have demonstrated, strengthening the planning, procurement, and information management of maternal, newborn, and child health (MNCH) life-saving commodities is critical to the survival and quality of care for millions of women and children in Pakistan. The country has made commendable progress in the prevention and control of pneumonia and diarrhea-related complications despite many challenges, and now must strive to build on that progress and reinvigorate efforts to address other causes of maternal and child mortality. To this end, it is essential that life-saving commodities be available when and where they are needed.

Current landscape:

Forecasting and supply planning (FASP) is the foundation for all other functions further down the supply chain as over estimation or underestimation of commodities can have serious implications on health delivery systems. It is a highly scientific and complex process, wherein numerous factors must be considered including demographics, morbidity rates, service data sets, and logistics data and requires a specialized skill set. Currently, FASP for a complete range of FP products for both departments and 22 MNCH commodities as per Very Essential Medicines List (VEML) for health department is being undertaken with technical assistance from the

GHSC-PSM project on the basis of logistics, demographic and morbidity indicators and enhancement in service delivery. The Integrated Health Project (IHP) also exercises quota/target-based forecasting and quantification for both FP and MNCH commodities. Availability of qualified and experienced human resources, structures, and tools remains a challenge for improved accuracy and timeliness of forecasting and supply planning for all medicines and supplies. Due to gaps identified in FASP projections, serious anomalies persist in district demand (mainly in FP and MNCH products). Both departments realize the need for having a structured mechanism for accurate FASP with dedicated trained staff as part of the Integrated Supply Chain Management and Coordination Cell at DOH.

FASP Roadmap

The objective of this roadmap is to establish a fully functional and structured FASP mechanism that systematically determines province specific FP and MNCH commodity requirements, estimates their financial costs, and coordinates fulfillment of projected needs to support the continuous availability of commodities.

Priority areas for improvement

- Reliable and quality data sets (demographic, disease prevalence/morbidity, and logistics) for accurate forecasting
- Dedicated resources (financial & trained HR) for FASP

- Institutionalization of FASP through capacity building of the provincial departments on accurate and timely forecasting and quantification of FP & MNCH commodities and identification of champions to form technical working groups under the ISCM&CC. As FP supply chain has higher maturity than MNCH with respect to procurement planning and monitoring functions, it is expected that, modelling FASP for MNCH supply chain will help in attaining departmental capacity within 2-3 years.
- Three data sets: logistics, services, and morbidity will be considered for forecasting and quantification of MNCH commodities depending upon availability of data and its quality. Knowledge and information of health departments' programmatic strategies will be important for accurate forecast and quantification of MNCH commodities. This needs to be ensured through document review and consultations with key stakeholders and / or focal points within the department.
- A forecasting exercise for FP and MNCH VEML will be done for three to five years and reviewed annually for adjustments, as per recommended models (Figure 1&2).

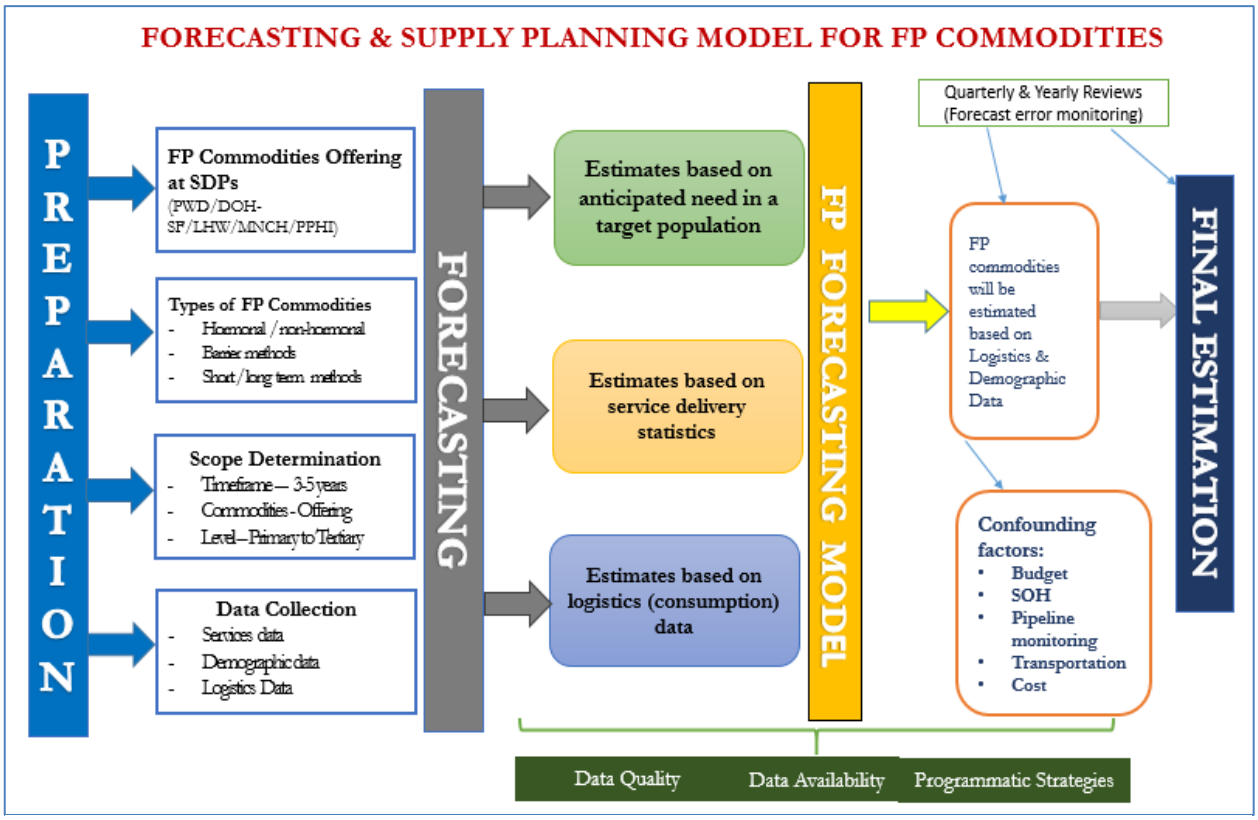

Figure 1: FASP Model for FP commodities

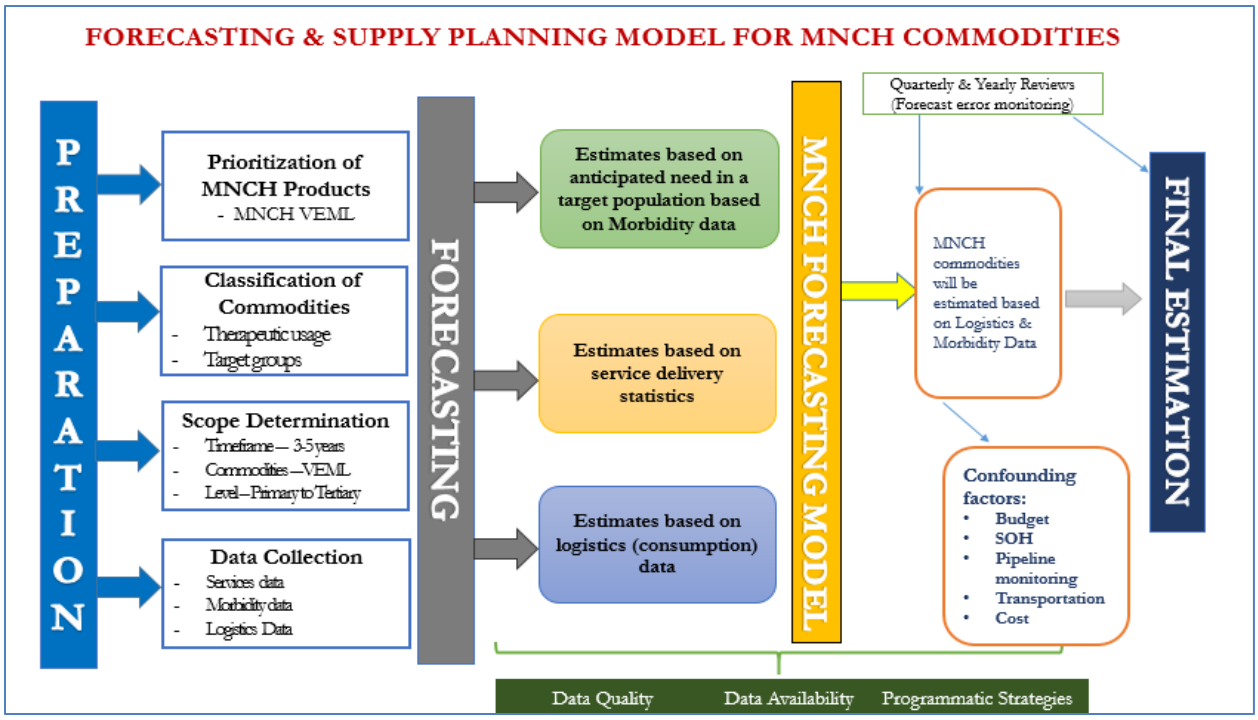

Figure 2: FASP Model for MNCH VEML

Implementation plan:

The health and population welfare departments of the Provincial Governments will carry out following activities to achieve articulated objectives.

- **Formation of Forecasting & Quantification Technical Working Group (TWG) at Provincial Level**
  Both health and population welfare departments will establish and notify a forecasting and quantification TWG at the provincial level under Procurement and FASP unit of ISCM&CC. The TWG will systematically determine provincial FP and MNCH commodity requirements, estimate their financial costs, and coordinate fulfillment of projected needs to support the continuous availability of commodities. The TWG will also analyze quantification figures related to MNCH commodity security issues and improve provincial capacity to perform this task independently. Improved inter-departmental coordination will facilitate consensus building on scope and assumptions for forecasting and quantification. It will also minimize duplication of efforts and wastage of resources.

- **Create Professionalized and Trained Human Resources at the Provincial and District Levels**
  At the provincial level, the capacity of the Procurement and FASP unit of the ISCM&CC will be trained in forecasting and quantification of FP and MNCH commodities. Pre-and in-service training courses will be organized / arranged that will contribute and ultimately lead to building of institutional capacity on forecasting and quantification within the provincial government.

- **Automation of Forecasting and Quantification Function into Integrated Web-based MIS**
  To reduce the likelihood of computational inaccuracies, forecasting and supply planning functions will be automated incrementally and made part of the integrated supply chain management information system. The province will design an EML forecasting and supply planning module in the web-based integrated MIS and will train users on the module. Thus, forecasting and supply planning will be graduated from manual to automated computation. The automation will help in timely and accurate forecasting and supply planning, which will, in turn, assist in procurement and commodity security.

RATIONALE FOR UNDERTAKING THIS EXERCISE

The Department of Health, Government of Khyber Pakhtunkhwa has documented the limited capacity within its structure to conduct the forecast for essential MNCH commodities. This lack of capacity has compelled the provincial health department and MNCH program to rely on the use of past distribution data and estimates of patient flows at facilities to calculate the need for MNCH commodities. The respective officials develop medicine requirements that are not scientifically appropriate to meet the current needs, thus making it difficult to maintain appropriate inventory to meet the needs of clients in the province. This current practice sometimes yields stock imbalances, stock- outs of some important medicines, and a preponderance of emergency orders, which in the end have been threatening the integrity of the MNCH programs. However, with the technical Assistance of GHSC-PSM project, the Directorate General of Health (DOH) of Khyber Pakhtunkhwa has established mechanisms to undertake the forecasting exercise of MNCH commodities through a Forecasting and Supply Planning Technical Group (FASP-TWG) comprised of technical experts and FASP champions. This approach helps to improve the forecasting and supply planning functions.

The need for a comprehensive, harmonized and coordinated forecasting exercise (first of its kind) in the DOH is heightened by a number of factors including:

- The lack of a formalized provincial coordinated system mechanism for forecasting and supply planning of MNCH commodities.
- The need to identify the current funding gap for the needed commodities to ensure efficient allocation of financial resources by the DOH, Government of Khyber Pakhtunkhwa.
- The introduction of new commodities for MNCH for which no distribution or consumption data are available.

This activity is aimed at developing a long term (five-year) provincial forecasting collaboration with the Directorate General of Health (DOH) of Khyber Pakhtunkhwa, which will better inform procurement decisions for the MNCH commodities. The exercise will also help DOH Khyber Pakhtunkhwa to populate a framework for computing the requirements for the MNCH products during the plan period and be able to take future procurement actions. Basically, the goal of this forecasting exercise is to optimize a data-driven procurement system and minimize losses through expiry by over stocking. The report will essentially guide the decision makers in setting up a provincial system for regular updates of the forecasts and introduce supply planning process for MNCH commodities.

GOALS AND OBJECTIVES

Goal

Determine the provincial needs for prioritized MNCH commodities

Objectives

1. Prepare the provincial forecast for the 22 very essential MNCH commodities for the period 2017-22

2. Discuss data sources and data gaps to support regular forecasting and supply planning, and ways to address those gaps

3. Develop recommendations for institutionalization of a formal MNCH forecasting and pipeline monitoring system within Department of Health, Khyber Pakhtunkhwa which is capable of conducting updates on the forecast and supply plan

METHODOLOGY

The GHSC-PSM project worked in close coordination with the Department of Health, Khyber Pakhtunkhwa to develop the forecast. Initially, the scope, purpose and period of the forecast was defined. Afterwards, GHSC-PSM project collected and reviewed existing documents to define assumptions and make adjustments based on recent demographic data. GHSC-PSM project then developed the algorithms of the forecasting process for each commodity. Furthermore, they were reviewed by key stakeholders. The steps of the process are detailed below.

Scope:

The forecast was meant to cover the notified very essential MNCH commodities (Table 1) prioritized by the Department of Health, Khyber Pakhtunkhwa and the estimated requirements of these commodities for health services provided at public health facilities in the province. The estimates included requirements for district and sub-district levels of health care system. The agreed upon timeframe is 2017-18—2022-23. However, through discussions with the department / program and upon review of existing data, forecasting was done for very essential commodities.

Table 1. Very Essential MNCH Commodities, prioritized by Department of Health, Khyber Pakhtunkhwa

Continuum of Care	Commodity	Use
Maternal Health	Misoprostol	Postpartum Hemorrhage
	Oxytocin	
	Tranexamic Acid	
	Sodium Lactate	
	Plasma Expander/ Substitute	
	Magnesium Sulphate	Eclampsia
	Calcium Gluconate	
	Diazepam	
	Hydralazine (Hydrochloride)	Hypertension
	Ampicillin (as sodium salt)	Maternal Sepsis
	Cefotaxime	
	Metronidazole	
	Adrenaline	
	Nifedipine	Inhibition of Uterine contractions
	Ferrous salt + folic acid	Anemia
Child and Newborn Health	Ampicillin (as sodium salt)	Neonatal Pneumonia
	Cefotaxime	
	Dexamethasone	Fetal Lung Maturity
	Low Osmolarity Oral Rehydration Salts	Diarrhea
	Zinc Sulphate	
	Amoxicillin	Pneumonia
	Vitamin K1	Premature Neonates
	Paracetamol	Palliative Care and Pain
	Chlorhexidine Digluconate	Cord Care

Forecasting Options

Estimates of commodity needs for multi-year planning are based on population data and linked to defined Provincial MNCH strategies and plans. Three methods of estimating commodity needs are commonly used:

- Estimates based on anticipated need in a target population based on morbidity data (more appropriate at the national and provincial levels);
- Estimates based on previous consumption of a commodity (more appropriate at the provincial level);
- Estimates based on the service delivery statistics (more appropriate at the service delivery level).

Whichever method is used, the accuracy of the estimate depends on the availability and quality of data used, as well as the forecasting team's knowledge of the specific conditions of the program. Due to the absence of reliable consumption and service data for the commodities mentioned in Table 1 above, the morbidity method is used for this forecasting.

Four basic sets of data are required for the morbidity method of forecasting commodity requirements:

1. Medicine lists with packaging and price data
2. Budgets in operational plans/procurement plans
3. Standard treatment guidelines in which the recommended treatment regimen is defined
4. A complete morbidity profile of the conditions for which the commodities are used.

The basic formula used in the morbidity method is:

Total quantity of a commodity required for a given health problem	=	Quantity of the commodity specified for a standard course of treatment	×	Number of expected treatment episodes of the health problem

The first element in the formula requires agreement on an average standard treatment regimen for each health problem. Since this average treatment will be multiplied by the total number of treatment episodes for that particular health problem, it is necessary to define an average quantity per course of treatment. Average drug treatment schedules also need to accommodate a system for specifying selection and dosage of drugs for patients of different age and disease severity.

Data and Review of Documents

As part of the forecasting exercise, we considered factors such as the estimated current need and provincial program strategies. This forecast is based on various assumptions regarding MNCH commodity needs. The process included a review of provincial policy and technical documents; we familiarized ourselves with the recommended treatment guidelines and previous activities that could impact the forecasting. In addition, we reviewed policy documents to assess information provided on other major policy decisions that may affect the MNCH program. Several of these documents are listed in bibliography.

Data Analysis

We used basic Excel to forecast the requirements for the MNCH commodities. The target population for respective commodities was determined which will help to analyze, plan, and advocate for improved programming. Excel facilitates the process of determining the quantities of medicines that are required for any health program. For each condition, we used incidence / prevalence / frequency rates obtained from literature to determine the total number of patients who required treatment for one year. We then entered information on all medicines and added the total requirement and costs by the maternal, newborn, and child categories. The specific forecasting methodologies, key assumptions, and forecasting results for each commodity category are included in the corresponding subsections presented in the quantification results.

Steps Used in Forecasting

The following steps were used to forecast the need for each commodity:

1. Calculate the target population (i.e., pregnant women or children) who will require very essential medicines (VEM).
2. Calculate the amount of very essential medicines needed in each case to manage the condition (i.e., prevention or treatment/establish standard or average treatment regimen)
3. Calculate the quantity of VEM needed for the forecast period
4. Adjust for programmatic changes
5. Adjust for losses (i.e., expiry and wastage)

Target Population

We estimated the target population based on recent population census (Census 2017) results. We obtained other information required to estimate this population from the Pakistan Demographic Health Surveys, Multiple Indicator Cluster Survey, and the website of Pakistan Bureau of Statistics. For population projection for 2017–2018 to 2022-23, we used the growth rate of 2017 census. Building upon this, we determined that our estimated total population would be 30.52 million, 0.8 million births, 1.03 million pregnant women and just under 4.5 million under 5 children in 2017. (Table 2).

Table 2. Estimated Target Population (Population, Births, Pregnancy, and Under-Five Children)

Year	Population	Births (2.7%)	Pregnant Women (3.4%)	Children U5 (14.6%)
2017	30,523,371	824,131	1,037,795	4,459,465
2018	31,405,496	847,948	1,067,787	4,588,343
2019	32,313,115	872,454	1,098,646	4,720,946
2020	33,246,964	897,668	1,130,397	4,857,381
2021	34,207,802	923,611	1,163,065	4,997,760
2022	35,196,407	950,303	1,196,678	5,142,195

Treatment Protocols

To obtain an accurate estimate of provincial needs for MNCH commodities, it is important to have specific treatment protocols for the dosage, frequency of administration, and duration of treatment. To estimate a standard list of medicines, we assumed that treatment in primary and secondary health care centers follows the recommendations / standard treatment guidelines of WHO. If no such guideline exists, treatment followed the international best practice guidelines.

Calculation of MNCH Commodities

The calculation of MNCH commodities depends on the provincial MNCH guidelines. This is calculated by multiplying the number of cases requiring the medicines by the amount needed per case.

Consultative Meeting with Different Stakeholder

After completing the forecast, we conducted consultative technical sessions with the FASP TWG, Khyber Pakhtunkhwa including DOH, MNCH program and development partners i.e. WHO, UNFPA, TRF and UNICEF. The objectives of the consultative meeting were to:

- Present and jointly review forecast.
- Review different data sources and ensure data is sufficient and of high-quality in order to build up the forecast.
- Review and validate the available data and methodologies.
- Review existing assumptions and adjustments based on recent demographic, logistics and services data.
- Discuss data sources and data gaps to support regular forecasting and supply planning, and ways to address gaps.
- Reach consensus and agree upon assumptions, data, methodologies, and current forecasting findings.

RESULTS

Forecasted Need for Oxytocin - Management of PPH

Postpartum hemorrhage (PPH), defined as *"a blood loss of 500 ml or more within 24 hours after birth" (WHO),* is a major cause of mortality, morbidity and long-term disability related to pregnancy and childbirth.
In Pakistan, around 7% of women suffer from PPH yearly and it accounts for more maternal deaths than any other cause. Most deaths resulting from PPH occur during the first 24 hours after birth; the majority of these could be avoided through the use of prophylactic uterotonics during the third stage of labor and by timely and appropriate management.
Oxytocin is the medicine that is most effective in preventing and treating postpartum hemorrhage. Oxytocin is most often available in 1ml glass vials, containing 10 IU, and is administered by injection into a woman's vein or muscle. All women giving birth should be offered uterotonics during the third stage of labor for the prevention of PPH; doses range between 10 IU for prevention of postpartum hemorrhage and up to 40 IU for treatment of PPH. The following input data are used to estimate the required oxytocin for the forecasting period 2018-2023 in the public sector.

Summary of Data Needed for Forecasting Oxytocin

- Target population (Expected pregnancies)
- Prevalence of PPH in Pakistan
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public health facility deliveries
- Number of public facility deliveries requiring oxytocin for treatment of PPH
- Standard or average treatment regimen (i.e., 40 IU of Oxytocin required for PPH)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula used for this calculation of oxytocin is:

Oxytocin Need for PPH treatment	=	Total expected pregnancies	x	Proportion of public facility deliveries	x	Proportion of women who require treatment for PPH	x	Dose per case for PPH treatment

Oxytocin requires storage at between 2 and 8 °C, with possible excursions to room temperature for brief time periods (up to four weeks). In practice, in countries where the average temperature is above 30 °C and where adequate infrastructure for cold chain management is often lacking, maintaining the required storage conditions for oxytocin is a challenge. As a result, compromising its effectiveness and shelf life.

The associated summary outputs for oxytocin are shown in Table 3. By applying the different attributes and assumptions the forecasted number of pregnancies for the year 2017-18 and 2022-23 are estimated at 1.03 million and 1.19 million, respectively. We have estimated (by trend analysis) that 31% of women will receive public facility delivery service in 2017-18. Thus, the total number of estimated facility deliveries in the public sector based on this assumption will be 20,709 and 27,769 in 2017-18 and 2022-23, respectively. Applying these parameters, we estimate the number of doses (10 IU) of oxytocin that needs to be procured for public facilities is 86,979 for 2017-18 and 116,629 for 2022-23.

Table 3. Forecasted Oxytocin Requirements

Total Population (projected, based on 2017 census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Expected Pregnancies (3.4%) KP DHIS Report 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Prevalence of PPH	7%	7%	7%	7%	7%	7%
C) Number of PPH cases (C = A × B)	67,457	69,406	71,412	73,476	75,599	77,784
D) % of public health facility deliveries (30.6% KP health survey 2017 - assuming 1% increase)	31%	32%	33%	34%	35%	36%
E) Number of PPH cases seeking treatment from public health facilities	20,709	22,002	23,352	24,761	26,233	27,769
F) Requirement of Oxytocin (40 IU= 4 x 10 IU vial) for treatment of PPH	82,837	88,007	93,407	99,045	104,932	111,076
G) 5% Wastage	4,142	4,400	4,670	4,952	5,247	5,554
H) Total requirement of Oxytocin (10 IU/1 ml vial) to procure including wastage	**86,979**	**92,407**	**98,077**	**103,998**	**110,178**	**116,629**

Forecasted Need for Misoprostol - Prevention of PPH

While oxytocin is the recommended choice for prevention and treatment of postpartum hemorrhage, use of oxytocin may not be feasible in low-income settings, where most births occur at home with untrained birth attendants.

Misoprostol has been suggested as an alternative to oxytocin since it has been proven to act as an effective uterotonic. It is inexpensive, can be taken orally, does not need refrigeration, and has a long shelf-life. The International Federation of Gynecology and Obstetrics (FIGO) and the International Confederation of Midwives (ICM) jointly recommended that where home births occur without a skilled birth attendant, misoprostol may be the only available technology to control PPH. Misoprostol is new in Pakistan and the feasibility of scaling up PPH prevention intervention is being assessed. Recognizing a need for strategies to prevent PPH among women who give birth at home without a skilled provider, three 200 μg tablets of misoprostol to women immediately after delivery under the direct supervision of a community midwife / lady health worker should be provided. It should be noted that the current recommendation of the World Health Organization is also for three 200 μg tablets dose. Women should be counseled on the use of misoprostol during antenatal visits.

Summary of Data Needed for Forecasting Misoprostol

- Target population (Expected number of pregnancies)
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of pregnant women attending public health facility for delivery
- Number of pregnant women attending public facility for delivery given Misoprostol for PPH prevention
- Standard or average treatment regimen (i.e. three 200 μg misoprostol tablets needed for each pregnant woman to prevent risk of PPH)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula used for this calculation of misoprostol tablets is:

Total misoprostol tablets needed for PPH prevention	=	Expected Pregnancies	x	Proportion of Pregnant women attending public health facility	x	Dose per Pregnant women for PPH prevention

Table 4 shows the amount of misoprostol required during the forecast period. The trend analysis shows that the number of home births is declining (DHIS reports). The estimated number of public health facility deliveries in 2017-18 is 0.32 million and in 2022-23 is 0.43 million, respectively. The total number of misoprostol tablets required is 0.80 million during the forecast period 2017-18 and 1.07 million during 2022-23. We assume that eighty percent pregnant women will receive three 200 μg misoprostol tablets.

Table 4. Forecasted Number of Misoprostol Tablets Required for Prevention of PPH

Total Population (projected, based on 2017 Census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Expected Pregnancies (3.4%) KP DHIS Report 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) % of public health facility deliveries (30.6% KP Health Survey 2017 - assuming 1% annual increase)	31%	32%	33%	34%	35%	36%
C) Number of pregnant women attending public health facility for delivery (C = A × B)	317,565	337,421	358,159	379,813	402,421	426,017
D)Assuming 80% of pregnant women attending health facility for delivery given Misoprostol for prevention of PPH D=Cx80%	254,052	269,937	286,527	303,851	321,936	340,814
E) Requirement of Misoprostol (3 x 200µg tablets) for prevention of PPH in public health facility deliveries (E = D × 3)	762,156	809,810	859,581	911,552	965,809	1,022,442
F) 5% Wastage	38,108	40,490	42,979	45,578	48,290	51,122
G) Total requirement of tablet Misoprostol (200 µg) to procure including wastage	**800,264**	**850,300**	**902,560**	**957,130**	**1,014,100**	**1,073,564**

Forecasted Need for Magnesium Sulfate - Management of Eclampsia

Hypertensive disorders of pregnancy affect about 10% of all pregnant women around the world and are an important cause of severe acute morbidity, long term disability and death among mothers and babies. This group of diseases and conditions includes pre-eclampsia and eclampsia, gestational hypertension and chronic hypertension.

Pre-eclampsia is characterized by presence of hypertension, proteinuria and maternal organ dysfunction, while Eclampsia is characterized by the occurrence of generalized seizures in women with pre-eclampsia, provided that the tonic–clonic seizures are not attributable to other causes (e.g. epilepsy). It is the third major cause of maternal mortality in Pakistan, most often detected through the elevation of blood pressure during pregnancy. It can lead to seizures, kidney and liver damage, and both maternal and infant deaths, if untreated

Magnesium sulfate is a lifesaving drug and should be available in all health-care facilities throughout the health system. It is recommended for the prevention and treatment of pre- and eclampsia in preference to other anticonvulsants. Magnesium sulfate (injection 500 mg/ml in 2 ml ampoule) is needed at every level of the health care system where deliveries occur, from urban hospitals to rural clinics [WHO 2012].

Summary of Data Needed for Forecasting Magnesium Sulfate

- Target population (Expected number of pregnancies)
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public health facility deliveries
- Number of pregnancies complicated by PE/E
- Standard or average prevention/treatment regimen (i.e., amount of magnesium sulfate needed for management of each case of PE/E (magnesium sulfate injection: 500 mg/ml in 2-ml ampoule)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula used for this calculation of magnesium sulfate is:

Magnesium Sulfate Need for PPH treatment (500mg/ml)	=	Total expected pregnancies	x	Proportion of public facility deliveries	x	Treatment dose per PPH case (2 ml ampoule = 1 gm MgSO4)

By applying the information on pregnancy complication (3% pregnancies are complicated), we estimated the number of women who require magnesium sulfate during pregnancy. Out of total of 31,134 pregnancies complicated with pre-/eclampsia, 9,527 pregnant women are estimated to visit public facility for prevention /treatment of PE/E during the forecasting period of 2017/18. A total of 440,145 gm (2 ml Ampoule) magnesium sulfate is required for 2017/18 while a total of 88,029 gm (10 ml Ampoule) is required for the same year, which is to be administered using Pritchard Regime. Table 5 shows the complete factorization for the forecast of Magnesium sulfate.

Table 5. Forecasted Number of Doses of Magnesium Sulfate Required for Treatment of Pre-Eclampsia / Eclampsia

Total Population (projected, based on 2017 Census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Expected Pregnancies (3.4%) KP DHIS Report 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) # of Pregnancies estimated to be complicated with PE/E (3%)	31,134	32,034	32,959	33,912	34,892	35,900
C) % of public health facility deliveries (30.6%-Health Survey 2017 - annual increase of 1% per year)	31%	32%	33%	34%	35%	36%
(D) # of deliveries in public health facility (D = B × C)	9,527	10,123	10,745	11,394	12,073	12,781
(E) Requirement of MgSO4 (in GMs) for treatment of eclampsia (Pritchard Regime= 44 gm / case) E=Dx44	419,186	445,395	472,769	501,354	531,195	562,343
(F) 5% wastage in GMs	20,959	22,270	23,638	25,068	26,560	28,117
(G) Total requirement of MgSO4 (in GMs) for Pre-eclampsia/eclampsia treatment G= E+F	440,145	467,665	496,408	526,421	557,755	590,460
(H) Requirement of Inj. MgSO4 (2 ml Ampoule --500 mg /ml) H=G x 1 ampoule	440,145	467,665	496,408	526,421	557,755	590,460
(I) Requirement of Inj. MgSO4 (10 ml ampoule-500 mg /ml) I = G/5 gm	**88,029**	**93,533**	**99,282**	**105,284**	**111,551**	**118,092**

Forecasted Need for Injectable Antibiotics - Management of Neonatal Pneumonia (Ampicillin, Cefotaxime)

Newborn or neonatal deaths account for 46% of all deaths among children under 5. The majority of all neonatal deaths (75%) occur during the first week of life, and about 1 million newborns die within the first 24 hours (WHO). Children who die within the first 28 days of birth suffer from conditions and diseases associated with lack of quality care at birth or skilled care and immediate treatment after birth. The main killers include preterm birth complications, pneumonia, intrapartum related events, diarrhea, neonatal sepsis and malaria. Delays in illness recognition and care seeking, a dearth of primary health care providers, and limited access to facility care also contribute to these deaths. Therapy with appropriate antibiotics and supportive management in neonatal nurseries is the cornerstone of management of these causes.

Summary of Data Needed for Forecasting Injectable Antibiotics (Ampicillin, Cefotaxime)

- Target population (total live births)
- Number of newborns at risk of neonatal Pneumonia
- Number of newborns who will be given ampicillin / cefotaxime
- Standard or average treatment regimen (i.e., amount of ampicillin / cefotaxime needed for each case to prevent risks of neonatal pneumonia (ampicillin / cefotaxime: 50mg/kg per dose: IM/IV every 6 hours for at least 5 days]
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula for calculation of ampicillin/cefotaxime is:

$$\text{Total need of ampicillin/cefotaxime (ampoule of 500 mg each)} = \text{Total Live births} \times \text{Proportion of newborns at risk of neonatal pneumonia} \times \text{Dose Per case of neonatal pneumonia}$$

By applying the related information provided above, we estimated that 1,470,990 ampoules of ampicillin / cefotaxime would be required for management of neonatal pneumonia in newborns during the forecast period of 2017-18. We also estimate the required number of ampicillin / cefotaxime that should be procured on yearly basis to meet the provincial health department requirements by using benchmark data as shown in tables 6.1 & 6.2.

Table 6.1 Forecasted Number of Injectable Antibiotic (Ampicillin)

Total Population (projected, based on 2017 census) (GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total live Births (2.7%) KP DHIS Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Incidence of Pneumonia in Neonates 0-28 days (episodes /child year)	0.38	0.38	0.38	0.38	0.38	0.38
C) Total number of pneumonia episodes in neonates (0-28 days) (C= B x A)	313,170	322,220	331,533	341,114	350,972	361,115
D) % of patients visiting public health facilities for treatment (30.6%-Health Survey 2017)	31%	32%	33%	34%	35%	36%
E) Number of neonatal pneumonia patients visiting public health facilities for treatment	96,143	102,144	108,411	114,955	121,787	128,918
F) Percentage receiving antibiotics (42% PDHS 2012-13) assuming 1% increase annually	100%	100%	100%	100%	100%	100%
G) Number of neonatal pneumonia patients requiring Ampicillin for treatment	96,143	102,144	108,411	114,955	121,787	128,918
H) Required number of Ampicillin 500mg Injections required (H= G x 15 Inj. / episode)	1,442,147	1,532,158	1,626,167	1,724,331	1,826,809	1,933,772
I) 2% Wastage	28,843	30,643	32,523	34,487	36,536	38,675
J) Total Requirement of Ampicillin 500mg Injections for neonatal pneumonia patients	**1,470,990**	**1,562,801**	**1,658,691**	**1,758,817**	**1,863,346**	**1,972,447**

Table 6.2 Forecasted Number of Injectable Antibiotic (Cefotaxime)

Total Population (projected, based on 2017 census) (GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total live Births (2.7%) KP DHIS Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Incidence of Pneumonia in Neonates 0-28 days (episodes /child year)	0.38	0.38	0.38	0.38	0.38	0.38
C) Total number of pneumonia episodes in neonates (0-28 days) (C= B x A)	313,170	322,220	331,533	341,114	350,972	361,115
D) % of patients visiting public health facilities for treatment (30.6%-Health Survey 2017)	31%	32%	33%	34%	35%	36%
E) Number of neonatal pneumonia patients visiting public health facilities for treatment	96,143	102,144	108,411	114,955	121,787	128,918
F) Percentage receiving antibiotics (42% PDHS 2012-13) assuming 1% increase annually	100%	100%	100%	100%	100%	100%
G) Number of neonatal pneumonia patients requiring Cefotaxime for treatment	96,143	102,144	108,411	114,955	121,787	128,918
H) Required number of Cefotaxime 500mg Injections required (H= G x 15 Inj. / episode)	1,442,147	1,532,158	1,626,167	1,724,331	1,826,809	1,933,772
I) 2% Wastage	28,843	30,643	32,523	34,487	36,536	38,675
J) Total Requirement of Cefotaxime 500mg Injections for neonatal pneumonia patients	**1,470,990**	**1,562,801**	**1,658,691**	**1,758,817**	**1,863,346**	**1,972,447**

Forecasted Need for Antenatal Corticosteroids

Preterm birth is a leading cause of perinatal death and disability and is an important global public health problem. Preterm birth accounts for approximately 6–7% of all births (WHO 2012). It is also the leading cause of neonatal mortality both in developed and developing countries, accounting for an estimated 24% of neonatal deaths. Preterm birth occurs most often in economically disadvantaged communities and those with high rates of urinary and genital tract infection. The administration of certain corticosteroids to women at risk of preterm birth yields a considerable reduction in risk of complications of prematurity such as respiratory distress syndrome, intraventricular hemorrhage, and perinatal death.
Dexamethasone is a fluorinated glucocorticoid steroid that is administered through intramuscular injections to prevent these complications—with the greatest effect seen when there is a 24-48-hour time span between the first dose and birth. According to the WHO, 7% of pregnant women are assumed to be at risk of preterm delivery (WHO 2012), whereas in Pakistan studies shows 16% of pregnant women are at risk of preterm delivery. An injection of 4 mg dexamethasone phosphate (as disodium salt) in a 1ml ampoule is needed to promote fetal lung maturation before preterm delivery.

Summary of Data Needed for Forecasting Antenatal Corticosteroid (ANCS)

- Target population (Expected Pregnant women)
- Number of pregnant women at risk of preterm birth
- Proportion of public health facility deliveries
- Standard or average treatment regimen (i.e., amount of dexamethasone needed for each case to prevent risks of preterm birth)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula for calculation of Injection dexamethasone is:

Total Need of Inj. dexamethasone (ampoule of 1 ml)	=	Total Pregnancies	x	Proportion of pregnant women at risk of preterm delivery	x	Proportion of pregnant women attending public health facility	x	Dose per case

Approximately 50,976 pregnant women are at risk of preterm birth during the forecast period, 2017-18 and 68,354 in 2022-23. To prevent the risks of preterm delivery a total of 321,152 ampoules for 2017-18 and 430,632 ampoules of dexamethasone (1 ml each) for 2022-23 should be procured during the forecast period, as depicted in Table 7.

Table 7. Forecasted Need for Dexamethasone

Total Population Projected based on Census 2017 GR 2.89%	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Number of pregnant women (3.4%) KP DHIS Report 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Percentage of pregnant women at risk of preterm delivery[1]	16%	16%	16%	16%	16%	16%
C) Number of pregnant women at risk of preterm delivery (C = A × B)	166,047	170,846	175,783	180,863	186,090	191,468
D) Percentage of public health facility deliveries (30.6%-Health Survey 2017 assuming annual 1% increase)	31%	32%	33%	34%	35%	36%
E) Number of pregnant women at risk administered dexamethasone (E = C×D)	50,976	54,158	57,481	60,951	64,573	68,354
F) Number of dexamethasone ampoules (4mg in 1-ml) required (F = E x 6 amp) WHO recommend 24 mg in divided doses	305,859	324,949	344,887	365,706	387,440	410,125
G) 5% Wastage	15,293	16,247	17,244	18,285	19,372	20,506
H) Adjusted amount of Inj. dexamethasone needed (plus wastage 5%) H= G+F	**321,152**	**341,196**	**362,131**	**383,991**	**406,812**	**430,632**

[1] *Meta-Analysis 2017 /Every Preemie Scale-Pakistan Profile / WHO 2015 Updated Recommendations*

Forecasted Need for Sodium Lactate Compound Solution (Ringer's Lactate)

Ringer's lactate solution (RL), also known as sodium lactate compound solution, is an infusion-based mixture of sodium chloride (6gm), sodium lactate (3.1gm), potassium chloride (0.3gm), and calcium chloride (0.2gm) in sterile water. It is infused for replacing fluids and electrolytes in those who have low blood volume when treating for PPH.

During PPH, a patient can lose significant amount of blood leading to imbalances in the blood chemistry. This compound could significantly help restore the electrolyte balance as well as the blood loss that can otherwise prove fatal to their life.

Summary of data needed for forecasting of Ringer's Lactate

- Target population (Expected pregnancies)
- Prevalence of PPH in Pakistan
- Number of PPH cases
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring Ringer's Lactate for management of PPH
- Standard or average management regimen
- Expected projected changes in consumption (potential loss or scale-up in use)

Formula used for the calculation of Ringer's Lactate;

Ringer's Lactate Need for PPH Management	=	Total Pregnancies	x	Proportion of facility deliveries	x	Proportion of women requiring RL for PPH management	x	Dose per PPH case for management

The associated summary outputs for Ringer's Lactate are shown in Table 8. By applying the different attributes and assumptions, the forecasted number of pregnancies for the year 2017-18 and 2022-23 are estimated at 1.03 million and 1.19 million, respectively. Thus, the total number of estimated facility deliveries in the public sector, based on this assumption, will be 20,642 and 27,691 in 2017-18 and 2022-23, respectively. Applying these parameters, we estimated the number of Ringer's Lactate injections that needs to be procured for public facilities is 43,348 for 2017-18 and 58,151 for 2022-23 as shown in table below.

Table 8: Forecasted Injection Ringer's Lactate Requirement

Total Population (projected, based on 2017 census -GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total Pregnancies (3.4%) DHIS Report KP 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Prevalence of PPH	7%	7%	7%	7%	7%	7%
C)Number of PPH cases (C = A × B)	67,457	69,406	71,412	73,476	75,599	77,784
D) Percent public health facility deliveries (30.6%-Health Survey 2017 assuming annual increase of 1%)	31%	32%	33%	34%	35%	36%
E) Number PPH cases seeking treatment from public health facilities	20,642	21,932	23,280	24,688	26,157	27,691
F) Requirement of Inj. Ringer's Lactate for PPH cases (2 Inj. per PPH case)	41,283	43,865	46,561	49,376	52,315	55,382
G) 5% Wastage	2,064	2,193	2,328	2,469	2,616	2,769
H) Total requirement of Inj. Ringer's Lactate for PPH cases including wastage	**43,348**	**46,058**	**48,889**	**51,845**	**54,930**	**58,151**

Forecasted Need for Tranexamic Acid (TXA) for Treatment of PPH

Tranexamic Acid (TXA) is a competitive inhibitor of Plasminogen activation and can reduce bleeding by inhibiting the breakdown of fibrinogen and fibrin clots. TXA is relatively cheap in most contexts, easy to administer, often available in health care settings due to its use in trauma and surgery. WHO recommends early use of intravenous Tranexamic Acid (TXA) within 3 hours of birth in addition to standard care for women with clinically diagnosed PPH following vaginal birth or caesarean section.

TXA should be used in all cases of PPH, regardless of whether the bleeding is due to genital tract trauma or other causes. The administered dosage is an injectable Tranexamic Acid (1 gm) for treatment of PPH in public health facility deliveries. The following input data are used to estimate the required TXA for the forecasting period 2018-2023 for the public sector.

Summary of data needed for forecasting TXA

- Target population (total expected pregnancies)
- Prevalence of PPH in Pakistan
- Number of estimated PPH cases
- Percent deliveries in public health facilities Khyber Pakhtunkhwa
- Number of public facility deliveries requiring TXA for treatment of PPH
- Standard or average treatment regimen per PPH case
- Expected projected changes in consumption (potential loss or scale-up in use)

Formula used for the calculation of TXA;

TXA Need for PPH treatment	=	Expected Pregnancies	x	Proportion of facility deliveries	x	Proportion of pregnant women seeking PPH treatment	x	Dose per PPH case

The associated summary outputs for TXA are shown in Table 9. By applying the different attributes and assumptions, the forecasted number of pregnancies for the year 2017-18 and 2022-23 are estimated at 1.03 million and 1.19 million, respectively. It is assumed that approximately 31% of women with PPH will consult public facilities in 2017-18. Based on this assumption, it is estimated that 20,642 and 27,691 PPH cases will attend public health facilities in 2017-18 and 2022-23, respectively. Applying these parameters, we estimated the number of TXA injections that needs to be procured for public facilities as 21,674 for 2017-18 and 29,076 for 2022-23, respectively.

Table 9: Forecasted Need for Tranexamic Acid

Total Population (projected based on 2017 census-GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total Pregnancies (3.4%) DHIS Report KP 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Prevalence of PPH	7%	7%	7%	7%	7%	7%
C) Number PPH cases (C = A × B)	67,457	69,406	71,412	73,476	75,599	77,784
D) Percent public facility deliveries (30.6%- KP Health Survey 2017- increase of 1% per year)	31%	32%	33%	34%	35%	36%
E) Number PPH cases seeking treatment from public health facilities	20,642	21,932	23,280	24,688	26,157	27,691
F) Requirement of Inj. Tranexamic Acid (1 gm) for PPH cases (E= D)	20,642	21,932	23,280	24,688	26,157	27,691
G) 5% Wastage	1,032	1,097	1,164	1,234	1,308	1,385
H) Total requirement of Inj. Tranexamic Acid for cases in public health facilities	**21,674**	**23,029**	**24,444**	**25,922**	**27,465**	**29,076**

Forecasted Need for Plasma Expander/Substitutes

Polygeline are macromolecular substances which are metabolized slowly; they may be used to expand and maintain blood volume in hypovolemic shock arising from post-partum hemorrhage. The loss of blood in PPH is managed using the plasma expanders. Plasma substitutes are often used as an immediate short-term measure to treat massive hemorrhage until blood is available.

Polygeline (Haemacel) is a plasma substitute listed in the WHO Model Formulary for the correction of low blood volume. The model formulary also lists Dextran 70 for a similar indication i.e. for short-term blood volume expansion. Both products are colloidal solutions that exert their activity by virtue of their physico-chemical properties; neither product possesses any intrinsic pharmacological activity. The common method of administration of plasma expanders is to inject the patient with the infusion of either Polygeline 3.4/4% or Dextran 6% w/v. Table 10 shows the required amount of plasma expander-Polygeline for the period 2017-18 to 2022-23.

Summary of Data Needed for Forecasting Plasma Expander/ Substitutes

- Target population (total pregnancies)
- Prevalence of PPH in Pakistan
- Number of total PPH cases
- Percent deliveries in public health facilities Khyber Pakhtunkhwa
- Number of PPH cases attending public facility requiring plasma expander/substitutes for treatment of PPH / Hypovolemic shock
- Standard or average treatment regimen (i.e., single infusion of plasma expander required for PPH treatment)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for the calculation of Plasma Expander/ substitute is:

Need for Plasma Expanders for PPH cases = Expected pregnancies x Proportion of public facility deliveries x Proportion of women who require treatment for PPH x Dose per PPH case

Based on standard assumptions, the estimated number of PPH cases that would be attending public health facilities for treatment is 20,642 and 27,691, in 2017-18 and 2022-23, respectively. (Table 10). Similarly, the total number of plasma expanders required would be 21,674 during the forecast year 2017-18 and 29,076 during the year 2022-23.

Table 10. Forecasted Number of Plasma Expander/Substitutes Required for Management of PPH

Total Population (projected based on 2017 census) (GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total Pregnancies (3.4%) DHIS Report KP 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Prevalence of PPH	7%	7%	7%	7%	7%	7%
C) # of PPH cases (C = A × B)	67,457	69,406	71,412	73,476	75,599	77,784
D) % of public health facility deliveries (30.6%-KP health survey 2017)	31%	32%	33%	34%	35%	36%
E) # of PPH cases seeking treatment from public health facilities D x C	20,642	21,932	23,280	24,688	26,157	27,691
F) Requirement of Inj. Polygeline (500 ml) for treatment of PPH	20,642	21,932	23,280	24,688	26,157	27,691
G) 5% Wastage	1,032	1,097	1,164	1,234	1,308	1,385
H) Total requirement of plasma expanders for PPH management G= E+F	**21,674**	**23,029**	**24,444**	**25,922**	**27,465**	**29,076**

Forecasted Need for Calcium Gluconate

In populations with low dietary calcium intake, daily calcium supplementation (1.5 g - 2.0 g oral elemental calcium) is recommended by WHO for pregnant women to reduce the risk of pre-eclampsia. As there is no clear evidence on the timing of initiation of calcium supplementation, stakeholders may wish to commence supplementation at the first ANC visit, given the possibility of compliance issues.

Calcium Gluconate is used for prevention of Pre-Eclampsia and Eclampsia (PE/E) which is one of the leading cause of maternal mortality. In addition, PE/E poses a serious fatality risk to the babies as well. The blood pressure in eclampsia is managed by taking Calcium Gluconate which is injected intravenously.

Summary of Data Needed for Forecasting Calcium Gluconate

- Target population (total expected pregnancies)
- Number of pregnancies complicated by PE/E
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring Calcium Gluconate for treatment of PE/E
- Standard or average treatment regimen (i.e., amount of calcium Gluconate needed for each case to prevent PE/E (Calcium Gluconate: injection 100 mg/ml in 10-ml ampoule
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of calcium Gluconate is:

Calcium Gluconate Need for PE/E cases	=	Expected pregnancies	x	Proportion of public facility deliveries	x	Proportion of PE/E cases consulting public facilities	x	Dose per PE/E case

By applying the information on pregnancy complicated with pre-eclampsia/eclampsia (3% pregnancies are complicated), we estimated the number of women who would possibly require calcium Gluconate. During the forecasting year 2017/18, 31,134 pregnant women are estimated to require Calcium Gluconate for the treatment of PE/E. Out of these, 9,527 pregnant women will seek treatment from public health facilities. A total of 10,003 ampoules of Calcium Gluconate are required for 2017/18 which is to be administered intravenously. Table 11 shows the complete factorization for the forecast of Calcium Gluconate

Table 11: Forecasted Ampoules of Ca+ Gluconate for Pre-Eclampsia/Eclampsia cases

Total Population (projected, based on 2017 census-GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total Pregnancies (3.4%) KP DHIS Report 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Pregnancies estimated to develop PE/E (3%)	31,134	32,034	32,959	33,912	34,892	35,900
C) Percent public health facility deliveries (30.6%-Health Survey 2017)	31%	32%	33%	34%	35%	36%
D) PE/E cases seeking care from public health facilities	9,527	10,123	10,745	11,394	12,073	12,781
E) Requirement of Ca+ Gluconate ampoules (1 Ampoule of 10 ml contains 1000 mg Ca+ Gluconate) for prevention/treatment of PE/E (E= D x 1 Ampoule)	9,527	10,123	10,745	11,394	12,073	12,781
F) 5% Wastage -in Ampoules	476	506	537	570	604	639
G) Total Requirement of Ca+ Gluconate Ampoules for PE/E cases (G= E+F)	**10,003**	**10,629**	**11,282**	**11,964**	**12,676**	**13,420**

Forecasted Need for Diazepam -- Pre-Eclampsia/Eclampsia

Eclampsia, defined as the occurrence of a seizures in association with pre-eclampsia, remains a serious complication of pregnancy. Several different anticonvulsants are used to control eclamptic fits and to prevent further fits. The drug of choice for both the prevention and treatment of eclampsia is Magnesium Sulphate. If magnesium sulphate is not available, diazepam may be given. Fits or convulsions which are prolonged or recurrent may be controlled by intravenous diazepam.

Summary of Data Needed for Forecasting Diazepam Injections

- Target population (total expected pregnancies)
- Number of pregnancies complicated by PE/E
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring diazepam for treatment of PE/E
- Standard or average treatment regimen i.e. amount of diazepam needed for each case to prevent PE/E (diazepam: injection 10 mg / ml in 2-ml ampoule)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of diazepam is:

Diazepam (Injections) Need for PE/E cases = Expected pregnancies x Proportion of public facility deliveries x Proportion of PE/E cases requires Inj. diazepam x Dose per PE/E case

By applying the information on pregnancies complicated with PE/E (3% pregnancies are complicated), we estimated the number of pregnant women likely to develop PE/E and hence would requires Diazepam. It is estimated that 31,134 pregnancies will be complicated with pre-eclampsia/eclampsia and will require diazepam for the treatment of PE/E during the forecasting year (2017/18). Out of these, 9,558 pregnant women will seek treatment from public health facilities. Approximately, 10,036 ampoules of diazepam are estimated to be required for the same year. Table 12 shows the complete factorization for the forecast of diazepam ampoules.

Table 12: Forecasted Number of Diazepam Injections for Pre-Eclampsia / Eclampsia cases

Total Population (projections based on 2017 census-GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Number of Pregnancies (3.4%) DHIS 2015 Annual Report KPK	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Pregnancies estimated to be complicated with PE/E (3%)	31,134	32,034	32,959	33,912	34,892	35,900
C) Percent public health facility deliveries (30.6%-Health Survey 2017 - assuming 1% increase annually)	31%	32%	33%	34%	35%	36%
(D) PE/E cases attending public health facilities (D = B × C)	9,558	10,155	10,778	11,428	12,108	12,816
(E) Requirement of Diazepam Injection (10 mg in 2 ml injection) for control of seizures in pre-eclampsia / eclampsia (dose 10 mg) E= 1 x D	9,558	10,155	10,778	11,428	12,108	12,816
(F) 5% Wastage	478	508	539	571	605	641
(G) Total requirement of Inj. Diazepam 10 mg for control of seizures in Eclampsia in public health facility (including wastage) G= E+F	**10,036**	**10,662**	**11,317**	**12,000**	**12,713**	**13,457**

Forecasted Need for Hydralazine - Management of severe Hypertension

Hydralazine is used with or without other medications to treat high blood pressure. It works by relaxing blood vessels (vasodilator) so blood can flow through the body more easily. It is a drug of choice for gestational hypertension or pregnancy-induced hypertension (PIH) which is the development of new hypertension in a pregnant woman after 20 week's gestations without the presence of protein in the urine or other signs of pre-eclampsia. Antihypertensive drugs should be given if the diastolic blood pressure is 110mm Hg or more. The aim is to keep the diastolic blood pressure between 90–100mm Hg to prevent cerebral hemorrhage.

Summary of Data Needed for Forecasting Hydralazine

- Target population (total expected pregnancies)
- Number of pregnancies complicated by Hypertensive disorders of pregnancy (HDP)
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring Hydralazine for management of HDP
- Standard or average treatment regimen i.e., amount of hydralazine needed for each case to manage hypertension (hydralazine injection 20 mg powder or 25 mg and 50 mg tablets).
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of Hydralazine is:

Hydralazine Need for management of hypertension	=	Expected pregnancies	x	Proportion of facility deliveries	x	Proportion of women who require Hydralazine for management of hypertension	x	Dose per case of hypertension

By applying the information on pregnancies complicated with hypertensive disorders of pregnancy (5% pregnancies are complicated), we estimated the number of women who require hydralazine during pregnancy. A total of 15,930 pregnant women are estimated to require hydralazine for the treatment of hypertension during the forecasting period (2017/18). A total of 16,727 injections of hydralazine would be require for 2017/18 which is to be administered intravenously, while a total of 6,021,596 (25/50 mg) hydralazine tablets are estimated to be required for the same year. Table 13 shows the complete factorization for hydralazine forecast.

Table 13: Forecasted Hydralazine Injections to manage Hypertensive Disorders of Pregnancy (HDP)

Total Population (projected based on 2017 census GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Expected total pregnancies (3.4%) KP DHIS Report 2015	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Pregnancies estimated to develop hypertensive disorders of pregnancy (5% of total pregnancies)	51,890	53,389	54,932	56,520	58,153	59,834
C) % of public facility deliveries (30.6%- KP Health Survey 2017- 1% increase per year)	31%	32%	33%	34%	35%	36%
D) Pregnant women with HDP seeking care from public health facilities	15,930	16,924	17,963	19,047	20,179	21,361
E) Requirement of Inj. hydralazine HCl (ampoule of 20 mg) for management of HDP (E= D x 1 ampoule)	15,930	16,924	17,963	19,047	20,179	21,361
F) 5% Wastage -in Ampoules	797	846	898	952	1,009	1,068
G) Total Requirement of Inj. Hydralazine HCl for management of HDP G= E+F	**16,727**	**17,771**	**18,861**	**20,000**	**21,188**	**22,429**
H) Requirement of Hydralazine HCl tablets (25/50mg twice daily) for prevention / treatment of HDP (H= D x 2 x 180 days = 360 tablets)	5,734,853	6,092,792	6,466,630	6,856,987	7,264,506	7,689,852
I) 5% Wastage -in tablets	286,743	304,640	323,331	342,849	363,225	384,493
(J) Total Requirement of Hydralazine HCl tablets (25/50 mg) for prevention / treatment of HDP J= H+I	**6,021,596**	**6,397,432**	**6,789,961**	**7,199,836**	**7,627,731**	**8,074,344**

Forecasted Need for Vitamin K Injection- Hemorrhagic Disease of the Newborn.

Hemorrhagic disease of the newborn is a bleeding problem that can occur after birth. It's a potentially life-threatening condition. The condition is caused by vitamin K deficiency and is often called vitamin K deficiency bleeding or VKDB. All newborns are born with low levels of vitamin K, an important factor that helps in blood clotting. Newborns do not get enough vitamin K from their mothers during pregnancy, or later when babies are breast feeding. VKDB can cause bleeding into the brain and may result in brain damage or even death. VKDB can be prevented by giving newborn babies extra vitamin K1.

WHO recommends that all newborns should be given 1 mg of vitamin K intramuscularly (IM) after birth to prevent Vitamin K deficiency bleeding (VKDB), formally known as hemorrhagic disease of the newborn. Although, both term and preterm infants are at risk of developing VKDB, preterm infants may be at particular risk of vitamin K deficiency bleeding, as they have hemostatic and hepatic immaturity and, although they benefit from maternal milk, it contains low concentrations of vitamin K.

Summary of Data Needed for Forecasting Vitamin K1

- Target population (total live births)
- Number of newborns at risk of developing hemorrhagic disease
- Percent births in public health facilities of Khyber Pakhtunkhwa
- Number of newborn requiring vitamin K1 injection to prevent/treat hemorrhagic disease
- Standard or average treatment regimen (i.e., amount of vitamin K1 needed for each case to prevent hemorrhagic disease)
- Expected projected changes in consumption (potential loss or scale-up in use

The formula used for this calculation of Vitamin K1 is:

Vitamin K1 Need to protect against hemorrhagic disease of the newborn.	=	Total live births	x	Proportion of facility births	x	Proportion of newborn at risk of hemorrhagic disease	x	Dose per newborn for protection

Table 14 shows the forecasted amount of Vitamin K1 by year. A total of 26,566 injections (10mg) are forecasted for the period (2017/18).

Table 14: Forecasted Number of Vitamin K1 Injections for Prevention of Hemorrhagic Disease of Newborn

Total Population (projected based on 2017 census GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Expected number of live births (2.7%) KPK DHIS Annual Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Percent public health facility births (30.6%-Health Survey 2017- assuming annual increase of 1%)	31%	32%	33%	34%	35%	36%
C) Live births at public health facility (C = A × B)	253,008	268,800	285,292	302,514	320,493	339,258
D Requirement of Vitamin K1 Injection (10 mg / 1 ml injection) (recommend dose is 1 mg / newborn) D = C x 1/10	25,301	26,880	28,529	30,251	32,049	33,926
E) 5% Wastage	1,265	1,344	1,426	1,513	1,602	1,696
F) Total Requirement of Vitamin K1 Injection for public health facility births to prevent hemorrhagic disease in newborns	**26,566**	**28,224**	**29,956**	**31,764**	**33,652**	**35,622**

Forecasted Need for Chlorhexidine - Cord Care in Newborns

Pakistan has one of the highest newborn mortality rates in the world and up to a third are because of infections. Unsafe conventions, such as cutting the birth cord with un-sterilized instruments, and the application of substances such as ash, surma, oil and even cow dung are practiced in many rural areas of Pakistan, and often associated with an increased risk of cord infection and death. A baby's newly cut umbilical cord can be an entry point for bacteria, which can lead to cord infection and potentially life-threatening sepsis. WHO recommends daily application of chlorhexidine (7.1% chlorhexidine digluconate aqueous solution or gel, delivering 4% chlorhexidine) application to the umbilical cord stump during the first week of life for newborns who are born at home in settings with high neonatal mortality (30 or more neonatal deaths per 1000 live births).

Summary of Data Needed for CHX Forecasting

- Target population (total live births)
- Standard or average treatment regimen (i.e. CHX Gel needed per newborn)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula for calculation of Chlorhexidine is:

Total need (Chlorhexidine) = Total live births × One Gel per birth

According to the current provincial guidelines, Chlorhexidine will be used for all births. Table 15 shows the forecasted amount of Chlorhexidine gel by year. A total of 265,659 gel tubes of 5 ml (7.1% CHX digluconate) will be procured for public health facilities to implement the provincial policy guidelines during the forecast period 2017-2023, as shown in table 15.

Table 15: Forecasted Number of Chlorhexidine Gel Required for Cord Care

Total Population (projected, based on 2017 census -GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total live Births (2.7%) KP DHIS Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Percent public facility births (30.6%- KP Health Survey 2017 - assuming increase of 1% per year)	31%	32%	33%	34%	35%	36%
C) Number health facility live births (C = A × B)	253,008	268,800	285,292	302,514	320,493	339,258
D) Requirement of Chlorhexidine Gel (Assuming 100% newborns given Chlorhexidine) D= Cx1	253,008	268,800	285,292	302,514	320,493	339,258
E) 5% Wastage	12,650	13,440	14,265	15,126	16,025	16,963
F) Total Requirement of Chlorhexidine Gel for prevention of cord infection G= E+F	**265,659**	**282,240**	**299,557**	**317,640**	**336,518**	**356,221**

Forecasted Need for Amoxicillin - Management of Pneumonia in 0-59 Months Children

Childhood pneumonia is among the leading causes of death in low-income countries, causing 18% of deaths in children under 5 years of age. With an estimated 10 million cases occurring each year, childhood pneumonia is a primary cause of under-five mortality in Pakistan (Black *et al.* 2010, Rudan *et al.* 2008). Amoxicillin is recommended by WHO for the treatment of pneumonia in children less than five years of age. The forecast below shows estimated requirement of Amoxicillin for treatment of pneumonia in children under five years of age.

Summary of Data Needed for Forecasting of Amoxicillin for Pneumonia in Children

- Target Population -- Number of children under five years of age
- Incidence of pneumonia in 0-59 months of children
- Standard or average treatment regimen (dose of amoxicillin per case of pneumonia)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula for calculation of Amoxicillin is:

Total Need for Amoxicillin	=	Estimated Number of under five children	×	Incidence of pneumonia in under five children	×	Percent pneumonia patients attending public health facility	×	Dose per episode

Table 16 shows the forecasted number of Amoxicillin required for the management of childhood pneumonia. A total of 5.60 million dispersible tablets, and/or 747,504 bottles of syrup (125 mg; 250 mg) and/or 5.06 million injections (250 mg; 500 mg) of Amoxicillin are required to treat childhood pneumonia during the period (2017-2018). Pakistan Bureau of Statistics and PDHS 2012-13 data were used to estimate this drug.

Table 16. Forecasted Number of Amoxicillin for Management of Pneumonia in 0-59 Months Children

Total Population (projected, based on 2017 census--GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Percentage of **0-59** months children in KP (PBS 2012-13)	14.6%	14.6%	14.6%	14.6%	14.6%	14.6%
B) Estimated Population of 0-59 months children (Pop x A)	4,459,465	4,588,343	4,720,946	4,857,381	4,997,760	5,142,195
C) Incidence of Pneumonia in 0-59 m (episodes/child/year)	0.26	0.26	0.26	0.26	0.26	0.26
D) Total Pneumonia episodes in 0-59 months (D= B x C)	1,159,461	1,192,969	1,227,446	1,262,919	1,299,418	1,336,971
E) % of deliveries in public facilities (30.6%-Health Survey 2017)	31%	32%	33%	34%	35%	36%
F) Number of 0-59 months patients visiting public health facilities for treatment	355,954	378,171	401,375	425,604	450,898	477,299
G) Percentage receiving Antibiotics (42% PDHS 2012-13)	100%	100%	100%	100%	100%	100%
H) # received Amoxicillin from public health facilities	355,954	378,171	401,375	425,604	450,898	477,299
I) Number of Amoxicillin tablets required for 0-59 months patients (I = H x 15 tablets /episode)	5,339,317	5,672,568	6,020,623	6,384,056	6,763,468	7,159,478
J) 5% Wastage	266,966	283,628	301,031	319,203	338,173	357,974
K) Total Requirement of Amoxicillin tablets for 0-59 months patients K= I+J	5,606,283	5,956,197	6,321,654	6,703,259	7,101,642	7,517,452
L) # of Amoxicillin Syrups required for 0-59 months patients (2 bottle /episode)	711,909	756,342	802,750	851,208	901,796	954,597
M) 5% Wastage	35,595	37,817	40,137	42,560	45,090	47,730
N) Total Requirement of Amoxicillin Syrup bottles for 0-59 months patients N= L+M	747,504	794,160	842,887	893,768	946,886	1,002,327
O) Number of Amoxicillin Inj. (250/500 mg) required for 0-59 months patients (15 Inj. /episode)	5,339,317	5,672,568	6,020,623	6,384,056	6,763,468	7,159,478
P) 5% Wastage	266,966	283,628	301,031	319,203	338,173	357,974
Q) Total Requirement of Amoxicillin Inj. 250/500 mg for 0-59 months pneumonia patients Q= O+P	**5,606,283**	**5,956,197**	**6,321,654**	**6,703,259**	**7,101,642**	**7,517,452**

Forecasted Need for Oral Rehydration Salts - ORS

Diarrheal disease is the second leading cause of death in children under five years old. Loss of water and salts resulting from diarrhea can result in severe dehydration which results in severe morbidity and mortality. In Pakistan, on an average each child under the age of 5 years, gets 3-4 episodes of diarrhea per year. Although the total number of deaths globally from diarrheal diseases remains high, the overall mortality rate has steadily declined over the last few decades. This decline especially in developing countries is largely due to the use of early and appropriate oral rehydration therapy (ORT) with oral rehydration salt (ORS) being its main component as well as improved nutrition and water sanitation measures.
ORS is the non-propriety name for a balanced glucose-electrolyte mixture, approved, recommended and distributed by WHO and UNICEF as a drug for the treatment of clinical dehydration throughout the world. Oral rehydration therapy(ORT) is a type of fluid replacement used to prevent and treat dehydration, especially that due to diarrhea.
Oral rehydration salts (ORS) when properly mixed with safe water can help rehydrate the body when a significant amount of fluid has been lost due to diarrhea. An ORS estimate is provided for children under 5. Assuming two packs per case, the total number of ORS is estimated at 3.6 million for the forecast period 2017-18 and 5.4 million for 2022-23 (Table 17).

Summary of Data Needed for Forecasting of ORS

- Target Population -- estimated number of children less than 5 years of age
- Incidence of diarrhea -- episodes of diarrhea per child per year
- Percent seeking diarrhea treatment from public health facility
- Standard or average treatment regimen (i.e., two packs per episode)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula used for the calculation of ORS need is;

Need for ORS	=	Estimated Population of <5 children	x	Incidence of diarrhea in <5 children	x	Proportion of <5 children who received ORS	x	Percent <5 children seeking ORS from public health facility	x	2 packets per episode

Table 17 shows that there will be 13.3 million estimated number of diarrhea episodes in 2017-18 and out of these 5.6 million will be treated with ORS. Out of 5.6 million, 1.7 million will seek ORS from public health facility. This means that a total of 3.62 million ORS packets are required for the year 2017-18 to treat diarrhea episodes in public health facility. Pakistan Bureau of Statistics and PDHS data were used to estimate the need for ORS.

Table 17. Forecasted Number of ORS Needed during the period (2017/18-2022/23)

Total Population (projected, based on 2017 census) (GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) % under 5 children in KP -- PBS 2012-13	14.6%	14.6%	14.6%	14.6%	14.6%	14.6%
B) Population of < 5 children (2017 Pop x A)	4,459,465	4,588,343	4,720,946	4,857,381	4,997,760	5,142,195
C) Incidence of diarrhea in < 5 children (episodes/child/year)	3	3	3	3	3	3
D) Total number of Diarrhea Episodes (D=B x C)	13,378,394	13,765,029	14,162,838	14,572,144	14,993,279	15,426,585
E) Percentage who received ORS (38% PDHS 2012-13) (assuming 1% increase annually)	42%	43%	44%	45%	46%	47%
F) Number of diarrhea patients treated with ORS	5,618,925	5,918,963	6,231,649	6,557,465	6,896,909	7,250,495
G) % of Patients receiving ORS from public facilities (30.6%-KP Health Survey 2017	31%	32%	33%	34%	35%	36%
H) Number seeking ORS from public health facility (H=F x G)	1,725,010	1,876,311	2,037,749	2,209,866	2,393,227	2,588,427
I) Requirement of ORS (I = H x 2 packet/episode)	3,450,020	3,752,622	4,075,498	4,419,731	4,786,455	5,176,853
J) 5% Wastage	172,501	187,631	203,775	220,987	239,323	258,843
K) Total Requirement of ORS packets K= I+J	**3,622,521**	**3,940,253**	**4,279,273**	**4,640,718**	**5,025,777**	**5,435,696**

Forecasted Need for Zinc Sulphate

Every year, more than a million children under five years of age succumb to the fluid loss and dehydration associated with the majority of diarrhea related deaths. Diarrhea is second only to pneumonia as the leading cause of death globally among children under 5. There are two simple and effective treatments recommended by WHO for the clinical management of acute diarrhea:

- use of low concentration oral rehydration salts (ORS).
- routine use of zinc supplementation, at a dosage of 20 milligrams per day for children older than six months or 10 mg per day in those younger than six months, for 10–14 days.

Zinc supplementation has been found to reduce the duration and severity of diarrheal episodes and likelihood of subsequent infections for 2–3 months (WHO). Zinc is essential for the normal growth and development of children and is naturally found in the diet, mainly in foods of animal origin. Dietary deficiency of zinc can lead to an increased risk of gastrointestinal infections and impaired gastrointestinal and immune function.

Summary of Data Needed for Forecasting of Zinc

- Target population -- estimated number of children 0-59 months
- Incidence of diarrhea -- episodes of diarrhea per child per year
- Percent seeking diarrhea treatment from public health facility
- Standard or average treatment regimen (i.e., 5 Zinc Sulphate tablets per episode in 0-6 and 10 tablets per episode in 6-59 months children)
- Expected projected changes in consumption (potential losses or scale-up in use)

The formula used for the calculation of Zinc Sulphate need is;

Total Need for Zinc Sulphate tablets	=	Estimated number of 0-59 months children	x	Incidence of diarrhea in\ under-5 children (case/child/year)	x	Percent 0-59 months who received Zinc Sulphate tablets	x	Percent 0-59 months seeking Zinc Sulphate from public facility	x	Dose per episode

Considering that the number of diarrhea episodes per child per year are 3 with other fixed parameters, we estimated the total zinc sulphate 20 mg tablet requirement for 2017-18 is 1.99 million for 0-6 months and 39.11 million for 6-59 months children, respectively. (Table 18).

Table 18. Forecasted Need for Zinc Sulphate Tablets for the Period (2017/18-2022/23)

Total Population (Projected, based on 2017 census GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) % of 0-6 Month children (IFE Core Group)	1.35%	1.35%	1.35%	1.35%	1.35%	1.35%
B) Number of 0-6 months children	412,066	423,974	436,227	448,834	461,805	475,151
C) Incidence of diarrhea in 0-59 months children (episodes/child/year)	3	3	3	3	3	3
D) Number of diarrhea episodes in 0-6 months children	1,236,197	1,271,923	1,308,681	1,346,502	1,385,416	1,425,454
E) Percent seeking treatment from public facility (30.6%-Health Survey 2017)	31%	32%	33%	34%	35%	36%
F) Number seeking treatment from public health facility (F=D x E)	379,512	403,199	427,939	453,771	480,739	508,887
G) Requirement of Zinc Sulphate 20 mg tablet (Dose: 10mg/day x 10days)	1,897,562	2,015,997	2,139,694	2,268,856	2,403,697	2,544,436
H) 5% Wastage	94,878	100,800	106,985	113,443	120,185	127,222
I) Total Requirement of tab. Zinc Sulphate for 0-6 months	**1,992,440**	**2,116,797**	**2,246,678**	**2,382,299**	**2,523,882**	**2,671,658**
A) % under 5 children (PBS 2012-13)	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
B) Number of 6-59 months children (2017 Pop x A)	4,044,347	4,161,228	4,281,488	4,405,223	4,532,534	4,663,524
C) Incidence of diarrhea in 6-59 months children (episodes/child/year)	3	3	3	3	3	3
D) Number of diarrhea episodes in 6-59 months children (B x C)	12,133,040	12,483,685	12,844,463	13,215,668	13,597,601	13,990,572
E) Percent seeking treatment from public facility (30.6%-Health Survey 2017)	31%	32%	33%	34%	35%	36%
F) Number seeking treatment from public health facility (F=D x E)	3,724,843	3,957,328	4,200,140	4,453,680	4,718,368	4,994,634
G) Requirement of Zinc Sulphate 20 mg tablet (Dose: 20mg/day x 10days)	37,248,433	39,573,281	42,001,395	44,536,802	47,183,676	49,946,341
H) 5% Wastage	1,862,422	1,978,664	2,100,070	2,226,840	2,359,184	2,497,317
I) Total Requirement of tab. Zinc Sulphate for 6-59 months	**39,110,854**	**41,551,945**	**44,101,465**	**46,763,642**	**49,542,860**	**52,443,658**

Forecasted Need for Ampicillin - Treatment of Maternal Sepsis

WHO estimates that the global prevalence of maternal sepsis is 4·4% among livebirths, representing more than 5·7 million cases per year. Important variations exist between regions, with higher incidence in low-income and middle-income countries (up to 7%) compared with high-income countries (1–2%). Despite the relative low prevalence and the availability of interventions for its prevention and treatment, maternal sepsis remains a life-threatening condition and one of the leading direct causes of maternal mortality worldwide, accounting for up to 10% of maternal deaths.

The new WHO definition of maternal sepsis says, "Maternal sepsis is a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or postpartum period". Undetected or poorly managed maternal infections can lead to sepsis, death or disability for the mother and increased likelihood of early neonatal infection and other adverse outcomes.

Several factors have been associated with increased risk of maternal peripartum infections, including pre-existing maternal conditions (e.g., malnutrition, diabetes, obesity, severe anemia, bacterial vaginosis) and spontaneous or provider-initiated conditions during labor and childbirth (e.g., prolonged rupture of membranes, multiple vaginal examinations, manual removal of the placenta, caesarean section). Strategies to reduce maternal peripartum infections and their complications have been largely directed at preventive measures where such risk factors exist.

Globally, the most common intervention for preventing morbidity and mortality related to maternal infection is the use of antibiotics for prophylaxis and treatment. Ampicillin is recommended as first line antibiotic for prevention and treatment of peripartum infections.

Summary of Data Needed for Forecasting Ampicillin

- Target population (expected live births)
- Number of deliveries complicated by Maternal Sepsis
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring Ampicillin for treatment of Maternal Sepsis
- Standard or average treatment regimen (i.e., amount of Ampicillin needed for each case to treat maternal sepsis)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of Ampicillin is:

Ampicillin Need for Maternal Sepsis Treatment	=	Expected Live births	x	Proportion of public facility deliveries	x	Proportion of deliveries complicated with maternal sepsis and requires Ampicillin	x	Dose per case for treatment

By applying the information on births /deliveries complication (10% pregnancies/deliveries are complicated), we estimated the number of women who require Ampicillin for the treatment of maternal sepsis. A total of 25,301 pregnant women with maternal sepsis seeking treatment from public facility, are estimated to require injection Ampicillin for the treatment of maternal sepsis during the forecasting period (2017/18). A total of 516,137 injections of Ampicillin are required for 2017/18 which are to be administered intravenously. Table 19 shows the complete factorization for the estimated forecast of Ampicillin.

Table 19: Forecasted Number of Doses of Ampicillin Required for the Treatment of Maternal Sepsis

Total Population (projected, based on 2017 census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total live Births (2.7%) KP DHIS Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Incidence of Maternal Sepsis (average pre-partum + postpartum sepsis according to WHO definition)	10%	10%	10%	10%	10%	10%
C) Number of Maternal Sepsis cases (C= B x A)	82,413	84,795	87,245	89,767	92,361	95,030
D) % of public facilities deliveries / births (30.6%-Health Survey 2017 - assuming an increase of 1% per year)	31%	32%	33%	34%	35%	36%
E) Number of Maternal Sepsis cases seeking treatment from public health facilities	25,301	26,880	28,529	30,251	32,049	33,926
F) Requirement of Ampicillin 500mg Injections (F= E x 20 injections---- 4 injections daily x 5 days)	506,016	537,599	570,585	605,028	640,986	678,516
G) 2% Wastage	10,120	10,752	11,412	12,101	12,820	13,570
H) Total Requirement of Ampicillin 500mg Injections for treatment of Maternal Sepsis Cases H= F+G	**516,137**	**548,351**	**581,997**	**617,129**	**653,806**	**692,087**

Forecasted Need for Metronidazole - Management of Maternal Sepsis

Bacterial infections around the time of childbirth account for about one tenth of the global burden of maternal death. Apart from severe morbidity and death, women who experience peripartum infections are also prone to long-term disabilities such as chronic pelvic pain, fallopian tube blockage and secondary infertility. Maternal infections before or during childbirth are also associated with an estimated 1 million newborn deaths annually.

Several factors have been associated with increased risk of maternal peripartum infections, including pre-existing maternal conditions (e.g., malnutrition, diabetes, obesity, severe anemia, bacterial vaginosis) and spontaneous or provider-initiated conditions during labor and childbirth (e.g., prolonged rupture of membranes, multiple vaginal examinations, manual removal of the placenta, caesarean section). Strategies to reduce maternal peripartum infections and their complications have been largely directed at preventive measures where such risk factors exist.

Globally, the most common intervention for preventing morbidity and mortality related to maternal infection is the use of antibiotics for prophylaxis and treatment. Metronidazole is recommended for prevention and treatment of peripartum infections.

Summary of Data Needed for Forecasting Metronidazole

- Target population (total live births)
- Number of deliveries complicated by Maternal Sepsis
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring Metronidazole for treatment of Maternal Sepsis
- Standard or average treatment regimen (i.e., amount of Metronidazole needed for each case to treat maternal sepsis)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of Metronidazole is:

Metronidazole Need for Treatment of Maternal Sepsis	=	Total Expected Live Births	x	Proportion of facility births	x	Proportion of women requiring Metronidazole for Maternal Sepsis treatment	x	Dose per Maternal Sepsis case for treatment

By applying the information on pregnancy/deliveries complication (10% pregnancies/deliveries are complicated), we estimated the number of women who require Metronidazole for the treatment of maternal sepsis. A total of 25,301 pregnant women are estimated to require Metronidazole for the treatment of maternal sepsis during the forecasting period (2017/18). A total of 516,137 injections of Metronidazole are required for 2017/18 which are to be administered intravenously. Table 20 shows the complete factorization for the forecast of Metronidazole.

Table 20: Forecasted Number of Doses of Metronidazole Required for Management of Maternal Sepsis

Total Population (projected, based on 2017 census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total live Births (2.7%) KP DHIS Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Incidence of Maternal Sepsis (average pre + postpartum sepsis according to WHO definition)	10%	10%	10%	10%	10%	10%
C) Number of pregnancies complicated with Maternal Sepsis (C= BxA)	82,413	84,795	87,245	89,767	92,361	95,030
D) Percentage of deliveries at public health facility (30.6%-KP Health Survey 2017 - assuming an increase of 1% per year)	31%	32%	33%	34%	35%	36%
E) Maternal Sepsis cases seeking treatment from public health facility	25,301	26,880	28,529	30,251	32,049	33,926
F) Requirement of Metronidazole 500mg Injections (F= E x 20 Injs -- 4 injs. x 5 days /patient)	506,016	537,599	570,585	605,028	640,986	678,516
G) 2% Wastage	10,120	10,752	11,412	12,101	12,820	13,570
H) Total Requirement of Metronidazole 500 mg Injections for Maternal Sepsis Treatment H= F+G	**516,137**	**548,351**	**581,997**	**617,129**	**653,806**	**692,087**

Forecasted Need for Cefotaxime - Treatment of Maternal Sepsis

Bacterial infections around the time of childbirth account for about one tenth of the global burden of maternal death. Apart from severe morbidity and death, women who experience peripartum infections are also prone to long-term disabilities such as chronic pelvic pain, fallopian tube blockage and secondary infertility. Maternal infections before or during childbirth are also associated with an estimated 1 million newborn deaths annually.

Several factors have been associated with increased risk of maternal peripartum infections, including pre-existing maternal conditions (e.g., malnutrition, diabetes, obesity, severe anemia, bacterial vaginosis) and spontaneous or provider-initiated conditions during labor and childbirth (e.g., prolonged rupture of membranes, multiple vaginal examinations, manual removal of the placenta, caesarean section). Strategies to reduce maternal peripartum infections and their complications have been largely directed at preventive measures where such risk factors exist.

Globally, the most common intervention for preventing morbidity and mortality related to maternal infection is the use of antibiotics for prophylaxis and treatment. Cefotaxime is recommended as first line antibiotic for prevention and treatment of peripartum infections.

Summary of Data Needed for Forecasting Cefotaxime

- Target population (total live births)
- Number of deliveries complicated by Maternal Sepsis
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring Cefotaxime for treatment of Maternal Sepsis
- Standard or average treatment regimen (i.e., amount of Cefotaxime needed for each case to treat maternal sepsis)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of Cefotaxime is:

Cefotaxime Need for Treatment of Maternal Sepsis	=	Total Expected Live Births	x	Proportion of facility births	x	Proportion of women who require Cefotaxime for Maternal Sepsis treatment	x	Dose per case for treatment

By applying the information on pregnancy complication (10% pregnancies are complicated), we estimated the number of women who require Cefotaxime for the treatment of maternal sepsis A total of 25,301 pregnant women are estimated to require Cefotaxime for the treatment of maternal sepsis during the forecasting period (2017/18 to 2022/23). A total of 516,137 injections of Cefotaxime are required for 2017/18 which are to be administered intravenously. Table 21 shows the complete factorization for the forecast of Cefotaxime.

Table 21: Forecasted Number of Doses of Cefotaxime Required for Treatment of Maternal Sepsis

Total Population (projected, based on 2017 census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total live Births (2.7%) KP DHIS Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Incidence of Maternal Sepsis (average pre + postpartum sepsis according to WHO definition)	10%	10%	10%	10%	10%	10%
C) Number of Maternal Sepsis cases (C= B x A)	82,413	84,795	87,245	89,767	92,361	95,030
D) % of public facilities deliveries/births (30.6%-Health Survey 2017 - assuming an increase of 1% per year)	31%	32%	33%	34%	35%	36%
E) Number seeking Maternal Sepsis treatment from public health facilities	25,301	26,880	28,529	30,251	32,049	33,926
F) Requirement of Cefotaxime 500mg Injections (F= E x 20 -- 4 injections daily x 5 days per patient)	506,016	537,599	570,585	605,028	640,986	678,516
G) 2% Wastage	10,120	10,752	11,412	12,101	12,820	13,570
H) Total Requirement of Cefotaxime 500mg Injections for Maternal Sepsis treatment H= F+G	**516,137**	**548,351**	**581,997**	**617,129**	**653,806**	**692,087**

Forecasted Need for Nifedipine - Inhibition of Pre-term Uterine Contractions

Since preterm uterine contractions are the most frequently recognized symptom and sign of preterm birth, inhibition of uterine contractions with tocolytic agents to prolong pregnancy and reduce neonatal complications has been and continues to be the focus of treatment of preterm labor. Tocolytic agents are intended to arrest uterine contractions during an episode of preterm labor (acute tocolysis) or maintain uterine quiescence after an acute episode (maintenance tocolysis)

When tocolysis (for inhibiting preterm labor, and improving newborn outcomes) is considered in this context, Nifedipine (a calcium channel blocker) is the preferred agent. Nifedipine can reduce the number and frequency of contractions, but its effect and how long it lasts varies from one woman to another. Like all tocolytic medications, Calcium Channel Blockers don't prevent or delay preterm delivery for a significant period.

Summary of Data Needed for Forecasting Nifedipine

- Target population (total expected pregnancies)
- Number of pregnancies complicated by preterm labor contractions
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of pregnant women requiring Nifedipine for prevention of preterm labor
- Standard or average treatment regimen (i.e., amount of Nifedipine needed for each case to treat preterm labor)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of Nifedipine is:

Nifedipine Need to inhibit uterine contractions	=	Total expected pregnancies	x	Proportion of facility deliveries	x	Proportion of women at risk of preterm contractions	x	Dose per case to inhibit preterm uterine contractions

Table 22 shows the forecasted amount of Nifedipine by year. By applying the information on pregnancy complication (16% pregnancies are complicated), we estimated the number of women who require Nifedipine for the treatment of preterm labor. A total of 166,047 pregnant women are estimated to require Nifedipine for the treatment of preterm labor during the forecasting period 2017/18. Out of total, 50,976 at risk pregnant women will seek treatment from public health facilities and will require 856,405 capsules (10 mg immediate release capsules) during the forecast year 2017/18. Table 22 shows the complete factorization for the forecast of Nifedipine.

Table 22: Forecasted Number of Nifedipine Capsules for the Inhibition of Pre-term Uterine Contractions

Total Population (projected, based on 2017 census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Expected number of Pregnancies (3.4%) KP DHIS 2015 Annual Report	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Percentage of pregnant women at risk of preterm delivery (Meta-Analysis 2017 /Every Preemie Scale-Pakistan Profile / WHO 2015 Updated Recommendations	16%	16%	16%	16%	16%	16%
C) # of pregnant women at risk of preterm delivery (C = A × B)	166,047	170,846	175,783	180,863	186,090	191,468
D) % of deliveries at public health facilities (30.6%- KP Health Survey 2017 -assuming an increase of 1% per year)	31%	32%	33%	34%	35%	36%
E) # of pregnant women at risk seeking treatment from public health facility (E = C × D)	50,976	54,158	57,481	60,951	64,573	68,354
F) Number of 10 mg Nifedipine Capsule required (total dose is 160 mg in divided doses/day for 48-72 hours - F = E x 16 cap)	815,624	866,530	919,698	975,216	1,033,174	1,093,668
G) 5% Wastage	40,781	43,327	45,985	48,761	51,659	54,683
H) Total Requirement of Nifedipine Capsule for prevention Preterm Deliveries H= G+F	856,405	909,857	965,683	1,023,977	1,084,833	1,148,351

Forecasted Need for Ferrous Salt + Folic Acid Tablets

It is estimated that 41.8% of pregnant women worldwide are anemic. At least half of this anemia burden is assumed to be due to iron deficiency. Daily oral iron and folic acid supplementation is recommended by WHO as part of the antenatal care to reduce the risk of low birth weight, maternal anemia and iron deficiency. Ferrous salt in combination with Folic acid is a supplement used to prevent iron deficiency and folic acid deficiency during pregnancy. It can also be used to treat iron deficiency anemia. It is a fixed dose combination of ferrous salt and folic acid which is taken by mouth. Ferrous salt + folic acid was approved for medical use in the United States as early as 1946. It is on the World Health Organization's list of Essential Medicines, the most effective and safe medicines needed in a health system.

WHO suggested scheme for daily iron and folic acid supplementation in pregnant women is;

i. Iron: 30–60 mg of elemental iron
ii. Folic acid: 400 μg (0.4 mg)

Summary of Data Needed for Forecasting Ferrous Salt + Folic Acid (FS+FA) Tablets

- Target population (total expected pregnancies)
- Proportion of pregnant women receiving Ante Natal Care (ANC).
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility pregnancies requiring FS+FA tablets for prevention & treatment of anemia
- Standard or average treatment regimen (i.e., amount of FS+FA tablets needed for each case to treat and prevent anemia)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula for calculation of ferrous salt/folic acid is:

Need for Ferrous salt + folic acid tablets to prevent/ treat anemia in pregnancy	=	Total expected pregnancies	x	Proportion of women who received ANC	x	Proportion of at risk women seeking anemia prevention / treatment from public health facility	x	Dose per pregnant women to prevent/ treat anemia

Table 23 shows the forecasted quantities of Ferrous salt + Folic acid tablet for the forecasted period 2017-18 to 2022-23. A total of 208,366 pregnant women are estimated to visit public health facilities during 2017-18 and 39.3 million Ferrous salt + Folic acid tablets are estimated to be required for prevention / treatment of anemia in these pregnant women. Table 23 shows the complete factorization for the forecast of ferrous salt + folic acid tablet.

Table 23: Forecasted Number of Ferrous Salt + Folic Acid Tablets

Total Population (projected, based on 2017 census -GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Expected number of Pregnancies (3.4%) DHIS 2015 Annual Report KPK	1,037,795	1,067,787	1,098,646	1,130,397	1,163,065	1,196,678
B) Percentage of pregnant women receiving ANC from a skilled provider (65.4%-KP health survey 2017- assuming 1% annual increase)	65%	66%	67%	68%	69%	70%
C) # of pregnant women who received ANC from a skilled provider (C = A × B)	678,718	709,010	740,487	773,191	807,167	842,461
D) % of Pregnant women receiving ANC from public health facility (30.6% deliveries at public facility – KP Health Survey 2017)	31%	32%	33%	34%	35%	36%
E) # of pregnant women receiving ANC from public health facilities (E = C × D)	208,366	224,756	242,139	260,566	280,087	300,759
F) Requirement of Ferrous salt + Folic Acid tablets (recommend dose is 1 tablet daily throughout pregnancy =30 tablets x 6 months=180 tablets/pregnant woman)	37,505,939	40,456,138	43,585,085	46,901,790	50,415,669	54,136,557
G) 5% Wastage	1,875,297	2,022,807	2,179,254	2,345,090	2,520,783	2,706,828
H) Total Requirement of ferrous salt + folic acid tablets for public health facilities H= G+F	**39,381,236**	**42,478,945**	**45,764,340**	**49,246,880**	**52,936,452**	**56,843,384**

Forecasted Need for Paracetamol

Paracetamol is a medicine used typically for mild to moderate pain and fever relief. It is administered either by mouth or rectally but is also available intravenously. Its effects last between two and four hours. The sections below show a structural way of forecasting the need of Paracetamol.

Summary of Data Needed for Forecasting Paracetamol

- Target population (0-59 months children)
- Number of children suffering from pain / fever
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number 0-59 months children requiring Paracetamol for treatment of pain and fever.
- Standard or average treatment regimen (i.e., amount of Paracetamol (syrup / suppository) needed for each case to treat pain / fever).
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of Paracetamol is:

Need for Paracetamol to relieve fever and pain.	=	Under 5 children population	x	Proportion of children visiting public health facility	x	Dose per child for relief of pain & fever

Table 24 shows the forecasted quantities of Paracetamol by year. A total of 544,474 Paracetamol syrup / suppository are forecasted for the period (2017/18).

Table 24: Forecasted Number of Paracetamol Syrup / suppository Required for fever & pain

Total Population (projected, based on 2017 census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) % 0-59 months children PBS 2012-13	14.61%	14.61%	14.61%	14.61%	14.61%	14.61%
B) Estimated Population of 0-59 months children (2017 Pop x A)	4,459,465	4,588,343	4,720,946	4,857,381	4,997,760	5,142,195
C) Percent 0-59 months children at risk of fever/pain (PDHS 2012-13)	38%	38%	38%	38%	38%	38%
D) Estimated number of 0-59 months children with fever/pain	1,694,597	1,743,570	1,793,960	1,845,805	1,899,149	1,954,034
E) Percentage visiting public health facility for treatment (30.6% deliveries in public facility -KP Health Survey 2017)	31%	32%	33%	34%	35%	36%
F) Estimated number of 0-59 months children visiting public health facility	518,547	550,968	584,831	620,190	657,105	695,636
G) Requirement of Paracetamol Syrup/Suppository for the treatment of fever/pain (1 bottle /episode)	518,547	550,968	584,831	620,190	657,105	695,636
H) 5% Wastage	25,927	27,548	29,242	31,010	32,855	34,782
I) Total Requirement of Paracetamol for 0-59 months children	544,474	578,517	614,072	651,200	689,961	730,418

Forecasted Need for Adrenaline - Septic Shock and Anaphylactic Reactions

Adrenaline is a naturally occurring chemical which is produced by our bodies in response to stress. An injection of adrenaline helps to relieve the symptoms of septic shock / anaphylaxis by causing blood vessels to narrow and opening up airways. This stops the blood pressure from dropping and makes breathing easier. Adrenaline is a direct-acting sympathomimetic agent. Adrenaline Injection BP. 1/1000 (1mg/ml) may be administered undiluted by Sub-Cutaneous or Intra-Muscular injection. In the shocked patient, the intramuscular route is recommended as absorption from the intramuscular site is more rapid and reliable than from the subcutaneous site.

Summary of Data Needed for Forecasting Adrenaline Injection

- Target population (total expected births)
- Number of deliveries complicated by Maternal Sepsis
- Percent deliveries in public health facilities of Khyber Pakhtunkhwa
- Number of public facility deliveries requiring adrenaline for treatment of Maternal Sepsis
- Standard or average treatment regimen (i.e., amount of adrenaline needed to treat maternal sepsis)
- Expected projected changes in consumption (potential loss or scale-up in use)

The formula used for this calculation of Adrenaline is:

Need for Inj. Adrenaline to treat Maternal Sepsis	=	Expected number of births	x	Proportion of public facility deliveries	x	Proportion of deliveries at risk of maternal sepsis	x	Dose per case of Maternal Sepsis

By applying the information on pregnancy complication (10% pregnancies are complicated), we estimated the number of women who require injection Adrenaline for the treatment of maternal sepsis. A total of 82,413 women are estimated to require Adrenaline injection for the treatment of maternal sepsis during the forecasting period 2017/18. Out of these, 25,301 pregnant women will seek treatment from public health facility. A total of 25,807 injections of Adrenaline are required for 2017/18 which are to be administered intramuscularly / intravenously. Table 25 shows the complete factorization for the forecast of Adrenaline.

Table 25: Forecasted Number of Adrenaline Injections Required

Total Population (projected based on 2017 census - GR 2.89%)	**30,523,371**	**31,405,496**	**32,313,115**	**33,246,964**	**34,207,802**	**35,196,407**
Parameters	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**
A) Total live Births (2.7%) KP DHIS Report 2015	824,131	847,948	872,454	897,668	923,611	950,303
B) Incidence of Maternal Sepsis (WHO)	10%	10%	10%	10%	10%	10%
C) Number of Maternal Sepsis cases (C= B x A)	82,413	84,795	87,245	89,767	92,361	95,030
D) % of deliveries at public facility (30.6%- KP health survey 2017, assuming an increase of 1% per year)	31%	32%	33%	34%	35%	36%
e) Number of maternal sepsis cases visiting public facilities	25,301	26,880	28,529	30,251	32,049	33,926
F) Requirement of Adrenaline Injections	25,301	26,880	28,529	30,251	32,049	33,926
G) 2% Wastage	506	538	571	605	641	679
H) Total Requirement of Adrenaline Injections for Maternal Sepsis Patients H= F+G	**25,807**	**27,418**	**29,100**	**30,856**	**32,690**	**34,604**

Adjust for Losses and Programmatic Changes

The proportion of patients likely to be treated with the product depends on programmatic factors. This adjustment is made either before or after converting the number of episodes to products. For example, if the number of episodes of diarrhea is expected to change, these adjustments are made when estimating the number of episodes. For forecasting and budgetary purposes, we are adding a percentage for uncertainties in demand to avoid stock-outs. It is also important to stress that, in these forecasts, the whole target population was considered, without taking into account the existing programmatic status (rate of scale up). When actual procurement of these commodities is being planned, DOH, KP will need to assess the status of implementation, particularly of new commodities such as Misoprostol and Chlorhexidine, and adjust the target population as relevant.

Forecast Limitations

Producing accurate forecasts of these MNCH commodities remains a challenge in Khyber Pakhtunkhwa because of unavailability of quality data including consumption and stock-on-hand data. Some of the other challenges or limitations faced in producing this forecast include the following:

- To conduct the forecasting exercise, 2017 census data is used for projections of the target population (births and pregnancies), while under 5 children percentages are of either PDHS 2012-13 or PBS website, leaving a chance of error regarding the actual number of the target population. Obtaining information on the different treatment regimens was a challenge in carrying out the exercise since standardized provincial treatment protocols do not currently exist for most of the conditions.
- The lack of a coordinated/unified provincial procurement and supply system within DOH and MNCH Program for a specific MNCH commodity still remains a challenge. For example, both entities are procuring Misoprostol to distribute at the community level using their own field network, which opens a window of targeting same women.
- Information on the number of days of stock-outs of products at the district and sub-district levels is not available.
- Information on the minimum and maximum stock levels at different levels of supply chain and buffer stock for MNCH commodities is not available.
- The official unit cost for different MNCH commodities is not available for costing purposes.
- The accuracy of this exercise fully depends on the full implementation of MNCH program strategies and policies.
- In some cases, the recommended product is not yet available in the market or is produced by a very small number of manufacturers.

RECOMMENDATIONS

- Since there is no information and data on the actual consumption of essential medicines, MNCH program, DOH, KP should develop a mechanism for collecting logistics data on a routine basis from the health facilities to enable expeditious determination of provincial requirements of very essential medicines.
- DOH and MNCH program should include these very essential MNCH commodities in their logistics reporting forms and take necessary steps to make the logistics data available in their existing MIS and ensure the ultimate availability of the necessary data in web based Pakistan LMIS.
- The technical capacity of the DOH staff for conceptualizing the forecasting methodology, assumptions data validation process, and for undertaking the overall forecasting and supply planning exercise, must be strengthened. Quantification can be institutionalized in DOH by establishing a unit of relevant technical personnel across the entities that can sensitize and transfer skills to the lower levels.
- Coordination among the stakeholders is essential before MNCH commodities are procured.
- DOH can consider disseminating the forecasting report to the drug manufacturers to inform them of the quantity of commodities needed for the whole province so they too can plan accordingly.
- This forecasting exercise should be reviewed annually by the entities and adjusted to account for changes in the assumptions or data in accordance with strategic plans and new data.
- District Managers can use the forecasting algorithms for each commodity presented in this document for their local procurement planning using their own routine health information systems and population data.
- Different stakeholders should maintain an effective coordination mechanism during procurement planning, particularly for items procured at provincial and district levels. This effort will minimize the over stocking and potential wastage of commodities.

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