

WHO Pakistan

Biomedical Equipment Survey

Summary Document

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9/1/2021

Objectives and Scope

- Conduct assessment of biomedical equipment especially focusing on oxygen supply systems through liaison with Provincial Focal Persons and WHO Provincial office teams for consolidating info on the tool including validation of collected data.
- Guidelines on interventions required on Oxygen Supply Roadmap through assessment of baseline availability & needs identification for infrastructure and essential workforce requirement.
- The assignment will also entail capacity building to ensure competent HR for efficient management of Biomedical Equipment at all levels.
- Quantify needs for Biomedical equipment inventory as per level of care/ facility-wise (TCH, DHQs,) as part of preparedness for outbreaks/ public health events such as the ongoing COVID-19 pandemic

Survey

This is the first edition of guidance on conducting a rapid inventory assessment to determine readiness of a health facility, as well as capacity to re-allocate biomedical equipment, for COVID-19 case management in Pakistan. . The tool comprises of a survey (paper or digital) divided in to four main parts.

1. Facility Identification
2. Basic Information
3. Maintenance Details
4. Oxygen Systems
5. Equipment Data (including functionality)

This tool is to be used in-line with WHO's emergency disease commodities package (DCP) for COVID-19, the WHO Priority List of medical devices for COVID, as well as Technical specifications for oxygen delivery systems, Resuscitation devices and Oxygen concentrators. This tool is intended for health facility administrators, clinical decision-makers, procurement officers, planning officers, biomedical engineers, or infrastructure engineers to identify readily available biomedical equipment for immediate use and/or re-allocation.

The following are the Stages of Life Cycle of Medical Equipment:

- Planning
- Acquisition
- Delivery and Inspection
- **Inventory and Documentation**
- **Training of users and Operator**
- Monitoring of use and Performance
- **Maintenance**
- Replacement and Disposal

As discussed earlier we have focused on 4 major stages in the life cycle highlighted above. All of these come under the purview of the Health facility and can easily be improved if steps are taken in the right direction. This Survey will create a baseline for the status of Biomedical Equipment Inventory in various health facilities and their maintenance system. This will enable us to move towards an evidence based national policy on medical equipment and a risk based maintenance management system to ensure available safe, reliable and functional medical equipment.

Approach and Methodology

The WHO country office, Islamabad identified Focal Person from the WHO provincial offices who liaised with the provinces and identify Focal Person from the provincial government. Through Extensive discussion, Health Care Facilities (HCF), to be included for this first edition, was identified. These ideally included a few Tertiary care Hospitals, DHQs and some private Health Care Facilities in the province. WHO country office facilitated in acquiring letters, addressed to the provincial government, from the DG National Health Services, Regulation and Coordination (NHSR&C) and WR recognizing the TS and requesting facilitation in conducting the survey.

The existing survey by WHO was modified keeping in view the level of expertise of the technical staff available in the health care facilities. A few new Equipment were added, and the existing Survey was divided into 4 Fields:

- Basic Information
- Oxygen Systems
- Medical Equipment
- Maintenance Information

A google® form and a **Guidance Document** on the Survey was prepared to facilitate the data collection. The new survey included 23 highly critical equipment essential for treatment and diagnosis of Covid-19 and other respiratory diseases. The WHO country office, Islamabad identified Focal Person from the WHO provincial offices who liaised with the provinces and identify Focal Person from the provincial government. Focal Persons were identified from the provincial government to have ownership of the Data. Different methodology to used in different provinces depending on the demographics

Punjab

- Primary and Secondary Department through BERC (23 Facilities)
- Specialized and Medical Education Department (5 Hospitals)
- .The Punjab Health Commission (4 Private Healthcare facilities 1 ‘other’ hospital data acquired by the TS)
- The WHO provincial office together with the TS facilitated in contacting the Punjab Health Commission and the Secretary Primary and Secondary Health Department.
- For the Specialized and Medical Education department, the TS had to make repeated efforts to highlight the importance of the exercise to the Secretary Health and his team. They only agreed to share data for 5 big hospitals in Lahore and agreed to provide data for other Hospitals after the positive outcomes for these 5 facilities have been shared.

AJK & GB

- The data collection of AJK & GB was relatively smoother. The WHO provincial office facilitated in provision of data for 8 healthcare facilities. All agreed healthcare facilities could not be included in the survey due to shortage of manpower.

Sindh

- The data collection from Sindh was one of the most difficult tasks.
- Out of the agreed on 36 facilities, data was gathered only from 7 healthcare facilities based on the previous survey. The provincial office helped in acquiring letters from DG health Sindh addressed to all healthcare managers but short on man power and start of polio campaign and floods made it difficult. .
- The TS tried to engage health managers on a personal level, both private and public, from tertiary health care facilities in province to acquire the required data. Data from a total of 12 (including AKUH & Indus Hospital) healthcare facilities have been analyzed.

Balochistan

- The WHO provincial office facilitated in acquiring data from healthcare facilities in the province. The healthcare structure in Balochistan is different from other provinces; there are not many private healthcare facilities. The

DHQs vary in size depending on the areas they are situated. Data from a total of 7 healthcare facilities was acquired out of which only 3 had provided data according to the new Survey.

KPK

Data Collection from the province was extremely difficult. The focal person identified by the WHO provincial office was not able to facilitate any data collection. All data collected from the province was through parallel sources

Challenges and Limitations

The overall challenges faced in Data collection are summarized below:

- Provincial governments were not ready to share the required data and a lot of delays were faced in persuading them.
- This made identifying provincial Focal Person and liaising with them difficult.
- The Bureaucratic processes (approvals, letters) in the government cause a lot of delays in data collection.
- WHO Provincial offices are short on man power hence different strategies had to be implemented in different provinces. Reliance mostly on the provincial government to provide the data.
- Delays in data due to unforeseen circumstances; start of polio campaign, floods etc.
- Although the Survey was modified for data collection, due to the limitation of technical staff (Biomedical Engineers) in HCF, the data is still incomplete. The HCF has to be individually contacted to verify the data.

Data Analysis

The data analyzed from health facilities across 5 provinces of Pakistan give a substantial evidence of equipment shortages across health facility. Disparity in equipment can be seen between the same level of facilities in one province and across 5 provinces as well. A summary of biomedical equipment availability and Oxygen Systems is given below.

Province	Punjab	Sindh	Balochistan	KPK	AJK & GB	Total
Total Facilities	32	10	7	48	7	104
Total Beds	13865	8459	2585	8624	1920	35453
ICU Beds	584	432	140	128	86	1370
Covid Beds	1304	109		1095	69	2577
HDU Beds	509	65		359	309	1242
ALS Ambulances	23	6	0		14	43
BLS Ambulances	41	67	27	92	2	229
Biomedical Equipment						
Ventilators	534	244	52	158	65	1053
Monitors	1910	322	95	633	145	3105
Pulse oximeters	1242	115	96	287	105	1845
Xray	110	30	4	96	14	254
CT	28	5		53	1	87
Ultrasound	189	51	2	92	22	356

Chemistry Analysers	65	4	5	89	12	175
Immuno Analysers	17	2		81	3	103
PCR	16	2		52	5	75
Oxygen System						
MGPL	32	7	5		3	47
VIE	9	3	1	Only in Tertiary Centres	1	14
Oxygen concentrator	184	2	9	29	74	298
Oxygen generator	1	2	3	0	1	7
Oxygen Flowmeter	4855	375	542	949	556	7277

These values were compared with identified five national best practices (**Aga Khan University Hospital Karachi, Indus Hospital Karachi, Shaukat Khanum Memorial Hospital and Research Centre Lahore, Fatima Memorial Hospital Lahore, Hayatabad Medical Complex Peshawar and Biomedical Equipment Resource Centre, Punjab**) as shown in the Table below. Aga Khan University Hospital and Shaukat Khanum Memorial Hospital are also two of the three JCIA accredited institutions in the country.
















Hospital Name		AKU	SKM	INH	FMH	HMC
Rationale for Equipment	Number of Beds in a Hospital	723	200	301	453	1380
	Critical Care Beds	195	46	45	14	140
	Pulse Oximeter				50	160
	Vital Signs Monitoring Device	186	70	20	145	260
	Patient Ventilator	617	52	13	31	68
	Anaesthesia Machine	31	16		15	25
	Xrays	7	5		3	8
	CT	2	2		12	1
	Ultrasounds	41			1	10
	OT Table	37	11	1	11	40
	Chemistry Analyzer	13	4	1	2	3
	Immuno Analyzer	13	7	3	2	3
	Ambulances			1	2	2
	PCR	40	3	16		2






Moreover a rationale for Ventilators, Pulse Oximeters, and Patient Monitoring devices considering these national best practices is shown in Table below with rounded off ratios to the nearest 0.5 value. Current National ratio and a recommended ratio is also devised. Recommended ratio was devised keeping in view data from three Low Middle Income Countries; **India, Zambia and Kenya** and consulting various guideline published by ECRI during Covid-19 and the Mexican Ministry of health.

Ratios	AKU	SKM	INH	FMH	HMC	National	Recommended
Critical Bed to Ventilator	1:3	1:1	3.5:1	1:2	2:1	5:1	1:1
Total Beds to Monitor	4:1	3:1	15:1	3:1	5:1	11:1	4:1
Total Bed to Pulse Oximeter				9:1	8.5:1	19:1	9:1

Summary

For the majority of hospitals and health service providers, no one has clear responsibility for managing medical equipment and its costs. Responsibility is dispersed across health service staff, biomedical engineers, hospital operations managers, heads of clinical service areas and central health department staff. This reduces accountability and efficiency. The Table below summarizes the province wise key findings.

Province	Identifiers	Assessment	Key Findings
Punjab	MGPL&PSA		• MGPL installed in DHQs and Tertiary Centres
	Maintenance System		• DHQs and THQS have a centralized maintenance management system. Most Tertiary Centers <u>donot</u> have a system in place
	Equipment availability		• Some centres are very well equipped while others are not
Sindh	MGPL&PSA		• MGPL not installed most DHQs and Tertiary Centres
	Maintenance System		• No proper maintenance Setup
	Equipment availability		• Some centres are very well equipped while others are not
Balochistan	MGPL&PSA		• PSA installed across few facilities
	Maintenance System		• No proper maintenance Setup
	Equipment availability		• Most DHQs are not equipped with basic diagnostic equipment such as pulse oximeters
AJK&GB	MGPL&PSA		• MGPL&PSA not installed in most centres
	Maintenance System		• No proper maintenance Setup
	Equipment availability		• Some centres are very well equipped while others are not
KPK	MGPL&PSA		• MGPL not installed most DHQs and Tertiary Centres
	Maintenance System		• Some sortof equipment maintenance management is in place through workshops but a lot needs to be done
	Equipment availability		• Some centres are very well equipped while others are not

 Do not Exist
  Minimal
  Partially
  Mostly
  Fully Exist

Recommendations

It is essential that the following steps are implemented Health System Strengthening and to ensure safe, appropriate and reliable biomedical equipment in Pakistan. A **National Biomedical Equipment (covering oxygen systems) policy** is the need of the hour. Hence, it is essential that a technical **focal person is present in WHO Pakistan** to coordinate and facilitate in implementing best practices, norms and standards with Health Ministry and department of Health related to management, maintenance and regulation biomedical equipment (including oxygen system) and medical devices. A short term and long term road map should be identified based on these recommendations.

Oxygen Systems

MGPL ideally be installed in at least in all DHQ and tertiary care level facilities with VIE tanks. PSA should be available in farfetched areas of the provinces where availability of liquid oxygen might be difficult due to accessibility. Based on medical oxygen requirements at district level hospitals and considering the best industry practices, following key measures must be taken on national and provincial levels. Details are given in the guidance document.

- Production of Oxygen on Provincial and Divisional Level
- Assessment of Oxygen gas Supply system
- Provision of appropriate and adequate technology
- Establishment of Medical Gases Committee
- Oxygen conservation
- Establishing Oxygen demand analysis and procurement system
- Establishing Oxygen monitoring system
- Maintenance system for Oxygen gas supply system
- Operational guidelines for clinical staff of the hospitals
- Training of staff handling medical gas

Biomedical Equipment and Maintenance Management System

- All equipment to bed/critical bed ratio should be same nationwide for the same level of facility.
- Create an facility wise essential medical equipment list keeping in view WHO's published Document and national and international best practices (India, Mexico)
- There is need to involve regulatory bodies such as DRAP in the maintenance management of equipment and compliance to medical equipment standards (IEC, ASNZ, ISO) for patient safety.
- Keeping Covid in perspective, WHO should provide technical support for Emergency Use and Refurbished Equipment in terms of regulation, maintenance and Callbacks.
- Health Ministry Provincial & Department of health should be advised on setting up training workshops and institutes of biomedical engineers.
- With the aid of WHO Biomedical Maintenance Setups (Ideal Biomedical Maintenance Setups identified in the guidance documents) should be regulated. QMS (SOPs) should be designed for each level of facilities on how to maintain and manage medical equipment through provincial level workshops and in the health care facility.
- Basic trouble shooting and most common maintenance problems for all equipment should be identified and a national repository should be devised.
- Designate dedicated maintenance staff and dedicate a maintenance budget on national and provincial levels or Maintenance firm for repair of critical equipment
- Health Ministry Provincial Department of health should be advised to create a network of master trainers on equipment maintenance (All equipment included) by engaging engineering from AKU, SKM and other national best practices and service engineering firms, and repeated training should be provided on a national and provincial to ensure better management of equipment.
- National Advisory Boards should be created to estimate Risk and Adverse effects caused by medical equipment.