World Health Organization

المركز الوطني لمكافحة الأمراض
NATIONAL CENTRE FOR DISEASE CONTROL - LIBYA

Assessment of COVID-19 Detection Laboratories

WHO Libya, in collaboration with NCDC and MoH

31 March 2021

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Key Highlights:

By end of March 2022:

- 42 COVID-19 detection laboratories were assessed in the 1st Quarter 2022.
- 23 (55%) Labs are reported fully functional, while 19 (45%) requires assistance to fully operate (i.e., medical supplies, equipment, maintenance, and staffing).
- 34 (89%) labs have RT-PCR machines, while 4 (11%) doesn't have.
- Most laboratories operate 1 shift of 8 hours 13 (34%), followed by 2 shifts of 16 hours 11 (29%).
- Over 1000 testing capacity per day is reported in Tripoli Biotechnical Centre Lab (5,000), Azzawya NCDC Lab (2,500), Tripoli NCDC public health lab (1500), Misrata NCDC Lab (1,300), and Misrata Medical centre Lab (1,300).
- The reported needs ranked per priority are equipment, consumables, and staff training; consequently.

1. Introduction

Assessment of COVID-19 detection laboratories was conducted to measure diagnostic testing capacity and availability of resources to provide a reliable service.

The following information pillars were covered under the assessment:

1) Location of the laboratory
2) Functionality Status, and main reasons of non-functionality
3) Diagnostic capacity (availability of RT-PCR & GeneXpert machines)
4) Staffing capacity
5) Consumables
6) Needs

A standard template was designed for data collection. The template was shared with WHO Field Coordinators, who collected data from the laboratories in coordination with NCDC (National Centre for Disease Control) and the Ministry of Health. Data is collected on quarterly basis. This analysis report reflects the laboratories assessed in the 1st Quarter of 2022 (last date for reported data is 31 March 2021); information reviewed and endorsed by NCDC.

The total assessed laboratories in the 1st Quarter 2022 are 42, compared to 38 assessed in the 4th Quarter 2021 out of total 40 (i.e., 2 labs were unreachable and not assessed).

Two additional labs were added to the scope of the assessment in 2022, those are Algarabolli Reference lab (Almargeb in Western region) and (Al-Marj hospital COVID-19 lab (Almarj in Eastern region), which increased the overall total labs to 42 labs compared to 40 last year.

The assessed labs are distributed across the three regions: Eastern (9), Southern (6), and Western region (27).

2. Functionality Status of Laboratories

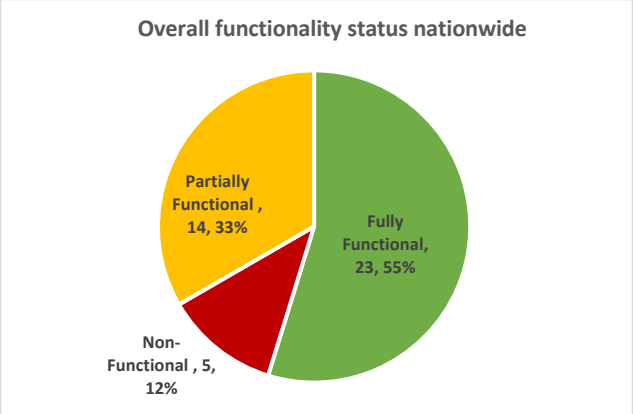
Functionality is defined as the capacity of the laboratory to provide COVID-19 testing services, and is assessed at three levels:

1. Fully Functional: the lab is open and provides COVID-19 testing services without impediments.
2. Partially Functional: the lab is open and provides healthcare services but is facing impediments in delivering the expected COVID-19 testing services (such as: lack staff, training, equipment, supplies or consumables).
3. Non-Functional: the lab is closed and not delivering services.

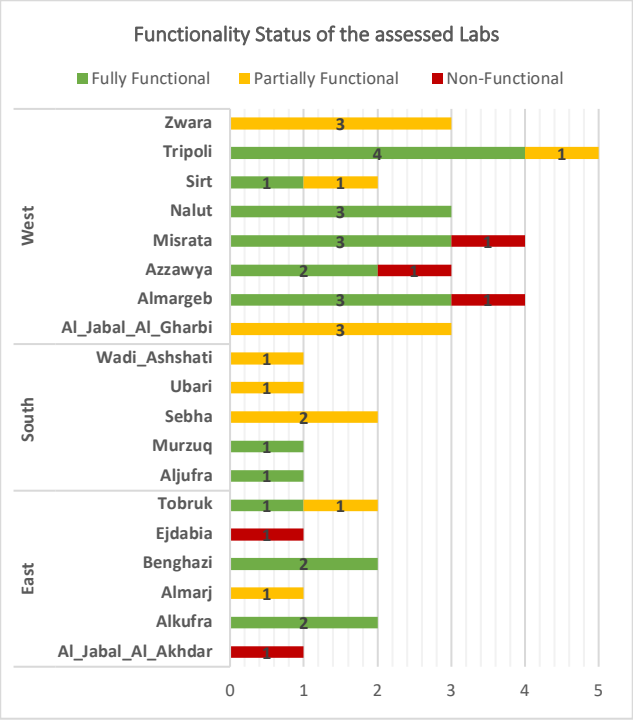
Out of 42 assessed laboratories, 23 (55%) are reported fully functional, 14 (33%) partially functional mainly because of lack of medical supplies, equipment, staff. 5 (12%) were reported non-functional mainly due to the lack of medical supplies (drugs and consumables), followed by lack of medical equipment, lack of staff and malfunction of the PCR analyser. Reported non-functional labs are Ejdabia NCDC lab and Al Bayda

Hospital Centre lab in Eastern region; Azzawiya Algharb COVID-19 lab and Bani Waleed lab in Western region. Algarabolli reference lab in Western region is reported non-functional due to administrative issues.

The overall functionality status is shown in the following diagram.



The distribution of laboratories per region and district according to its functionality status, are shown in the following diagram.



The highest gap in functionality status is reported in the Southern region, where 67% (4) out of (6) labs reported partially functioning, followed by Eastern region with 44% (4) out of (9) labs reported either partial or non-functioning, and then Western region with 41% (11) out of (27) labs reported either partial or non-functioning.

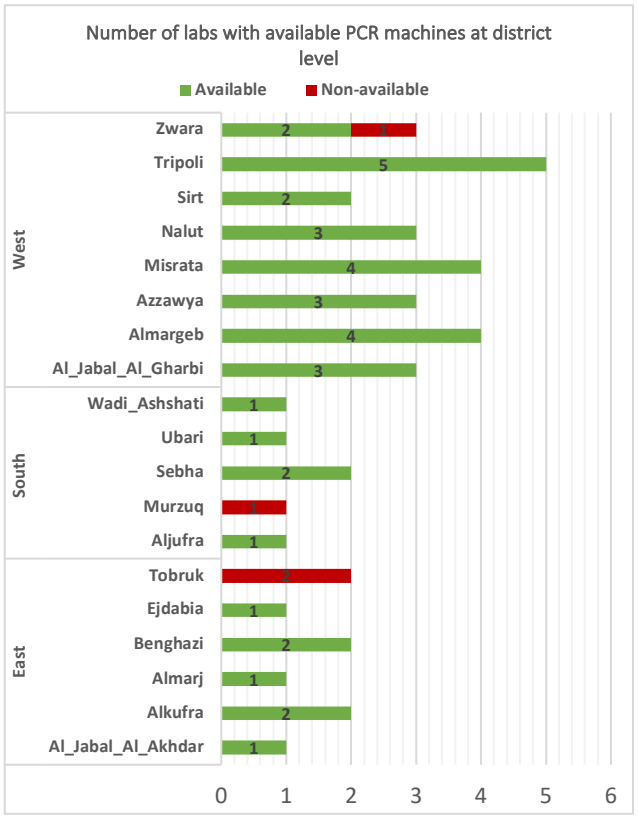
3. Diagnostic Capacity

Assessment of diagnostic capacity is measured in terms of availability of RT-PCR machines, GeneXpert machines, their numbers, and modules at lab level. The following sections provide analytical summary at district level, while further details per lab are available upon request.

3.1 RT-PCR Machines

Out of a total 42 assessed laboratories, 38 (90%) have RT-PCR machines, while 4 (10%) doesn't have (one lab in Zwara, one lab in Murzuq, and 2 labs in Tobrouk).

The distribution of labs with available RT-PCR machines per District is shown in the following diagram.



The same **laboratories** in 4th Quarter 2021, reported **non-available RT-PCR** during 1st Quarter 2022. Those are:

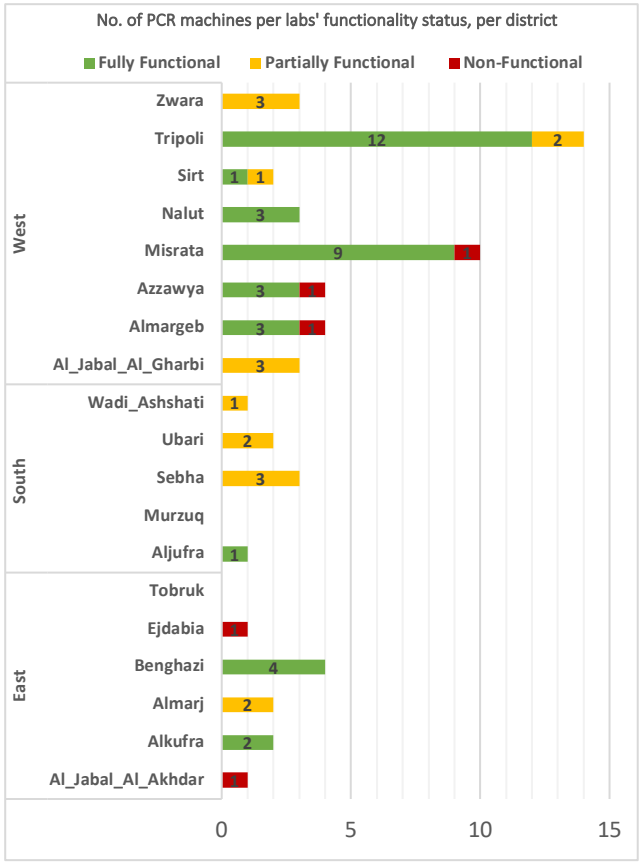
Region	District	Municipality	Name of the Lab
Western	Zwara	Zwara	Zwara NCDC Lab
East	Tobruk	Emsaed	Emsaed General Hospital Lab
		Tobruk	Tobruk NCDC Lab
South	Murzuq	Taraghin	Taraghin lab

Of note, Sebha Medical Centre Lab in Sebha district had reported one RT-PCR Machines during the 4th Quarter 2021, while it was reported an extra RT-PCR machine during the 1st Quarter 2022 (provided by Tripoli Biotechnology Research Centre Lab).

The number of available RT-PCR machines according to labs' functionality status was also assessed.

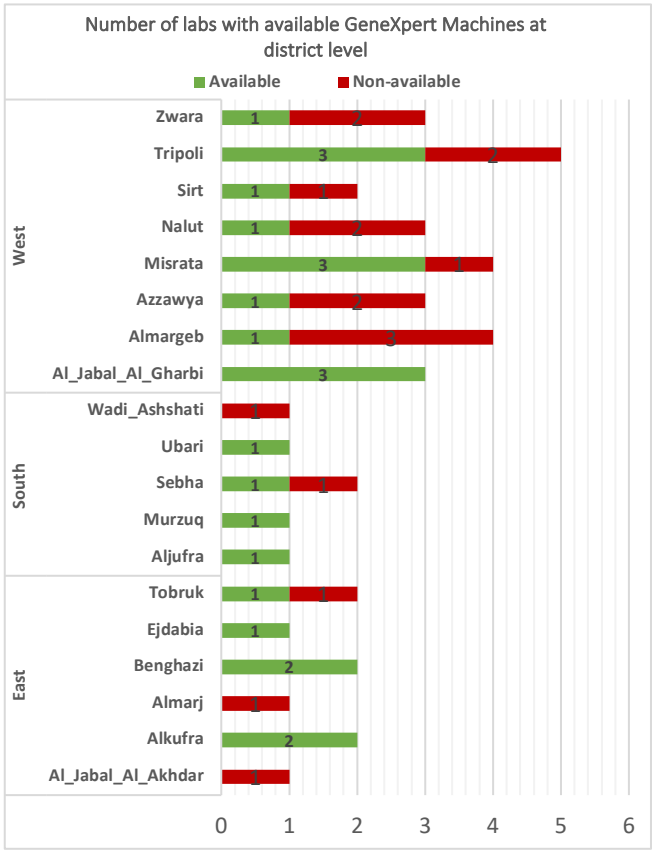
Out of a total (60) RT-PCR machines available in public COVID-19 detection labs across Libya, 63% (38) is reported available in the fully functional labs, 28% (17) in the partially functional labs, and 8% (5) in the non-functional labs.

Details at district level are shown in the following diagram.



3.2 GeneXpert Machines

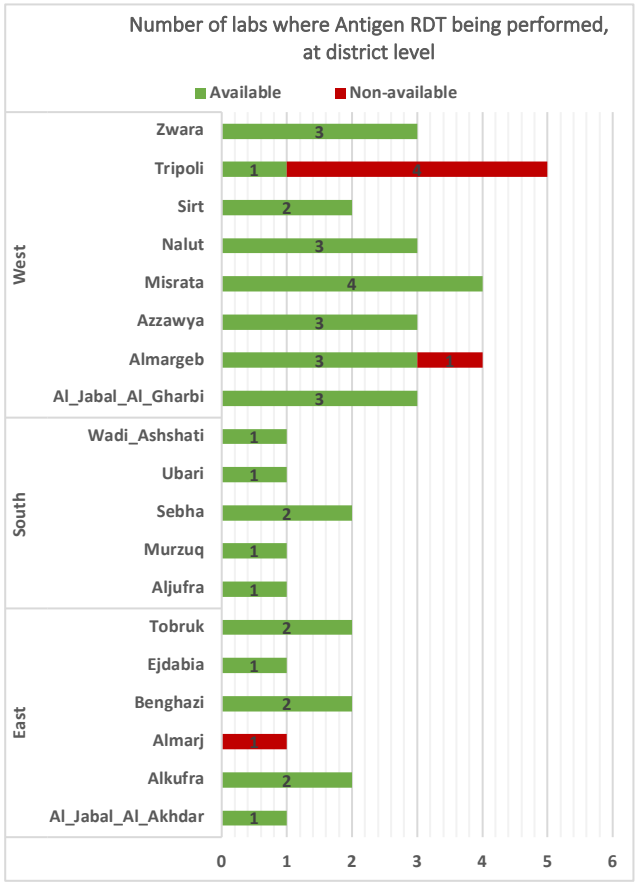
Out of a total 42 assessed laboratories, 24 (57%) reported available Cepheid GeneXpert machines, while 18 (43%) reported not available machines. Number of labs with available GeneXpert Machines at district level is shown in the diagram below.

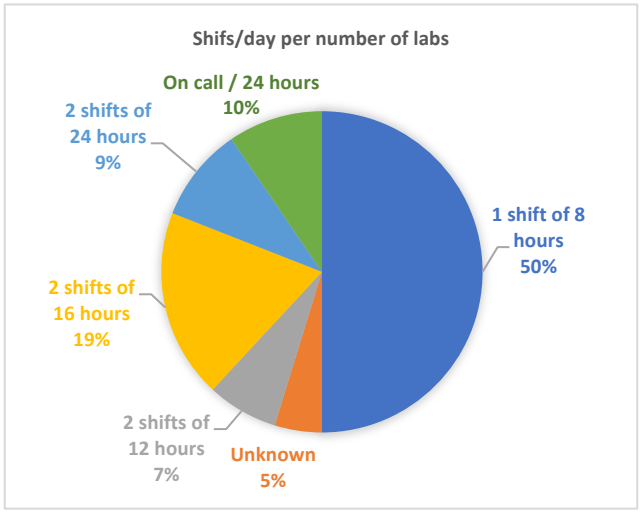


Of note, the lab in Ubari (Bent Bayya hospital lab – triage centre Alroqaiba) has GeneXpert machine, but it's not working due to lack of reagents; *same need reported in the last quarter (also reflected under needs section)*.

3.3 Antigen RDT

Out of a total 42 assessed laboratories, 36 (86%) reported available Antigen RDT, 6 (14%) reported non availability. Of note, Antigen RDTs are mostly used in case of shortage of RT-PCR and GeneXpert consumables. Number of labs where Antigen RDT being performed is summarized at district level in the diagram below.





4. Laboratories' Operational Capacity

The operational capacity of COVID-19 detection laboratories was assessed in terms of number of working shifts per day, working days per week, maximum lab testing capacity, staffing, and training received.

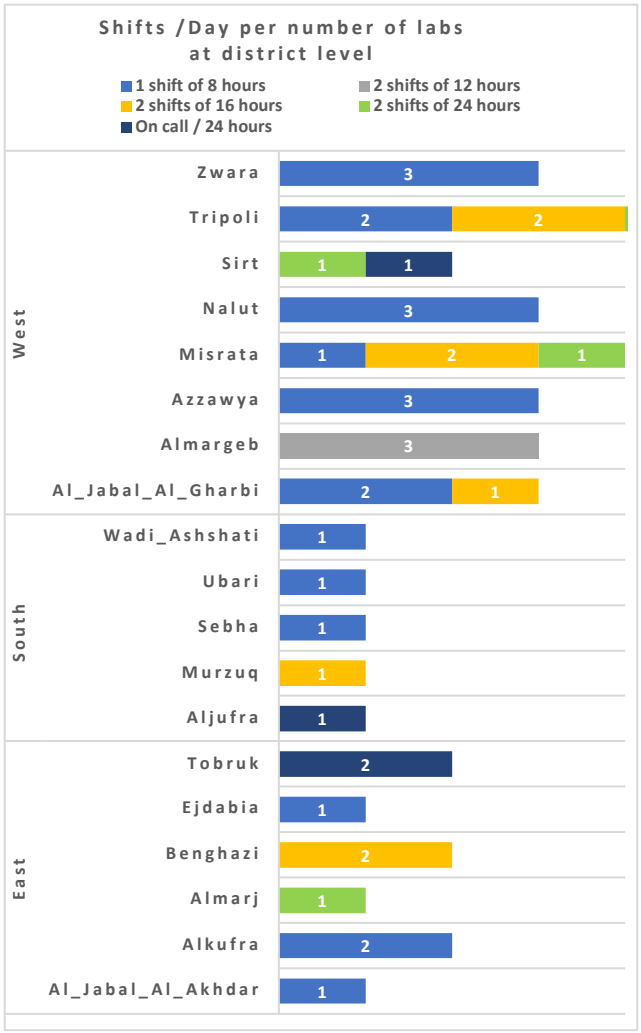
4.1 Working shifts/day

Different working hours were reported for the laboratories' daily shifts.

Majority of the assessed laboratories are operating 1 shift of 8 hours 21 (50%), followed by 2 shifts of 16 hours 8 (19%), and on call/24 hours (10%); further details provided in the following diagram.

It was observed that no standard modality is followed for working hours in COVID-19 and working shifts are changing according to the workload in laboratories (i.e., increase of cases during COVID-19 wave in winter) in addition to staff turnover (financial issue).

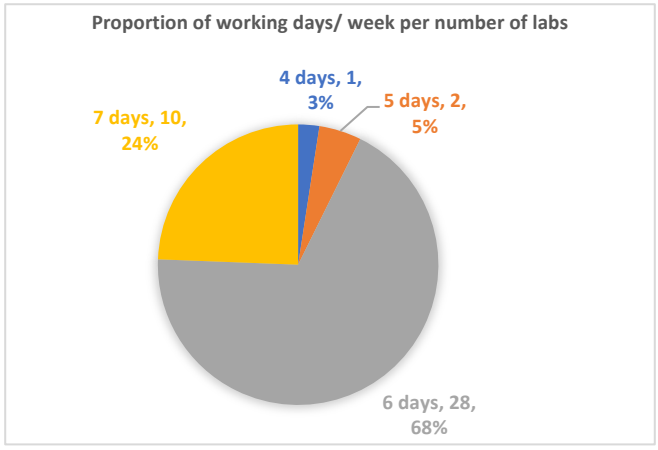
The distribution of labs per different working hours shown in the diagram below.

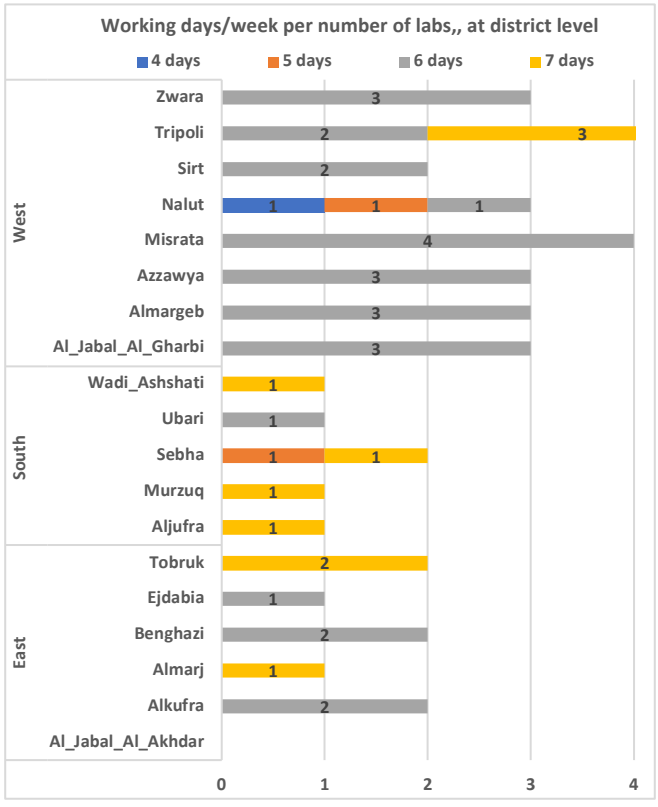


4.2 Working shifts/day Working days/week

Out of a total 42 laboratories, 27 (64%) operate 6 days a week, 10 (24%) operate 7 days a week, while two labs operate 5 days a week and one lab operates 4 days a week both reported in Nalut district; see diagrams below.

One lab (Al Bayda Hospital Lab) in Al Jabal Al Akhdar district/ East region, did not report the working days per week.





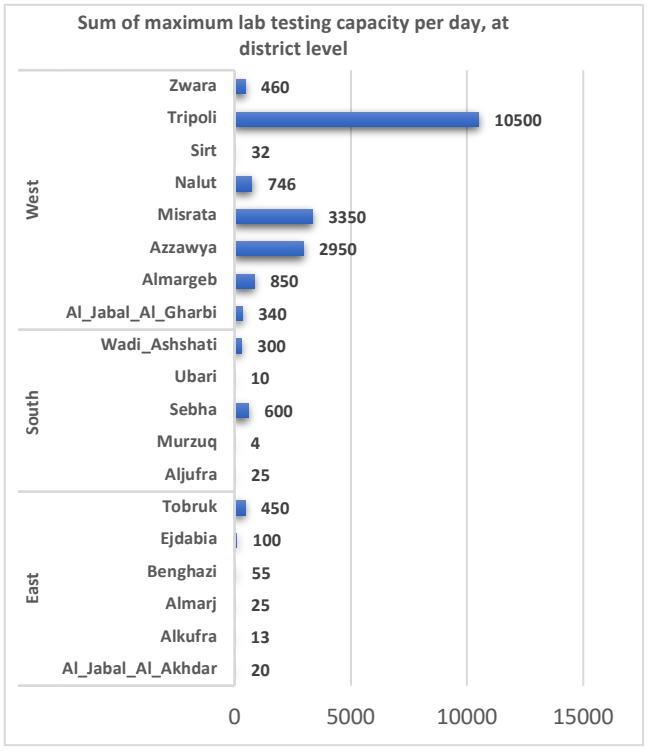
4.3 Maximum daily lab testing capacity

The testing capacity of laboratories varies, depending on the availability of machines and staffing.

The highest testing capacity at district level is reported in Tripoli with a total of 10,500 tests per day in 5 labs, disaggregated as follows:

1. Public Health Reference Lab- NCDC: 3,500 tests per day
2. Suq Aljuma lab- NCDC: 500 tests per day
3. Tripoli Biotechnical Centre Lab in Ain Zara municipality: 5,000 tests per day
4. Animal Health lab: 1000 tests per day
5. College of Medicine Lab in NCDC: 500 tests per day

Details of COVID-19 testing capacity per day is summarized at district level in the following diagram.

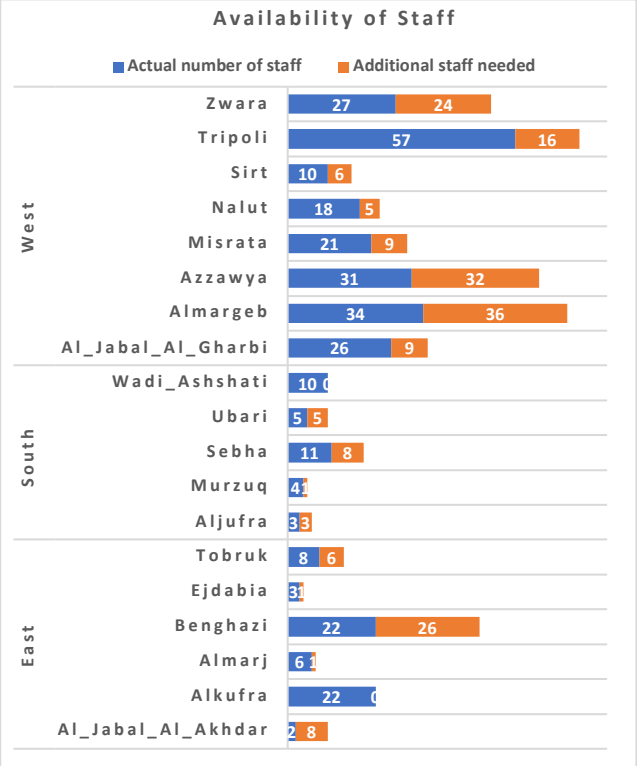


4.4 Availability of Lab staff for COVID-19 testing

Part of the assessed laboratories has designated staff for COVID-19 testing, while other labs depend on the hospital staff to perform this task.

There are disparities in distribution of number of staff available to perform COVID-19 testing vs., the overall number of needed staff at district; some districts are experiencing staff shortage (i.e., Al Bayda Hospital Lab in Al Jabal Al Akhdar operates with 2 staff and needs 8 more).

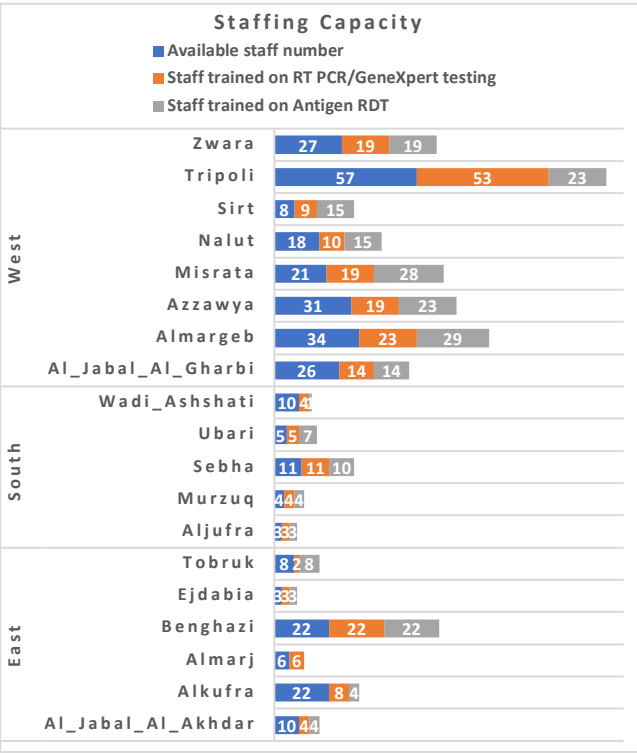
Wadi Alshati is the only district reported sufficient staff number (has one lab: Ashshati College of Engineering Biotech). See the following diagram for more details.



4.5 Staff training on RT-PCR/Gene-Xpert and Antigen RDT testing:

The distribution of the number of staff trained on RT-PCR/GeneXpert and Antigen RDT vs., number of available staff in laboratories, is shown in the diagram below.

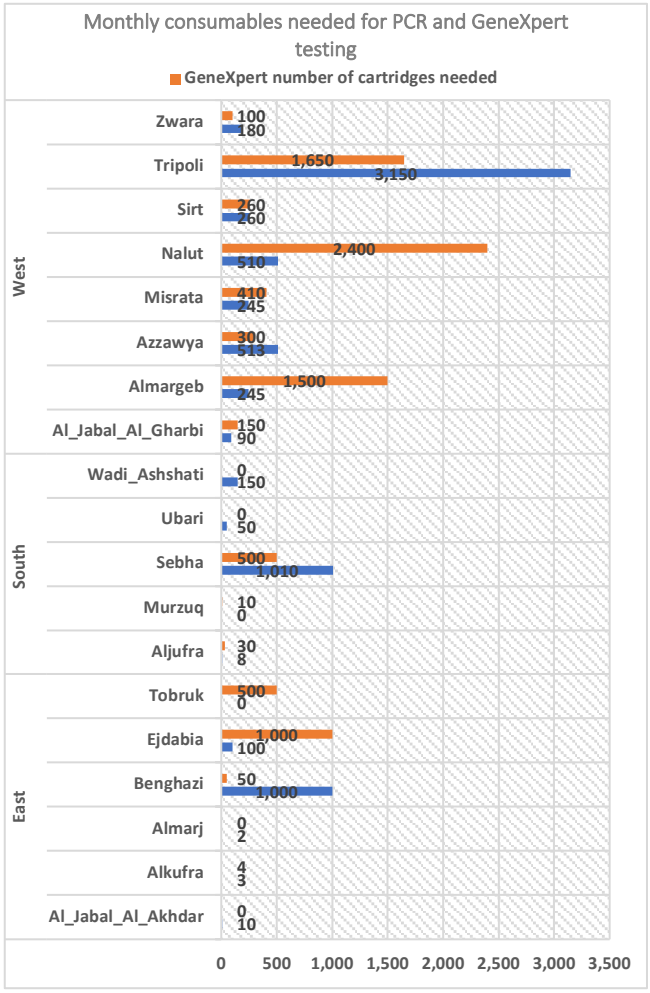
Of note, no staff received training on RT-PCR/GeneXpert and Antigen RDT in Alshati College of Engineering Biotech Lab in Wadi Alshati district.



5. Consumables' availability

The availability of consumables for one month (March 2022) was assessed as the number of kits required for RT-PCR and the number of cartridges required for GeneXpert machines, for one month per lab. The monthly consumables are summarized at district level, as shown in the diagrams below.

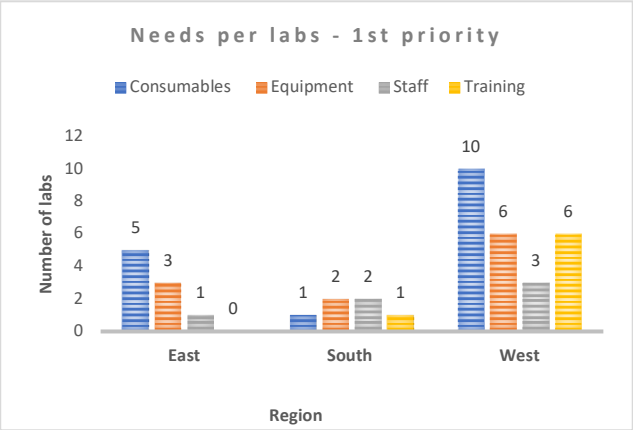
Consumable equals Zero for labs reported lack of RT-PCR/GeneXpert machines.



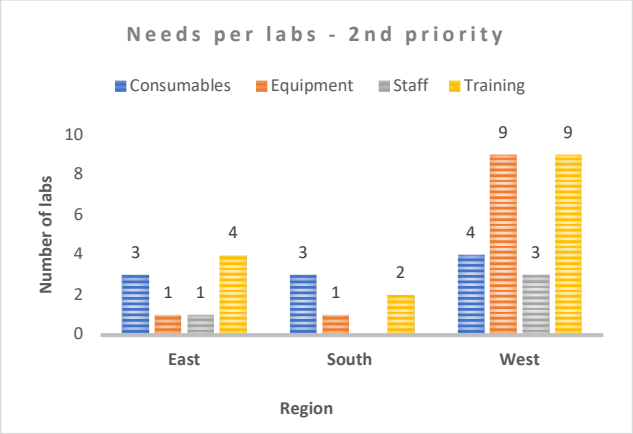
6. Ranking of Needs per priority

Lab's needs were assessed in terms of consumables, equipment, staff, training. Each lab ranked their needs according to priority, using a standard list of predefined categories, to select between one to 3 options at a maximum.

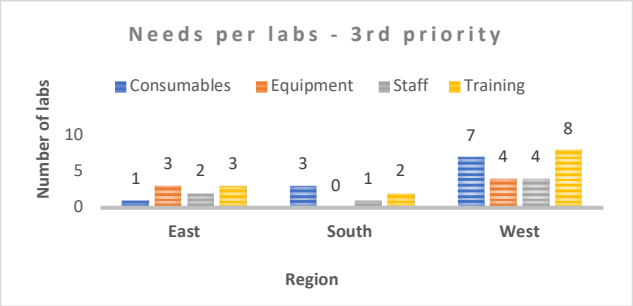
The top priority reported need is consumables (16 labs nationwide), mainly in the West Region. Details are shown in the diagram below.



The 2nd priority reported need is for training (15 labs nationwide), mainly in the West Region. Details are shown in the diagram below.



The 3rd priority reported need is for training (13 labs nationwide), mainly in the West Region. Details are shown in the diagram below.



7. WHO Response

As part of WHO efforts to strengthen capacity to respond to COVID-19, WHO has provided support to build capacity of 103 COVID-19 lab technicians, during the 1st Quarter 2022, summary below:

Topic	District	Trained persons
Improving quality of COVID-19 laboratories	Al Jabal Al Akhdar	54
Quality Control Assessment in COVID-19 Laboratories	Tripoli	49

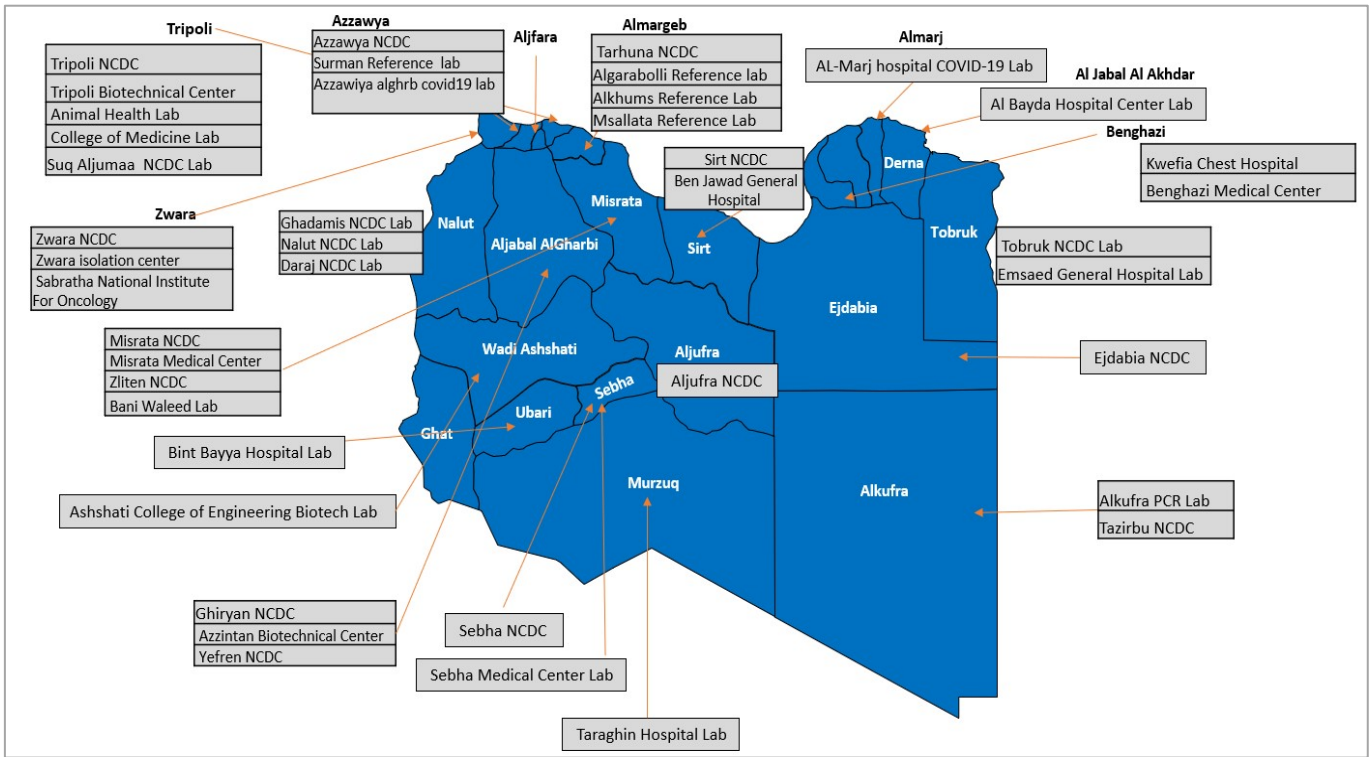
Also, the following supplies were distributed as part of WHO response:

Location	Item	Quantity
Al Majouri Polyclinic	Panbio COVtD-19 AG RAPID 25T	450
Tobruk HSD	Panbio COVtD-19 AG RAPID 25T	275
Albayda	Panbio COVtD-19 AG RAPID 25T	150
NCDC Tripoli	COVID-19 AG (D) 25T_NS V4,24M	25,000

Other reported needs (e.g., consumables and equipment) will be explored together with the NCDC and health sector partners.

Annex-I: Map of COVID-19 Laboratories

Distribution of COVID-19 laboratories, 1st Quarter 2022:



Annex-II: Additional reported gaps, needs, and issues per laboratory

A comparison between 4th Quarter 2021 & 1st Quarter 2022:

Region	District	Name of the Laboratory	4th Quarter 2021	1st Quarter 2022
West	Tripoli	Tripoli NCDC public health lab	NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert	NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert
		College of Medicine Lab	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2
		Tripoli Biotechnical Centre Lab	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert
		Animal Health Lab	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert
	Misrata	Zliten Reference Lab	96 well RT-PCR instrument Cartridges for GeneXpert NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000)	96 well RT-PCR instrument Cartridges for GeneXpert NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000)
		Misrata Medical centre Lab	Bio-Rad RT-PCR, Safety Cabinet Class 2 PCR workstation Plate Vortex Plate Centrifuge Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000) Multichannel Pipette The Lab needs more support in other disease detection like; viral screening, bacterial diagnoses, cancers (colon, lung, ovary, breast, and skin)	Bio-Rad RT-PCR, Safety Cabinet Class 2 PCR workstation Plate Vortex Plate Centrifuge Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000) Multichannel Pipette The Lab needs more support in other disease detection like; viral screening, bacterial diagnoses, cancers (colon, lung, ovary, breast, and skin) Shortage of supply occurred in the last two weeks of February in which no sample was tested.
		Bani Waleed Lab	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2	96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2
		Misrata NCDC Lab	Digital RT-PCR Machine RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert	Digital RT-PCR Machine RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert

Region	District	Name of the Laboratory	4th Quarter 2021	1st Quarter 2022
	Al Jabal Al Gharbi	Ghiryan NCDC Lab	96 well RT PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert Staff training	96 well RT PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert Staff training
		Yefren NCDC branch	Cartridges for GeneXpert Staff training	Cartridges for GeneXpert Staff training
		AlZentan biotechnical research centrebranch	96 well RT-PCR instrument GeneXpert instrument NuActor instrument Extraction reagents RT-PCR detection kits Sars-Cov-2 Cartridges for GeneXpert Staff training	96 well RT-PCR instrument GeneXpert instrument NuActor instrument Extraction reagents RT-PCR detection kits Sars-Cov-2 Cartridges for GeneXpert Staff training
	Azzawya	Azzawya NCDC Lab	Medical waste problem more than 4 months ago	Medical waste problem more than 4 months ago
		Gharb Azzawya	PCR analyzer Under maintenance	PCR analyzer Under maintenance
	Zwara	Zwara NCDC Lab	Cartridges for GeneXpert Lack of financial resources	Cartridges for GeneXpert Lack of financial resources
		Sabratha National Institute for Oncology	Cepheid GeneXpert machine 96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert Automatic extraction machine needs maintenance Medical waste problem Lack of financial resources	Cepheid GeneXpert machine 96 well RT-PCR instrument NuActor instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert Automatic extraction machine needs maintenance Medical waste problem Lack of financial resources
		Zwara isolation centre Lab	Lack of financial resources	Lack of financial resources
	Nalut	Ghadames NCDC Lab	GeneXpert cartridges	Extraction machine (Procomcure Biotech GmbH “phoenix-pure 32”) GeneXpert cartage Antigen RDT kits
		Daraj NCDC Lab		Antigen RDT kits, type: 1- 2019-nCoV Antigen Device Prestige .2- STANDARD Q COVID -19 Ag test 3-PerkinElmer COVID -19 Antigen Test (NS,NP). Extraction machine (phoenix pure -32)
		Nalut NCDC Lab		Antigen RDT kits, type: 1- 2019-nCoV Antigen Device Prestige .2- STANDARD Q COVID -19 Ag test 3-PerkinElmer COVID -19 Antigen Test (NS,NP). Extraction machine (phoenix pure -32)
	Sirt	Sirt NCDC Lab	NuActor instrument Lack of finances	NuActor instrument Lack of finances

Region	District	Name of the Laboratory	4th Quarter 2021	1st Quarter 2022
		Ben jawad General Hospital Lab	Lack of finances	Lack of finances
	Almargeb	Msallata Reference Lab	NuActor Instrument Cepheid GeneXpert machine Staff training Plate Centrifuge Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000) Bio-Rad RT-PCR, Safety Cabinet Class 2 cups Tubes Ebben Dorff tubes assorted sizes The laboratory needs big size automated extraction machine	NuActor Instrument Cepheid GeneXpert machine Staff training Plate Centrifuge Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000) Bio-Rad RT-PCR, Safety Cabinet Class 2 cups Tubes Ebben Dorff tubes assorted sizes The laboratory needs big size automated extraction machine
		Tarhuna NCDC Lab	Staff training NuActor instrument RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert UBS 4000 watt	
		Alkhums Reference Lab	GeneXpert machine & Cartridges Isolation Cabinet Ice Rack Ultra pipet (10 - 500 Ml) for automated Extraction machine	GeneXpert machine & Cartridges Isolation Cabinet Ice Rack Ultra pipet (10 - 500 Ml) for automated Extraction machine
East	Benghazi	Benghazi Medical Centre Lab	Staff recruitment NuActor instrument Sacace PCR system	Staff recruitment NuActor instrument Sacace PCR system RT-PCR machin brand is Phoenex
		Kwefia Chest Hospital Lab	Extraction reagents	Extraction reagents RT-PCR machin brand is Phoenex
	Alkufra	Tazirbu NCDC Lab	Extraction reagents Cartridges for GeneXpert Staff training	Extraction reagents Cartridges for GeneXpert Staff training Automated extraction machine brand : phoenix pure 32
		Alkufra NCDC Lab	Extraction reagents Cartridges for GeneXpert Staff training	Extraction reagents Cartridges for GeneXpert Staff training Automated extraction machine brand : phoenix pure 32
	Ejdabia	Ejdabia NCDC Lab	NuActor Instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert	NuActor Instrument Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert Currently the lab is closed from (Jan 2022)
	Tobruk	Emsaed General Hospital	Staff training NuActor Instrument	Staff training NuActor Instrument
		Tobruk COVID19 Lab	Staff training Extraction reagents GeneXpert machine & Cartridges	Staff training Extraction reagents GeneXpert machine & Cartridges
		Tobruk NCDC Lab	Cartridges for GeneXpert	Cartridges for GeneXpert

Region	District	Name of the Laboratory	4th Quarter 2021	1st Quarter 2022
			Staff training	Staff training
	Al Jabal Al Akhdar	Al Bayda Hospital Lab	Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert NuActor Instrument	Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert NuActor Instrument
	Almarj	AL-Marj hospital COVID-19 lab		Antigen RDT kits
South	Sebha	Sebha Medical Centre Lab	Extraction reagents RT-PCR detection kits SARS-Cov-2 Staff training Cepheid GeneXpert machine Bio-Rad RT-PCR, Safety Cabinet Class 2 Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000) Biomedical waste products management	Extraction reagents RT-PCR detection kits SARS-Cov-2 Staff training Cepheid GeneXpert machine Bio-Rad RT-PCR, Safety Cabinet Class 2 Electronic Micropipette, sizes: (0.5-10), (10-100), (100-1000) Biomedical waste products management Lack of staff
		Sebha NCDC Lab	Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert 96 well RT-PCR instrument Staff recruitment NuActor instrument Training	Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert 96 well RT-PCR instrument Staff recruitment NuActor instrument Lack of training and staff
	Aljufra	Al-Jufra NCDC Lab	Staff training RT-PCR detection kits SARS-Cov-2	Staff training RT-PCR detection kits SARS-Cov-2
	Ubari	Bint Bayya COVID-19 Lab	Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert Extraction machine	Extraction reagents RT-PCR detection kits SARS-Cov-2 Cartridges for GeneXpert Extraction machine Training
	Murzuq	Taraghin lab Partially functioning	96 well RT-PCR instrument RT-PCR detection kits SARS-Cov-2	96 well RT-PCR instrument RT-PCR detection kits SARS-Cov-2