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Strengthening Indonesia's capacity to use mechanical ventilators for COVID-19 treatment and mitigation: Field monitoring report

Linkages Across the Continuum of HIV Services for Key Populations Affected by HIV (LINKAGES) Project

Cooperative Agreement No. AID-OAA-A-14-00045

Strengthening Indonesia's capacity to use mechanical ventilators for COVID-19 treatment and mitigation: Field monitoring report

Background and Purpose

In 2020, the United States Government, through USAID, donated 1,000 Vyaire LTV1200/2200 mechnical ventilators to mitigate the impact of COVID-19 in Indonesia. The LINKAGES Across the Continuum of HIV Services for Key Populations Affected by HIV (LINKAGES) Project was contracted to strengthen Indonesia capacity to utilize the mechanical ventilators for COVID-19 care and treatment, while Meditrans Indonesia handled ventilator distribution, set up and support for machine maintenance. Over the course of the project – which formally ended on 30 November 2021 – approximately 905 ventilators were distributed by Meditrans[1] and 1,572 health care workers across 458 facilities in 211 districts and 13 provinces received ventilator capacity development by the LINKAGES project.

This report represents the findings of a field monitoring visit at 44 COVID-19 treatment hospitals across 13 provinces in October – November 2021. These hospitals received 123 Vyaire ventilators, or 13.5% of the total distributed ventilators, and were among the more established COVID-19 treatment sites in Indonesia. A listing of selected facilities is included in Annex 1.

Facilitated by a team of national and sub-national Government, USAID, LINKAGES and Meditrans personnel,[2] the field monitoring visit sought to:

- Assess the condition of donated ventilators at facility levels;
- Understand whether, or to what degree, donated ventilators have been utilized by hospital personnel over a three-month implementation period;

[1] The remaining ventilators were distributed to the Ministry of Defense (or were open box failures) and are not included within the focus of this assessment.

[2] See Annex 1 for a breakdown of the monitoring team.

- Identify challenges and lessons learned from the ventilator distribution and capacity building processes; and
- Issue recommendations to facilitate continued ventilator utilization following the end of US Government support.

The field monitoring assessment incorporated information from in-person consultations with Provincial Health Office staff, health care providers and hospital administrators at selected facilities; and from two online ventilator monitoring forms administered at the Provincial Health Office and hospital levels. Assessment tools and an illustrative three-day agenda is included in Annex 2 of this report.

Assessment Findings

Ventilator distribution mechanisms

With the exception of South Sumatra and West Nusa Tenggara provinces, assessment provinces developed and operationalized ventilator distribution plans prior to receiving US-donated ventilators. The criteria for selecting hospital recipients for ventilator equipment varied by province, and included factors like existing health care worker and facility capacity to utilize equipment; COVID-19 burden; bed occupancy rates; and availability of intensive care units (ICU) or isolation rooms (Table 1).

Table 1 | PHO criteria for selecting hospitals to receive mechanical ventilators

Criteria	Provinces Highlighting Criteria	Number of Provinces Highlighting Criteria	Proportion of Provinces Highlighting Criteria
Capacity (facility, health worker) to utilize ventilators	Bali, Banten, Central Java, Jakarta, East Java, North Sumatra, Maluku	7	53.8%
Number/type of specialized staff (e.g. anesthesiologists)	Bali	1	7.6%
COVID-19 burden / identification as COVID-19 referral facility	Banten, Central Java, East Java, Papua, South Kalimantan, South Sulawesi, South Sumatra, Maluku	8	61.6%
Bed occupancy rates	Bali, Banten, Jakarta, East Java, North Sumatra, South Sumatra, West Nusa Tenggara, Maluku	8	61.6%
Availability of ICU or isolation rooms	Bali, Banten, Jakarta, East Java, South Kalimantan, Maluku	6	46.1%
Provincial decree / plan	West Java, West Nusa Tenggara	3	23%

While four provinces (Bali, Banten, Central Java and West Java) received US-donated ventilators at provincial warehouses and arranged for hospitals to pick up the equipment at the provincial warehouse, the remaining nine provinces distributed ventilators directly to the designated facility, via the District Health Office or through the Provincial Health Office.

Five provinces (Jakarta, Banten, South Kalimantan, South Sulawesi and West Nusa Tenggara) noted that their ventilator distribution mechanisms operated smoothly with minimum or no challenges. Other provinces highlighted difficulties such as limited warehouse space to hold ventilation equipment (Bali): insufficient staffing or financing for ventilator distribution (East Java, South Sumatra); ventilator distribution coordination issues between government entities (Papua, North Sumatra); missing ventilator parts (North Sumatra); and geographic considerations which made distribution challenging (Maluku).

Figure 1. Vyaire LTV1200/2200 mechanical ventilators in Jakarta facility

Condition of donated ventilators

The majority of ventilators – 120 or 97.5% – arrived at the designated facility in good working order, with just three experiencing open box failures (OBF) that required replacement.

Ninety-seven facilities (78.8%) performed a ventilator check over the course of the initiative, with 76 of these sites sending the results of the ventilator checks to Meditrans Indonesia. Only two of the 44 assessed hospitals utilized the ventilator warranty service, describing the process as straightforward and easy.

Figure 2. Discussing the condition and features of donated ventilators in West Nusa Tengara province

Ventilator training and capacity development

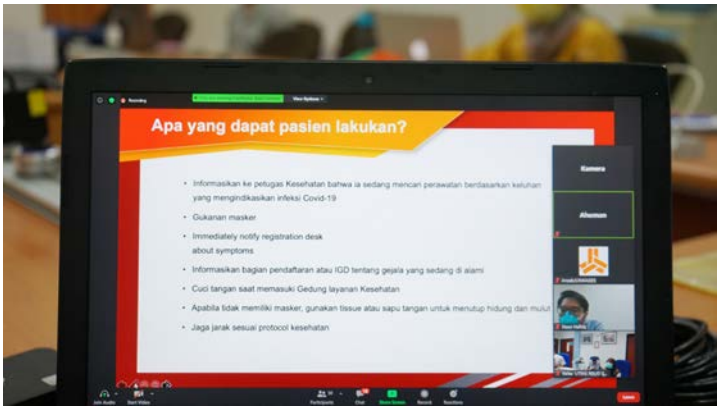
Facilities received training on ventilator set up and operations from Meditrans Indonesia, followed by the use of mechanical ventilation for COVID-19 treatment and mitigation from the LINKAGES project. A total of 122 health care workers at 44 facilities participated in the Meditrans-facilitated training sessions, while 84 persons availed the LINKAGES' capacity development sessions. The assessment was unable to confirm the proportion of staff that participated in both types of training, although MOH guidance outlined that implementing staff should participate in Meditrans and LINKAGES training sessions. Nurses represented the highest number of personnel trained by both Meditrans (n=65) and LINKAGES (n=43), followed by electromedical officers in Meditran-delivered training (n=27) and general practitioners in LINKAGES-facilitated sessions (n=20).

Participants in the assessments overwhelmingly described the need for additional training and mentoring support to increase their confidence and skills in ventilator maintenance and utilization. Face-to-face capacity development was highlighted, as participants shared capacity development or connection difficulties incurred as a result of remote or online training which was prioritized in the wake of Government COVID-19 travel and activity restrictions. Some facilities suggested the need for training of trainers (TOT) sessions to cascade capacity development for new staff, and/or asked for training materials to enable facilities to carry out training sessions independently after the end of the project.

Ventilator use

With the exception of three sites, assessment facilities employed their US-donated ventilators in ICU wards. Nine facilities added that Vyaire ventilators were used in their emergency rooms and seven sites highlighted ventilator utilization during patient transport. The portability of US-donated ventilators for patient transport was emphasized by health care professionals in Bali, Banten, Central Java, and Jakarta, who stated that incompatible equipment (such as oxygen connectors); insufficient commodities such as breathing circuits; and limited monitor information functions, small screen size or loud alarms impeded Vyaire ventilator use in other hospital settings.

Figure 3. Virtual training session on mechanical ventilation for COVID-19



Approximately 1,042 COVID-19 patients received mechanical ventilation using US-donated ventilators since installation at the assessment facilities, noting that 19 sites reported that they have not yet utilized this equipment and/or were not able to share patient data during the assessment period. Fifty-nine per cent (n=622) of ventilated patients received care at four Jakarta hospitals, followed by two facilities in East Java which provided mechanical ventilation services to 18% (n=190) of total ventilated patients using US-donated ventilators.

During a three-month period before the receipt of US-donated ventilators, 40 reporting facilities provided mechanical ventilation (all types of ventilators) to 842 patients, serving approximately seven patients at each reporting facility per month. After receiving Vyaire ventilators, 42 reporting facilities provided mechanical ventilation (all types of ventilators) to 1,120 patients, and increased the number of ventilated patients at each reporting facility per month to 8.9 (Table 2). Sizeable gains were reported at RSKD Duren Sawit in Jakarta which increased the total number of patients receiving mechanical ventilation from 150 patients before receipt of Vyaire ventilators to 200 patients in the three months after ventilator donation. RSUD Dian Harapan in Papua province (46 to 89 patients) and RS Roemani Muhammadiyah in Central Java (18 to 45 patients) also demonstrated significant increases in the utilization of ventilators for COVID-19 treatment.

Table 2 | Average number of COVID-19 patients using ventilators (all types) before and after receiving Vyaire ventilators

Number of patients	Three months before receiving US-donated ventilators	Three months after receiving US-donated ventilators
Total patients receiving mechanical ventilation	842	1,120
# reporting hospitals	40	42
Average ventilated patients per facility	21.1	26.7
Average ventilated patients per facility per month	7.0	8.9

Participant Recommendations

Over the course of the field monitoring visit, participants identified four key recommendations to facilitate ventilator utilization following the end of US Government support:

1. **Strategically place ventilators where mechanical ventilation services are most needed |** Hospitals that served significant numbers of COVID-19 patients and retained staff that were already familiar with using ventilators reported higher utilization rates of US-donated ventilators. Participants in the assessment highlighted the importance of strategically placing ventilators at well-equipped facilities that primarily managed severe COVID-19 cases to ensure continued ventilator use.
2. **Procure and provide essential consumables in addition to ventilator equipment |** The procurement and provision of consumables, including breathing circuits and test lungs, was highlighted as a critical need by participants in the assessment, with many individuals identifying a lack of consumables as a main factor inhibiting ventilator utilization. As a result, USAID concurred on a one-time procurement of essential ventilator consumables that was provided to the Indonesia Ministry of Health in December 2021.
3. **Implement on-going capacity development and monitoring measures |** Assessment participants – at provincial, district and facility levels – pointed out the need for continued capacity development and monitoring efforts to assure proper use and maintenance of ventilator equipment. Site-level mentoring, training of trainers, and provision of training materials directly to facilities were identified as ways by which to promote the transfer of ventilator knowledge and skills. Participants further highlighted the monitoring roles and responsibilities of provincial and district health office personnel to ensure proper ventilator use and to highlight and respond to capacity gaps / needs.
4. **Develop and operationalize uniform standard operating procedures to guide future ventilator procurement, distribution, maintenance and use |** The significant scale of the US Vyaire ventilator donation raised the need for uniform standard operating procedures that could guide future ventilator procurement, distribution, maintenance and use to maximize the impact of this equipment for the treatment and mitigation of COVID-19 or other illnesses in Indonesia.

Annex 1

Assessment Facilities, Monitoring Team and Monitoring Schedule

Annex 1 provides a listing of assessment facilities by province (Table 1.1); outlines the composition of the monitoring team (Table 1.2); and details the assessment schedule by province and facility (Table 1.3).

Table 1.1 | Listing of assessment facilities by province and type of ventilator received

PROVINCE	NAME OF HEALTH FACILITY	LTV1200	LTV2200
Bali	RSU Daerah Mangusada		v
	RSUD Klungkung		v
	RSUD Tabanan		v
	RSUP Sanglah		v
Banten	RSUD Banten		v
	RSUD dr. Drajat Prawiranegara		v
	RSUD Balaraja		v
	RSUP dr. Sitanala		v
Central Java	RS Pelita Anugrah		v
	RS Roemani Muhammadiyah		v
	RS St. Elizabeth		v
DKI Jakarta	RS Hermina Kemayoran		v
	RSKD Duren Sawit	v	v
	RSUD Cengkareng	v	v
	RSUD Pasar Minggu	v	v
East Java	RS Husada Utama		v
	RS Manyar Medical Centre		v
	RS Siti Khodijah		v
North Sumatera	RSUD Dr. H. Kumpulan Pane		v
	RSUD Dr. Pirngadi		v
Papua	RS Dian Harapan		v
	RSUD Abepura		v
	RSUD Wamena		v
South Kalimantan	RS Islam Banjarmasin		v
	RS Sari Mulia		v
	RS Tk. III Dr. R. Soeharsono		v
	RSUD Ulin Banjarmasin		v
South Sulawesi	RSUD Daya Makassar		v
	RSUD Padjonga dr. Ngalle		v
	RSUD Sayang Rakyat		v
	RSUD Syekh Yusuf Gowa		v
South Sumatra	RS Bunda Palembang		v
	RS Ernaldi Bahar		v
	RSUD Provinsi Siti Fatimah		v

West Java	RS Hasan Sadikin Bandung	v	
	RS Rotinsulu	v	
	RS Santosa	v	
	RSKIA Bandung	v	
West Nusa Tenggara	RSAD Wira Bhakti		v
	RSUD Praya		v
	RSUD Provinsi NTB		v
Maluku	RS Al Fatah Ambon		v
	RSUD dr H. Ishak Umarella		v
	RS Bhayangkara Ambon		v

Table 1.2 | Composition of assessment team

National Level Participants		Sub-National Level Participants	
Type	**Number**	**Type**	**Number**
Director of Fasyankes	2	Provincial Health Office	2
MoH Foreign Cooperation Bureau (KSLN Bureau)	2	Health Facility Security Centre (BPFK), Health Facility Security Area (LPFK) or Health Facility Security Unit (UPFK)	2
USAID	3	District Health Office	2
LINKAGES	2	Hospital	5
Meditrans	1		

Table 1.3 | Monitoring visit schedule by province and facility

	Province	Facility Name	Location	Monitoring Dates
1	North Sumatra	RSUD dr. Pirngadi Medan	Medan	18-20 October 2021
2		RSUD Kumpulan Pane	Tebing Tinggi	
3	South Sulawesi	RSUD H. Padjonga Dg. Ngalle	Takalar	21-23 October 2021
4		RSUD Daya Kota Makassar	Makasar	
5		RSUD Sayang Rakyat	Makassar	
6		RSUD Syehk Yusuf Gowa	Gowa	
7	Maluku	RSUD Dr.M. Haulussy	Ambon	25-27 October 2021
8		RSUD Masohi	Masohi	
9		RSUD al Fatah	Ambon	
10	West Nusa Tengara	RSU Praya	Lombok Tengah	1-3 November 2021
11		RSAD REM Wirabhakti	Mataram	
12		RSUD Provinsi NTB	Mataram	
13	Banten	RSUD Banten	Serang	4-6 November2021
14		RS Balaraja	Kab Tangerang	
15		RSUP dr. Sitanala	Kota Tangerang	
16		RSUD Drajat Prawiranegara	Serang	

17	Papua	RS Dian Harapan	Jayapura	4-6 November 2021
18		RSUD Abepura	Jayapura	
19		RSUD wamena	Wamena	
20	South Sumatra	RSUD Siti Fatimah	Palembang	8-10 November 2021
21		RS dr. Ernaldi Bahar	Palembang	
22		RS Bunda Palembang	Palembang	
23	South Kalimantan	RSUD Soeharsono	Banjarmasin	8-10 November 2021
24		RS Islam Banjarmasin	Banjarmasin	
25		RSUD Ulin Banjarmasin	Banjarmasin	
26		RS Sari Mulia	Banjarmasin	
27	DKI Jakarta	RS Hermina Kemayoran	Jakarta Pusat	11-13 November 2021
28		RS Fatmawati	Jakarta Selatan	
29		RSUD Cilincing	Jakarta Utara	
30		RSUD Ciracas	Jakarta Timur	
31	West Java	RS hasan Sadikin	Bandung	11-13 November 2021
32		RS Rotinsulu	Bandung	
33		RSKIA Bandung	Bandung	
34		RS Santosa	Bandung	
35	Central Java	RS Pelita Anugerah	Semarang	15-17 November 2021
36		RS St. Elizabeth	Semarang	
37		RS Roemani Muhammadiyah	semarang	
38	Bali	RS Daerah Mangusada	Badung	15-17 November 2021
39		RSUD Tabanan	Tabanan	
40		RSUD Klungkung	Klungkung	
41		RSU Sanglah	Denpasar	
42	East Java	RSU Manyar Medical Center	Surabaya	18-20 November 2021
43		RSU Husada Utama Surabaya	Surabaya	
44		RSU Siti Khodijah	Sidoarjo	

Annex 2

Assessment Agenda and Tools

Annex 2 outlines the assessment tools utilized in the field monitoring report (Tables 2.2 and 3) and includes a draft monitoring agenda (Table 2.1).

Table 2.1 | Draft monitoring visit agenda

Day	Time	Activities	Team Members
Day 1	08.00-12.00	• Arrive at provincial capital and visit Provincial Health Office (PHO)	Ministry of Health, USAID, Meditrans and LINKAGES
	13.00 – 16.00	• Discuss USAID ventilator assistance with PHO • Conduct a document review of distribution plans and distribution reports • Identify challenges and lessons learned from the ventilator distribution and capacity building processes • Prepare monitoring documents for hospital visits	Ministry of Health, USAID, Meditrans, LINKAGES, PHO, BPFK
	16.00 - 17.00	• Review Day 1 and prepare for Day 2	Ministry of Health, USAID, Meditrans and LINKAGES
Day 2	08.00-15.00	• Visit recipient hospitals At every hospital: • Discuss USAID ventilator assistance and ventilator utilization • Review documents related to USAID ventilator assistance • Perform ventilator unit examinations • Identify challenges and lessons learned from the ventilator distribution and capacity building processes	MOH , USAID, Meditrans, LINKAGES, PHO , BPFK, Hospital
	15.00-17.00	• Review Day 2 and prepare for Day 3	Ministry of Health, USAID, Meditrans and LINKAGES
Day 3	08.00-12.00	• Discuss recommendations and develop follow-up ventilator monitoring activities with PHO • Return to Jakarta	Ministry of Health, USAID, Meditrans, LINKAGES, PHO
	13.00-17.00		

Table 2.2 | Monitoring Instrument, PHO

COVID-19 Ventilator Technical Assistance Monitoring

A. Ventilator Distribution Monitoring Sheet (to be discussed with Provincial Health Office)

I. Health Office Information

1. Date :
2. Provincial Health Office :
3. Health Care Facility Address :

II. List of oxygen ecosystem and mechanical ventilation assessors for COVID-19 management

No	Name	Institution	Phone Number

III. List of Provincial Health Office Staff Attending the Monitoring Process

No	Name	Position / Unit	Phone Number

COVID-19 Ventilator Technical Assistance Monitoring

1. Does the Provincial Health Office have a ventilator distribution plan?
   ☐Yes ☐No
2. What are the underlying criteria to decide which hospitals to receive USAID ventilators?
   _____
3. Which of these mechanisms applied for the ventilator distribution in the province?
   ☐ From the Provincial Health Office, delivered to the District Health Office and then distributed to the Hospital
   ☐ From the Provincial Health Office delivered directly to the Hospital
   ☐ The hospitals picked the ventilators from the Provincial Health Office
   ☐other _____
4. Did the provincial health office check the Vyaire ventilator prior to distribution?
   ☐Yes ☐No
5. Were there any challenges faced by in the distribution process of Vyaire ventilators?

   Mention the challenges and important circumstances experienced _____

Table 2.3 | Monitoring Instrument, Hospital

B. Monitoring sheet to be used for monitoring activities in health facilities

I. Health Facility Information

1. Date
2. Name of health facility:
3. Type of health facility : (Government-owned hospital/ Private Hospital/ Specialistic Hospital/ Educational Hospital)
4. Address of Health Facility :
5. District/ Province :

II. List of assessors of the oxygen and mechanical ventilation ecosystem monitoring for COVID-19

No	**Name**	**Institute**	Telephone Number

III. List of Hospital Staff and Officers participating in monitoring

No	Name	Position/Task Unit	Telephone Number

IV. Utilization of the Vyaire ventilators received by health facility

1. Type of Vyaire ventilator received by facility
☐ LTV1200 ☐ LTV2200

2. Number of Vyaire ventilators received _____ Units

3. Have the ventilator check for Vyaire ventilators receive been done?
☐ Has been checked ☐ Has NOT been checked

4. Have the results of the vent check been sent to Meditrans?
☐Yes ☐ No

5. Was there an Open Box failure when unboxing the package for the first time?
☐No ☐Yes, and received a replacement ☐ Yes, and did not receive a replacement

How many ventilators with OBF among all the entilators received? (specify serial number)

6. Current condition of the Vyaire ventilator received:
☐Good condition ☐Unknown ☐Broken

7. Have the Vyaire ventilators received been used to serve COVID-19 patients?
☐Yes ☐No

8. Where have the Vyaire Ventilators been used? (mention all units where the Vyaire ventilators has been used before)
☐ICU
☐ER
☐Operation Room
☐ Patient transport
☐ Others _____

9. Have the Vyaire ventilators received a warranty service?
☐Yes ☐No

10. If yes, did the process go smoothly?
☐Yes ☐No

11. To support the documentation, please include or upload the following photos:
a. All of the USAID donated ventilators, both used or unused.
b. Any technical problems or damage to the ventilators, if present. (OBF/Faulty unit)

V. The benefits of the donated Vayire ventilators

1. How many patients were on ventilators (all types) in this facility in the last 3 months?

☐<6 patients
☐6-10 patients
☐11-20 patients
☐> 20 patients
Others _____

2. How many patients have the Vyaire ventilators been used to serve? (since installation)
_____ Patients

3. What is the average number of COVID-19 patients who used ventilators (all types) in the 3 months prior to receiving the Vyaire ventilators at this facility? _____ patients

4. What is the average number of COVID-19 patients who used ventilators (all types) in the 3 months after receiving the Vyaire ventilators at this facility? _____ patients

5. Have the staff at this facility received training on setting up the Vyaire ventilator from the Meditrans?
☐Yes ☐No

6. How many staff in this facility that have received training from Meditrans?
Electro Medical officer _____
Anesthesiologist _____
General Practitioner _____
Nurse _____
Others (please specify) _____

7. Have the staff at this facility received training on how to use the Vyaire ventilators from LINKAGES?
☐Yes ☐No

8.How many officers in this facility have received training from LINKAGES?
Electro Medical officer _____
Anesthesiologist _____
General Practitioner _____
Nurse _____
Others (please specify) _____

VI. Suggestions and input in utilizing and operation of the Vayire ventilators

1. Were there any problems during the installation and/or utilization of the Vayre Ventilators?
☐No
☐Yes, please specify _____

2. Mention the experiences or challenges about the distribution, training or use of Vayire ventilators:

Distribution _____

Training _____

Utilization and use _____

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