



Report on the Field Visit to Zomba Central Hospital by The Open O₂ Team

Summary

For five days beginning on Monday, 15 February 2021, a five-member team from Open O₂, an initiative by the Global Health Informatics Institute worked at the Physical Assets Management offices at Zomba Central Hospital with the aim of repairing oxygen concentrators. The team assessed 50 oxygen concentrators. Three were considered beyond economical repair as they were more than 20 years old and parts had been scavenged. An additional seven were donated units from the US, requiring 110 Volt step-down transforms. As transformers were not available we selected not to focus on those. Of the 40 remaining concentrators, ten concentrators were repaired. Four were put back into service during the week that the team spent on site. A further six oxygen concentrators are awaiting fitting with refilled sieve beds to be put back into service. This report provides details on the entire field visit and provides observations that were made on this maiden trip of the Open O₂ mobile workshop to a facility outside of Lilongwe.

Introduction

The COVID-19 pandemic has highlighted the significant gaps in capacity within the Malawian health facilities to provide oxygen therapy to patients. As the numbers of admitted patients has increased with the second wave of COVID-19 infections, widespread shortages of oxygen therapy have been reported. To address the increased demand in oxygen therapy, the global health informatics institute in Lilongwe, Malawi launched Open O₂, an initiative that seeks to repair oxygen concentrators that have fallen into disuse at hospitals within Malawi. This initiative is primarily motivated by the fact that many oxygen concentrators already exist within the country that can be repaired and provide oxygen at a lower cost than through the use of oxygen cylinders.

To increase the reach of the Open O₂ initiative, GHII bought a bus that was converted into a mobile workshop. The mobile workshop is designed to bring a team of technicians and some spare parts to health facilities for on-site repair of oxygen concentrators. With the support of the Scotland Malawi Partnership, the Open O₂ team responded to a call for help from Zomba Central Hospital (ZCH) which had indicated that they had many oxygen concentrators that were in need of repairs. This visit was the first time the mobile workshop travelled outside of Lilongwe to conduct repairs. This report details the activities, accomplishments, and observations from this trip.

Objectives

The objectives of the visit to ZCH were as follows:

1. Assess the oxygen concentrators that have fallen into disuse and are in need of repairs.
2. Repair as many oxygen concentrators using parts found in the PAM workshop.
3. Assess the performance of oxygen concentrators that are currently in use at ZCH.
4. Demonstrate the use of the “T” connector for connecting together two 5 lpm concentrators to provide adequate oxygen flow for COVID patients.

Methodology

The Open O₂ team travelled to Zomba on Sunday, 14th February 2021 with the aim of starting work at ZCH Physical Assets Management (PAM) offices early on Monday morning. The team utilized a standard configuration while working at ZCH. A power cable was run from the main building to the mobile workshop. Oxygen concentrators were taken from the PAM office to the mobile workshop where they were assessed and worked on. Since most COVID patients require high flow oxygen, the team started the assessment with the high flow concentrators first followed by the other concentrators that were found at the facility.

All concentrators that were in the ZCH office were assessed first and their details recorded. The details that were recorded included the serial number, the manufacturer, model type, concentrator capacity, the parts that were missing, and the problem that the concentrator had. Once assessment had been completed, the concentrators were triaged based on the problems that they had. This was done to ensure that by the end of the visit, the maximum number possible of concentrators had been repaired.

Results

Concentrator Status	Quantity
Fixed and put back into service	4
Fixed but awaiting refilled sieve beds	6
Used for parts	3
Repair work not completed	8
Very old models (beyond economical repair)	3
Wrong voltage	8
Not Fixed	18
Total	50

The table above provides a complete overview of the outcomes of the team's visit to ZCH. By Friday, 19th February, 2021, the team had assessed 50 oxygen concentrators that were located in the ZCH PAM offices. Of these, four were repaired and put back into service. Six concentrators were repaired but not immediately returned to service because they had bad sieve beds. The Open O₂ team took the sieve beds from these concentrators with them to Lilongwe where the sieve beds will be refilled with Zeolite before being sent back to Zomba for fitting. Eight concentrators were not repaired due to the fact that they run on the wrong voltage for the Malawian electrical grid and require step down transformers for them to work. The remaining 18 concentrators were assessed but were not repaired due to time limitations.

The Open O₂ team took 50 6 millimeter T-connectors with them to ZCH. However, it was discovered that the giving sets for both the cannula and face masks had a slightly smaller diameter such that there were leaks in Oxygen when connected. It was therefore resolved to send a mix of T-connectors with 6 millimeter and 4 millimeter outlets.

Limitations

There were multiple challenges encountered during the visit. The biggest limitation that the team faced while working from ZCH PAM offices was the frequent interruption in the supply of electricity. This was attributed to the rains that were falling in Zomba during the time that the team was there. While the hospital has a generator to provide backup power during power outages, the PAM offices are not connected to the backup power. The team tapped power from a neighboring building but due to the long distances involved, there was a significant voltage drop which meant that the team could only connect one concentrator at a time. This greatly reduced the productivity of the team overall.

The second challenge that the team faced and later resolved to a smaller degree had to do with the differences in working hours between the team and the PAM staff at the facility. Unlike the PAM office at KCH, the office at ZCH is closed for 90 minutes during the lunch hour. Furthermore, the PAM office opened later than 8am thereby reducing the amount of time spent working on oxygen concentrators.

The final challenge that the team encountered was a false assumption regarding the involvement of the ZCH PAM team in the week long exercise. Since Open O₂ is playing a supporting role to PAM technicians that are already assigned to these facilities, we assumed that the PAM staff will work together with the Open O₂ team during their visit. However, during the time that the team was at ZCH, only two interns worked with the team during part of the visit. While we understand that the PAM technicians are responsible for much more than oxygen concentrators, this was not what we expected.

Recommendations

Based on our experiences during this trip, we recommend the following:

1. Purchase of a generator to minimize loss in productivity due to power cuts.

2. Advance liaison with hospital administration and biomedical technicians to determine the number and models of broken down oxygen concentrators.
3. Pre-arranging access to oxygen concentrators and electricity to ensure that field teams can work from 8am to 1630pm.

Financial Reconciliation

Expenses

Description	Quantity	Unit Price	Total	Service Provider
Accommodation	5 nights for 5 People	MWK 13,000	MWK 325,000	Masuku Lodge
Daily subsistence allowance (DSA)	5 people for 6 days	MWK 10,000	MWK 300,000	
Fuel			MWK 98,000	
Total			MWK 723,000	

The Global Health Informatics Institute received MWK 629,033.89 from the Scotland Malawi Partnership to fund the trip to Zomba. The total expenses were 723,000 as itemized above. The deficit in funds was covered by the Global Health Informatics Institute. This deficit was a result of a decision that was made after the budget had already been shared with Scotland Malawi Partnership for the team to travel to Zomba on Sunday as opposed to Monday. This allowed the team to spend a full day working at ZCH on Monday.

Conclusion

Several lessons have been learnt from this maiden long-distance off-site oxygen concentrator repair exercise. The percentage of repaired concentrators was not as high as we had initially hoped. However, we believe that this was a first pass at repairing oxygen concentrators at ZCH. We intend to return to ZCH in the future once we have spares for compressors and finish repairing the concentrators that we did not get to on this trip.