

# Wall-mounted Oxygen Reading Accuracy in Academic Institution vs. Rural Setting

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## Background

Precise oxygen flow is important in helping patients who are in any respiratory distress achieve a stable blood oxygen level (Howard). There is a danger in delivering both low and high oxygen levels. Inappropriate oxygen levels can lead to dyspnea, longer hospital stay, increased admissions to critical care units, and adverse effects such as death (Cousins). High concentrations of oxygen can cause absorption atelectasis, surfactant inactivation, release of free radicals, and retinopathy of prematurity. High flow rates can cause nasal bleeding due to mucosal dryness (Davidson). To correctly set flow rates, it is suggested that a person is eye level to the meter and the knob is adjusted so that the middle of the indicator ball is on the prescribed rate (Amvex).

## Introduction

A pulse oximeter is a sensor used to determine the oxygen saturation of a person's blood. Reusable probes are generally designed for the fingers and ears. Ideal sites for disposable probes include fingers, toes, wrists, noses, and even foreheads (Wolfe). The flow rates of oxygen meters can be adjusted to obtain a targeted SpO<sub>2</sub> (Howard). Oximeters give estimates of oxygen saturation, therefore, low values should be checked first for correct placement. If reading still low, oxygen saturation should be assessed with blood gases (Wolfe).

It is suspected that there is a lack in knowledge among healthcare workers who have direct access to reading and adjusting wall-mounted oxygen meters in regards to accurately reading the meters. It is further suspected that there is a difference in conditions requiring oxygen use in an academic hospital vs a rural hospital. The perception that healthcare workers can accurately read oxygen meters should give way to some cautionary concern. Cousins et al notes that insufficient training, education, and familiarity with oxygen delivery devices add to the poor practice of prescribing oxygen therapy. There is not one single subsection of hospital staff that set or read oxygen meters, therefore all staff involved in reading or adjusting flow rates should be educated in how to properly read the meters.

## Methods

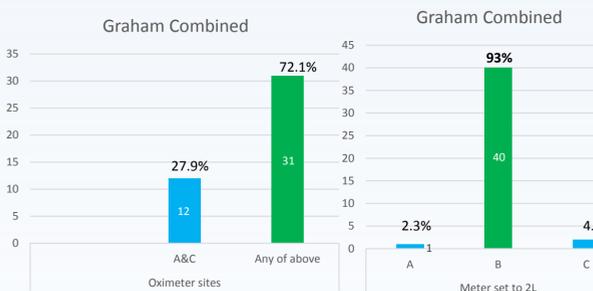
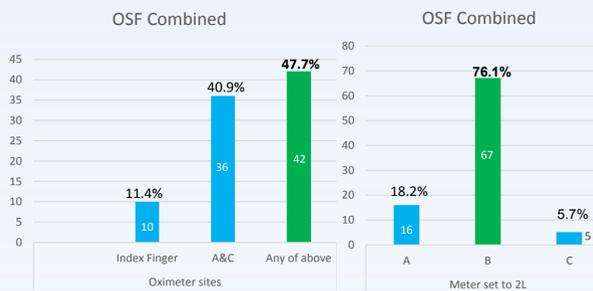
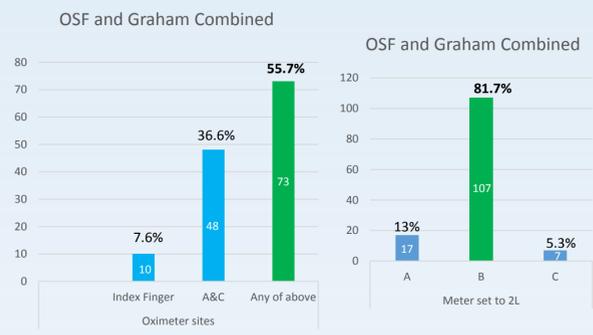
A knowledge survey was formatted using survey monkey to be sent to participants via an email link on listservs of medical students, doctors, nurses, and technicians. Email links and paper surveys were also distributed at Graham hospital. Participants were asked to answer questions regarding oximeter placement sites, correct wall-mounted oxygen meter setting, the purpose of an oximeter, and most common condition they see oxygen therapy being used. Choices for oximeter sites included: index finger, great toe, earlobe, forehead, nose, index finger & earlobe, or any of the above. Participants were given a scenario of a patient needing 2L of oxygen and were asked to choose from three images of wall-mounted meters. Option A was set at 2.5L, option B at 2L, and option C was set to 1.5L. These choices allowed participants the option of choosing whether to read the indicator ball from above, in the middle, or at the bottom of the ball. The third question, in true or false format, assessed participants' knowledge in the purpose of oxygen meters and titrations. Data was compiled in an excel file on a rolling basis. OSF combined data includes medical students since their rotations are completed at OSF.

## Results

35% of medical students correctly acknowledged that oximeters could be placed on any of the listed sites. 53% of OSF doctors, 81.3% of Graham nurses, 37.5% of Graham doctors, 47.7% OSF combined, 72.1% Graham combined, and 55.7% of OSF and Graham combined also indicated any of the listed choices as possibilities. The second most common answer for this question was index finger and earlobe.

80% of medical students acknowledged reading the indicator ball in the middle, option B, which is the correct answer. 74.2% of OSF doctors, 96.9% of Graham nurses, 75% of Graham doctors, 76.1% OSF combined, 93% Graham combined, and 81.7% of OSF and Graham combined also indicated option B.

73.7% of medical students acknowledged that oxygen meters and titrations could be adjusted to obtain a targeted SpO<sub>2</sub>. 86.2% of OSF doctors, 93.5% of Graham nurses, 100% of Graham doctors, 83.7% OSF combined, 95.2% Graham combined, and 87.5% of OSF and Graham combined also indicated that oxygen meters and titrations could be adjusted to obtain a targeted SpO<sub>2</sub>.



## Discussion

Participants included 20 medical students, 66 OSF doctors, 32 Graham nurses, and 8 Graham doctors. There were lower responses from Graham doctors, OSF nurses (2) and Graham technicians (3) so their data is included in combined data versus as a separate category.

There are studies such as those by Howard and Davidson that bring to question the accuracy of oxygen flow through various meters. However, to my knowledge this is the first study to assess the knowledge of healthcare workers who are required to adjust the oxygen meters in accuracy of setting flowrate or reading the meters. Improperly setting the gauge on the wall-mounted meters would increase the discrepancy of oxygen delivery to patients. Regarding the importance of this therapy, quality improvement standards can be made to educate healthcare workers on the types, use, and reading of oximeters. The results show that 55.7% of healthcare workers know the various placements for oximeters, 81.7% can correctly identify meter gauge readings, and 87.5% understand the use of oximeters.

Conditions that require oxygen therapy could influence knowledge in use of oxygen delivery and measurement equipment. According to US News and World Report, Graham hospital in Canton, Il typically sees the following conditions: COPD, colon cancer surgery, heart failure, hip replacement, knee replacement, and lung cancer. Health care workers at Graham indicated that COPD was the most common condition in which oxygen was seen used as a therapy. OSF St. Francis Medical Center in Peoria, Il typically sees the following conditions: abdominal aortic aneurysm repair, aortic valve surgery, COPD, colon cancer surgery, heart bypass surgery, heart failure, hip replacement, knee replacement, and lung cancer surgery. Health care workers at OSF also indicated seeing oxygen therapy most commonly used to treat COPD. Each institution identified asthma and CHF as second and third most common conditions warranting oxygen therapy.

## Limitations

Responses for some healthcare worker categories were low. I was in the Graham community during this study so it was easier to distribute paper copies of the survey after getting a low email response. Email response was fair for the OSF community. OSF has a greater population pool than Graham, therefore some healthcare worker categories would not reach n=30 when separated even if all from the category responded. Heavier weight should be given to combined category data. No incentives were given for this study.

## Future Directions

It would be ideal to have 100% accuracy with healthcare workers involved in the reading or setting of wall-mounted oxygen meters. Increasing from 81.7% of healthcare workers who demonstrated accuracy in reading oxygen meters will take additional efforts in training. A quick demonstration on the reading or setting of the wall-mounted meter and oximeter site placement can become a component of healthcare worker orientations. A meeting with educators and nurse managers could help streamline efforts to incorporate meter reading into orientations.

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## Acknowledgements

Thank you to Graham hospital in Canton, IL for being generous to me during my RSPP community rotation and allowing me to include their community in this survey.