

[Open Peer Review on Qeios](#)

Clinical Audit: Oxygen Prescription with Target Saturations in Post Anesthesia Care Unit

Murtaza Hassan, Muhammad Imran Khan¹, Nasir Ali, Sidra Nadeem, Mohsin Kamal, Adil Shewani, Abdul Basit, Ashfaq Afridi

¹ Cork University Hospital

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.

Abstract

Background: Supplemental oxygen therapy is commonly administered to the majority of postoperative surgical patients in order to prevent hypoxemia, which is one of the most common and significant respiratory problems following surgery. Furthermore, although regular supplemental oxygen administration is not advised for non-hypoxemic patients suffering from a number of acute conditions, including acute coronary syndrome and stroke, high-dose oxygen therapy is advised in a few specific situations to lower the risk of surgical site infections (SSIs) following surgery. In the proposed audit, we examine the practice of oxygen prescription related to the oxygen therapy. According to Choudhury et al. [1], the primary goal of this audit is to evaluate both the physician and nursing team follow the guidelines in the prescription, monitoring, and documentation of oxygen utilization. Its goals are to identify presently non-compliant with local hospital guidelines and provide solutions to help the hospital improve compliance.

Methods: 30 patients in PACU were monitored for supplementary oxygen treatment over a month during February 2024. The oxygen prescription of all patients was analyzed using their prescription drug kardex.

Result: Out of 30 total patients, there is a valid oxygen therapy prescription in main PACU of CUH (100%), oxygen prescription section in the PACU drug chart completed (3.3%), correct target oxygen saturation is prescribed for the 1 patient (3.3%), patient with a target saturation range (0%), patient have a valid oxygen delivery device prescribed on the drug chart (3.3%), valid time duration for oxygen delivery mentioned in the drug chart (0%), documentation contain observation of oxygen saturation (100%)

Conclusions: This audit uncovered major gaps in tertiary care hospital oxygen prescription. As many PACU patients who use supplemental oxygen are still at risk of developing hypoxic injury due to non-complaint with local guidelines for oxygen prescription. The training of physicians and nurses in the use of oxygen should be updated regularly.

Keywords: Clinical Audit, PACU, Health professionals, Oxygen prescription.

Introduction

According to Horncastle, E. and Lumb^[2], hypoxemia can occur in postoperative patients due to a variety of factors, including incomplete lung re-expansion, decreased chest wall and diaphragmatic activity from surgical wounds and pain, hemodynamic impairment, and anesthetic drug side effects (particularly residual neuromuscular blockade). These side effects can include atelectasis, ventilation–perfusion mismatch, alveolar hypoventilation, and impaired upper airway patency. Additionally, shivering after surgery may raise oxygen use and raise the risk of hypoxemia]. As a result, persistent hypoxemia may encourage detrimental effects such as arrhythmias, myocardial ischemia, and cognitive impairment.

Additionally, reports have demonstrated that systemic hypoxemia inhibits several components of the immune response and hinders the healing of wounds, hence raising the risk of wound infections. According to Barrot et al.^[3], Neutrophils' capacity to kill oxidatively was reduced at low oxygen tensions, which are frequently present in wounds. Based on available data, it is recommended that postoperative hypoxemia be avoided with caution and treated very away as it poses a considerable danger. As a result, giving more oxygen could raise arterial blood oxygen tensions, acting as a safety net to stop hypoxemic events before they happen inside of cells.

Aims/Objectives

The primary goal of this audit is to evaluate whether both physician and nursing team follow the guidelines in the prescribing, monitoring, and documenting of oxygen therapy. Its goals are to identify presently non-compliant with local hospital advice and to provide solutions to help the hospital improve compliance^[4].

Methodology

Sample size

Patients were chosen from PACU in CUH. A total of 30 patients were taken from the PACU.

Data source

A study of the drug chart was taken as the source of data. If there was a need to reconcile target saturations with clinical state, medical data was sought.

System design

The descriptive quantitative technique was utilized to gather, analyse, and provide audit in a systematic manner.

Data Collection

The data of 30 patients from the PACU were collected prospectively over 30 days. The charts available in the patients rounding folders were consulted [5]. The key goals of the study were; to identify key areas that should be non-compliant with the hospital's local advice and integrate solutions to improve the current conditions; the current study has developed a fundamental line [6]. The reason behind the conducted survey is to see the physician and nurses' perceptions and practices related to oxygen therapy [7].

Data was collected based on the following criteria:

Standards/Guidance

The main standards, according to local guidelines, are as follows:

- 100% of patients admitted to PACU have a valid oxygen prescription.
- 100% of patients have a prescription with correct target saturations.
- 100% of patients have a prescription with a target saturation range (BTS).
- 100 % should have a valid oxygen delivery device prescribed on the drug chart.
- 100 % of patients must have valid time duration for oxygen delivery.
- 100% must complete the oxygen prescription section in the PACU drug chart.
- 100% of patients receiving supplemental oxygen are observed.

Result

The results obtained through the SPSS analysis can be found below:

Valid	Percent
Yes	96.7
No	3.3
Total	100.0

The results indicate that most people believe there is a local oxygen policy because 38% marked no and 62% marked yes.

Valid	Percent
Yes	100.0
No	0.0
Total	100.0

The table above results indicates valid oxygen prescription in the drug chart because 100% of respondents marked yes and 0% marked no.

Valid		Percent
	Yes	0.0
	No	100.0
	Total	100.0

The above table indicates that a valid target saturation range prescription is not followed because 100% marked no while 0% marked yes.

Valid		Percent
	Yes	100.0
	No	0.0
	Total	100.0

The oxygen monitoring for patients receiving oxygen is done because 100% marked yes and 9% marked no.

Valid		Percent
	Yes	0.0
	No	100.0
	Total	100.0

A valid oxygen delivery device is not prescribed on the drug chart because 100% of the respondents marked no while 0% marked yes.

Valid		Percent
	Yes	0.0
	No	100.0
	Total	100.0

Valid time duration for oxygen delivery to the patient is not mentioned in the drug chart according to the respondents because 100% marked no and only 0% marked yes.

Valid	Percent
Yes	3.3
No	96.3
Total	100.0

Valid signature after oxygen prescription is not done by the doctors because 96.7% marked no and only 3.3% marked yes in response to the above question.

Previous research has found that redesigned inpatient drug charts, and nurse-led oxygen prescriptions training improved oxygen therapy practices significantly [8][9]. These optimistic findings show that implementing oxygen treatments can have a favorable effect, measured in upcoming re-audits.

Discussion

Oxygen is the most frequently used and prescribed therapy in the health and medical sector. At the same time [10][11], it is a highlighting problem nationwide due to inappropriate prescription and poor compliance of guidelines. Poor and inappropriate oxygen prescription in clinical premises of the Ireland is causing many problems in the medical and health sector. Also, the nurses and other medical staff lack information, education, and awareness [12]. At the same time, operating and running oxygen therapy along with training and workshops in quality improvement programs are necessary. The training related to oxygen prescription requires appropriate education and awareness, which should improve future practices [13]. The current study is conducted on oxygen prescription with target saturation in PACU. The key goals of the study were; to identify key areas that should be non-compliant with the hospital's local advice and integrate solutions to improve the current conditions; the current study has developed a fundamental line [14][15][16].

Furthermore, the study's primary goal is to construct a formal standard guidelines in which the appropriate and effective guidelines of the study are based on patients admitted to PACU to have a valid oxygen prescription, patients to have a prescription with correct target saturation [17], drug kardex to document oxygen usage and signed drug chart, valid oxygen delivery device prescription on the drug chart, observation rounds to contain documentation of oxygen saturation. Apart from this, the study's findings have demonstrated that the target intervention should be effectively improved through efficient compliance with the prescription of oxygen [18][19].

Conclusion

Oxygen prescribing remains a threat to patient safety due to poor prescribing practice. Current research's primary objective revolves around investigating and evaluating physicians and nursing teams to follow our respective guidelines and principles of oxygen prescription, monitoring oxygen saturation range, and appropriate documentation of oxygen utilization. For properly conducting the study, 7 fundamental guidelines focusing on patients admitted to PACU to have a

valid oxygen prescription, patients to have a prescription with correct target saturations, patients to have a prescription with target saturation range, valid oxygen delivery device mentioned on the drug chart, observation rounds to contain documentation of oxygen saturation, oxygen prescription section in the PACU drug chart. To improve the oxygen prescription through monitoring of oxygen saturation range and appropriate documentation of oxygen utilization, it is effective that management and other policymakers have to consider the guidelines and principles for effective outcomes of the relative gap. It is very important to re-examine the practice of oxygen therapy for patients who are admitted to PACU.

Limitations

The proposed system illustrates the need for study related to the prescription of oxygen in Ireland hospitals and timely change in the behaviour of the medical staff and physicians related to oxygen therapy ^[19]. The system of hospitals requires making clear instructions for oxygen therapy and examining it frequently. There are certain limitations to this audit, such as the fact that data was only obtained from one institution. First, a real study represents our organization's practice; however, our findings were similar to those reported in the International hospital's research and comparable in other hospitals without an oxygen therapy policy ^[19]. Furthermore, our sample size was only 30 patients.

Recommendations

Acute medical clerking program

The oxygen given to the patients by nurses and other hospital staff is observed to be given without an oxygen order. The fundamental acute medical clerking training program can be initiated with the significant objective of delivering an improved procedure of delivering oxygen to the respective patients. The required program has to integrate and improve measuring respiratory rate, oximetry saturation, oxygen flow rate, etc. Effective training should be provided to the medical staff in PACU and wards to record and monitor the target oxygen saturation rate and oxygen orders to provide an appropriate report to the senior doctors inwards.

Posters and other awareness materials

Posters and signs should be placed inside the PACU to inform staff in critical times to avoid significant health-related risks. In most cases, nurses have poor medical prescriptions and lack of education on coping in critical situations. To improve these operations, hospitals should educate staff in multiple ways. One of the practical approaches is placing such posters and signs of oxygen prescription in hospitals as included in the content; does your patient have their oxygen prescription? Do you know their target oxygen saturation range? Is the target saturation documented or reported? If these requirements and procedures are not fulfilled properly, report to the management teams.

Oxygen monitoring and controlling

Oxygen prescription and monitoring of target oxygen saturation range to record and report to the senior staff according to the guidelines and principles should be focused at.

Formulation of work schedule

According to the effective oxygen prescription, administration, and monitoring policies of HSE, it is illustrated that the effective work schedule has to include practice groups, their key roles, and responsibilities. The primary roles and responsibilities of nurses and other staff who are engaged in the oxygen prescription, monitoring, and administration operations should have essential information related to current patient oxygen prescriptions and its guidelines; and other roles included to ensure appropriate lawful consents, which is the major priority in PACU for examining and providing adequate medical treatment to the patients.

Bring improvement and practices to hospitals

Re-audit the other appropriate data that should be acquired from the respective respondents and public and private hospitals that will encourage specified practices and behaviour to enhance national standards in hospitals.

Other References

- Barrot, L., Asfar, P., Mauny, F., Winiszewski, H., Montini, F., Badie, J., Quenot, J.-P., Pili-Floury, S., Bouhemad, B., Louis, G., Souweine, B., Collange, O., Pottecher, J., Levy, B., Puyraveau, M., Vettoretti, L., Constantin, J.-M. and Capellier, G. (2020). Liberal or Conservative Oxygen Therapy for Acute Respiratory Distress Syndrome. *New England Journal of Medicine*, 382(11), pp.999–1008. doi: <https://doi.org/10.1056/nejmoa1916431>.
- Dellinger, R.P., Levy, M.M., Rhodes, A., Annane, D., Gerlach, H., Opal, S.M., Sevransky, J.E., Sprung, C.L., Douglas, I.S., Jaeschke, R., Osborn, T.M., Nunnally, M.E., Townsend, S.R., Reinhart, K., Kleinpell, R.M., Angus, D.C., Deutschman, C.S., Machado, F.R., Rubenfeld, G.D. and Webb, S. (2013). Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock, 2012. *Intensive Care Medicine*, [online] 39(2), pp.165–228. doi: <https://doi.org/10.1007/s00134-012-2769-8>
- Goonasekera, C.D.A., Carcillo, J.A. and Deep, A. (2018). Oxygen Delivery and Oxygen Consumption in Pediatric Fluid Refractory Septic Shock During the First 42 h of Therapy and Their Relationship to 28-Day Outcome. *Frontiers in Pediatrics*, 6. doi: <https://doi.org/10.3389/fped.2018.00314>
- Harper, J., Kearns, N., Bird, G., McLachlan, R., Eathorne, A., Weatherall, M. and Beasley, R. (2021). Audit of oxygen administration to achieve a target oxygen saturation range in acutely unwell medical patients. *Postgraduate Medical Journal*, p.postgradmedj-2020-139511. doi: <https://doi.org/10.1136/postgradmedj-2020-139511>
- Kamran, A., Chia, E. and Tobin, C. (2018). Acute oxygen therapy: an audit of prescribing and delivery practices in a tertiary hospital in Perth, Western Australia. *Internal Medicine Journal*, 48(2), pp.151–157. doi:

<https://doi.org/10.1111/imj.13612>

- Mabry, R., Koohsari, M.J., Bull, F. and Owen, N. (2016). A systematic review of physical activity and sedentary behaviour research in the oil-producing countries of the Arabian Peninsula. *BMC Public Health*, 16(1). doi: <https://doi.org/10.1186/s12889-016-3642-4>
- Malby, R., Edmonstone, J., Ross, D. and Wolfenden, N. (2011). Clinical leadership: the challenge of making the most of doctors in management. *British Journal of Hospital Medicine*, 72(6), pp.341–345. doi: <https://doi.org/10.12968/hmed.2011.72.6.341>
- Thein, O.S., Chan, C.M.T., McCance, E., Mullins, M. and Dosanjh, D. (2018). Oxygen prescription: improving compliance using methods from BMJ Open Quality journal. *BMJ Open Quality*, 7(2), p.e000288. doi: <https://doi.org/10.1136/bmjopen-2017-000288>

References

1. [^]Choudhury, A., Young, G., Reyad, B., Shah, N. and Rahman, R. (2018). Can we improve the prescribing and delivery of oxygen on a respiratory ward in accordance with new British Thoracic Society oxygen guidelines? *BMJ Open Quality*, 7(4), p.e000371. doi: <https://doi.org/10.1136/bmjopen-2018-000371>.
2. [^]Horncastle, E. and Lumb, A.B. (2019). Hyperoxia in anaesthesia and intensive care. *BJA Education*, 19(6), pp.176–182. doi: <https://doi.org/10.1016/j.bjae.2019.02.005>.
3. [^]Nguyen, B., Gunaratne, Y., Kemp, T., Chan, W. and Cochrane, B. (2021). The Oxygen project: a prospective study to assess the effectiveness of a targeted intervention to improve oxygen management in hospitalised patients. *Internal Medicine Journal*, 51(5), pp.660–665. doi: <https://doi.org/10.1111/imj.15249>.
4. [^]Dellinger, R., Levy, M., Rhodes, B., Annane, D., Gerlach, H., Opal, S., Sevransky, J., Charles, Sprung, L., Douglas, I., Jaeschke, R., Osborn, T., Mark, Nunnally, E., Townsend, S., Reinhart, K., Ruth, Kleinpell, M. and Derek (2012). Special Articles Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012. *Critical Care Medicine*, [online] 41(2). doi: <https://doi.org/10.1097/CCM.0b013e31827e83af>.
5. [^]Edmonstone, J. (2009). Clinical leadership: the elephant in the room. *The International Journal of Health Planning and Management*, 24(4), pp.290–305. doi: <https://doi.org/10.1002/hpm.959>.
6. [^]Froghi, F., Soggiu, F., Ricciardi, F., Gurusamy, K., Martin, D.S., Singh, J., Siddique, S., Eastgate, C., Ciaponi, M., McNeil, M., Filipe, H., Schwalowsky-Monks, O., Asis, G., Varcada, M. and Davidson, B.R. (2019). Ward-based Goal-Directed Fluid Therapy (GDFT) in Acute Pancreatitis (GAP) trial: study protocol for a feasibility randomised controlled trial. *BMJ Open*, 9(10), p.e028783. doi: <https://doi.org/10.1136/bmjopen-2018-028783>.
7. [^]Ham, C. (2003). Improving the performance of health services: the role of clinical leadership. *The Lancet*, [online] 361(9373), pp.1978–1980. doi: [https://doi.org/10.1016/s0140-6736\(03\)13593-3](https://doi.org/10.1016/s0140-6736(03)13593-3).
8. [^]O'Driscoll, B.R., Howard, L.S., Earis, J. and Mak, V. (2017). British Thoracic Society Guideline for oxygen use in adults in healthcare and emergency settings. *BMJ Open Respiratory Research*, [online] 4(1). doi: <https://doi.org/10.1136/bmjresp-2016-000170>.
9. [^]Poncette, A.-S., Wunderlich, M.M., Spies, C., Heeren, P., Vorderwülbecke, G., Salgado, E., Kastrup, M., Feufel, M.

and Balzer, F. (2020). *Patient Monitoring Alarms of an Intensive Care Unit: Observational Study with DIY Instructions (Preprint)*. *Journal of Medical Internet Research*, 23(5). doi: <https://doi.org/10.2196/26494>.

10. [^]Proctor, E.K., Landsverk, J., Aarons, G., Chambers, D., Glisson, C. and Mittman, B. (2008). *Implementation Research in Mental Health Services: an Emerging Science with Conceptual, Methodological, and Training challenges*. *Administration and Policy in Mental Health and Mental Health Services Research*, 36(1), pp.24–34. doi: <https://doi.org/10.1007/s10488-008-0197-4>.
11. [^]Ramukumba, M.M. and Amouri, S.E. (2019). *Nurses' perspectives of the nursing documentation audit process*. *Health SA Gesondheid*, [online] 24(1121). doi: <https://doi.org/10.4102/hsag.v24i0.1121>.
12. [^]Rebmann, T., Carrico, R. and Wang, J. (2013). *Physiologic and other effects and compliance with long-term respirator use among medical intensive care unit nurses*. *American Journal of Infection Control*, 41(12), pp.1218–1223. doi: <https://doi.org/10.1016/j.ajic.2013.02.017>.
13. [^]Ruggles, D.R., Freyman, R.L. and Oxenham, A.J. (2014). *Influence of Musical Training on Understanding Voiced and Whispered Speech in Noise*. *PLoS ONE*, 9(1), p.e86980. doi: <https://doi.org/10.1371/journal.pone.0086980>.
14. [^]Schalk, R., Seeger, F., Haitham Mutlak, Uwe Schweigkofler, Zacharowski, K., Peter, N. and Byhahn, C. (2014). *Complications associated with the prehospital use of laryngeal tubes—A systematic analysis of risk factors and strategies for prevention*. 85(11), pp.1629–1632. doi: <https://doi.org/10.1016/j.resuscitation.2014.07.014>.
15. [^]Shillan, D., Sterne, J.A.C., Champneys, A. and Gibbison, B. (2019). *Use of machine learning to analyse routinely collected intensive care unit data: a systematic review*. *Critical Care*, 23(1). doi: <https://doi.org/10.1186/s13054-019-2564-9>.
16. [^]Siemieniuk, R.A.C., Chu, D.K., Kim, L.H.-Y., Güell-Rous, M.-R., Alhazzani, W., Soccac, P.M., Karanickolas, P.J., Farhoumand, P.D., Siemieniuk, J.L.K., Satia, I., Iruken, E.M., Refaat, M.M., Mikita, J.S., Smith, M., Cohen, D.N., Vandvik, P.O., Agoritsas, T., Lytvyn, L. and Guyatt, G.H. (2018). *Oxygen therapy for acutely ill medical patients: a clinical practice guideline*. *BMJ*, 363(363), p.k4169. doi: <https://doi.org/10.1136/bmj.k4169>.
17. [^]Skrifvars, M.B., Sekhon, M. and Åneman, E.A. (2021). *Monitoring and modifying brain oxygenation in patients at risk of hypoxic ischaemic brain injury after cardiac arrest*. *Critical Care*, 25(1). doi: <https://doi.org/10.1186/s13054-021-03678-3>.
18. [^]Venn, R.M. and Grounds, R.M. (2001). *Comparison between dexmedetomidine and propofol for sedation in the intensive care unit: patient and clinician perceptions †*. *British Journal of Anaesthesia*, 87(5), pp.684–690. doi: <https://doi.org/10.1093/bja/87.5.684>.
19. ^{a, b, c}Zelege, S. and Kefale, D. (2021). *Nurses' Supplemental Oxygen Therapy Knowledge and Practice in Debre Tabor General Hospital: A Cross-Sectional Study*. *Open Access Emergency Medicine*, Volume 13(2021), pp.51–56. doi: <https://doi.org/10.2147/oaem.s299139>.