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Research Article

Improving the Prescribing, Documentation, and Monitoring of Oxygen Therapy in Adult Inpatients: Findings from a Second-Cycle Clinical Audit

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ABSTRACT

Background: Oxygen therapy is a widely used medical intervention, yet inappropriate prescribing, inadequate documentation, and poor monitoring remain common and are associated with preventable patient harm. International guidelines emphasize that oxygen should be prescribed and monitored as a drug with clearly defined target saturation ranges. The first audit cycle at Lady Reading Hospital (LRH), Peshawar, revealed major deficiencies in oxygen stewardship practices.

Objective: To evaluate the impact of targeted quality improvement interventions on adherence to international oxygen therapy guidelines during the second cycle of a clinical audit.

Methods: A retrospective cross-sectional re-audit was implemented at LRH three months into a period of consolidation that involved introduction of structured educational interventions, use of standard templates on oxygen prescription, and strengthening of monitoring practices. Two hundred and twenty adult patients who were admitted on medical and surgery wards and undergoing oxygen therapy were sampled. A standardized audit proforma that would evaluate the suitability of prescription, documentation quality, and monitoring and reassessment practices were used to collect data. Findings were compared to the baseline findings conducted at the opening audit cycle.

Results: The general adherence to the total number of audit domains increased significantly, as there was 28.6% compliance in Cycle-1 and 67.7% in Cycle-2. The rates of formal oxygen prescription improved (41.8 to 85.0), the records of the target saturation levels improved (19.5 to 73.6), and key device selection improved (48.2 to 81.8). Total prescription chart documentation went up by 38.6 per cent to 79.1, with regular SpO 2 monitoring rising by 58.2 per cent to 90.0. Reported oxygen regulation on request of saturation levels improved by half, reaching 71.4%.

Conclusion: Low-cost institutional interventions that were specifically focused on were also effective at enhancing oxygen prescribing, documentation, and monitoring practices. Permanent audit loops and persistent education reinforcement are critical to make safe oxygen stewardship a part of regular clinical practices.

Keywords: Oxygen therapy, Clinical audit, Patient safety, Quality improvement, Guideline adherence

INTRODUCTION

One of the most commonly used medical procedures in hospital treatment is oxygen therapy, which is the foundation of managing a large repertoire of acute and chronic diseases (Li et al., 2021; Navuluri et al., 2021; Ramadan et al., 2024; Rizki et al., 2024). Supplemental oxygen is potentially a life-saving tool when used correctly; however, extensive evidence suggests that its improper use is prevalent and may lead to serious

patient damage (Suen et al., 2023). Hypoxemia and hyperoxemia are both linked to negative physiological consequences such as oxidative stress increase, vasoconstriction, worsening ventilation perfusion mismatch, and in vulnerable patients, retention of carbon dioxide and respiratory acidosis (Lellouche et al., 2021; Post et al., 2024; Lopez-Pascual et al., 2021; Kalaria et al., 2024). These dangers highlight the ever-industry of considering oxygen as a medication that needs an overt label, defined prescription, and continuous follow-up as opposed to a non-beneficial support mechanism.

The international guidelines have continually provided the importance of controlled and titrated oxygen therapy. According to the recommendations by the British Thoracic Society (BTS), all hospitalized patients who are placed under oxygenation must have a written prescription that specifies the oxygen delivery device, flow rate, and a specifically defined target oxygen saturation interval that is dependable on the clinical state of a patient (Gottlieb et al., 2022; Coker et al., 2022; Ahmed et al., 2024). Likewise, the American Association to Respiratory Care (AARC) and the World Health Organization (WHO) promote the instilled use of oxygen, promoting the dangers of uncontrolled and excessive oxygen supply, especially in patients with chronic obstructive lung disease (COPD) and other conditions fating hypercapnic respiratory failure (Piraino et al., 2022; Buchan et al., 2024; Napolitano et al., 2021). Regardless of the existence of these solid guidelines, practical compliance does not reach its peak in different healthcare systems.

Various research and national audits have shown that there are enduring gaps in the oxygen prescribing and documentation practices. The gaps that are likely to be commonly reported are: no formal oxygen prescription is present, the targeted saturation ranges were not specified, the choice of delivery devices was not suitable, and monitoring and reassessment were not properly documented (Harper et al., 2022; Sheikh et al., 2023). These shortcomings are medically important, with improper titration of oxygen being identified to cause more fatalities during acute COPD attacks and other emergent diseases (Echevarria et al., 2021; Prediletto et al., 2023; Young and Frei, 2021; Rosenwasser et al., 2022). Additionally, inadequate documentation and tracking may postpone the identification of complications related to oxygen and disrupt continuity of care, especially when nurses transfer handovers between nurses and between wards.

Clinical audit is a mature quality improvement tool that can be used to measure the actual practice against the well-spelt out standards, effect change and reassess the outcomes by undertaking cycles of iteration and reiteration. Plan-Do-Study-Act (PDSA) framework offers an organized approach to the translation of audit finding into a long-term change by incorporating education, system redesign, and feedback systems. Repeat audit cycles and specific interventions, including standardized prescription charts, staff education, and monitoring protocol reinforcement, have appeared to make a great impact on the adherence to the recommended practices in the context of oxygen therapy (Nguyen et al., 2021).

Such interventions are urgently needed especially in the low and middle income countries where healthcare systems are often overwhelmed with patients, staff shortage, and inadequate access to electronic prescribing and monitoring systems. Most often, oxygen therapy is only commenced as a reaction in these settings, and the documentation provided may be inconsistent or incomplete, which heightens the chances of improper use. Similar to most of the South Asian nations, Pakistan has a high number of respiratory and infectious diseases, so safe and effective use of oxygen is a routine clinical challenge. Nevertheless, evidence provided by published sources indicates that the practice of common oxygen stewardship is not being universally applied to hospitals in the public sector thus creating a dire discrepancy in evidence-based suggestions and usual clinical practice.

The initial round of this clinical audit at Lady Reading Hospital (LRH) in Peshawar, revealed wide gaps in the adequacy, recording, and tracking of the oxygen therapy among adult inpatients in comparison with BTS, AARC, and WHO guidelines. As a reaction, a row of specific quality improvement measures was implemented, such as organized educational activities, guideline-based target saturation ranges distribution, and adoption of standardized, prescription-oxygen templates. These were interventions which were to stimulate cultural change towards the acknowledgement of oxygen to be a prescription-only drug and reinstate multidisciplinary responsibility in its safe administration.

The current research presents a second round of this clinical audit, which is a post-intervention re-assessment. The main goal of this re-audit was to determine the effect of these specific interventions on compliance to international oxygen therapy in adult medical and surgical wards. The objectives of the current study, by using the same standards and the same methodology as to the one employed in the first audit, are to discover whether structured, low-cost, system-level interventions could result in significant and lasting changes in oxygen prescribing, documentation, and monitoring practices. Such a way, it adds to the accumulating evidence on the impact of clinical audit as one of the methods to enhance patient safety and quality of care in tertiary care, especially in resource-constrained settings.

METHODOLOGY

The current research is the second round of a clinical audit (re-audit) study based on a cross-sectional (retrospective) design at Lady Reading Hospital (LRH), Peshawar, and that was implemented as a second, post-intervention study to investigate the usefulness of specific quality-improvement initiatives in the area of prescribing, recording, and observing oxygen therapy among adult inpatients. The re-audit was designed based on the conventional methodology of clinical audit and operationalised in the Plan-Do-Study-Act (PDSA) model of quality improvement. The methodological soundness and to permit a direct comparison with baseline results, the same audit standards were used that is based on the British Thoracic Society, American Association to Respiratory Care, and World Health Organization guidelines.

After the completion of the initial audit cycle, formal ethical approval was requested on this re-audit according to the modified institutional governance conditions. Although the first audit was classified as a service evaluation, the later policy revision required all audit cycles using retrospective patient information to be ethically cleared, thus the present study required an Institutional Review Board.

After the first audit cycle, a three-month consolidation process was carried out in a structured manner where some interventions towards the institution as a whole were established. These consisted of specific educational interventions provided to medical and nursing staff on the topic of oxygen as a prescription-only drug, dispersion of the recommended target oxygen saturation ranges with guidelines, and the implementation of standardized oxygen prescription forms in the ward records and reinforcement of regular pulse oximetry documentation during nursing shifts. During this period, there were no changes in admission pathways, staffing patterns, and everyday clinical processes, which marginalized the effect of the applied interventions.

The second audit cycle covered 220 adult patients. The participants who qualified included patients aged 18 years or older assigned to medical and surgical wards and underwent oxygen therapy at some time during hospitalization. Patients who had been admitted to high-dependency units or intensive care units and the palliative or end-of-life patients were excluded to ensure direct comparability with the first audit cycle. A record of patient was located using a ward admission log and oxygen therapy documentation registers and consecutive sampling conducted until the decided sample size was attained.

The first cycle used the same structured audit proforma to collect data retrospectively therefore maintaining the same outcome measurement. Three specified areas of audit were assessed: (i) the suitability of oxygen therapy, including documentation of indication, specifications of target saturation ranges, and choice of a delivery device; (ii) the quality of documentation, including completeness of prescription charts, specification of flow rate, and a nursing documentation; and (iii) practices of monitoring and reassessment, such as frequency of SpO 2 monitoring and documented changes in oxygen therapy. As a measure to improve the reliability of data obtained, two auditors were assigned to review every record and any disagreement resolved by consensus with oversight of senior clinicians.

The anonymized data were inputted into a secure database and were analyzed using the descriptive statistics. The information was summarised as frequencies and percentages of categorical variables, and as means and standard deviations of continuous variables. The overall rate of compliance with individual audit requirements was determined and directly compared against baseline results during the first audit cycle. Compliance was overall measured as having satisfied all the three audit domains.

The re-audit received ethical approval by the Institutional Review board of Lady Reading hospital. Since the study is retrospective and improvement-related regarding quality, the informed consent was not necessary. De-identification of records and access to authorized audit staff only ensured patient confidentiality.

RESULTS

Patient Characteristics

The second audit cycle involved 220 adult inpatients who had oxygen therapy. The median age of the patients was 56.4 years of age 28, including 124 men (56.4) and 96 women (43.6). Majority of patients were (142, 64.5 percent) medical admissions whereas 78 (35.5 percent) were surgical admissions. Lower respiratory tract infections (32.3%), acute exacerbation of chronic obstructive pulmonary disease (COPD) (21.4%), and cardiac conditions (18.2) were the most prevalent signs of oxygen therapy.

Overall Compliance

An improvement of the overall compliance with all of the three predefined audit domains was noted with a significant rise in compliance rate, rising at 28.6% in Cycle-1 and to 67.7% in Cycle-2 with the use of institutional interventions.

Reasonableness of Oxygen Prescription.

Prescription practice was improved significantly (Table 1). Documentation of oxygen as a formal prescription has risen to 85.0 percent of the total (it was 41.8 percent previously) and documentation of target oxygen saturation ranges rose to 73.6 percent of the total (it was 19.5 percent previously). There was also an increase in the use

of appropriate selection of oxygen delivery devices, which went up to 81.8%.

Quality of Documentation

Major improvements were observed to have been made in the quality of documentation (Table 2). In Cycle-2, it was 79.1 per cent, and in Cycle-1 it was 38.6 per cent. Flow rate documentation rose to 82.3 and 45.0 percent respectively and nursing recording of oxygen administration rose to 88.2 and 52.3 percent respectively.

Reassessment and Monitoring.

There was also significant improvement in monitoring and reassessment practices (Table 3). Frequent SpO 2 was reported in 90.0% versus 58.2% of patients in Cycle-1 and recorded oxygen changes in response to saturation measurements rose by 34.1% to 71.4%.

Table 1. Appropriateness of Oxygen Therapy (Cycle-1 vs Cycle-2)

Parameter	Cycle-1 (n=220)	Cycle-2 (n=220)
Oxygen formally prescribed	92 (41.8%)	187 (85.0%)
Target SpO_2 range documented	43 (19.5%)	162 (73.6%)
Appropriate delivery device used	106 (48.2%)	180 (81.8%)

Table 2. Documentation Quality (Cycle-1 vs Cycle-2)

Parameter	Cycle-1 (n=220)	Cycle-2 (n=220)
Complete prescription chart	85 (38.6%)	174 (79.1%)
Flow rate documented	99 (45.0%)	181 (82.3%)
Nursing documentation completed	115 (52.3%)	194 (88.2%)

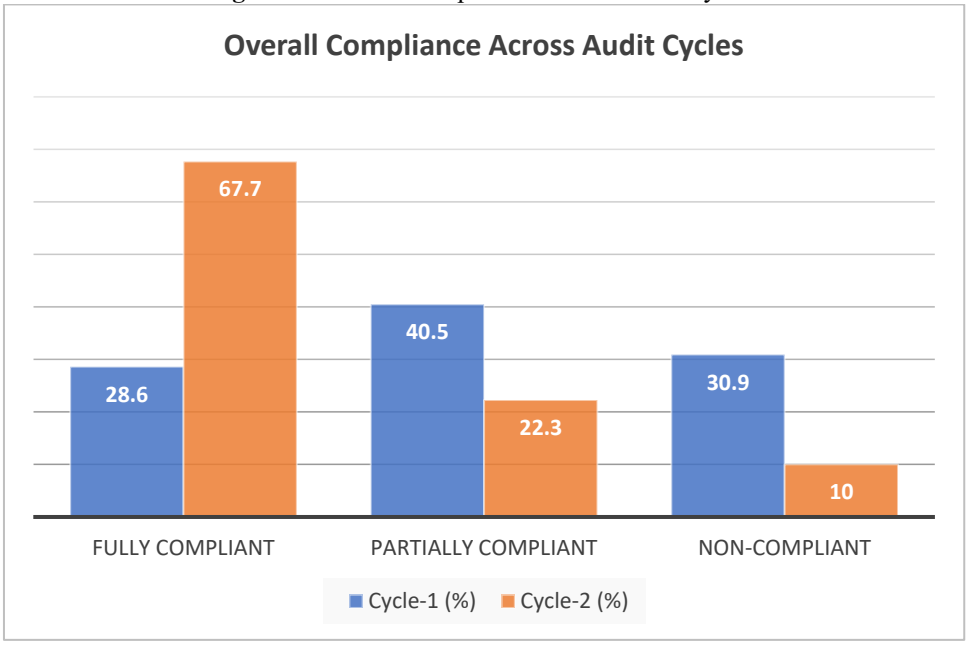
Table 3. Monitoring and Reassessment (Cycle-1 vs Cycle-2)

Parameter	Cycle-1 (n=220)	Cycle-2 (n=220)
Regular SpO_2 monitoring	128 (58.2%)	198 (90.0%)
Documented oxygen adjustment	75 (34.1%)	157 (71.4%)

Table 4. Overall Compliance Across Audit Cycles

Compliance Status	Cycle-1 (n=220)	Cycle-2 (n=220)
Fully compliant	63 (28.6%)	149 (67.7%)
Partially compliant	89 (40.5%)	49 (22.3%)
Non-compliant	68 (30.9%)	22 (10.0%)

Figure: 1 Overall Compliance Across Audit Cycles



DISCUSSION

The second-cycle clinical audit shows a significant and clinical significant response to prescribing, documentation, and monitoring of oxygen therapy when switching to specific institutional interventions at Lady Reading Hospital. Total compliance improved in the re-audit (67.7% vs. 28.6% in the baseline cycle) which indicated the benefit of structured education, standardized prescription tools, and reinforcement of habitual monitoring behaviors. These results underscore the importance of the fact that oxygen stewardship remains an important subject in which relatively inexpensive, system-level quality improvement initiatives can play a key role.

There was a significant increase in the suitability of oxygen prescribing. Prescription of oxygen was formalized at 85.0 and documenting target oxygen saturation ranges at 73.6, as opposed to significantly less in the first cycle. This is more so considering that oxygen as a drug is known to have risks well identified such as hypercapnia, oxygen toxicity and situations whereby signs of clinical deterioration may take time before it is recognized when used inappropriately. The better choice of delivery devices also implies the increased awareness of clinicians regarding the guideline-based oxygen therapy and more akin practice to BTS, AARC, and WHO recommendations.

There was also significant improvement in documentation quality, with total prescription charts, flow-rate documentation, and nursing records all becoming more than 79% compliant in Cycle-2. Better documentation is necessary not only to provide patient safety and continuity of care, but also to ensure medicolegal accountability and auditability of clinical practice. The significant enhancement of the nursing documentation highlights the beneficial effects on the strengthening of the oxygen-related practices during the handovers and the regular workflow on the ward.

Remarkably, monitoring and reassessment practices presented one of the most significant gains where regular SpO 2 monitoring (90.0 per cent) and recorded adjustments in oxygen levels (71.4) improved significantly. This indicates that employees were more sensitive to the patient oxygenation condition, and more susceptible to regulate therapy according to the objective results of measurements, and it minimized the chances of extended inadequate deliverance of oxygen. The increased surveillance is especially essential in the high-risk groups including COPD patients that comprised a considerable percentage of the audited population.

Regardless of these advances, one in every third patients failed to comply with all audit standards, and this shows gaps to practice. This could be linked to the turnover of staffs, workloads, or the lack of uniform implementation of standardized prescription tools amongst the wards. Such observations highlight the necessity of continuous learning, active follow-up and introduction of oxygen stewardship as an integral component of the hospital quality assurance systems that can help to maintain the improvements in the long term.

On the whole, this re-audit shows that complex quality improvement measures can positively influence oxygen therapy practice in a tertiary care hospital facility. It is suggested to continue PDSA cycles, increase the utilization of electronic prescribing solutions, and provide frequent feedback to clinical teams to implement additional initiatives and proposals to enhance compliance and integrate safe oxygen prescribing into the standard of care.

CONCLUSION

This second-cycles clinical audit shows that guideline-based, structured quality improvement initiatives can lead to significant improvement of oxygen stewardship in a tertiary care inpatient hospital environment. In response to the focused education, standardized prescription forms, and the strengthening of monitoring procedures, the overall adherence to the international standards of oxygen therapy increased more than twofold. A significant rise was noted in all areas of importance, such as formal prescription, target saturation range documentation, proper device choice, nursing documentation, and daily monitor and reassessments. These results verify that with even in constrained resource settings, low-cost system-level strategies can optimize oxygen therapy practices. But the continued lapses in complete compliance suggest the necessity of continuous education, frequent feedback and frequent audit cycles. It is advisable to incorporate oxygen stewardship as a component of standard hospital quality assurance programs to maintain the gains and promote patient safety to a larger degree.

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