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Oxygen Therapy Education to Improve Oxygen Safety in the Emergency Department: A Quality Improvement Project

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Oxygen Therapy Education to Improve Oxygen Safety in the Emergency Department: A Quality Improvement Project

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A DNP Project submitted in partial fulfillment of the requirements for the degree of

Doctor of Nursing Practice

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July 30, 2023

This is to certify that the DNP Project Final Report by

Latania Wolfe
has been approved by the DNP Project Team on
July 30, 2023
for the Doctor of Nursing Practice degree

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Practice Mentor: Jeanie Haggan, RN, MHA, MS, CPHQ

Abstract

Background and Significance: Oxygen is often administered in emergency departments (ED) in US without the nurses and other healthcare staff inputting orders for this medication. This gap in placing orders poses a risk to patient safety and poses a regulation issue.

Purpose: The goal of this quality improvement project is to increase the rate of orders placed for patients using oxygen in ED staff by 12% from March 1, 2023 to May 31, 2023.

Methods: The Model for Improvement guided this quality improvement project. Two PDSA cycles were completed.

Results: ***PDSA #1*** Completed SWOT analysis and used information to inform education training that was developed with the ED safety manager. Training materials included posters, handouts, and pocket cards that had detailed instructions for placing oxygen orders. Staff (RN, MD, PA, APRN) were educated 1:1 during their shifts and reminders at the change of shift huddles. Ninety-five percent of staff were educated between March and May. Oxygen use and orders in were tracked using the ED oxygen safety dashboard. The baseline metric was 47.5% for February 2023 and after education rate was 48.8% March and 42.9%. **PDSA #2** Additional 1:1 education and reminders in May 2023. Nurse manager reminded staff at meetings to place orders and sent reminders via emails to staff. Rate of oxygen orders increased to 73% for May and 64.6% for June.

Conclusion:

Education and reminders worked to increase the oxygen orders placed. Ongoing reminders to staff were found to be needed to maintain the gains in oxygen orders. To sustain gains it is recommended that ED nurse educator and quality person continue to monitor the oxygen safety dashboard and give staff reminders.

Keywords: *oxygen orders, PDSA, oxygen safety, emergency department* **,** *guideline* , oxygen therapy, *algorithm, oxygen usage, oxygen therapy, inpatient, quality improvement,*

Acknowledgment

I would like to recognize the following people for their support throughout the program and DNP project at Sacred Heart University:

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- Kerry A. Milner DNSc, APRN, FNP-BC, EBP-C, Project Faculty Advisor. I thank her for sharing her knowledge and providing guidance with the quality improvement project
- Jeanie Haggan Jeanie Haggan, RN, MHA, MS, CPHQ, project mentor. I thank her for assisting with facilitating the implementation of project in the emergency department.

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Problem Identification

National Description of Problem

Low oxygen level can lead to organ failure and death. Excessive oxygenation can be harmful especially in patients with chronic obstructive pulmonary disease (COPD) and patients in hypercapnic respiratory failure (Desalu et al., 2019). Oxygen is often inappropriately administered leading to over utilization (Abhilash et al., 2020). Previous studies demonstrate variability in oxygen administration practices by nurses in the emergency department and critical care units (Getahun et al., 2022). Gaps in the knowledge of health care providers on oxygen therapy have been report and this may be a barrier to optimal oxygen administration (Desalu et al.,2019). Due to the frequency of use as a clinical intervention there is potential for misuse. There is a need for awareness of the effects of both over and under oxygenation (Kelly & Lynes ., 2015) and regular education and training on oxygen therapy are needed to increase the level of practice among nurses (Getahun et al., 2022).

Local Description of Problem

A reoccurring problem in the ED is an increase in patients using oxygen without orders. Appendix A displays the oxygen safety dashboard data for the ED. Since May 2022 to November 2022 there has been a 16% decrease in rate of patients on oxygen without orders has. An education intervention done earlier in 2022 increased the rate to 69% however the data show that this did not sustain (J. Haggan, personal communication December 23, 2022). Oxygen is considered a medication, so oxygen orders are a requirement for all patients receiving oxygen. The ED nurse and providers have the capability of entering orders for oxygen therapy. This gap in placing orders poses patient safety and regulation issues.

Organizational Priority

Safe oxygen use is a priority in this health system as evidenced by the investment in OxyTOTE DTE, a portable oxygen system regulator, to improve the safety of intrahospital transport of patients on oxygen. Adverse events decreased with the implementation of OxyTOTE DTE. However, a reoccurring problem is patients using oxygen without an order. It is important to address on this problem because oxygen is a medication that must have an order, and the ED and hospital could face penalties for lack of orders.

Development of Clinical Question

The focused clinical question guiding the search for evidence is as follows. In ED setting (P), how does guideline-based oxygen usage (I) compared to no guideline (C) affect appropriate oxygen usage (O)?

Evidence Review

External Evidence Search Plan and Results

CINAHL, Cochrane library, PubMed and MEDLINE databases patient safety websites, practice organization websites, Departments of Public Health, National Quality Forum were used to conduct this evidence search. The key words used to search were guideline-based oxygen usage, appropriate oxygen usage, oxygen safety, transport safety, patient transport, transport safety checklist, transport checklist, and intrahospital transport. Adding the keywords inpatient, emergency department, and in-hospital narrowed the search. Filters included English language. The inclusion criteria for article selection were articles that included any interventions to address patient oxygen use during hospitalization. The strategy for selecting articles included looking for systematic review, peer-reviewed articles. Articles were appraised using the Rapid Critical Appraisal Tools (Melnyk& Fineout-Overholt, 2019).

Appendix B displays the search results by database. The final yield from each database search was 1 article (Cochrane Library), 10 articles (PubMed) and 3 articles (CINAHL). A total of 14 articles were selected for rapid critical appraisal.

Internal Evidence Search Plan and Results

In spring of 2022 oxygen use education and training was done in the ED for nurses and providers and the rate of patients on oxygen with orders increased to 69% (J. Haggan, personal communication December 23, 2022). To understand the current factors related to this issue a SWOT analysis will be done (see Table 1). This analysis along with the external evidence will help to inform the recommendations.

Table 1.

SWOT Analysis: Oxygen Orders for Patient Using Oxygen

Strengths	**Weaknesses**
What positive processes exist that facilitate orders for patient oxygen? •	*What aspect of the oxygen orders process and/or documentation has room for growth? What part could be improved and how?* •
Opportunities	**Threats**
What are you looking for in an oxygen orders process? •	*What obstacles do you see challenging the success oxygen orders?* •

Evidence Appraisal, Summary, Synthesis, and Recommendations

A total of 14 articles were reviewed and underwent rapid critical appraisal (RCA) using Melnyk & Fineout-Overholt's (2019) tools. One of the completed RCA tools is found in Appendix C. Most of the evidence was on oxygen usage and how to prevent inappropriate usage. Appraisal of these articles revealed that inappropriate oxygen usage can be reduced using guidelines, algorithms, and educational training programs (Abhilash et al.,2020; Getahun et

al.,2022; Grenseman et al., 2018; Hale et al., 2008; Kane et al.,2013; Sieber & Osterwalde, 2016; Zeleke & Kefale., 2021). A cross section study conducted at University of Gondar Comprehensive Specialized Hospital Northwest, Ethiopia revealed that regular educational and training programs about oxygen therapy are needed to increase the level of practice among nurses (Getahun et al., 2022). A validation questionnaire was useful in assessing knowledge gaps and providing better understanding of barriers to oxygen therapy guidelines (Desalu et al., 2019). Based on the currently available evidence, it is recommended that oxygen use education and training be done in the ED for all staff and that this training be continued at regular intervals. Additionally, ED staff should be given the oxygen therapy algorithm as a pocket card to refer to as needed.

Project Plan

Project Goals

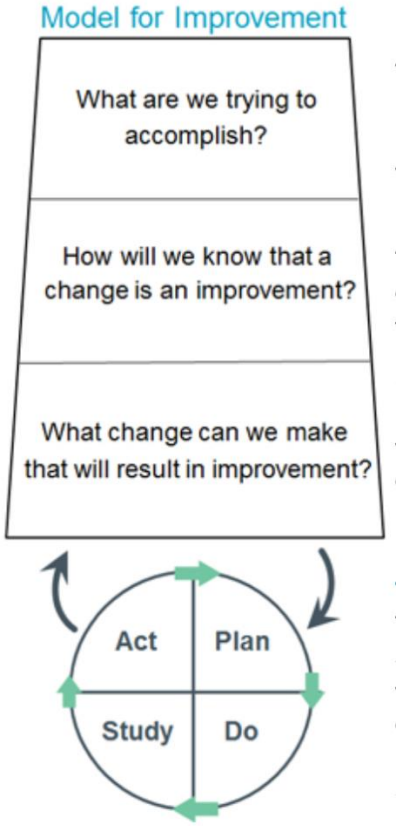
1. To develop an education training with the ED quality and safety manager for ED staff nurses and providers on oxygen orders in patients using oxygen by April 2023.
2. To provide 1:1 oxygen order education to 90% of ED staff.
3. To increase the oxygen orders placed by ED staff for patients receiving oxygen therapy by 12% by April 2023.

EBP/QI Model

The Model for Healthcare Improvement (MFI) will guide this project ("How to Improve", n.d.). Each component of the MFI is addressed in the relevant section of the project plan (e.g., project goals, project team, establishing measures, selecting changes, testing changes, and spreading changes).

Figure 1

Model for Healthcare Improvement



Context

Description of Setting and Population

The large tertiary care, level 1 trauma center hospital is in a city in New England. The project setting is the adult ED. Participants are ED nurses and providers and patients.

Project Team Members and Roles

The Vice President of Medicine Services and the Patient Safety Nurse will play a role in project plan and approval. The Manager of Quality and Safety of the ED will assist with the implementation of the project. Kerry A. Milner, DNSc, APRN, FNP-BC, EBP-CH is the academic partner, DNP project faculty advisor and will make sure that the project is evidence - based and meets quality improvement standards.

Description of Practice Change and Evaluation

The practice change is to implement 1:1 education and training to address lack of oxygen order utilization in the ED. Appendix F displays the oxygen therapy algorithm. Appendix G displays the education power point and script. See timeline for the project roll out in Appendix H. Table 2 describes the planned activities for the first Plan, Do, Study, Act (PDSA) cycle.

Table 2.

PDSA Plan

	Activity	Person/s Responsible	Timeline
Plan	• Complete SWOT analysis and use information to inform education training. Work with safety manager to develop education training. • Create educational materials that include posters/handouts and pocket cards. Appendix K displays pocket card and poster.	DNP student Practice project preceptor	01/2023

Do	• Educate staff (RN, MD, PA, APRN) 1:1 during shift and reminders at change of shift huddles. Goal is to educate 90% staff (process measure).
	• Track oxygen use in patients and oxygen orders in EHR using ED oxygen safety dashboard.
	  ○ Baseline metric 53%, 11/2022 (patients on oxygen with order divided by all patients on oxygen)
	  ○ Goal is to increase by 12% to 65% in 2 months (outcome measure)
		DNP student	02/2023

Study	• Review process and outcome measures	Project team and ED key stakeholders	04/2023
Act	• Determine if additional PDSA cycles are needed. Discuss sustainability plan	Project team	04/2023

Key Stakeholders and Buy-in

The key stakeholders are the ED nurses, ED nurse manager and assistant nurse manager, ED care providers, assistant manager of quality and safety in the ED, and patients. A SWOT analysis will be done to engage the key stakeholders in this practice problem and hear their ideas about how the problem can be addressed. In the education training the current oxygen safety dashboard data will be shared, and data sharing in real time has been shown to be an effective strategy for engaging staff in practice change (Cullen et al., 2018).

Possible Barriers for Implementation

Table 3 summarizes the possible barriers to project implementation and strategies to overcome these barriers. Barriers to implementation include the workflow of staff. Staff might not have the time to read educational posters therefore, pocket guides will be created so it can be easily carried around and used as a reference. It is important to develop trust, use effective communication, and praise staff when they have met goals. Snacks will be provided to ED staff for improvements (e.g., an increase of oxygen order set placed for patients using oxygen) to celebrate the staff's quality of care. It would be integral if oxygen order safety champs are identified, and they can point out improvements or decreases in oxygen safety dashboard data and give engagement certificates to the staff they identify as following the process.

Table 3.

Possible Barriers to Implementation and Strategies to Overcome Barriers

Barrier	Strategy
All ED nurses and providers receiving education	Sign-in sheet for all ED nurses and providers receiving education. 90% of ED nurses and providers will receive education by 04/2023.
Time to read posters	Pocket guides
Resistance to change	Snacks, safety champs, engagement certificates

Facilitators

The main facilitator of this project is the support from the practice organization's administration and their desire to fix this practice problem. Continued lack of orders for patient using oxygen could result in penalties from the Department of Public Health.

Project Timeline

The implementation timeline is found in Table 4. The DNP Project Roadmap with the dates that each section was completed is found in Appendix I.

Table 4.

Implementation Timeline for DNP Project

Project Goal: To increase the rate of orders placed for patients using oxygen in ED staff by 12% from March 1, 2023 to May 31, 2023.
Team Leader: Latania Wolfe, BSN, RN, DNP student
Team Members: Kerry Milner, DNSc, APRN, FNP-BC; DNP Project Faculty Advisor. XXXX, RN, MHA, MS, CPHQ ; Practice Preceptor .
Pilot site: ED

Pre-Implementation	Topic	Notes	Actions	Outcome/Status
A	Approval from the XXXX Nursing Scientific Review Committee (NSRC)	Reviewed by Dr. Milner and NSRC	DNP student submit letter of intent and scholarly project endorsement application to NSRC	Anticipated approval date by NSRC 01/15/2023
B	DNP project proposal presentation		DNP student submit proposal to Dr Milner and Practice Mentor. Schedule date for presentation	Complete DNP project proposal by date 01/10/2023
C	SHU IRB Approval		DNP student submit IRB application	01/15/2023
D	XXXX ED Patient Safety		DNP student submit presentation for review/approval	02/02/2023

	Quality meeting SWOT Analysis		to Practice Mentor before 02/2/2023 meeting. Complete SWOT analysis. Handout pocket guides and set up posters	
Implementation				
A	1:1 training in ED for staff who could not attend 2/2/2023 training at quality and safety meeting		DNP student to do these trainings on rotating basis covering most shifts. Will also recruit trained staff to help with this (train the trainer model)	02/2023
B	Review Oxygen Safety Dashboard data		DNP student to meet with Practice Mentor weekly to discuss data and further actions if needed	02/2023 - 04/2023
Post-Implementation	Sustainability		DNP student to discuss with Practice Mentor.	04/2023 - 05/2023

Estimated Resources/Budget

Table 4 displays the anticipated costs for this project.

Table 4.

Resource	Time	Costs
Project manager	5% effort X for 6 Months (annual salary $100,000)	$2500
Quality and Safety Manager Expertise	Part of job	Cost neutral
Report creator	Oxygen safety dashboard	Cost neutral
Posters 8x11 x3 pocket guides 5x7 x30	Staples	$60
Snacks variety pack	BJs	$80
Paper and ink for engagement certificate	Staples	$100

Ethical Review

A letter of intent and the project proposal will be submitted to the practice setting Nursing Scientific Review Committee for review and approval. Per DNP program policy the QI checklist was completed and demonstrated that this was a QI project (Appendix J). Per SHU policy this QI project will be submitted to the IRB for review and approval. This DNP student has successfully completed and obtained certification in CITI training for ethical practice (Appendix K).

Sustainment Plan

Continued education on oxygen safety for staff that can be easily accessed along with support of the quality and safety manager. Disseminate results from the project to stakeholders and assign champions to continue education on order sets and chart audits. The need for education will be reevaluated monthly based on the oxygen safety dashboard. Re-education training will be given when the rate of oxygen order set falls below 65%.

Dissemination Plan

The practice setting requires an abstract submission to the Nursing Scientific Review Board upon project completion. This DNP student will also submit an abstract for poster or podium presentation to the annual practice setting research conference. Journal of emergency nursing. An executive summary will be prepared for the practice setting administrators and key stakeholders. An abstract and poster will be prepared for Sacred Heart University DNP program.

Evaluation

Prior to the implementation this quality improvement project was reviewed by the SHU IRB and given an exempt status (see Appendix M). This project was also reviewed and approved by the NSRC, see Appendix N for the letter of approval.

Results

SWOT Analysis

Some positive processes that facilitate oxygen orders reported by staff includes oxygen order sets can be placed by nurses and providers, the order set can be found under nurses' order panels, the order is found under hypoxia and there are different ways to place the oxygen order set in EHR. The aspects of the oxygen order process or documentation that could improve included the location of where to find the oxygen order sets and the pop-up that interrupts workflow and create extra charting. Suggestion from staff nurse to improve the rate of placing order sets includes placing oxygen order sets under not just hypoxia but under dyspnea. Staff reported looking for quick and easy process to place oxygen orders. Obstacles to being successful at placing oxygen orders sets reported by staff includes busy work shift, forgetting, lack of knowledge of how to place orders, lack of knowledge that nurse can place orders and nurse reports relying on provider to place orders.

Educational Training and Oxygen Orders Placed

Table 5 summarizes the staff that received education by month and the oxygen order rate from February to May 2023. There are approximately 150 staff. Staff (n=143, 95%) received the educational training in March and April and the goal of >90% was met. In March there was a small increase in the oxygen orders placed. There was a drop in oxygen orders placed for April, so in May, email reminders were sent as well as reminders during all shifts and at safety huddles. These strategies resulted in an increase of 30.1% to 73% which exceeded the goal of a 12% increase. There was a slight decrease in June.

Table 5

Staff Educational Training and Oxygen Orders Placed per Month in 2023

Month	1:1 Staff Education	Oxygen Orders Placed

	n	%
February	0	47.5
March	121	48.8
April	22	42.9
May	*Reminders all shifts and several safety huddles*	73
June		64.6

Table 6 displays the nurse knowledge of key elements of the educational training on oxygen safety. All nurses knew oxygen was a medication and could demonstrate how to order oxygen using the order set in Epic. Most nurses were not able to estimate the current rate of oxygen orders placed.

Table 6.

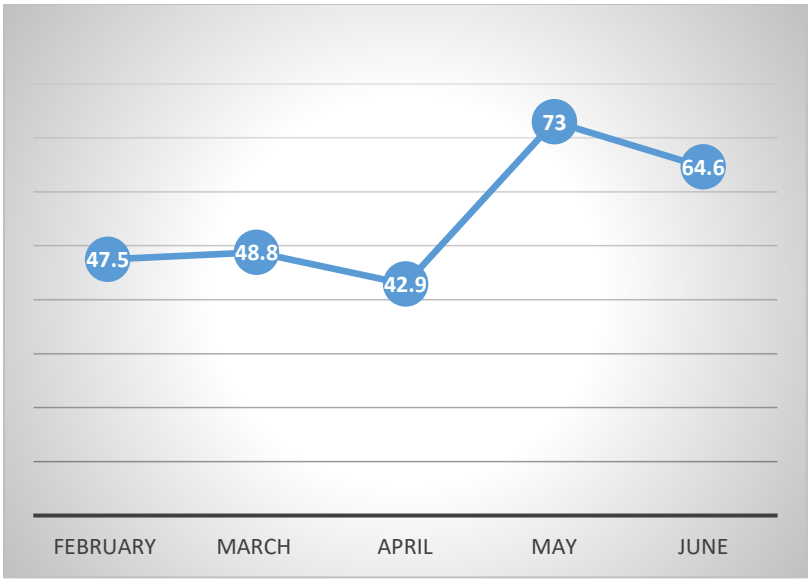
Nurse Knowledge of Key Elements of Education Training on Oxygen Safety

Key Element	**Achieved**	
	n	**%**
Return demonstration ordering oxygen	127	100
Found information useful to practice	143	100
Estimates current rate of oxygen order placed (n=143)	0	0
Able to access to dashboard (n=127)	2	1.6
RN Knowledge of oxygen is a medication	127	100

Figure 2 displays the oxygen orders place over time. From February to June there was a 17.1% increase in oxygen orders placed in EHR.

Figure 2.

Rate of Oxygen Orders Placed in Emergency Department per Month



Final Project Costs

The final project costs are the same as appears in Table 4 in the Project Plan section. The value of investment (VOI) ties the amount of time it takes the nurses and physicians to make sure the orders are placed for every patient using oxygen in the ED in the EHR and this was done quickly with the existing order set. Assessing the appropriateness of the use of oxygen for patients with oxygen in the ED was also done and this addresses safety.

Deviations from Project Plan

There were no deviations from the project plan. An additional PDSA cycle was executed when the oxygen safety dashboard data for April 2023 dipped to 42.9%. Reasons for this could have been the closing of a section in the ED because of a lack of staff, using more travel nurses to staff ED, and new staff nurses starting.

Lessons Learned

A major lesson learned is the multimodal approach (1:1 education, reminders by email, and staff huddle) that is needed to get nurses engaged in behavior change. This DNP student also found that being physically present was an effective reminder to the staff. Another lesson learned was the need for additional education when there is staff changeover (e.g., travel nurses, new staff) and one cannot assume that this information will be covered in their new staff orientation or because they are experienced nurses, they will enter the oxygen orders.

Sustainability

Recommendation for sustainability includes continued education and reminders on oxygen order utilization. Assignment of champions or staff each shift to provide reminders on the unit during all shifts. The need for education will be reevaluated monthly based on the oxygen safety dashboard. Provide re-education training and email reminders when the rate of oxygen order set utilization falls below 65%.

Dissemination

An abstract will be submitted to the Nursing Scientific Review Board and to the annual practice setting research conference. Submission of a manuscript to the Journal of Emergency Nursing will be explored. The executive summary in Appendix L was prepared and disseminated to the practice setting administrators and key stakeholders. An abstract and poster (see poster in Appendix O).was prepared for Sacred Heart University DNP program. A presentation was completed for the project committee and a presentation is planned for the practice setting Nursing Grand Rounds.

Conclusion

Education and reminders worked to increase the oxygen orders placed in the ED of a busy level-one trauma center. Ongoing reminders to staff were found to be needed to maintain the gains in oxygen orders. To sustain gains it is recommended that the ED nurse educator and quality person continue to monitor the oxygen safety dashboard and give staff reminders.

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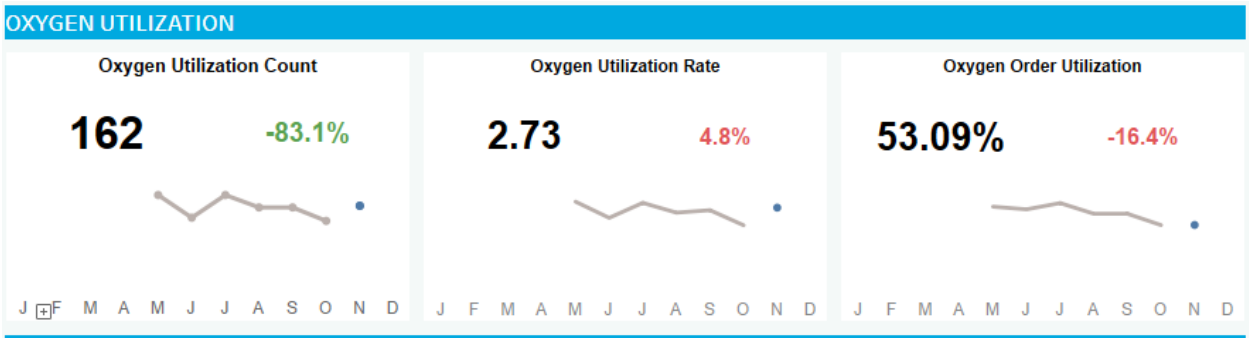
Appendix A

Figure.

Emergency Services Oxygen Safety Dashboard Data Through November 2022.



Appendix B

Search Results Cochrane Library

Search Terms	Number of hits	Number of title & abstract reviewed	Number of full-text articles reviewed	Number of articles selected for this review without duplicates	Total number of articles used for evidence
Transport Safety	115	4	4	2	0
Inpatient and In-hospital patient transport	11	1	0	0	0
In-hospital Transport safety checklist	2493	10	5	3	0
Transport checklist	2	0	0	0	0
Intrahospital transport	16	6	5	2	0
Oxygen Safety	10	1	1	1	1
					1

Search Results CINAHL

CINAHL					
Search Terms	Number of hits	Number of title & abstract reviewed	Number of full-text articles reviewed	Number of articles selected for this review without duplicates	Total number of articles used for evidence
Transport Safety	106	7	5	3	0
Inpatient and In hospital patient transport	45	8	0	0	0
In hospital Transport safety checklist	2	1	1	1	0
Transport checklist	15	5	5	1	0
Intrahospital transport	105	4	3	3	2
Oxygen safety	156	10	5	2	1
					3

Search Results PubMed

PubMed					
Search Terms	Number of hits	Number of title & abstract reviewed	Number of full-text articles reviewed	Number of articles selected for this review without duplicates	Total number of articles used for evidence
Oxygen usage	2118				
Appropriate oxygen usage	99	99	0	0	0
Oxygen safety	17351				
					10*

*Google/Google Scholar search and obtained articles via SHU PubMed

Finding evidence by searching the common databases of CINHAL, Cochrane, and PubMed yielded few articles, so a search of Google and Google Scholar was done. This search yielded 10 relevant articles and the articles were obtained using SHU PubMed.

Appendix C

Evidence Summary

In ED setting (P), how does guideline-based oxygen usage (I) compared to no guideline (C) affect appropriate oxygen usage (O)?

Article number and title	Author & Year	Evidence type & methods	Sample Size	Findings that help answer the question.	Limitations	Source	Level of evidence	Worth to Practice
1. Impact of oxygen therapy algorithm on oxygen usage in the emergency department	Abhilash et al.,2020	prospective observational study	769 patients and the 3-week post-protocol observation phase in April 2017 included 4608 patients.	After the strict implementation of the algorithm, the number of patients receiving oxygen therapy decreased from 9.63% to 4.82%, The average amount of total oxygen used decreased from 55.4 liters per person in pre-protocol group to 42.1 liters per person in the post-protocol group with a mean difference	Did not differentiate between oxygen therapy by mask and by ventilator support and all of them were considered to be administered oxygen. Generalizability	PubMed	Level III	Shows that the implementation of an oxygen therapy algorithm significantly reduces inappropriate oxygen use and decreases treatment cost to the patient

				of 13.28 (95% CI 5.30-21.26; *P* = 0.001). Inappropriate oxygen usage decreased from 37.2% to 8.6% . . The total duration of inappropriate oxygen usage significantly decreased from 987 h to 89 h over the 21-day study period.				
2. Development and validation of a questionnaire to assess the doctors and nurses knowledge of acute oxygen therapy.	Desalu et al.,2019	questionnaire contents by a literature review	pilot-tested on a convenience sample of 16 consenting doctors and nurses 6 nurses and ten doctors including an	There is a huge gap in the knowledge of health care providers on various aspects of oxygen therapy, and this knowledge deficiency may also be a barrier	Generalizability	PubMed	Level III	Acute oxygen therapy questionnaire (AOTQ) can be a useful tool in the university and hospital to improve the

			emergency physician. test- retest study using a convenience sample of 121 doctors and nurses drawn from all the public and private hospitals.	to optimal oxygen administration .				knowledge about oxygen therapy of Doctors, Nurses, medical and nursing students. The AOTQ can be used as an exploratory tool to gather baseline information .
3. Assessment of practice and barriers of oxygen therapy in critically ill patients among nurses: A survey from University of Gondar Comprehensive Specialized Hospital	Getahun et.,2022	Cross-sectional study May 23 to June 07, 2021	A total of 400 nurses	The overall proportion of good practice on oxygen therapy for critically ill patients was 47% (95% CI: 43–51.8). Age >39 years (AOR; 3.17, 95% CI: 1.42–7.08), nurses have good knowledge on oxygen therapy (AOR; 1.74, 95% CI: 1.11–2.74),	Temporality between outcome and exposure cannot be determined as both are assessed at the same time. Generalizability	PubMed	Level III	Regular educational and training programs about oxygen therapy are needed to increase the level of practice among nurses.

Northwest, Ethiopia				labeling of the volume of the cylinder after use (AOR; 2.51, 95% CI: 1.36–4.63), were significantly associated with good practice on oxygen therapy in critically ill patients.				
4. Analysis of Adverse Events during Intrahospital Transportation of Critically Ill Patients	Gimenez et al. (2017)	Prospective cohort study of patients admitted to the ICU 2014-2015	293 patients	A total of 293 patients were analyzed with follow-up of 143 patient transportations and records of 86 adverse events. Of these events, 44.1% were related to physiological alterations, 23.5% due to equipment failure, 19.7% due to team failure, and 12.7% due to delays. Half of the events were classified as moderate. The mean time of hospital stay of the group with adverse events was higher	-External Validity - single center studied.	CINAHL Hindawi Journal	Level II	Shows that there is a problem with equipment failures during transport that results in longer hospital stays.

				compared to patients without adverse events (31.4 versus 16.6 days, resp., P<0.001).				
5. Oxygen Treatment in Intensive Care and Emergency Medicine	Grenseman et al .,2018	Prospective, randomized trials	17 213 patients	In patients with acute exacer-bations of chronic obstructive pulmonary disease and in ventilated intensive-care patients, normoxia was associated with a lower mortality than hyperoxia (2% vs. 9%). In patients with myocardial infarction, restrictive oxygen administration was associated with a smaller infarct size on cardiac MRI at 6 months compared to oxygen administration. For patients with stroke, the	Generalizability	PubMed	Level III	To improve patient outcomes, a conservative oxygenation strategy that includes administering only to patient requiring oxygen accompanied by training measures should be implemented. Shows that there is no benefit from administration of oxygen to non-hypoxic patients.

				currently available data do not reveal any benefit or harm from oxygen administration. None of the trials showed any benefit from the administration of oxygen to non-hypoxemic patients.				
6. Audit of oxygen use in emergency ambulances and in a hospital emergency department.	Hale et al.,2008	6-week audit of emergency oxygen use	1022 patients ED Records	Oxygen saturation (SpO_2) was recorded for 90% of patients, 17% of whom had SpO_2 ,94% at some time and 7% had SpO_2 ,90%, including 33% of patients with COPD and 5.5% of patients without COPD. 34% of patients received oxygen in the ambulance and almost half of these had oxygen discontinued in the ED. Only	Generalizability	PubMed	Level IV	Guidelines can be of value to ambulance services and EDs by standardizing and enhancing oxygen therapy in medical emergencies, including the introduction of target saturation ranges for all common

				62% of ambulance oxygen use was in accordance with JRCALC guidance, but most ‘‘under-treated’’ patients were stable normoxaemic patients for whom guidance recommends high-flow oxygen. Only 58% of patients with COPD were correctly identified in the ambulance and 73% of these patients were treated with flow rates .4 l/min (equivalent to .35% oxygen).				medical emergencies.
7. Adverse Events during Intrahospital Transport of Critically Ill Children:	Haydar et al. (2019)	Systematic Review 471 articles reviewed 40 met inclusion criteria	4104 patient transports	Respiratory and airway events were the most common types of adverse events. Most events were judged to have been preventable by	Selection and sampling bias. Recall bias , inconsistent data collection, measurement errors. Confounding. Heterogeneity.	Cochrane International Anesthesia Research Society	Level I	Shows that adverse events during transport can be prevented with double checks and

Systematic Review				improved double checks and usage of checklists.				usage of checklist
8. Intrahospital Transport of critical Ill patients : A survey of emergency nurses.	Hu et al. (2021)	Retrospective cohort Observational study May 2015	528 Nurses attendees at a emergency medicine conference	The absence of written transport protocols was perceived to be significantly associated with the occurrence of adverse events such as oxygen supply depletion and incorrect destination.	-Retrospective recall of events -Convenience sampling	CINAHL British Association of Critical Care Nurses	Level III	Shows that if there is a problem with lack of protocols for transport adverse events such as oxygen depletion can occur
9. Emergency oxygen therapy: from guideline to implementation	Kane et al.,2013	Literature review		Oxygen is the most commonly used drug in emergency medicine There are common misconceptions regarding the safe use of oxygen and many people are unaware of the dangers of hyperoxaemia	Generalizability	PubMed	Level II	oxygen is a treatment of hypoxemia and that oxygen should be prescribed to a target range. EDs should utilize guidelines that are objective, evidence based and peer

				Oxygen prescribing is po prescribed. Oxygen is a drug and hence should be prescribed, administered and monitored by trained staff In 2008, the first formal guidance on emergency oxygen use was produced by the British Thoracic Society.				reviewed advocating safe use of oxygen by encouraging target saturation levels to be prescribed for each patient, based on a combination of what is believed to be safe and normal or near-normal.
10. To Give or Not To Give – Is that the Question?: The Changing Face of Emergency Oxygen Therapy	Kelly & Lynes ., 2015	Literature review		Despite widely accepted guidelines poor practice persists. The reasons why this may be the case remains elusive, but conjecture implies an ingrained culture of 'more is better' and a belief that	Generalizability	PubMed	Level II	There is a need to raise awareness of the importance of maintaining normal oxygen levels and be aware of the detrimental effects of both over

				oxygen alleviates breathlessness. Titrating oxygen to achieve target saturation ranges has become increasingly apparent, with a number of randomized controlled trials indicating that failure to do so, instead over-oxygenating patients presenting with respiratory conditions, can lead to life threatening, if not fatal, respiratory acidosis.				and under oxygenation.
11. Adverse clinical events during Intrahospital transport by a specialized team: A preliminary report.	Kue et al. (2011)	Retrospective study of patient transport in a hospital from November 2007 - April 2008	3383 charts reviewed (91.8% of all completed transports)	The overall rate of adverse events was 1.7% (59 events). Most events were related to hypoxia (25/59) and blood pressure changes (25/59). One extubation and one code team	Generalizability	CINAHL National Library of Medicine	Level III	The rate of clinically significant adverse events during patient transport by specialized trained personnel is

				activation occurred. Most interventions involved adjustments to oxygen therapy (22/59) and vasopressor management (18/59).				relatively low. Adverse events during intrahospital transport have been reported as high as 70 %. that most of the adverse events that occur during transport were related to hypoxia and blood pressure changes .
12. Treatment algorithm reduces oxygen use in the Emergency Department	Sieber & Osterwalde, 2016	Single-centre cohort study with 4 weeks of observation before and after the introduction of an O2	Before the intervention included 2190 patients and the 4-week period after the intervention included 2122 patients	After the intervention, the proportion of patients with supplemental O2 therapy was reduced from 11% (246) to 9% (182) ($P < 0.003$), a relative decrease of 18%.	Generalizability	PubMed	Level III	The use of the algorithm statistically significantly reduced the proportion of patients requiring O2 therapy from 11 to 9%, a relative decrease of 18%,

		treatment algorithm.						without an increase in undesired effects
13. The use of medical orders in acute care oxygen therapy	Wong & Elliot.,2009	Literature review	No sample size	Nurses should have the authority to administer oxygen without a medical order. However, when nurses do this, they should not perceive it as a cure for the patient's clinical problem. The initiation of oxygen therapy or an increase in the oxygen the patient is currently receiving, should be complemented with clinical assessment.	Generalizability	PubMed	Level II	Clearly, defined protocols should exist to allow for the legal administration of oxygen by nurses without a physician's order because any delay in administering oxygen to patients can very well lead to their death.
14. Nurses' supplemental oxygen therapy	Zeleke & Kefale., 2021	Cross sectional study	All nurses (N=105) working in Debre	one-third of nurses had a good practice on supplemental	Generalizability	PubMed	Level III	Nurses who had good knowledge of

knowledge and practice in Debre Tabor General Hospital: A cross-sectional study.		November 1, 2019 to December 1, 2019. Structured questionnaires that measure nurses' knowl-edge and practice regarding supplemental oxygen therapy	Tabor General Hospital were included in the study	oxygen administration. Nurses who had good knowledge of supplemental oxygen administration were 12-times (AOR=12.25, 95% CI=6.48–32.93) more likely to have a good practice of supplemental oxygen administration than those who had poor knowledge of supplemental oxygen administration.				supplemental oxygen administration were 12-times more likely to have a good practice of supplemental oxygen administration than those who had poor knowledge of supplemental oxygen administration.

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Appendix D

Level of Evidence Synthesis Table

Article Number*	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Level I: Systematic review or meta-analysis							X							
Level II: Randomized controlled trial				X					X	X			X	
Level III: Controlled trial without randomization	X	X	X		X			X			X	X		X
Level IV: Case-control or cohort study						X								
Level V: Systematic review of qualitative or descriptive studies														
Level VI: Qualitative or descriptive study, CPG, Lit Review, QI or EBP project														
Level VII: Expert opinion														

*See Appendix C for references for each article number

Appendix E

Outcome Synthesis Table

Article Number*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Education program and protocol on O2 therapy for nurses	↓	↓				↓		↓					↓	↓
Equipment failure on oxygen safety adverse events				↑										
Hypoxia and BP changes on adverse events during patient intra-hospital transport											↑			
Reminder assisted briefings on inappropriate oxygen use														
Guideline Oxygen usage on inappropriate oxygen use	↓					↓			↓	↓		↓	↓	
Validation questionnaire , training programs on knowledge of oxygen therapy use.		↑	↑		↑									
oxygen therapy algorithm on inappropriate oxygen use	↓											↓		

SYMBOL KEY ↓ decrease, ↑ increase, ↓↑ both observed, NE not evaluated

*See Appendix C for references for each article number

Appendix F

Oxygen Algorithm

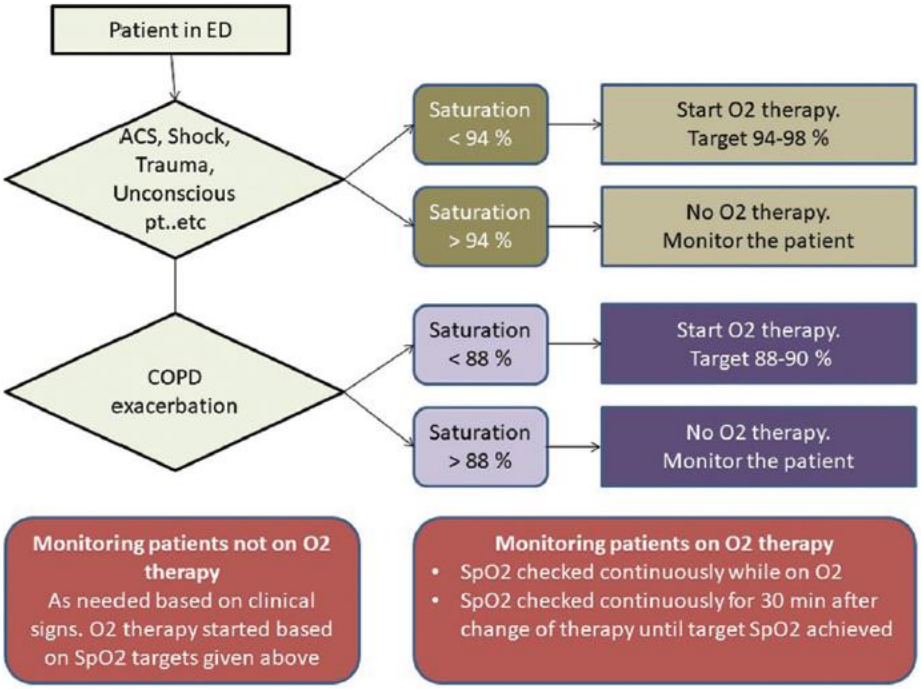


Figure 1: Oxygen therapy algorithm

Appendix G

Education Modules

Improving Oxygen Safety in the Emergency Department

Latania Wolfe BSN, RN
DNP student

1

Purpose of the education

- To provide in- person education to nurses and providers in the ED.
- Increase the number of oxygen orders set placed by nurses and providers for patients receiving oxygen therapy in the ED.

2

Why we need practice change ?

The reoccurring problem in the ED is an increase in patients using oxygen without orders. Oxygen is considered a medication, so oxygen orders are a requirement for all patients receiving oxygen. The ED nurse and providers have the capability of entering orders for oxygen therapy. This gap in placing orders poses patient safety and regulation issues

3

Example of Algorithm

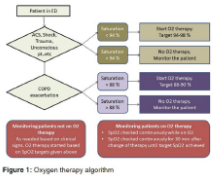
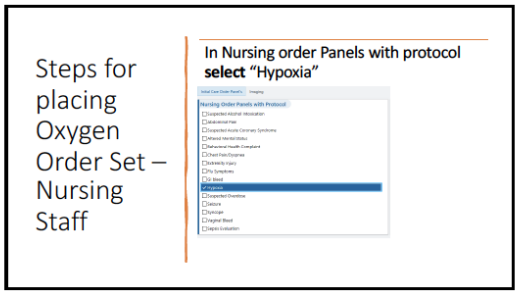


Figure 1: Oxygen therapy algorithm

4



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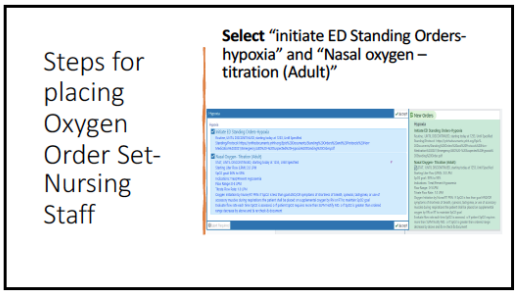

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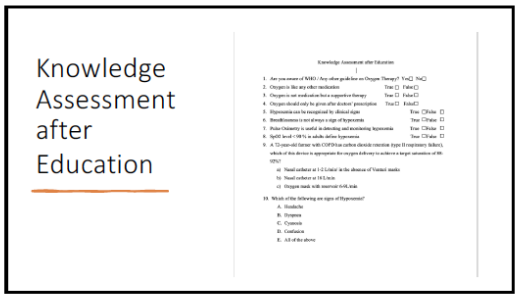

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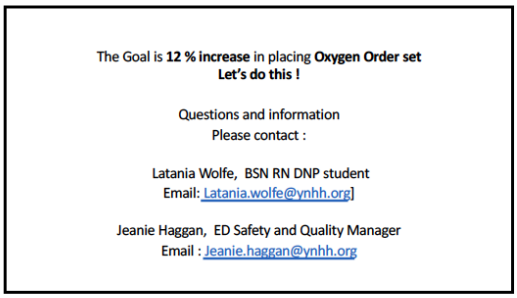


8

Script

- My name is Latania Wolfe and I am working on my DNP project in the ED. The project goal is to improve oxygen orders placed by ED staff for patients receiving oxygen therapy by 15% by April 2023.
- What do you think the current rate is for oxygen orders for patient using oxygen? *[First knowledge check]*.
- Where is this information kept? *[Second knowledge check]*

- Discuss oxygen safety dashboard. What data does the oxygen safety dashboard give? Do you have access to it? *[Third knowledge check]*
- Discuss need for placing an order when patient using oxygen. Do you think oxygen is a medication or supportive therapy? *[Fourth knowledge check]*.
- Do walk through with the nurse/s/provider/s of the process of placing oxygen order set in EHR. Return demonstration if needed *[Fifth knowledge check]*.
    - Share pocket card/handout screenshot with steps of placing oxygen order will be given to those who want it.
- Assess if barriers still exist. What do you think are the challenges/barriers for placing orders for patient using oxygen? Any suggestions for resolving these challenges?
- How and how often would you like me to share how nurses and providers are doing with entering oxygen orders for patients using oxygen? [Dissemination and reinforcement/reminders]
- Share DNP student contact information that they can use for questions or if they think of something.

Appendix H

Differentiating Quality Improvement and Research Activities Tool

Question	Yes	No
1. Is the project designed to bring about immediate improvement in patient care?	X	
2. Is the purpose of the project to bring new knowledge to daily practice?	X	
3. Is the project designed to sustain the improvement?	X	
4. Is the purpose to measure the effect of a process change on delivery of care?	X	
5. Are findings specific to this hospital?	X	
6. Are all patients who participate in the project expected to benefit?	X	
7. Is the intervention at least as safe as routine care?	X	
8. Will all participants receive at least usual care?	X	
9. Do you intend to gather just enough data to learn and complete the cycle?	X	
10. Do you intend to limit the time for data collection in order to accelerate the rate of improvement?	X	
11. Is the project intended to test a novel hypothesis or replicate one?		X
12. Does the project involve withholding any usual care?		X
13. Does the project involve testing interventions/practices that are not usual or standard of care?		X
14. Will any of the 18 identifiers according to the HIPAA Privacy Rule be included?		X

Adapted from Foster, J. (2013). Differentiating quality improvement and research activities. Clinical Nurse Specialist, 27(1), 10–3. https://doi.org/10.1097/NUR.0b013e3182776db5

Appendix I

DNP Project Roadmap Completion Dates

Component	Definition	Date Done
Phase 1: Problem Identification and Evidence Review		
Description of problem	Describe the local problem with link to national problem if applicable. Include why the problem needs an evidence-based solution.	09/2022
Question in searchable format	Write a focused, searchable practice question using an established method (e.g. PICO). Some projects may have >1 question.	09/2022
Methods for gathering external and internal evidence; and tools used for appraisal	External evidence • Summarize search strategy (e.g. key words, databases, filters/limits, criteria for article selection); include practice-based evidence (e.g. contact experts/other health systems that have evidence-based solution for problem) Internal evidence • Summarize applicable unit/community agency/departmental/hospital/organizational level data or data required for national entities (e.g. CMS, NDNQI, AHRQ) • Perform needs assessment if applicable	12/20222
Evidence appraisal, results, and recommendations	• Organize all evidence that answers clinical question in a clear concise format (e.g. table or matrix) • Summarize the strength and quality of evidence using an established method (e.g. Johns Hopkins Nursing Evidence Based Practice strength and quality rating system) • State recommendation(s) and link to strength and quality of evidence and risk/benefits.	12/2022
	Phase 2: Planning	
Project goals	State intended outcomes of project using established method (e.g. SMART criteria)	12/2022
Framework(s)	Select appropriate framework (e.g. EBP model, QI framework, or change theory) to guide project implementation	12/2022

	If applicable, select a theoretical framework to inform and guide the whole project. This may be identified and described in evidence review under external evidence.	
Context	Describe project setting and participants or population; or other elements that are central to where the change will happen	12/2022
Intervention/practice change	Provide a detailed description of intervention or practice change	12/2022
Measures and analysis	Summarize plan that includes: • Measurement tools • Data collection plan • Data analysis plan • Possible barriers to implementation and sustainability and plans for addressing both	12/2022
Key stakeholders, staff, and buy-in	Identify agencies, departments, individuals needed to complete the project, affected by project, and strategies for buy-in.	12/2022
Timeline	Create a realistic timeline for project completion	12/2022
Resources	Identify all resources (e.g. indirect and direct) needed to complete the project and calculate the return on investment	12/2022
Review for ethical considerations	Identify and obtain the required review and approval needed for implementation (e.g. institution, community agency, Institutional Review Board)	01/2023
	Phase 3: Implementation	
Project Implementation	• Carry out project using selected framework for implementation • Track any deviations from project plan and changes if applicable	03/2023
	Phase 4: Evaluation	
Results/Interpretation	Using an established method (e.g. run chart, control chart for data over time) display and interpret project outcomes.	05/2023
	Phase 5: Dissemination	
Dissemination	Share results locally, regionally, nationally, and internationally using following methods: Traditional • Executive summary for project setting • Electronic poster for DNP program and academic setting	05/2023

- Poster/Podium presentation for practice organization
- Final project write-up in manuscript for possible publication using appropriate reporting guidelines (e.g. SQUIRE, EPQA)

Non-traditional

- Website
- Social media that may be personal or DNP program Twitter, Facebook

PICO, Population, Intervention, Comparison, Outcome; CMS, Center for Medicaid and Medicare Services; NDNQI, National Dataset of Nursing Quality Indicators; AHRQ, Agency for Healthcare Research and Quality; SMART, specific, measurable, attainable, relevant, timely; SQUIRE, Standards for QUality Improvement Reporting Excellence; EPQA, Evidence-Based Practice Process Quality Assessment Guidelines; DNP, doctor of nursing practice.

Appendix J

CITI Training Completion Certificates

CITI PROGRAM

Completion Date 06-Jun-2022
Expiration Date 05-Jun-2025
Record ID 49005945

This is to certify that:

Latania Wolfe

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

Students conducting no more than minimal risk research
(Curriculum Group)
Students - Class projects
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Sacred Heart University, Inc.

CITI
Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 06-Jun-2022
Expiration Date 05-Jun-2026
Record ID 49005948

This is to certify that:

Latania Wolfe

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

Conflict of Interest mini-course
(Curriculum Group)
Conflict of Interest
(Course Learner Group)
1 - Stage 1
(Stage)

Under requirements set by:

Sacred Heart University, Inc.

CITI
Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 08-Jun-2022
Expiration Date 07-Jun-2025
Record ID 49005947

This is to certify that:

Latania Wolfe

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

Responsible Conduct of Research (RCR)
(Curriculum Group)
Responsible Conduct of Research (RCR)
(Course Learner Group)
1 - RCR
(Stage)

Under requirements set by:

Sacred Heart University, Inc.

CITI
Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 15-Aug-2022
Expiration Date N/A
Record ID 49005946

This is to certify that:

Latania Wolfe

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

CITI Health Information Privacy and Security (HIPS)
(Curriculum Group)
Information Privacy and Security (IPS)
(Course Learner Group)
1 - Basic Course
(Stage)

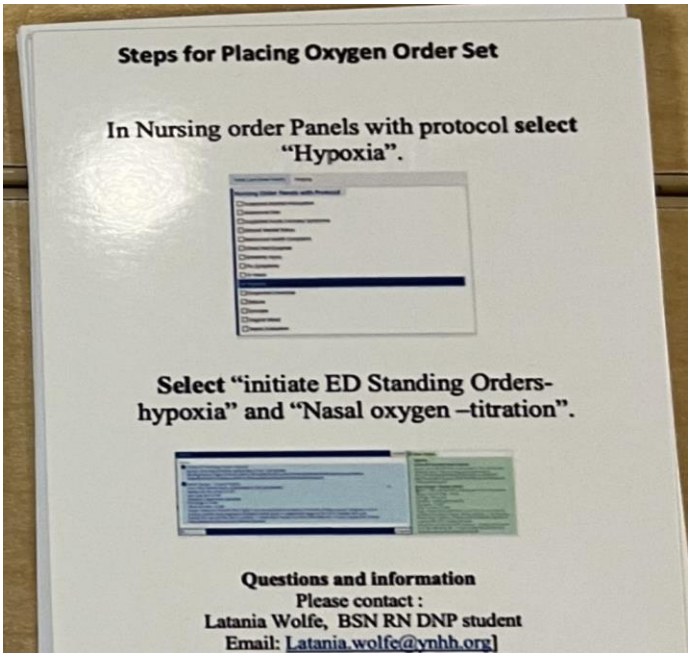
Under requirements set by:

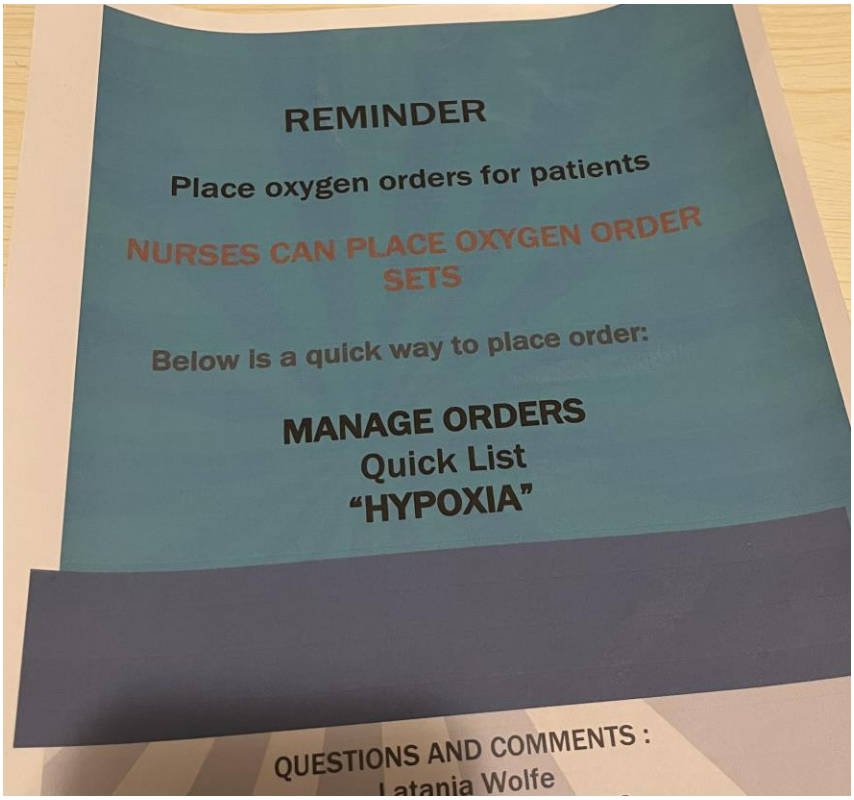
Sacred Heart University, Inc.

CITI
Collaborative Institutional Training Initiative

Appendix K

Pocket Card and Poster





Appendix L

Executive Summary

Oxygen is considered a medication, so oxygen orders are a requirement for all patients receiving oxygen. The ED nurses and providers have the capability of entering orders for oxygen therapy. A reoccurring problem in the ED was an increase in patients using oxygen without orders. Oxygen is considered a medication, so oxygen orders are a requirement for all patients receiving oxygen. This gap in placing orders poses patient safety and regulation issues. Hospital values providing optimal patient-centered care. Safety and quality improvement are fundamental parts of maintaining those values. The goal of this quality improvement project was to increase the rate of orders placed for patients using oxygen in the ED by 12% from March 1, 2023 to May 31, 2023.

The model of quality improvement was used to guide the project. Two (2) PDSA cycles were completed. ***PDSA #1*** a SWOT analysis was completed, and information used to inform education training that was developed with the ED safety manager. Training materials included posters, handouts, and pocket cards that had detailed instructions for placing oxygen orders. Staff (RN, MD, PA, APRN) were educated 1:1 during their shifts and reminders at the change of shift huddles. Ninety-five percent of staff were educated between March and May. Oxygen use and orders in were tracked using the ED oxygen safety dashboard. The baseline metric was 47.5% for February 2023 and after education rate was 48.8% March and 42.9%. **PDSA #2** Additional 1:1 education and reminders in May 2023. Nurse manager reminded staff at meetings to place orders and sent reminders via emails to staff. Rate of oxygen orders increased to 73% for May and 64.6% for June.

The total staff on the unit was approximately 150. The number of staff provided with 1:1 education from March to May 2023 is (n=143, 95%). The implementation of 1:1 education training in addition to multimodal reminders in the emergency department worked to increase oxygen orders placed. Recommendation for sustainability includes continued ongoing education and multimodal reminders for staff during shift.

Appendix M

IRB Exempt review

IRB#230111A - Exempt Status Request Inbox ×

Taber, Prof. Christopher B. <taberc@sacredheart.edu> Wed, Jan 11, 10:26 AM
to Latania, Feride, Madeline

Dear Applicant,
Thank you for your submission to the IRB requesting exempt review. Based on the application submitted, the IRB is pleased to approve your submission and we wish you great success in your research.

Sincerely,
Christopher Taber
Chair, IRB

Christopher B. Taber, PhD, CSCS*D, USAW3, EP-C, PES
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To learn more about the M.S. in Exercise and Sport Science program, click here.

To see where our M.S. alumni are working, click here.

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Appendix N

Nursing Scientific Review Committee Approval Letter

TO: Latania Wolfe
FROM: [redacted]
Nursing Scientific Review Sub-Committee Chair
(On behalf of [redacted] Nursing Research and Evidence-Based Practice Committee)

DATE: 1/25/2023

RE: **Improving Oxygen Safety in the Emergency Department**

Latania:

Thank you for submitting your Scholarly Project Application.

On behalf of the Nursing Scientific Review Sub-Committee [redacted] Nursing Research and Evidence-Based Practice Steering Committee, your scholarly project application has been reviewed and endorsed.

After committee review, the main purpose of the project was determined to improve the quality of care. Given the nature of the project, it is not seeking to generalize knowledge, generate new knowledge, or create a scientific inquiry. The project is not considered human subjects research. Your application will be entered into the [redacted] Office of Privacy and Corporate Compliance database. Your approval will expire in 12 months from the date of this letter.

Please remember to inform the Nursing Scientific Review Committee [redacted] when you conclude work on this project [redacted]. **With that notification**, please include an abstract of your completed project to this email address as well.

Please let me know if you have any questions.

CC:
File
Student Faculty Advisor Kerry Milner
[redacted]

Appendix O

Abstract Poster

DR. SUSAN L. DAVIS, R.N., & RICHARD J. HENLEY COLLEGE OF NURSING
Sacred Heart University

Oxygen Therapy Education to Improve Oxygen Safety in the Emergency Department : A Quality Improvement Project

Latania Wolfe, BSN, RN. Kerry Milner APRN ,FNP-BC,EBP-CH DNP.

BACKGROUND/EVIDENCE

- There is decrease in oxygen orders placed in the ED for patients utilizing oxygen.
- ED nurses and providers have capability of entering orders for oxygen therapy. Gap in placing oxygen orders for patients utilizing oxygen poses patient safety and regulation issues.
- 14 articles reviewed support education and training on oxygen therapy to increase the level of practice.

Change Case

PROJECT GOALS

1. To develop an education training with the ED quality and safety manager for ED staff nurses and providers on placing oxygen orders .
2. To provide 1:1 oxygen order education to 90% of ED staff.
3. To Increase the oxygen orders placed by ED staff for patients 12% by April 2023.

METHOD

Design: EBP-QI project

Setting/Population: Hospital Emergency Department.

PDSA Cycle

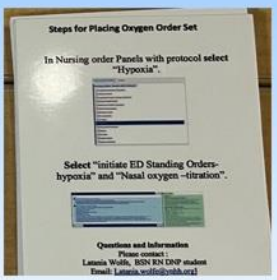
PLAN SWOT analysis. Develop education training. Create educational pocket cards and posters.

DO Educate Staff nurses and providers 1:1 during shift and reminders at shift change huddles. Track data using oxygen safety dashboard.

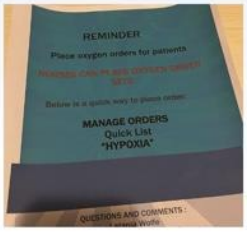
STUDY Review processes and outcomes

ACT Discuss sustainability . Determine if additional PDSA cycles are needed.

Pocket Card



Poster



RESULTS

PDSA #1 Completed SWOT analysis and used information to inform education training that was developed with the ED safety manager. Training materials included posters, handouts, and pocket cards that had detailed instructions for placing oxygen orders. Staff (RN, MD, PA, APRN) were educated 1:1 during their shifts and reminders at the change of shift huddles. Ninety-five percent of staff were educated between March and May. Oxygen use and orders in were tracked using the ED oxygen safety dashboard. The baseline metric was 47.5% for February 2023 and after education rate was 48.8% March and 42.9%. **PDSA #2** Additional 1:1 education and reminders in May 2023. Nurse manager reminded staff at meetings to place orders and sent reminders via emails to staff. Rate of oxygen orders increased to 73% for May and 64.6% for June.

CONCLUSIONS

Education and reminders worked to increase the oxygen orders placed. Ongoing reminders to staff were found to be needed to maintain the gains in oxygen orders. To sustain gains it is recommended that ED nurse educator and quality person continue to monitor the oxygen safety dashboard and give staff reminders.

NEXT STEPS

- Assign staff champs to continue ongoing education and reminders.