

# [Benefits of different oxygen levels administered in icu](https://assignbuster.com/benefits-of-different-oxygen-levels-administered-in-icu/)

ABSTRACT:

There have been numerous studies conducted to identify the benefits of different oxygen levels administered in ICU (Intensive Care Unit) patients. However, the studies do not reveal a definitive conclusion. The proposed systematic review plans to identify if either conventional or conservative oxygen therapy methods is more constructive in critically ill adult patients who are admitted in ICU.

BACKGROUND

Oxygen therapy is a treatment that provides oxygen gas to aid breathing when it is difficult to respire and became a common form of treatment by 1917. (Macintosh et. al 1999). It is expended for both acute and chronic cases and can be implemented according to the needs of the patient either in hospital, pre-hospital or entirely out of hospital based on their medical professionals opinions. It was established as the most efficient and safest medicines required by the health system by World Health Organisation (WHO). PaO2 has become the guideline test for finding out the oxygen levels in blood. And by the 1980s, pulse oximetry method which measures arterial oxygen saturation was also progressively used alongside PaO2 (David 2013). The chief benefits of oxygen therapy comprise slowing the progression of hypoxic pulmonary hypertension, emotional status, cognitive function and improvements in sleep (Zielinski 1998). In UK, according to the national audit data about 34% of ambulance journeys involve oxygen use at some point while 18% of hospital inpatients will be treated with oxygen at any time (Lo EH 2003). In spite of the benefits of this treatment, there have been instances where oxygen therapy can negatively impact a patient’s condition. The most commonly recommended amount of saturation for oxygen intake is about 94-98%, and saturation levels of about of 88-92% are preferred for those at risk of carbon dioxide retention (BMA 2015).

According to standard ICU practice, the conservative method denotes that patients receive oxygen therapy to maintain PaO2 between 70 and 100 mm Hg or arterial haemoglobin saturation between 94-98% while conventional method allow PaO2 values to rise up to 150 mm Hg or SpO2 values between 97% and 100% (Massimo et al. 2016). There are also low flow systems where the delivered oxygen is at 100% and has flow rates lower than the patients inspiratory flowrate ( i. e., the delivered oxygen is diluted with room air) and, hence the Fraction of Inspired Oxygen(FIO2) may be low or high. However, this depends on the particular device and the patient’s inspiratory flowrate.

AIM

To investigate and conclude whether the use of a strict protocol for conservative oxygen supplementation would help to improve outcomes, while maintaining PaO2 within physiologic limits among critically ill patients.

RESEARCH QUESTION

A well- defined, structured and exclusive research question will lead as a guide in making meticulous decisions about study design and population and consequently what data can be collected and used for analysis.(Brian, 2006)

The early process of research for finding the research questions is a challenging task as the scope of the problem is bound to be broad. Significant time and care is needed to polish, extract and compare the information required from the vast sea of information (Considine 2015) . If a proper and specific research question is not formed, the whole process will be useless (Fineout-Overholt 2005). The fundamental success of any research project is attributed in establishing a clear and answerable research project that is updated with a complete and systematic review of the literature, as outlined in this paper. A PICO framework is a universally used framework used to develop a robust and answerable research question which is also a useful framework for assuring the quality or for evaluating projects. PICO stands for Problem / Population, Intervention, Comparison, and Outcome.

The research question presented in this paper is to identify whether conventional or conservative oxygen therapy methods is more beneficial among critically ill adult patients admitted in Intensive Care Unit.

LITERATURE REVIEW

The literature has focused on the effect of conservative and conventional oxygen therapy methods on mortality among patients in an Intensive Care Unit.

Although there have been several studies to analyse which of the two methods is more beneficial to critically ill patients, a definitive study which determines the mortality rate among the different categories needs to be analysed and investigated for its benefit.

Different devices used to administer Oxygen:

1. Nasal cannula provides about 24-40% oxygen and flow rates up to 6L/min in adults (Fulmer JD 1984).
2. A basic oxygen mask delivers about 35-50% FIO2 and can have flow rates from 5-10L/min depending on the fit and requirement of flow rate.
3. The other respiratory aiding device is a partial rebreathing mask which has an additional reservoir bag with it which is also classified as a low flow system with flow rate of 6-10L/min and delivers about 40-60% oxygen.
4. The non-breathing system is similar to the partial rebreathing mask, where it has an additional series of one way valves and it delivers about 60-80% FIO2 with a flow rate 10L/min.

Review and findings of different oxygen therapy studies:

A systematic review of two different published Journals indicated that the usage of additional oxygen when managing acute myocardial infarction arrived at the same result: that there is no significant benefit when oxygen therapy is administered while being assessed with air breathing (Cabello 2010) and it may in fact be damaging which results in greater infarct size and higher mortality rate (Wijesinghe 2009). Although a number of smaller studies could clarify the reviews, none of the original studies could reach a statistically substantial result ( Atar 2010); this stresses the need to provide data that validates the requirement for further analysis. Studies to support this have already been started, where The AVOID (Air Versus Oxygen In Myocardial Infarction) study is presently hiring patients to resolve this critical medical question (Stub 2012). Actual clinical trial data suggesting the effects of varied inspired oxygen levels are even more inadequate in acute ischemic stroke. It is proposed that oxygen therapy may be beneficial if administered within the first few hours of commencement, however it has also been observed that with continued administration, it may induce harmful results (higher 1-yr mortality) (Ronning 1999).

In a survey of group study where more than 6, 000 patients were case studied following resuscitation from cardiac arrest , hyperoxemia ( defined as a PaO2 > 300 mm Hg (40 kPa), the results obtained were considerably worse than both normoxemia (60-300 mm Hg (8to 40kPa) and hypoxemia (PaO2 <60mmHg(8kPa) (Kilgannon 2010). The authors of these article concluded that excessive oxygen has harmful potential during adult resuscitation post cardiac arrest, possibly via ischemic reperfusion damage to central nervous tissue. The data surrounding the link between arterial oxygenation, morbidity and mortality in critically ill patients is extremely restricted. The intricacy and challenge involved in this study relies on the successful separation of signal from noise among the group of heterogeneous patients. An independent study found evidence of low SaO2 among acute medical emergency admissions can also be an independent predictor of mortality (Goodcare 2006), however, this is more complex in established critical illness with persistent hypoxemia. Also the extent to which a reduction in arterial oxygenation can be tolerated in the critically ill is difficult to determine and remains tentative (Gothgen 2007).

There is also no robust proof for the postulation that an increased PaO2 is interrelated with improved long-term survival in critically ill patients( Young JD2000). A reflective study where more than 36, 000 patients were considered and arterial oxygenation was administered while being mechanically ventilated, signs of a biphasic relationship was observed within a span of 24 hours between PaO2 and in-hospital mortality(De 2008). The average PaO2 level found was 99mm Hg, yet the foundation for unadjusted hospital mortality was just below 150mm Hg. A very similar study of more number of patients was conducted in Australia and New Zealand and this resulted in a report recording a mean PaO2 of 152. 5mm Hg, indicating supraphysiological levels of oxygenation, with 49. 8%of the 152, 680 group was categorised as hyperoxemic PaO2> 120mmHg(Eastwood , 2012). In contrast to the Dutch study, even though hypoxemia was associated with elevated mortality, after an adjustment of disease severity, a progressive association between progressive hyperoxemia and in-hospital mortality could not be linked together effectively. (Martin 2013).

The assumption that patients with hypoxemia secondary to ARDS (acute respiratory distress syndrome) respond positively to elevated arterial oxygenation reinforces many studies done in this field (McIntyre 2000). Nevertheless, data from clinical trials in patients with ARDS seem to disregard this assumption as frequent oxygenation and long-term outcome have a disconnection (Suchyta 1992). And the studies that report a correlation arterial oxygenation and mortality, a systemic review of 101 clinical studies in ARDS patients came to the conclusion that P/F ratio was not such a reliable predictor (Krafft 1996). Thus a more intense study was conducted to compare the supplementary oxygen therapy with no oxygen therapy in normoxic patients with ST Segment elevation myocardial infarction (STEMI). Oxygen therapy has been known to be only universally used for the initial treatment of patients with STEMI which is based on the belief that the additional oxygen may increase oxygen delivery to ischemic myocardium and hence reduce myocardial injury and is supported by laboratory studies done by Atar in 2010. The adverse effects of supplementary oxygen therapy were noted from a meta-analysis of 3 small, randomized trials as done by Cabello in the same year. More recently, another analysis was done by comparing high concentration oxygen with titrated oxygen in patients with suspected acute myocardial infarction which found no difference in myocardial infarct size on cardiac magnetic resonance imaging (Ranchord 2012). Hence, there are no studies that assess the effects of supplemental oxygen therapy in the setting of contemporary therapy for STEMI, specifically acute coronary intervention. With these reports and analysis put together, we can safely deduct that there remains a substantial amount of uncertainty over the usage of routine supplemental oxygen in uncomplicated Acute Myocardial Infarction, with absolutely no clear indication or recommendation for the level of oxygen therapy in normoxic patients in the STEMI guidelines. More recently, another analysis was done by comparing high concentration oxygen with titrated oxygen in patients with suspected acute myocardial infarction which found no difference in myocardial infarct size on cardiac magnetic resonance imaging (Ranchord 2012). The annual congress of European Society of ICU (2016) states that patients dying in the ICU was lowered by 9% while using conservative oxygen strategy as compared with the conventional one(JAMA 2016).

METHODOLOGY

Firstly the terms method and methodology needs to be differentiated. Method is a process used to collect and examine the data whereas methodology includes a philosophical inquiry of the research design as stated by Wainworth (1997). It is vital that the suitable methodology needs to be analysed in carrying out the research question and in assembling the data (Matthews 2010). Research Methodology is a way to find out the result of a given problem on a specific matter or problem that is also referred as research problem (Jennifer 2011). In Methodology, researcher uses different criteria for solving the given research problem and always tries to search the given question systematically in their own way to find out all the answers till conclusion. If the research does not work systematically on the problem, there would be less possibility to find out the final result. For finding or exploring research questions, a researcher faces lot of problems that can be effectively resolved while using a correct research methodology (Industrial Research Institute, 2010).

This research proposal was done under the systematic review method because it provides a very comprehensive and clear way of assessing the evidence (Chalmers 2001). Also it lowers error and bias and establishes a high standard of accuracy (Jadad, 1998). Healthcare providers, researchers, consumers and policy makers are overwhelmed with the data, evidence and information available from healthcare research. It is unlikely that the all this information is digested and used for future decisions. Hence a systematic review of such research will help to identify, assess and synthesize the information based on evidence needed to make those critical decisions. (Mulrow 1994). There are a number of factors for choosing systematic review for this study. A systematic review is generally done to resolve mismatched evidence, to verify the accuracy of current practice, to answer clinically unanswered questions, to find changes in practice or to focus for the need for any future research.

Systematicreviews[AD1]are increasingly being used as a preferred research method for the education of post graduate nursing students (Bettany- Saltikuv, 2012). One of the best resources available on the conduct of systematic reviews of interventions is the Cochrane Collaboration (Tonya 2012). As defined by the Cochrane Collaboration (Higgins & Green, 2011[AD2], Pg 6); ‘ A systematic review attempts to collate all empirical evidence that fits pre-specified eligibility criteria in order to answer a specific research question. It uses explicit, systematic methods that are selected with a view to minimizing bias, thus providing more reliable findings from which conclusions can be drawn and decisions made’.

The aim of a systematic review is to incorporate the existing knowledge into a particular subject or regarding a scientific question (British Journal of Nutrition (2012). According to Gough et al (2012) a systematic review is a research method that is undertaken to review several relevant research literatures. Systematic reviews can be considered as the gold standard for reviewing the extensive literature on a specific topic as it synthesises the findings of previous research investigating the same or similar questions (Boland et al 2008). Using systematic and rigorous methods systematic reviews are often referred to as original empirical research because they review primary data, which can be either qualitative or quantitative (Aveyard & Sharp 2011).

Over the past years, various standards have been evolved for portraying systematic reviews, staring from an early statement called the QUOROM guidelines to an updated widely accepted statement called the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al, 2009). While there are many differences in how each author approach a systematic review and there is no universal approach on one methodology for conducting review. However there are a set of fundamental set regarding the report of systematic reviews that authors are recommended to follow (Tonya 2012).

METHODS

SEARCH STRATEGIES:

The selection of relevant study is based on two concepts: sensitivity and specificity (Wilma 2016). The purpose of the literature search is to identify existing published research in the particular area of interest to assist the researcher to clarify and specify the research question, and to identify whether the research question has been answered. The search of the literature must be strategic and systematic, and informed by a documented strategy. Search strategies have two major considerations: search terms, and databases. Some of the most common and beneficial search strategies used in systematic reviews are using the database of Cochrane Central Register of Controlled Trials (CENTRAL), hand searching, Grey literature which contains unpublished studies, clinical trials and ongoing research on the trials. Contacting an expert and extracting information is another useful method. The internet provides access to a huge selection of published and unpublished database. Studies can also be found by referring the reference lists of the available published data.

The database that have been referenced in this paper have been searched, collected and for extraction from the vast base ofNorthumbria[AD3]University accessible Journals. Journals from Medline, Ovid, ELSEVIER, PubMED and Cochrane Central Register of Controlled Trials, Journal of the American Medical Association( JAMA), newspaper articles from CHEST, Intensive Care Medicine , CLOSE and ANZICS Clinical trial group, Resuscitation, Critical care journal, (all of the selected journals from the databases was validated as peer reviewed journals) were reviewed for this paper.

INCLUSION AND EXCLUSION CRITERIA

The inclusion of unpublished and grey literature is essential for minimizing the potential effect of publication bias (Cochrane Corner 2007). If systematic reviews are limited to published studies, they risk excluding vital evidence and yielding inaccurate results, which are likely to be biased as always positive results (Alderan 2002). The inclusion criteria should consider gender, age of participants, year(s) of publication and study type. For this review purpose, as conventional and conservative oxygen therapy studies are the primary research questions, patients aged 18 years or older and admitted to the Intensive Care Unit (ICU) with an expected length of stay of 72 hours or longer were considered for inclusion.

Exclusion criteria also need to be justified and detailed and papers may be excluded according to paper type (such as discussion papers or opinion pieces), language, participant characteristics, or year(s) of publication. For the exclusion criteria, patients under 18 years, pregnant patients, and those who were readmitted in ICU, patients with DNACPR (do not actively resuscitate) and neutropenia or immunosuppression and the patients on who more than one arterial blood gas analysis was performed in 24 hours.

STUDY SELECTION

For the purpose of this research proposal the literature selected are based on Randomized Clinical Trials ofconservative oxygen therapy methods and conventional (traditional)[AD4]oxygen therapy methods used in ICU and some systematic reviews of effective oxygen therapy in ICU, if they met the inclusion criteria. The controlled clinical trials provide the most appropriate method of testing effectiveness of treatments (Barton 2000). Observational studies on effect of hyperopia on post cardiac arrest are also reviewed.

These studies can help to determine whether conservative oxygen therapy can help increase mortality among critically ill patients.

PREPARATION FOR DATA EXTRACTION

Data will be[AD5]extracted from the studies and grouped according to outcome measure. The data extraction tools should be used to ensure relevant data’s is collected, minimise the risk of transcription errors, allow accuracy of data to be checked and serve as a record of the data collected.

The data collected for extraction should be validated against evidence. It is necessary to extract the necessary studies and data that will help in resolving the research question which involves analysing different studies and a preferred way of methodology that reduces errors and bias.

QUALITY ASSESSMENT

Cochrane risk of bias tool (Higgins2011) will be[AD6]used for the assessment of risk of bias in estimating the study outcome. For the better outcome of this review involved few randomized clinical trials, some observational studies and pilot RCT studies for comparison among various methods.

Quality assessment is given special importance because of the inclusion of RCT and non-RCT methodology (Eggers et al 2001). And only quality studies that satisfies the inclusion, exclusion and data requirements, validity and no bias and studies that are needed to answer the research question are carefully selected.

SYNTHESIS STUDIES

Synthesis helps to summarize and connect different sources to review the literature on a specific topic, give suggestions, and link the practice to the research (Cosette 2000). It is done by gathering and comparing evidence from a variety of sources when there is conflicting evidence or limited number of patients or large amounts of unclassified data. Systematic reviews of RCT’s(Randomized control Trial) encompass the most strong form of clinical evidence (Sheik 2002) and occupies the highest layer in the hierarchy of evidence-based research, at the same time qualitative case studies and expert opinions occupy the lowest layer (Evans 2003 and Frymark et al 2009).

RCT helps to understand the differences data among various studies (For Example, the studies considered here, conventional versus Conservative Oxygen therapy methods). RCT is the most applicable study used in assessing the results of an intervention, because it limits the effects of bias when performed correctly. (CRD’s Guide 2009). It also easier to understand and any observed effect is easily contained to the treatments being compared. (Stuart 2000). The favourable results of an RCT lies with the methodology domain followed in the trial and it reviews its practicality which helps healthcare professionals, clinicians, researchers, policymakers and guideline developers to apply and review the effectiveness of the trials and tests. For example, if a study overestimates the effects of an intervention, it concludes wrongfully that the intervention works; similarly if the study is underestimating the effects, it wrongfully reflects that there is no effect to that study. This is where RCT’s stands out, where minimum bias and evidence is the basis of such a study (According to Cochrane reviews). Hence this is why RCT’s form the gold standard of comparison studies while questioning effectiveness of different interventions while limiting bias. As an example, groups that are randomly assigned are different from groups that follow criteria in the sense that the investigator may not be aware of certain attributes that they might have missed. It will also be likely that the two groups will be the similar on significant characteristics using chance. It is possible to control the factors that are known but randomisation helps to control the factors that are not known, which drastically reduces bias. Therefore assigning participants in other study designs may not be as fair and each participant may vary in characteristics on main standards. (Cochrane Handbook for Systematic Reviews of Interventions 2017)

The observational studies or non-randomised studies can be argumentative as the choice of treatment for each person and the observed results may cause differences among patients being given the different types of treatments. (Stuart 2000).

ETHICAL CONSIDERATION

A systematic review is the scientific way of classifying the overabundant amount of information existing in research by systematically reviewing and accurately examining the studies concerning a particular topic. But in doing so, topic of ethics is hardly questioned. This will have some major downsides as some systematic reviews may have studies with ethical deficiencies, which in turn lead to the publication of an unethical research and such research is susceptible to bias. Systematic review does not automatically give the updated approval for an original study. Hence systematic reviews that are methodically and ethically assessed will have better ethical and methodological studies overall (Jean et al 2010). If an original study does not mention the ethical issues, it does not automatically mean that the studies in original papers avoided those ethical concerns and may indicate a lower risk (Tuech 2005). A primary rule for publishing articles is that redundant and overlapping data should be avoided or needs to be cross-referenced while making the purpose clear to the readers in an unavoidable case. (Elizabeth et al 2011). Plagiarism is clearly unacceptable and care should be taken care to not replicate other people’s research work and the original words and data needs to be acknowledged as a citation or quote. A responsible publisher should follow the COPE (Committee on Publication Ethics) flowchart that explains suspected plagiarism (Liz 2008). It is also important to give information on funding and competing interests. The Cochrane Collaboration (2011) has very strict rules about funding and it is important to give reasons why the author may or may not be neutral or impartial on the review prepared and it relates to financial support, while competing interests can be personal, academic or political (WAME Editorial Policy and Publication Ethics Committees 2009).

REFLECTION

The objective of systematic reviews is to translate the results to clinically useful and applicable information while meeting the highest methodological standards. They offer a very useful summary of the present scientific evidence on a particular domain which can be developed into guidelines on the basis of such evidence. However, it is imperative that practitioners understand the reviews and the quality of the methodology and evidence used (Franco 2012). This study proposes to find the systematic review approach of conservative and conventional oxygen therapy methods used among critically ill adult patients in ICU. Incidentally, a RCT study by Susan (2016) found that the strategy of conservatively controlling oxygen delivery to patients in ICU results in lower mortality than the conventional and more liberal approach whereby patients are often kept in a hyperoxemic state.