

Background:

Supplemental oxygen is a fundamental treatment for the prevention of life-threatening hypoxia in the pre-hospital environment. However, the use of pressurized oxygen cylinders entails a significant logistical burden, especially within a military setting, due to their size, weight and requirements for safe transport and storage. With technological advances in this field, the aim of this literature review was to determine the evidence base for alternative delivery devices for the provision of supplemental oxygen in pre-hospital care, particularly within austere and remote environments.

Thirty-nine research articles met the search criteria. Those studies that did not meet the study question were excluded as well as those relating to the use of home oxygen concentrators. Eleven articles were found that examined the use of alternative sources of supplemental oxygen in an “austere” clinical environment. These studies were subsequently analysed by two independent reviewers with relevant data collected separately using a pre-determined form.

The results highlighted that oxygen concentrators may offer a viable alternative supplemental oxygen supply in the austere environment. Two papers reported logistical savings compared to oxygen cylinder use, with one study demonstrating a four-fold reduction in costs while maintaining an oxygen supply that was “just as effective and reliable.” At present it was found that chemical oxygen generation would not meet user requirements, though further concept study in this area was continuing.

Overall, there is paucity of literature examining the use of oxygen concentrators to supply supplemental pre-hospital oxygen, with the majority of studies focusing on use in a remote operating theatre setting. Additionally, there is only a single study, which examined the use of sole battery supplied oxygen concentrators, something that would be an essential requirement in the pre-hospital environment.



Figure 1: Royal Navy Medics use cylinder delivered oxygen on a simulated casualty. Crown Copyright

Method:

A literature review was undertaken of PubMed, The Cochrane Library and military specific publications for English language studies between 2000 and 2018. Search terms used were combinations of “oxygen” AND “concentrators” OR “devices” OR “generators” AND “pre-hospital” OR “austere”. The primary outcome was reported use of an alternative supplemental oxygen delivery device in the pre-hospital environment. Secondary outcomes included the demographics of location used, functionality and oxygen rate and flows.

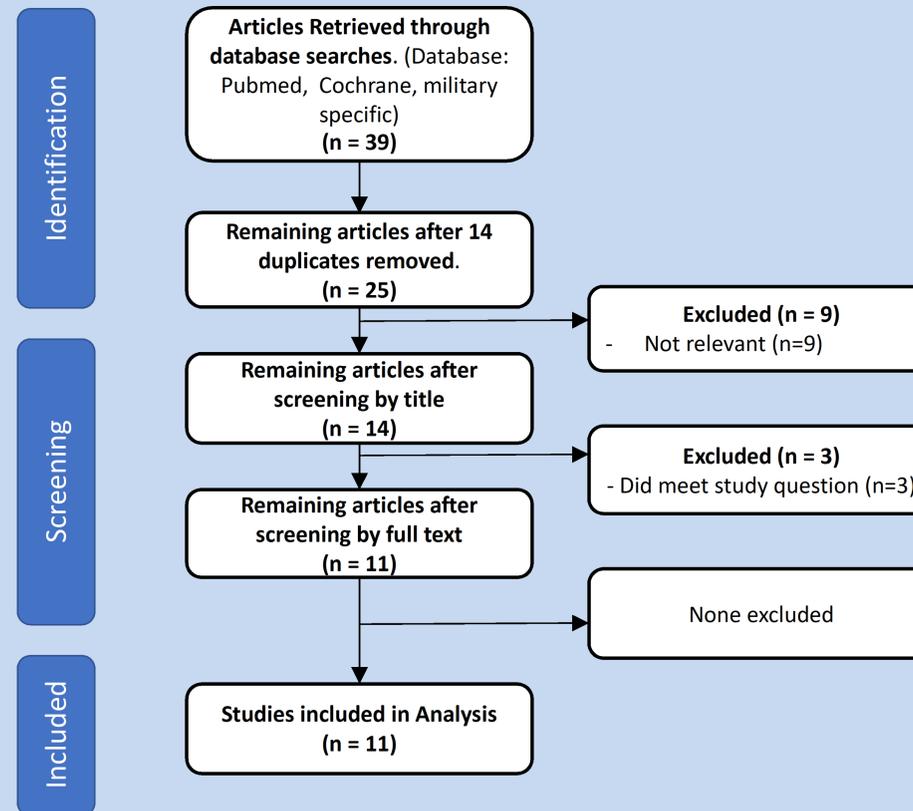


Figure 2: Prisma Flowchart of Study selection and exclusion

Results & discussion :

The articles examined looked at a wide range of alternative supplemental oxygen devices. Seven papers related to use in the austere military setting, two to use at high altitude and two papers assessed function in a high temperatures and high humidity environment. A single paper examined a new concept of alternative chemical oxygen generation; however, this had not yet progressed beyond laboratory experimentation.



Figure 3: SAROS 15, oxygen concentrator designed for military use. Image – Caire Inc.

Conclusion:

Though the consensus in the present literature is supportive of oxygen concentrator use and offers much promise, there are a number of key areas relating to performance and longevity that need to be addressed before replacement of pressurized oxygen cylinders can take place in the austere clinical environment.

Acknowledgements : Many thanks to Surgeon Captain Jason Smith and Surgeon Cdr Dan Henning for their kind assistance in this project.