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Review article

Barrier enclosure use during aerosol-generating medical procedures: A scoping review

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ABSTRACT

Introduction: Barrier enclosure devices were introduced to protect against infectious disease transmission during aerosol generating medical procedures (AGMP). Recent discussion in the medical community has led to new designs and adoption despite limited evidence. A scoping review was conducted to characterize devices being used and their performance.

Methods: We conducted a scoping review of formal databases (MEDLINE, Embase, Cochrane Database of Systematic Reviews, CENTRAL, Scopus), grey literature, and hand-searched relevant journals. Forward and reverse citation searching was completed on included articles. Article/full-text screening and data extraction was performed by two independent reviewers. Studies were categorized by publication type, device category, intended medical use, and outcomes (efficacy – ability to contain particles; efficiency – time to complete AGMP; and usability – user experience).

Results: Searches identified 6489 studies and 123 met criteria for inclusion (k = 0.81 title/abstract, k = 0.77 full-text). Most articles were published in 2020 (98%, n = 120) as letters/commentaries (58%, n = 71). Box systems represented 42% (n = 52) of systems described, while plastic sheet systems accounted for 54% (n = 66). The majority were used for airway management (67%, n = 83). Only half of articles described outcome measures (54%, n = 67); 82% (n = 55) reporting efficacy, 39% (n = 26) on usability, and 15% (n = 10) on efficiency. Efficacy of devices in containing aerosols was limited and frequently dependent on use of suction devices.

Conclusions: While use of various barrier enclosure devices has become widespread during this pandemic, objective data of efficacy, efficiency, and usability is limited. Further controlled studies are required before adoption into routine clinical practice.

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1. Introduction

During the COVID-19 pandemic, the threat of diminishing supplies of personal protective equipment sparked an interest in alternative means to protect healthcare providers. One such means included barrier enclosure devices, which are generally described as a plastic sheet over a structural frame or a transparent plastic four-sided box that are used as a potential method of protecting healthcare providers from SARS-CoV-2 during aerosol generating medical procedures (AGMP) (e.g. intubation or extubation). This device is typically placed in between a patient and airway operator during an AGMP as a means of physically limiting the transmission of aerosols and/or droplets to healthcare providers.

Currently there is limited evidence to support the use of barrier enclosure devices and important questions remain regarding their efficacy in reducing contamination, efficiency of use, and usability within various healthcare settings. In May 2020, the United States Food and Drug Administration issued a temporary emergency medical device license for the use of protective barrier enclosures [1]. While healthcare institutions continue to test, modify, and adopt these barriers into practice, we sought to collate and characterize the published literature on devices that are being used in various settings, as well as elucidate any performance outcomes (i.e., efficacy, efficiency, usability) associated with
each system. A scoping review was selected given the heterogeneity of the literature on this topic.

2. Methods

2.1. Identifying relevant studies

A protocol of our methodology was published a priori and followed PRISMA-ScR guidelines [2,3]. A search to identify barrier enclosure devices was executed by an academic information specialist in bibliographic databases including Ovid MEDLINE, Ovid Embase, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials and Scopus (2000-01-01 to 2020-06-24) for the main concepts of AGMPs and barrier enclosure devices (Appendix A) across all languages. The year 2000 was chosen to capture barrier devices potentially used during previous pandemics (e.g., SARS-CoV-1). We excluded non-human studies, conference and book materials. Additionally, a grey literature search of Google Scholar, clinical trials registries (ClinicalTrials.gov, WHO Clinical Trials), pre-print repositories (OSF, MedRxiv), disseminated reports (Canadian Agency for Drug Technologies in Canada, World Health Organization, National Health Service, Public Health Agency of Canada, Centers for Disease Control and Prevention) was performed. Relevant journals in emergency medicine (American Journal of Emergency Medicine, Annals of Emergency Medicine, Canadian Journal of Emergency Medicine, British Medical Journal – Emergency Medicine), anesthesiology (Anesthesia, Anesthesia & Analgesia, British Journal of Anesthesia, Canadian Journal of Anesthesia, Journal of Clinical Anesthesiology), and otolaryngology (Head & Neck and Ear, Nose & Throat Journal) were manually searched on 2020-07-03 reviewing articles published in March to July 2020 issues and those available as early release. Forward and reverse citation searching was completed on all included articles (2020-07-19). All citations were managed in Covidence (covidence.org) screening software.

2.2. Study selection

Two reviewers (CP, DT) independently evaluated the eligibility of studies on the basis of title and/or abstract using pre-established inclusion and exclusion criteria (Table 1). A sample of 100 articles were screened to ensure consistency among reviewers and fidelity of established criteria. Reviewers independently evaluated the eligibility of all articles; disagreements were resolved by re-evaluation, discussion, and when necessary, in consultation with a third reviewer. Full-text articles were retrieved if reviewers considered a citation potentially relevant, and when necessary, a second reviewer. Reviewer agreement for study eligibility was assessed using the unweighted Cohen’s kappa coefficient.

### Table 1

| Inclusion criteria | Exclusion criteria |
|--------------------|--------------------|
| 1) Descriptions, design, and/or protocol for barrier enclosure use in AGMPs* | 1) Conference abstracts, posters or proceedings, registered trials, online website material |
| 2) All article types (e.g. original research, reviews) | 2) Critique or opinion on prior published work, with no introduction of a new device |
| 3) Any publication status (e.g., pre-print, online) | 3) Non-infectious risk exposure (e.g., chemotherapy, radiation) |
| 4) Time frame: 2000–2020-06-24 | |
| 5) Studies in: humans, experimental, simulation | |
| 6) Any language | |

* Defined as any enclosure which surrounds the patient and aims to prevent droplet spread and aerosol dispersion into the environment during an intervention.

2.3. Charting the data

Data abstraction was completed independently by one reviewer (CP) using a standardized form (Appendix B) and verified by a second reviewer (DT, JC, MBV). We abstracted publication details (author, title, publication date, country of origin, publication status, publication type), setting, device design details, intended medical use, methods and outcomes. A list and definition of variables collected can be found in Appendix B.

2.4. Collating, summarizing, and reporting the results

Devices were categorized as either a box, plastic sheet (with frame), plastic sheet (without frame), or other system. Outcomes, both qualitative and quantitative, were categorized as either efficacy (i.e., related to the device’s ability to protect the intubator and contain particles), efficiency (i.e., time taken to perform an AGMP) or usability metrics (i.e., feedback on experience of the use of the system).

3. Results

A total of 6336 articles were identified through formal database search strategies, and 153 articles through grey literature and citation screening (Fig. 1). After duplicate removal, 4509 unique articles were screened, and 169 full-text articles were assessed for eligibility. We identified 123 articles for inclusion. Our kappa coefficient was good for title/abstract screening (kappa = 0.81) and full-text review (kappa = 0.77).

Most articles were published between March 2020 – July 2020 (n = 120), with three articles published prior to 2020 [4-6]. Over half of articles were published as letters/commentaries (58%, n = 71), 29% as original research studies (n = 36), and 13% (n = 16) as brief/short reports. Publications originated from 27 unique countries with the top 3 countries including the United States (34%, n = 42), India (10%, n = 12), and Canada (10%, n = 12).

3.1. Device design

Commonly reported barrier enclosure devices include box (42%, n = 52) and plastic sheet (54%, n = 66) systems. Over half (50%, n = 39/66) of plastic sheet systems utilized a supportive frame and 41% (n = 27/66) had no supportive structure (Fig. 2).

Box designs were often similar to the original design in Canelli et al. [7], which is a transparent 4-sided structure with two open faces: an inferior face bound by the stretcher and a caudal face pointed towards the foot of the bed. Common modifications included change in the number or size of ports (i.e., for operators and/or tools) [8-12], increased device size for improved operator ergonomics and/or patient body habitus [13-15], built-in gloves and/or port coverings [11,12,16,17], addition of a plastic drape or covering on the caudal face [18-20], a sloped top panel for improved visibility [15,18,21] and the use of a negative suction system [22-24].

Conversely, plastic sheet systems with frames were constructed using polyvinyl chloride tubing [25,26], operating room equipment (e.g., anesthetic screens) [24,27], and Mayo stands [28,29]. Six articles introduced a plastic canopy system, which is semicircular in shape enclosing the patient’s upper or full body [4,30-34]. Alternatively, plastic sheet systems without a frame were often akin to surgical draping, where a clear sheet drapes over the patient’s head, neck and/or entire body and the physician works beneath the drape or cuts an opening into the plastic sheet [5,35-37].

There were a number of other unique designs. Three articles introduced large, non-mobile plastic chamber units for COVID-19 testing [38,39] and outpatient ENT procedures [40] in which the patient entered the closed system and the procedure was performed through...
two ports. Seven articles described shield structures (e.g. 1 or 2-faced plastic stand or board). [21,41-46]

3.2. Intended medical use/medical context

The most commonly reported use was for airway management (67%, n = 83) (Table 2). Within these, 84% reported use for intubation or extubation (n = 70/83), 7% (n = 6/83) for tracheostomies [23,47-51], and 6% (n = 5/83) for non-invasive respiratory support (e.g. high-flow nasal cannula) [26,30,34,52,53]. Two studies (2%, n = 2/83) used a device in pediatric laryngoscopy and bronchoscopy [54,55]. Nine studies (7%) discussed these devices for general AGMPs [22,25,32,46,56-60] and 9 (7%) for endoscopic procedures. [10,11,43,45,61-64]

A small proportion of studies (11%, n = 14) used an enclosure during surgical procedures, mainly for otolaryngology procedures (57%, n = 8/14) (e.g. mastoidectomy, endo-nasal/endo-oral procedures) [40,65-71] as well as in other types of surgery (43%, n = 6/14) (e.g. craniotomy, oral maxillofacial, colorectal surgery) [5,6,72-75]. Other uses included dental procedures [41,76], dermatological procedures [29], and regional anesthesia [9,77] (4%, n = 5/123).

3.3. Evaluation

Over half of articles included an evaluation component (54%, n = 67), the majority of which only included qualitative outcomes (54%, n = 36/67). Among these, 70% (n = 47) of studies reported on the use of enclosures in simulation settings, 19% (n = 13) reported...
their use in real patients, and 10% (n = 7) reported on use in both environments. Efficacy was the most frequently reported outcome among articles (82%, n = 55/67) followed by usability (39%, n = 26/67) and efficiency (15%, n = 10/67).

### 3.3.1. Efficacy

The most common method to assess the device’s ability to contain particles or prevent contamination was through the visual assessment of droplets or smoke (71%, n = 39/55), primarily with box systems (51%, n = 20/39). Four studies used the ability to smell [78,79] or taste a bitter solution [60,80] as a proxy for aerosols escaping into the environment. Using these qualitative methods, studies concluded that the use of a barrier device was effective at either preventing or reducing the number of particles escaping the system.

Only 40% (n = 22/55) studies reported quantitative results. Three of these studies used pre-established grids to quantify exposure outside of the enclosure with fluorescent dye or gross droplets and reported success in reducing contamination [13,49,81]. Two studies reported no SARS-CoV-2 infection rates of physicians after using the system [59,82], while another four studies detected the presence of molecules contained within the enclosure and/or a decrease in particles outside the enclosure as a proxy for its effectiveness [5,6,34,74].

The majority of barriers (77%, n = 17/22) with objective findings used suction to generate negative pressure and reported particle counts or aerosol clearance rates (59%, n = 13/22) (Table 3). In contrast to the visual contamination studies showing effectiveness, evidence from quantitative data was often less favourable and contingent on the use of suction devices. For example, Simpson et al. [24] evaluated the efficacy of four different designs – a box, sealed box (caudal end closed), and two plastic sheet barrier systems and found that only when suction was applied, particle counts decreased. Similar results were seen in Lyaker et al. with increased particle detection outside the chamber without the use of suction [83].

### 3.3.2. Usability

Usability was assessed primarily by self-reported qualitative feedback from physicians using these devices (81%, n = 21/26). Generally, authors reported success carrying out procedures using the device with no major issues, [33,44,54,61,75,77,84] however four studies using the box system reported additional work (23%, n = 6/26, 4, 12, 88) and challenges while performing intubation. [12,86,87].

Six articles included a quantitative assessment of usability for intubation (23%, n = 6/26, 4, 12, 88–91), mainly in the box (83%, n = 5/6) [12,88–91] and one in a plastic sheet system (canopy) (17%, n = 1/6) [4]. Seger et al. reported a limited increase in time required for device maneuverability: removal and disposal within 10 s, and completion of a position change within the enclosure in less than 2 s. [91] However, Clariot et al. [88], Begley et al. [12], and Hamal et al. [89] reported worsening laryngoscopic views when using a box system. Similarly, Serdinek et al. [90] and Plazikowski et al. [4] both reported more difficulty with airflow management when using box and plastic canopy systems.

### 3.3.3. Efficiency

The most frequent efficiency metric reported was time to intubation or related metrics to securing an airway (e.g., first-pass success) (70%, n = 7/10, 4, 12, 88–92) primarily in the box system (86%, n = 6/7) [12,88–92]. Those assessing intubation times (40%, n = 4/10) noted

| Table 2 | Summary of barrier devices by category, intended use, and purpose of publication |
|---------|--------------------------------------------------------------------------------|
| **Device category** | **Intended medical use** | **Total** | **Objective** | **Evaluation** |
| **Airway Management** | **Intubation/Extubation (38)** | 40 | 33 (83%) | 23 (58%) |
| **Tracheostomy (1)** | 1 |
| **Bronchoscopy & Laryngoscopy (1)** | 1 |
| **Endoscopic** | **Endoscopy (5)** | 5 | 5 (100%) | 3 (60%) |
| **Surgical** | **Craniotherapy (1)** | 1 | 1 (100%) | 1 (100%) |
| **AGMPs (General)** | **AGMPs (General) (3)** | 3 | 3 (100%) | 2 (67%) |
| **Other** | **Dental (1)** | 4 | 3 (75%) | 1 (25%) |
| **Plastic Sheet (Frame, No Frame, Canopy)** | **Description:** Clear plastic sheet draped over a rigid frame or sheet placed directly on the patient during a procedure. | **Description:** 4-sided transparent plastic box. Typically includes 2 ports for the provider and/or assistant. | **Endoscopic** | **Endoscopy (2)** | 2 | 2 (100%) | – |
| **Surgical** | **ENT Procedures (7)** | 12 | 10 (83%) | 8 (67%) |
| **AGMPs (General)** | **AGMPs (General) (5)** | 5 | 5 (100%) | 5 (100%) |
| **Other** | **Outpatient ENT (1)** | 7 | 7 (100%) | 1 (14%) |
| **Sampling (5)** | | | | |
| **Dental (1)** | | | | |
| **Total** | **Intubation / Extubation (36)** | 47 | 43 (91%) | 23 (49%) |
| **Airway Management** | **Respiratory Support (5)** | 65 | 60 (91%) | 36 (55%) |
| **Tracheostomy (5)** | 5 |
| **Bronchoscopy & Laryngoscopy (1)** | 1 |
| **Endoscopic** | **Endoscopy (2)** | 2 | 2 (100%) | 2 (100%) |
| **Surgical** | **Other Surgery (5)** | 12 | 10 (83%) | 8 (67%) |
| **AGMPs (General)** | **AGMPs (General) (5)** | 5 | 5 (100%) | 5 (100%) |
| **Other** | **Outpatient ENT (1)** | 7 | 7 (100%) | 1 (14%) |
| **Sampling (5)** | | | | |
| **Dental (1)** | | | | |
| **Total** | 13 | 13 (100%) | 6 (46%) |

* Note: 8 articles discuss the use of multiple device types. 6 were discussing a box & plastic sheet system, 1 box & other, and 1 other & plastic sheet. These articles have been counted in their respective groups in category counts and only once in the summary total count.

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increased time to intubation using the box system. [12,88-90] In Clariot et al., median tracheal intubation was longer (53 s vs. 48 s, p < 0.01) compared to no system. [88] Similarly, in Begley et al., comparison of two box systems to no barrier system increased time to intubation by 48 s and 28 s seconds, respectively [12]. First-pass success when using barrier systems was variable. While Plazikowski et al. [4] and Begley et al. [12] reported lower first-pass success when using plastic canopy and box systems, others noted no intubation failures or challenges with box systems. [88,90-92]

3.3.4. Box vs. sheet system comparisons

Five articles compared the box and plastic sheet systems [13,20,21,24,87]. In Brown et al. [87], Ibrahim et al. [20], and Gore et al. [21], particles escaped through the open caudal end of box systems with increased contamination of the operator and/or environment relative to the plastic systems during airway management. Laosuwan et al. also assessed droplet contamination on a standardized grid in an extubation simulation and similarly reported increased contamination with box systems relative to plastic sheet systems [13]. Simpson et al. found that there was no significant difference in particle exposure outside the enclosure when comparing plastic sheet systems to no system during intubation, whereas the use of the box system concentrated particles without limiting dispersion [24]. Only one study compared usability between a box and plastic sheet system and reported that physicians favoured the plastic sheet system due to ease of mobility and the ability to accommodate an airway assistant [87].

4. Discussion

Barrier enclosures are described as innovative systems which protect healthcare workers from infectious disease transmission. We identified 123 articles from 27 countries, the majority of which were published following the original aerosol box design released in April 2020 [7]. Across these studies, three general device types were identified: box, plastic sheet with frame, and plastic sheet without frame systems for use in airway management (intubation, extubation, tracheostomies or respiratory support) or general aerosolizing medical procedures.

To date, there is a lack of strong evidence to support the use of barrier systems in clinical settings. Our review demonstrated a reliance on short letters/commentaries to validate various devices’ medical use and safety and limited rigorous trials. Currently, evidence to support the reduction of aerosol and droplet contamination is based primarily on visual assessments of aerosol and droplet spread. While these results are generally positive, emerging quantitative studies have reported less favourable results that frequently depend on concurrent use of a suction device [24,83]. Often discussed as a low-cost, pragmatic means of protecting physicians, use of the box systems in some instances demonstrated a delay in time to intubation [12,88]
and worsening laryngoscopic views [12,88,89], which has important clinical implications in physiologically difficult intubations. In fact, while simplistic, plastic sheet systems appear to outperform box systems in efficacy and usability characteristics, with less environmental contamination [13,24] and better ergonomics [87].

These variable characteristics are important to consider in light of the evolving SARS-CoV-2 pandemic. In May 2020, the United States FDA granted emergency approval for barrier enclosure device manufacturing, distribution and use during AGMs without guidance on the design or intended medical uses for these devices [1]. Subsequently, a plethora of various devices were heavily promoted through social media, press and in many medical journals translating to a large uptake of these systems [93] despite limited scientific evidence on efficacy, efficiency and usability. Recognizing this risk, the FDA has since revoked its emergency license for barrier enclosures devices in August 2020 [1], and now recommends the use of enclosures with suction devices in keeping with emerging objective evidence. [12,24]

The pandemic has highlighted the delicate balance of thorough evaluation with the need for immediate solutions. Commercial medical devices undergo rigorous testing in order to prove efficacy and safety for the patient and physician and requires strict reporting of adverse events through a centralized system to make decisions regarding continued use [94]. This is an opportunity for regulatory bodies to reexamine how emergency approvals are granted, and to set up infrastructure to encourage local innovation while providing a platform to register and monitor its effects, similar to how trials are registered.

In light of the established characteristics and performance outcomes, researchers and innovators looking to further develop and optimize barrier enclosures should focus on quantitative assessments of efficacy, efficiency, and usability in real clinical environments. Other opportunities for further exploration include focusing on patient-centered outcomes, such as frequency of desaturations and peri-intubation cardia arrest, as well as the economics associated with implementation, widespread adoption, and maintenance (e.g., sterilization) of these devices.

5. Limitations

Our review focused on the published literature related to the use of barrier enclosure devices and did not include designs that were published on websites, social media or design sites. While devices published in non-academic mediums may have been missed in our scoping review, we believe this further highlights the need for a central platform to catalog and regulate the use of barrier enclosures. We also performed the last formal search on 2020-06-24 and were unable to obtain the full text of one study. As a rapidly growing field of research, other studies published since that time were not included in this review. However, forward and reverse citation screening on included articles was completed.

Many of these enclosure systems were devised in the early stages of the pandemic when things were rapidly evolving with many unknowns. As a consequence of that, the studies largely included qualitative and simulation-derived data on process measures. It will be important to perform quantitative studies analyzing real-world outcome (e.g. infectivity rates) in order to make any conclusions on the efficacy of these devices.

6. Conclusions

The use of barrier systems in clinical care was introduced to protect physicians during AGMs. However, the efficacy of barrier enclosures in protecting physicians is limited. Overall, clinical use of these devices in the absence of thorough medical device testing is concerning and contrary to regulatory legislation intended to safeguard patient and physician safety.

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Declaration of Competing Interest

None.

Appendix A: Sample Database Search Strategy

Ovid MEDLINE(R) ALL <1946 to June 24, 2020>.

| # | Searches | Results | Type |
|---|---|---|---|
| 1 | Autopsy/ | 41,987 | Advanced |
| 2 | Bronchoscopy/ | 25,070 | Advanced |
| 3 | exp "Nebulizers and Vaporizers"/ | 11,291 | Advanced |
| 4 | exp Aerosols/ | 31,294 | Advanced |
| 5 | exp Airway Management/ | 114,940 | Advanced |
| 6 | exp Cardiopulmonary Resuscitation/ | 17,925 | Advanced |
| 7 | exp Oxygen Inhalation Therapy/ | 25,828 | Advanced |
| 8 | exp Respiratory Function Tests/ | 233,679 | Advanced |
| 9 | exp Respiratory Therapy/ | 114,316 | Advanced |
| 10 | exp Ventilators, Mechanical/ | 9044 | Advanced |
| 11 | Laryngoscopy/ | 12,643 | Advanced |
| 12 | Suction/ | 12,404 | Advanced |
| 13 | Thoracostomy/ | 1453 | Advanced |
| 14 | Aerosol*.mp. | 55,689 | Advanced |
| 15 | AGMP?.mp. | 24 | Advanced |
| 16 | (Airway adj2 control*).mp. | 1736 | Advanced |
| 17 | (Airway adj2 manage*).mp. | 9341 | Advanced |
| 18 | (Airway adj2 manipulat*).mp. | 231 | Advanced |
| 19 | (Airway adj2 surger*).mp. | 754 | Advanced |
| 20 | (artificial adj2 respirat*).mp. | 49,345 | Advanced |
| 21 | Aspirat*.mp. | 114,006 | Advanced |
| 22 | Atomizer*.mp. | 749 | Advanced |
| 23 | (Autopsy adj3 lung?).mp. | 819 | Advanced |
| 24 | BiPAP.mp. | 670 | Advanced |
| 25 | Bronchoscopy*.mp. | 39,004 | Advanced |
| 26 | (cardiac adj2 life support*).mp. | 1980 | Advanced |
| 27 | code blue.mp. | 8377 | Advanced |
| 28 | Cpr.mp. | 12,426 | Advanced |
| 29 | (Dental adj3 procedure*).mp. | 4780 | Advanced |
| 30 | Estubat*.mp. | 13,693 | Advanced |
| 31 | HFOV.mp. | 737 | Advanced |
| 32 | (high flow adj2 oxygen*).mp. | 710 | Advanced |
| 33 | (High frequency adj2 oscillat*).mp. | 3833 | Advanced |
| 34 | (High speed adj2 drill*).mp. | 167 | Advanced |
| 35 | (Inhalation adj2 device*).mp. | 388 | Advanced |
| 36 | (Inhalation adj2 device*).mp. | 605 | Advanced |
| 37 | (Inhalation adj2 therap*).mp. | 16,350 | Advanced |
| 38 | Inhalator*.mp. | 692 | Advanced |
| 39 | (insert* adj2 chest tube*).mp. | 869 | Advanced |
| 40 | Intubat*.mp. | 84,407 | Advanced |
| 41 | lppb.mp. | 296 | Advanced |
| 42 | lppv.mp. | 731 | Advanced |
| 43 | Laryngoscopy*.mp. | 22,075 | Advanced |
| 44 | (Lung adj2 function test*).mp. | 3992 | Advanced |
| 45 | (Nasal cannula adj2 therap*).mp. | 316 | Advanced |
| 46 | Nasopharyngoscopy*.mp. | 488 | Advanced |
| 47 | Ncpap.mp. | 1086 | Advanced |
| 48 | Nebulizer*.mp. | 11,985 | Advanced |
| 49 | (oral adj2 surger*).mp. | 12,381 | Advanced |
| 50 | (Pharyngeal adj2 surger*).mp. | 379 | Advanced |
| 51 | (physiotherapy* adj3 chest).mp. | 871 | Advanced |
| 52 | (Positive adj2 Airway Pressure*).mp. | 13,879 | Advanced |
| 53 | (Positive end adj2 inspiratory pressure*).mp. | 5925 | Advanced |
| 54 | (positive adj2 pressure breath*).mp. | 1341 | Advanced |
| 55 | (positive adj2 pressure respirat*).mp. | 17,429 | Advanced |
| 56 | (Pulmonary adj2 function test*).mp. | 12,273 | Advanced |
| 57 | respirator*.mp. | 570,255 | Advanced |
Appendix B: Data abstraction form with variable definitions

| Data field | Definition |
|------------|------------|
| Publication details | Full article title. |
| Study Date | Date of first publication. If online, indicated the date the article was first available. |
| Primary Author | First author listed. |
| Publication Status | Status at the time of data abstraction. |
| Publication Type / Country | Options: Letter to The Editor, Original Research, Commentary, Brief Report, Opinion/Editorial, Other. |
| Setting | Country where the study took place, or where the study was published from (corresponding author's location). |
| Study Category | Options: ED/Critical Care, Surgical/Draping, GI/ENT, Procedures, Non-Emergent Airway Management (e.g. general OR procedures), Other. |
| Device Description | Design details of all the device (e.g. # of drapes, different size / shapes, coverage provided) and any unique features included. |
| Device Category | Options: - Plastic Box – similar in design to the 4-sided aerosol box design - Plastic Sheet – Rigid Frame |

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