

Classification of Aerosol-Generating Procedures: A Rapid Systematic Review

Online Appendices

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Appendix 1

PRISMA Checklist

#	Topic	Checklist item	Section
1	Title	Identify the report as a systematic review, meta-analysis, or both.	Title
2	Structured summary	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Abstract
3	Rationale	Describe the rationale for the review in the context of what is already known.	Introduction
4	Objectives	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Introduction
5	Protocol and registration	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Methods
6	Eligibility criteria	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Methods
7	Information sources	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Methods
8	Search	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendices
9	Study selection	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Methods
10	Data collection process	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Methods
11	Data items	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Methods
12	Risk of bias in individual studies	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	N/A
13	Summary measures	State the principal summary measures (e.g., risk ratio, difference in means).	Results
14	Synthesis of results	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Results

#	Topic	Checklist item	Section
15	Risk of bias across studies	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
16	Additional analyses	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
17	Study selection	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Results
18	Study characteristics	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	N/A
19	Risk of bias within studies	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	N/A
20	Results of individual studies	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
21	Synthesis of results	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Appendices
22	Risk of bias across studies	Present results of any assessment of risk of bias across studies (see Item 15).	N/A
23	Additional analysis	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
24	Summary of evidence	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Discussion
25	Limitations	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Discussion
26	Conclusions	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Discussion
27	Funding	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Funding

Appendix 2

English Search Strategies

1. Medline: using the search term "aerosol generating procedures.mp" (as keyword)
2. Google, using the following search term combinations:
 - a. "aerosol generating procedure" AND guidelines
 - b. Physiotherapy:
 - i. HSE AND "aerosol generating procedures"
 - ii. "Physiotherapist ISCP aerosol generating procedures"
 - iii. "CSP aerosol generating procedures Chartered Society of Physiotherapists"
 - c. Canadian provinces/territories (other than Quebec, which was included in the French search):
 - i. British Columbia AND "health authority" AND "aerosol generating procedure"
 - ii. Alberta AND "health authority" AND "aerosol generating procedure"
 - iii. Saskatchewan AND "health authority" AND "aerosol generating procedure"
 - iv. Manitoba AND "health authority" AND "aerosol generating procedure"
 - v. Ontario AND "health authority" AND "aerosol generating procedure"
 - vi. New Brunswick AND "health authority" AND "aerosol generating procedure"
 - vii. Nova Scotia AND "health authority" AND "aerosol generating procedure"
 - viii. Prince Edward Island AND "health authority" AND "aerosol generating procedure"
 - ix. Newfoundland AND "health authority" AND "aerosol generating procedure"
 - x. Northwest Territories AND "health authority" AND "aerosol generating procedure"
 - xi. Nunavut AND "health authority" AND "aerosol generating procedure"
 - xii. Yukon AND "health authority" AND "aerosol generating procedure"
 - d. Site-specific searches:
 - i. "Aerosol generating procedures" AND site:nhs.uk, site:gov.uk, site:org.uk,site:gov.au, site:govt.nz

French Search Strategies

1. Google, using the following search term combinations:
 - a. "procedures generant des aerosols", "interventions medicales pouvant generer des aerosols"
 - i. AND France
 - ii. AND Belgique
 - iii. AND Suisse
 - iv. AND Luxembourg
 - v. AND Quebec
 - b. (intervention OR procedure) generant "aerosols"
 - i. AND France
 - ii. AND Belgique
 - iii. AND Suisse
 - iv. AND Luxembourg
 - v. AND Quebec
 - vi. AND Cameroun
 - vii. AND Cote d'Ivoire
 - viii. AND Algerie

2. Site searches:
 - a. Haute Autorite de Sante: <https://www.has-sante.fr>
 - b. Agence Nationale de Securite Sanitaire, de l'alimentation, de l'environnement et du travail: <https://www.anses.fr/fr>
 - c. Sante Publique France : <https://www.santepubliquefrance.fr>
 - d. Societe Francaise de Medecine du Travail : <http://www.chu-rouen.fr/sfmt/pages/accueil.php>
 - e. Societe Francaise de Medecine d'Urgence : <https://www.sfm.u.org>
 - f. Societe de Reanimation de Langue Francaise : <https://www.srlf.org>
 - g. Societe de Pneumologie de Langue Francaise : <http://splf.fr>
 - h. Societe Francaise d'Hygiene Hospitaliere : <https://www.sf2h.net>
 - i. Societe Francaise de Sante Publique : <https://www.sfsp.fr>
 - j. Haut Conseil de la Sante Publique : <https://www.hcsp.fr/explore.cgi/Accueil>

Appendix 3

Included Documents

1. Agence canadienne des médicaments et des technologies de la santé. Risque de transmission d'une infection respiratoire aigüe au cours de l'intervention produisant des aérosols : étude méthodique. *Apen;us Technol l'ACMTS* 2013; 3: 4.
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Appendix 4

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Appendix 5

Aerosol-Generating Procedure Definitions

Aerosol-Generating Procedure Definition	Reference # in Appendix 3
"Medical intervention susceptible to generate aerosols because of an artificial manipulation of the patient's airways." ("interventions medicales pouvant generer des aerosols en raison d'une manipulation artificielle des voies respiratoires d'une personne.") p. 6	2
"Any procedure carried out on a patient that can induce the production of aerosols as a result of manipulation of a person's airway." p. 1	10
"AGMPs that generate small droplet nuclei in high concentration present a risk for airborne transmission of pathogens not otherwise able to spread by the airborne route (e.g. coronavirus, influenza)." p. 3	16
"Aerosol generating procedures (AGP) are defined as 'any medical and patient care procedure that results in the production of airborne particles (aerosols).'" p. 3	17
"Procedures that stimulate coughing and promote the generation of aerosols..." p. 15	18
"Certain medical procedures used in the treatment of acute respiratory infection may increase the risk of aerosol generation from a patient above that of natural processes (coughing etc). By inputting energy into the respiratory tract or inducing coughing or sneezing, these procedures could artificially generate aerosolised respiratory secretions." p. 123	25
"Certain medical and patient care activities that can result in the release of airborne particles (aerosols). AGPs can create a risk of airborne transmission of infections that are usually only spread by droplet transmission." p. 43	26
"Aerosol-generating medical procedures (AGMPs) are medical procedures that can generate aerosols as a result of artificial manipulation of a person's airway." p. 10	27
"AGMPs are medical procedures that can generate aerosols as a result of artificial manipulation of a person's airway." p. 1	32
"Aerosol-generating medical procedures (AGMPs) are medical procedures that can generate aerosols as a result of artificial manipulation of a person's airway."	36
"Procedures likely to increase cough..." (translated) p. 34	39
"In addition, certain healthcare activities and procedures termed 'aerosol generating procedures' (AGPs) can generate aerosols, and create the potential for airborne transmission of infections that may otherwise only be transmissible by the droplet route." p. 7	43
"... 'aerosol generating procedures' (AGPs) can generate aerosols, and create the potential for airborne transmission of infections that may otherwise only be transmissible by the droplet route." p. 7	44
"Aerosol-generating procedures (AGP) are procedures that stimulate coughing and promote the generation of aerosols." p. 1	45
"When performing certain medical procedures on patients infected with respiratory viruses, including SARS-CoV-2, smaller droplets can be formed which are light enough to travel on air... Some procedures have been associated in studies with increased risk transmission of respiratory virus although it is not clear if this is because of airborne transmission or because there are aspects associated with the procedure that expose the operator to a high risk of infection by contact or droplets." p. 2	47
"In the context of infectious disease transmission, many bodily processes and medical procedures generate aerosols, and the aerosol particles may contain pathogens in conjunction with body fluids." p. 501	51

Aerosol-Generating Procedure Definition	Reference # in Appendix 3
"Medical procedures that have the potential to create aerosols in addition to those that patients regularly form from breathing, coughing, sneezing, or talking are called AGMPs." p. 2	52
"Procedures and practices that promote the generation of aerosols..." p. 4	57
"Aerosol-generating medical procedures (AGMPs) are medical procedures that can generate aerosols as a result of artificial manipulation of a person's airway." p. 7	62
"Aerosol generating procedures are those that produce droplets that are small enough to be widely dispersed." p. 4	67
"Aerosol-generating medical procedures (AGMPs) are any procedure carried out on a patient that can induce the production of aerosols of various sizes, including droplet nuclei." p. 1	69
"Aerosol-generating medical procedures are medical procedures that can generate aerosols as a result of artificial manipulation of a person's airway." p. 99	71
"AGMPs are medical procedures that can generate aerosols that consist of small droplet nuclei in high concentration and present a risk for airborne transmission of pathogens that would not otherwise be spread by the airborne route (e.g. coronavirus, influenza)." p. 1	73
"Aerosol-generating procedures (AGPs) are medical procedures that have been associated with an increased risk of transmission in healthcare settings." p. 4	79
"Procedures highlighted as generating aerosols and with a documented increase of risk of transmission of pathogens." (translated) p. 8	82
"Aerosol generating procedures (AGPs) are defined as any medical and patient care procedure that results in the production of airborne particles (aerosols)." p. 3	83
"AGMPs that generate small droplet nuclei in high concentration present a risk for airborne transmission of pathogens not otherwise able to spread by the airborne route (e.g., coronavirus, influenza)."	86
"An aerosol generating medical procedure (AGMP) is a medical or surgical procedure that involves manipulation of a patient's airway in a manner that may stimulate coughing and/or promote the generation of aerosols." p. 18	87
"Any procedure carried out on a patient that can induce the production of aerosols as a result of manipulation of a person's airway." p. 9	88
"Aerosol-generating medical procedures are medical procedures that can generate aerosols as a result of artificial manipulation of a person's airway." p. 167	89
"During AGPs there is an increased risk of aerosol spread of infectious agents irrespective of the mode of transmission (contact, droplet, or airborne), and airborne precautions must be implemented..." p. 1	91
"Aerosol generating medical procedures (AGMP) are any procedure carried out on a patient/resident/client that can induce the production of aerosols of various sizes, including droplet nuclei." p. 1	101
"Several medical procedures have been reported to generate aerosols and to increase the risk of pathogen transmission." p. 2	102
"Any intervention performed on a patient, possibly generating aerosols of any dimension, including droplet nuclei." ("...toute intervention mène sur un patient pouvant entraîner la production d'aérosols de différentes dimensions, notamment des noyaux de gouttelettes.") p. 1	104
"Several medical procedures have been reported to generate aerosols and to increase the risk of pathogen transmission." p. 2	112

Aerosol-Generating Procedure Definition	Reference # in Appendix 3
"Procedures that are believed to generate aerosols and droplets as a source of respiratory pathogens..." p. 1	114
"Procedures that are believed to generate aerosols and droplets as a source of respiratory pathogens..." p. 3	115
"Procedures that may increase potential exposure to aerosol transmissible disease pathogens due to the reasonably anticipated aerosolization of pathogens." p. viii	116
"Aerosol generating medical procedures (AGMP) are any procedure carried out on a patient/resident/client ¹ that can induce the production of aerosols of various sizes, including droplet nuclei." p. 1	117
"Certain medical interventions [...] may create localized aerosol generation that can allow airborne transmission to those closely involved in the procedure." p. 3	118
"Aerosol-generating medical procedures can generate aerosols as a result of artificial manipulation of a person's airway." p. 119	119
"...any medical procedure that can induce the production of aerosols of various sizes, including droplet nuclei." p. 37	120
"AGPs are procedures thought to generate respirable aerosols and have been associated with increased risk of occupationally acquired infection among healthcare personnel." p. 707	127

Appendix 6

Aerosol-Generating Procedure Groups

Line	Aerosol-Generating Procedure Group	Frequency Count
1	intubation and extubation procedures	114
2	airway suctioning	92
3	bronchoscopy	89
4	non-invasive ventilation	78
5	nebulized or aerosol therapy	75
6	cardiopulmonary resuscitation	66
7	sputum induction	60
8	tracheostomy and tracheostomy procedures	57
9	manual ventilation	52
10	autopsy	33
11	high-flow oxygen therapy	32
12	oral and dental procedures	31
13	high-frequency oscillatory ventilation	27
14	chest physiotherapy	23
15	surgery/post-mortem procedures with high-speed devices	14
16	nasopharyngeal aspirate	13
17	nasopharyngoscopy or laryngoscopy	12
18	breaking closed ventilation systems (intentionally or unintentionally)	11
19	coughing	10
20	nasopharyngeal and oropharyngeal swabbing	9
21	mechanical ventilation	8
22	handling soiled laundry	5
23	manipulation of masks	5
24	upper GI endoscopy	5
25	lung function testing	4
26	nasogastric tube insertion	4
27	prone positioning	4
28	thoracic surgery and procedures	4
29	ENT and neurosurgery	3
30	mechanical insufflation and exsufflation	3
31	suction of body fluids (not further specified)	3
32	GI endoscopy (not further specified)	2
33	intra/extra pulmonary high-frequency oscillation devices	2
34	toilet use and flushing	2
35	vacuum cleaning	2
36	colonoscopy	1
37	supraglottic airways	1

Appendix 7

Aerosol-Generating Procedures List

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
abscess/wound irrigation (non-respiratory TB)	1	117
accidental extubation and re-intubation	1	98
accidental extubation requiring immediate re-intubation	1	103
activity at bed	1	126
administering aerosols	2	35, 39
administration of aerosolized medication	3	8, 10, 97
administration of aerosolizing or nebulized medications, however: avoid the use of nebulizer if possible (use of alternatives such as meter-dose inhaler with spacer are preferable)	1	73
administration of nebulized treatment	2	30, 122
administration of nebulizing medications, does not include administration of an MDI	1	101
administration of oxygen	2	114, 115
aerosol humidification	3	114, 115, 128
aerosol inhalation	1	60
aerosol medication	1	104
aerosol therapies	2	53, 105
aerosolized administration of pentamidine or other medications	1	116
aerosolized or nebulized medication administration	4	18, 69, 117, 119
air turbines	1	126
air water syringes	1	126
airway stabilization	1	103
airway suction(ing)	4	18, 114, 115, 117
any diagnostic interventions that involve the use of video laryngoscopy that can result in airway irritation and coughing (e.g. direct visualisation during airway clearance techniques or when assisting speech and language therapists performing fiberoptic endoscopic evaluation of swallow)	1	68
any mobilisation or therapy that may result in coughing and expectoration of mucus	1	68
artificial ventilation	1	106
aspiration of respiratory airways secretion in an opened circuit in an intubated patient or a patient with a tracheotomy	1	19
aspiration of respiratory tract	1	120
autopsies involving respiratory tissues	3	16, 73, 86
autopsy	20	2, 19, 23, 25, 27, 38, 47, 50, 62, 65, 76, 80, 81, 82, 87, 88, 93, 99, 119, 120
autopsy examination	1	72

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
autopsy of lung tissue	4	6, 101, 117, 119
autopsy procedures involving oscillating saws	1	102
autopsy, clinical, surgical and laboratory procedures that may aerosolize pathogens, such as operating bone saws, centrifuges, blenders, and aspiration equipment	1	116
awake tracheal intubation under fibroscopy	1	106
bag valve masks, includes where performed with ECT	1	5
bag-valve mask ventilation	7	20, 46, 114, 115, 117, 118, 128
bed making	1	126
bi-level positive airway pressure	8	2, 5, 6, 7, 8, 10, 88, 104
breaking closed ventilation systems intentionally (e.g. open suctioning) or unintentionally (e.g. patient movement)	2	73, 117
breathing	1	59
bronchial challenge tests	1	29
bronchial endoscopy	1	109
bronchial suctioning	1	30
bronchoalveolar lavage	1	14
bronchoscopy	70	3, 4, 5, 6, 7, 8, 10, 11, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, 30, 31, 33, 34, 37, 38, 39, 43, 46, 48, 49, 50, 52, 57, 62, 64, 65, 67, 68, 69, 71, 74, 77, 78, 79, 80, 81, 82, 84, 85, 87, 88, 89, 93, 96, 97, 98, 99, 102, 104, 110, 111, 112, 116, 118, 119, 120, 122, 124, 126, 127, 128
bronchoscopy (diagnostic or therapeutic)	2	47, 76
bronchoscopy and bronchoalveolar lavage	8	15, 16, 31, 73, 86, 90, 101, 117
bronchoscopy and upper ENT airway procedures that involve suctioning	1	90
bronchoscopy or other upper airway endoscopy	3	114, 115, 119
bronchoscopy with nebulized medication administration (NMA)	1	75
BubblePEP	1	76
cardiopulmonary resuscitation	46	2, 3, 6, 7, 8, 10, 11, 14, 15, 17, 19, 21, 22, 23, 25, 27, 30, 34, 37, 38, 46, 47, 49, 50, 52, 54, 62, 67, 71, 77, 78, 79, 81, 82, 85, 88, 89, 96, 98, 105, 116, 117, 119, 122, 124, 128
cardiopulmonary resuscitation (CPR) with respiratory (bvm, intubation)	1	5
cardiopulmonary resuscitation (with manipulation of the airway)	1	101
cardiopulmonary resuscitation during airway management	2	76, 93

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
cardiopulmonary resuscitation with bag valve mask ventilation	4	16, 31, 73, 86
certain dental procedures	1	4
chest compressions	2	114, 115
chest physiotherapy	8	21, 57, 69, 104, 114, 115, 119, 126
chest physiotherapy (manual and mechanical cough assist device (MI-E))	1	117
chest tube or chest needle insertion	1	21
circumstances where emergent resuscitation efforts are anticipated	1	119
clapping	1	49
cleaning patients room	1	126
cleaning the nebulizer	1	126
cold-mist humidifier	1	126
collection of induced sputum	1	14
collection of nasopharyngeal aspirate	1	57
collection of nasopharyngeal or throat swab specimens	1	113
collection of sputum sample	2	114, 115
colonized tracheostomy	1	72
colonoscopy	1	126
continuous positive airways pressure (CPAP)	1	57
cough - mechanical cough assist, mechanical insufflation exsufflation (MIE)	1	5
cough after nebulization (toux induite apres nebulisation)	1	107
cough generating procedures e.g. cough during treatment, huff	1	76
cough-inducing procedures	1	4
coughing	4	13, 56, 59, 110
CPR (pre intubation due to manual ventilation)	1	47
CPR prior to intubation	1	111
cutting/shaving frozen sections (cryostat)	1	5
deep tracheal suctioning	1	5
defibrillation	3	114, 115, 126
dental amalgam removal	1	40
dental care	3	34, 35, 40
dental examinations	1	4
dental procedures involving high-speed devices (e.g. high-speed drilling)	1	43
diagnostic bronchoscopy	2	72, 92
diagnostic sputum induction	3	18, 69, 119
disconnecting the patient from the ventilator	3	17, 30, 122
disconnection of endotracheal tube from ventilator	1	128
drainage of peritonsillar abscess	1	33
drug nebulizer	1	100
drugs round	1	126

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
dysphagia assessment	1	17
endoscopic examination of the nose, sinuses, oropharynx, hypopharynx, and larynx	1	33
endoscopy of the respiratory system	1	105
endotracheal aspiration	2	114, 115
endotracheal extubation	1	50
endotracheal intubation	22	1, 18, 21, 30, 38, 47, 50, 51, 64, 69, 77, 88, 97, 101, 102, 104, 114, 115, 116, 117, 119, 122
endotracheal intubation and its related procedures	3	25, 46, 78
endotracheal intubation, including during cardiopulmonary resuscitation	3	76, 93, 99
endotracheal intubation/surgical airway	1	118
endotracheal suction	1	35
evening meal	1	126
exercise testing	1	29
extractions	1	61
extubation	19	5, 6, 7, 17, 19, 33, 43, 46, 47, 73, 79, 85, 87, 90, 96, 101, 111, 117, 128
extubation and related procedures	3	26, 31, 68
facial mask conventional oxygen therapy (e.g. Ventimask)	1	23
first stage endodontic treatment	1	61
floor mopping	1	126
foreign body management in the airway	1	33
foreign body management in the nose	1	33
front of neck airway procedures (insertion of tracheostomy, cricothyroidotomy)	1	47
gastrointestinal endoscopy	2	33, 118
gastroscopy	1	23
generated from human sources (e.g., during suctioning or wound irrigation)	1	102
generated from human sources (expulsion from the respiratory tract during coughing, sneezing, talking or singing)	1	102
handling soiled laundry	3	42, 102, 108
handling waste	1	108
heated high flow <6 LPM	1	5
high flow heated humidity oxygen therapy devices (ex. ARVO, Optiflow)	1	11
high flow heated humidity oxygen therapy devices (ex. Optiflow)	1	8
high flow nasal cannula oxygen therapy (e.g. Optiflow)	5	8, 23, 46, 47, 79
high pressure 3:1 air syringe	1	83
high speed hand pieces	1	126

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
high-flow nasal oxygen	8	15, 17, 26, 41, 67, 68, 90, 111
high-flow oxygen therapy	11	10, 21, 76, 77, 93, 99, 106, 114, 115, 117, 128
high-frequency oscillatory ventilation	27	5, 6, 7, 8, 10, 11, 17, 18, 21, 26, 38, 43, 47, 49, 68, 69, 73, 79, 90, 97, 104, 114, 115, 117, 119, 125, 128
humidification	1	57
humidified high-flow oxygen systems	3	5, 6, 2007
hydraulic action in vertical soil stacks when toilets were flushed	1	123
incision draining of a dental abscess	1	61
induction of sputum	9	14, 17, 19, 26, 43, 68, 79, 90, 97
insertion of nasogastric tube	3	114, 115, 126
inspiratory muscle training, particularly if used with patients who are ventilated and disconnection from a breathing circuit is required	1	76
instillation	1	78
intentional break in closed ventilation system (e.g., open suctioning)	1	101
intra/extra pulmonary high frequency oscillation devices (e.g. The Vest/MetaNeb/Percussionaire)	2	68, 76
intubation	34	2, 4, 10, 17, 22, 27, 33, 35, 39, 45, 48, 53, 54, 65, 70, 73, 74, 79, 80, 81, 84, 85, 87, 94, 98, 102, 103, 109, 110, 111, 120, 124, 125, 128
intubation (in spontaneously breathing patients)	1	118
intubation and extubation procedures	2	16, 86
intubation and mechanical ventilation	1	111
intubation and related procedures	19	3, 5, 6, 7, 8, 11, 26, 31, 37, 43, 49, 62, 68, 71, 82, 88, 89, 90, 119
intubation with neonates	1	5
invasive sample collection procedures	1	4
invasive vascular procedures	1	108
laboratory handling of mycobacterium tuberculosis such as concentrating respiratory samples for smear and culture	1	72
laryngoscopy	4	23, 73, 101, 117
laryngoscopy (with coughing patient)	1	118
laser plume	1	52
laundry (e.g., bedding, towels and clothing) (only if shaken or handled in a manner that may aerosolize infectious particles)	1	18
laundry chutes	1	102

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
lunch time	1	126
lung function tests (LFTs)	1	29
lung testing (pulmonary function studies) with nebulized medication	1	5
lung tissue autopsy	1	104
lung volume recruitment maneuvers (LVRM)	1	5
making beds	1	42
manipulation of BiPAP mask	2	114, 115
manipulation of medical devices	1	108
manipulation of oxygen mask	3	114, 115, 126
manual bag mask ventilation	1	101
manual hyperinflation (MHI)	1	76
manual techniques (e.g. percussion/manual assisted cough) that may lead to coughing and expectoration of sputum	1	68
manual ventilation	26	2, 3, 5, 6, 7, 8, 11, 17, 26, 27, 43, 45, 46, 47, 52, 67, 68, 71, 79, 88, 89, 90, 98, 114, 115, 119
manual ventilation (intubation and related procedures)	1	62
manual ventilation after intubation	2	114, 115
manual ventilation before intubation	11	1, 14, 15, 19, 23, 30, 24, 96, 114, 115, 122
mechanical insufflation- exsufflation (MI-E) devices	1	76
mechanical insufflation-exsufflation (cough assist) devices	1	68
mechanical ventilation	2	114, 115
mechanical ventilation circuit nebulizer	1	107
mechanical ventilation without HEPA filter on exhaust port	1	128
mechanical ventilation, unfiltered air - open system	1	5
mechanical ventilation/high frequency oscillatory ventilation	1	46
medication administration via continuous nebulizer	1	79
moving furniture	1	126
mucosal surface endoscopic examinations of the head and neck	1	33
nasal wash/aspirate	1	14
nasogastric tube insertion	1	101
nasopharyngeal aspirate	3	21, 74, 94
nasopharyngeal aspirates, washes, and scoping	5	16, 31, 73, 86, 117
nasopharyngeal aspiration in children	2	19, 23
nasopharyngeal or oropharyngeal suctioning	1	76
nasopharyngeal swab	6	14, 21, 35, 72, 74, 128
nasopharyngeal washing and scoping	1	101
nasopharyngoscopy	1	11
nasopharyngoscopy or flexible laryngoscopy procedures with high pressure irrigation or suction	1	5

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
nasotracheal or orotracheal suctioning	1	128
nCPAP with bubble humidifier (humidificateur a bulles)	1	107
nebulization	14	14, 15, 22, 27, 28, 29, 58, 63, 67, 94, 103, 111, 118, 128
nebulized medication administration	2	55, 75
nebulized treatment/nebulizer therapy	24	3, 8, 9, 11, 12, 16, 17, 21, 37, 38, 46, 49, 52, 62, 64, 71, 78, 86, 88, 89, 114, 115, 119, 125
nebulized therapy for symptoms of respiratory infection	1	87
nebulized therapy/aerosolized medication administration	5	2, 5, 6, 7, 11
neonatal: CPAP in isolette	1	5
non invasive ventilation (e.g. optiflow)	1	19
non-invasive positive pressure ventilation	11	27, 30, 37, 38, 62, 69, 101, 119, 122, 125, 128
non-invasive positive pressure ventilation for acute respiratory failure	3	21, 76, 93
non-invasive tracheotomy	1	1
non-invasive ventilation	16	11, 14, 15, 34, 41, 57, 67, 85, 96, 103, 106, 111, 114, 115, 118, 126
non-invasive ventilation (BiPAP, CPAP, HFOV)	1	52
non-invasive ventilation (CPAP and BiPAP)	16	3, 16, 17, 26, 43, 45, 46, 47, 68, 71, 79, 86, 89, 90, 114, 118
office-based nasal and laryngeal endoscopy	1	33
open airway suctioning	6	16, 47, 73, 76, 86, 93
open artificial airway suctioning (i.e., ETT, tracheostomy)	1	21
open endotracheal suctioning	15	2, 3, 5, 6, 7, 8, 11, 27, 46, 48, 71, 88, 89, 99, 119
open endotracheal suctioning (intubation and related procedures)	1	62
open lung testing (pulmonary function studies) with open system	1	5
open respiratory/airway suctioning	7	5, 6, 7, 11, 87, 116, 125
open suction tracheotomy	1	60
open suctioning	9	17, 26, 30, 43, 47, 68, 76, 79, 122
open suctioning (i.e. mouth or nose)	1	21
open suctioning of respiratory tract	4	31, 46, 90, 124
open suctioning of respiratory tract (including tracheostomy care)	1	38
open thoracotomy	2	114, 115
open tracheal suctioning	1	10
open ventilation	1	70
open-circuit airway suctioning	1	50
opening a ventilation circuit	1	35

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
optiflow	1	106
oral examination	1	61
oro-tracheal suctioning	1	20
oropharyngeal swab	2	14, 35
other breaches to the integrity of a mechanical ventilation system (e.g., filter changes)	1	21
oxygen therapy	1	111
oxylator	1	98
patient receiving oxygen through nasal cannula	1	95
patient with a forceful cough and is non-compliant with cough etiquette	1	119
pediatric nasopharyngeal suction	1	96
PEP and oscillating PEP devices	1	76
placement of nasal packing	1	33
polishing teeth	1	83
positioning/gravity assisted drainage techniques and manual techniques (e.g. expiratory vibrations, percussion, manual assisted cough) that may trigger a cough and the expectoration of sputum	1	76
positive pressure non-invasive ventilation	1	78
positive pressure non-invasive ventilation for acute respiratory insufficiency (spontaneous ventilation with continuing positive pressure, BPAP 3-5)	1	99
positive pressure non-invasive ventilation with a facial mask (e.g. bi-level positive airway pressure [BiPAP] and continuous positive airway pressure [CPAP])	7	18, 19, 23, 49, 96, 97, 115
positive pressure ventilation	4	51, 65, 114, 117
positive pressure ventilation for acute respiratory insufficiency (CPAP, BiPAP)	1	77
positive pressure ventilation such as continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP), high flow nasal oxygen therapy	1	73
positive pressure ventilation with inadequate seal	1	47
post-mortem procedure using a high speed device	1	49
powered instrumentation in mucosal head and neck surgery	1	33
procedure where a single-use catheter inserted into the ETT either by disconnecting the ventilator tubing or via a swivel connector	1	47
prone positioning	2	30, 111
pulmonary function testing	1	116
recruitment maneuvers	1	111
respiratory and airway suctioning	6	8, 20, 69, 94, 112, 119
respiratory assistance during CPR	1	99
respiratory physiotherapy	2	34, 105
respiratory therapy	1	35
respiratory tract drainage	1	104

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
resuscitation	3	51, 84, 120
routine patient care (patient breathing on their own with healthcare professionals present)	1	24
saline instillation via an open circuit/endotracheal tube	1	76
sampling activities done to test surfaces, items, and air for the virus	1	95
shower	1	126
sneezing	3	13, 59, 110
some dental procedures (e.g. high speed drilling)	6	17, 26, 68, 79, 90, 101
some routine patient care with ventilated patients if there is excessive risk of unintentional breaks in closed ventilation system (e.g., turning patient, proning patient, caring for agitated/restless patient, oral care in awake patients)	1	101
speaking	2	13, 59
sputum (not induced sputum)	1	14
sputum induction	39	2, 3, 5, 6, 7, 8, 10, 11, 16, 21, 23, 27, 30, 37, 38, 39, 46, 49, 52, 62, 65, 67, 71, 72, 73, 77, 78, 86, 87, 88, 89, 92, 96, 104, 114, 115, 116, 117, 119
sputum induction (diagnostic or therapeutic)	4	47, 76, 93, 99
sputum induction using hypertonic saline	1	101
sputum samples	1	111
stabilization (not further specified)	1	98
suction	9	22, 52, 54, 57, 65, 78, 84, 102, 111
suction (in certain circumstances)	1	64
suction after tracheal nursing	1	60
suction before and after intubation	3	114, 115, 126
suction in an open circuit for a patient with intubation or tracheotomy	1	96
suction of airway secretions in a non-closed circuit, in an intubated patient	1	49
suction of airway secretions in an opened circuit in an intubated or tracheotomized patient	1	23
suction of body fluid	2	114, 115
suction of respiratory secretions in an open circuit	1	85
suction of the respiratory tract (tracheotomy)	1	77
suctioning of the respiratory tract	2	31, 80
supraglottic airways (i.e., LMA, King LT, iGel used pre-hospital)	1	5
surgery	5	2, 25, 27, 52, 88
surgery and post-mortem procedures involving high-speed devices	6	17, 26, 43, 68, 79, 90
surgery using a high speed device	3	49, 81, 82
surgical airway	1	128
surgical tracheostomy	1	115

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
tea trolley round	1	126
three in one syringes	1	126
toilet use	1	126
tracheal intubation	14	14, 15, 19, 20, 30, 34, 52, 57, 67, 96, 114, 115, 121, 126
tracheal intubation and extubation	1	23
tracheostomy	10	30, 33, 34, 45, 67, 73, 111, 114, 115, 122
tracheostomy and tracheostomy procedures	1	17
tracheostomy care	12	5, 6, 7, 8, 10, 11, 33, 69, 104, 116, 117, 119
tracheostomy care if requiring deep suctioning	1	101
tracheostomy insertion, changing and/or care	1	21
tracheostomy procedures	2	88, 101
tracheotomy	2	14, 15
tracheotomy and tracheotomy care	3	19, 23, 96
tracheotomy care	1	49
tracheotomy/tracheostomy procedures	5	26, 43, 68, 79, 90
transesophageal echocardiography	1	101
transsphenoidal surgery	1	5
tube or needle thoracostomy	1	119
turning the patient to prone position	2	17, 122
ultrasonic scalers	1	126
upper ENT airway procedures that involve suctioning	1	17
upper gastro-intestinal endoscopy where there is open suctioning of the upper respiratory tract	2	17, 90
upper GI endoscopic procedures	1	101
use of an air/water syringe during dental procedure	1	50
use of cavitron, piezosonic or other mechanised scalers	1	83
use of high flow oxygen (>6 L/min)	1	57
use of high speed handpieces for routine restorative procedures	1	83
use of nebulisers	1	57
use of oscillating saws	1	18
use of positive pressure breathing devices (e.g. IPPB)	2	68, 76
use of power tools (dental context)	1	61
use of propellant anesthetic freezing sprays such as oral lidocaine	1	5
use of scopes (dental context)	1	61
use of ultrasound descaler (dental procedure)	1	50
using a vacuum cleaner	2	42, 126
using dental drills	1	50
ventilation (not further specified)	1	78

Aerosol-Generating Procedure	Frequency Count	Reference # in Appendix 3
ventilation via Combitube	1	98
ward rounds	1	126
washing the patient	1	126

Appendix 8

Possibly Aerosol-Generating Procedure Groups

Possibly Aerosol-Generating Procedure Groups	Frequency Count
chest physiotherapy	14
nasopharyngeal aspirate	12
nasopharyngeal and oropharyngeal swabbing	10
high-frequency oscillatory ventilation	9
nebulized or aerosol therapy	9
non-invasive ventilation	8
tracheostomy and tracheostomy procedures	8
airway suctioning	6
coughing	5
intubation and extubation procedures	5
high-flow oxygen therapy	4
mechanical ventilation	4
cardiopulmonary resuscitation	3
breaking closed ventilation systems (intentionally or unintentionally)	2
bronchoscopy	2
lung function testing	2
manual ventilation	2
nasopharyngoscopy or laryngoscopy	2
sputum induction	2
suction of body fluids (not further specified)	2
thoracic surgery and procedures	2
upper GI endoscopy	2
intra/extra pulmonary high-frequency oscillation devices	1
mechanical insufflation and exsufflation	1
nasogastric tube insertion	1

Appendix 9

Possibly Aerosol-Generating Procedures List

Possibly Aerosol-Generating Procedures	Frequency Count	Reference # in Appendix 3
administration of intravenous resuscitation drugs	1	118
administration of medication via nebulization	2	26, 68
administration of pressurized humidified oxygen	2	26, 68
aerosol humidity (not further specified)	1	69
any mobilization or therapy that may result in coughing and expectoration of mucus	1	111
artificial ventilation	1	1
bag-valve ventilation	1	69
bi-level positive pressure ventilation	1	82
bronchoalveolar lavage	1	14
bronchoscopy	1	55
BubblePEP	1	111
cardiopulmonary resuscitation (CPR), chest compressions alone	1	5
chest drain insertion	1	77
chest physiotherapy	7	1, 3, 62, 71, 88, 89, 112
chest physiotherapy in absence of other AGPs	1	47
circuit changes	1	69
clinical dysphagia examinations-this examination includes orofacial assessment and administration of food and/or fluids to evaluate swallowing ability	1	47
closed suction systems (CSS) enable patients to be suctioned by a suction catheter enclosed within a plastic sleeve, without the need for ventilator disconnection	1	47
closed suction tracheotomy	1	60
collecting a nasopharyngeal swab	1	47
cough generating procedures (e.g., cough during treatment, huff)	1	111
cough induction	1	71
CPR, as it can include a number of different procedures, some of which are AGPs	1	43
defibrillation, cardioversion, transcutaneous pacing	1	118
delivery of nebulized medications via simple face mask	1	47
disruption of a mechanical ventilation system (filter change)	1	77

Possibly Aerosol-Generating Procedures	Frequency Count	Reference # in Appendix 3
endotracheal suction	1	1
extubation	3	24, 55, 69
fibreoptic endoscopic evaluation of swallowing (FEES)	1	47
heat and moisture exchange HME (F) changes	1	69
high flow nasal cannula	1	118
high flow oxygen	1	38
high flow oxygen therapy	2	1, 47
high-frequency oscillation (HFOV)	1	77
high-frequency oscillatory ventilation	8	1, 3, 25, 62, 71, 82, 88, 89
in-tube infusion or spray humidification to humidify the trachea	1	60
induced sputum	1	14
insertion of a nasogastric tube	1	47
inspiratory muscle training, particularly if used with patients who are ventilated and disconnection from a breathing circuit is required	1	111
intra/extra pulmonary high-frequency oscillation devices (e.g. The Vest, MetaNeb, Percussionaire)	1	111
intubation	1	98
laparoscopic surgery	1	33
laryngoscopy	1	47
lung function testing	1	13
manual hyperinflation	1	111
manual ventilation before intubation	1	121
mechanical insufflation- exsufflation (MI-E) devices	1	111
mechanical ventilation	1	55
nasal wash/aspirate	1	14
naso-pharyngeal aspiration or sampling	1	77
nasopharyngeal aspirates	3	71, 88, 89
nasopharyngeal aspiration (NPA)	1	38
nasopharyngeal or oropharyngeal suctioning	1	111
nasopharyngeal suction	1	49
nasopharyngeal swab	5	3, 14, 71, 88, 89
nebulization	3	25, 41, 82
nebulization therapy	1	77

Possibly Aerosol-Generating Procedures	Frequency Count	Reference # in Appendix 3
non-invasive positive pressure ventilation	2	25, 82
non-invasive positive pressure ventilation for acute respiratory failure (CPAP, BiPAP3-5)	1	47
non-invasive ventilation	2	55, 121
obtaining intravenous or intraosseous access	1	118
obtaining nasopharyngeal aspirates	2	62, 119
obtaining nasopharyngeal swabs	2	62, 119
open suction	1	111
opened aspiration (mouth or nose)	1	77
oropharyngeal swab	1	14
oxygen therapy (administration of oxygen)	1	1
patients on oxygen concentrations of 50% or higher	1	69
PEP and oscillating PEP devices	1	111
positioning / gravity assisted drainage techniques and manual techniques (e.g. expiratory vibrations, percussion, manual assisted cough) that may trigger a cough and the expectoration of sputum	1	111
respiratory physiotherapy	1	77
rhinopharyngeal suction	1	3
saline instillation via an open circuit endotracheal tube	1	111
soft-tissue surgery as long as the blood is not aerosolized by the use of energy devices	1	33
spirometry & pulmonary function tests (PFTs)	1	69
sputum (not induced)	1	14
sputum inductions	1	111
suction before tracheal nursing	1	60
suction of body fluid	1	1
suctioning	1	24
suctioning (open or tracheostomy)	1	55
swabbing the oropharynx or nasopharynx	1	47
tracheostomy care	5	3, 62, 71, 88, 89
tracheotomy	1	121
tracheotomy care, insertion and change	1	77
transesophageal echo	1	47
tube or needle thoracostomy	1	69
upper GI endoscopy	1	47

Possibly Aerosol-Generating Procedures	Frequency Count	Reference # in Appendix 3
use of a mechanical ventilator	1	24
use of an incentive spirometer	1	24
use of nebulizers	1	56
use of positive pressure breathing devices (e.g. IPPB)	1	111
using topical lidocaine for intubation	1	98
vomiting	1	102
water used for the humidifier in nasal CPAP by convection	1	107

Appendix 10

Not Aerosol-Generating Procedure Groups

Not Aerosol-Generating Procedure Groups	Frequency Count
nasopharyngeal and oropharyngeal swabbing	15
chest physiotherapy	9
oral and dental procedures	9
thoracic surgery and procedures	8
nebulized or aerosol therapy	7
airway suctioning	5
cardiopulmonary resuscitation	5
nasogastric tube insertion	4
nasopharyngeal aspirate	4
bronchoscopy	3
coughing	3
high-frequency oscillatory ventilation	3
manipulation of masks	3
mechanical ventilation	3
non-invasive ventilation	3
upper GI endoscopy	3
manual ventilation	2
nasopharyngoscopy or laryngoscopy	2
Nitrous Oxide (Entonox®) administration	2
sputum induction	2
colonoscopy	1
handling soiled laundry	1
high-flow oxygen therapy	1
labour and delivery	1
lung function testing	1
prone positioning	1
suction of body fluids (not further specified)	1

Appendix 11

Not Aerosol-Generating Procedures List

Not Aerosol-Generating Procedures	Frequency Count	Reference # in Appendix 3
adjustment of a bi-level positive pressure ventilation machine	1	1
administration of oxygen	1	121
administration of pressurized humidified oxygen	1	90
assessments and examinations (routine patient care that does not involve patient movement)	1	101
bronchial artery embolization - open procedure, not bronchoscopy	1	5
bronchoscopy	2	1, 121
bronchoscopy without nebulized medication administration	1	75
changing bed linens	1	75
chest compressions	2	1, 121
chest compressions and defibrillation (as part of resuscitation)	1	90
chest physiotherapy	6	5, 6, 7, 43, 45, 121
chest tube for pneumothorax	1	5
collection of nasopharyngeal aspirates	1	101
collection of nasopharyngeal swabs	1	101
collection of sputum sample	1	121
cough - manual cough assist (not induced sputum)	1	5
cough from a trach	1	5
coughing induced after nebulization	1	107
CPAP with bubble humidifier	1	107
defibrillation	2	1, 121
dry oxygen via non-rebreather mask with reservoir	1	5
endotracheal aspiration	1	121
Entonox® - administration of nitrous oxide	1	5
Entonox® [nitrous oxide] or medication via nebulization	1	90
examinations (dental context)	1	83
flushing liquid waste	1	75
gastro-jejunostomy tube placement	1	5
gastrostomy	1	5

hand scaling with suction	1	83
high- frequency oscillatory ventilation (adult)	1	19
high-flow oxygen	1	121
high-frequency oscillatory ventilation	2	23, 121
hyperbaric therapy	1	5
incentive spirometry	1	5
insertion of nasogastric tube	1	121
intranasal narcain administration (if no bvm)	1	5
IV pump check (routine patient care that does not involve patient movement)	1	101
jejunostomy	1	5
labour & delivery	1	5
low flow dry oxygen systems (e.g., nasal prongs or masks)	1	5
lower GI endoscopy	1	47
lung ablation - open procedure, not via bronchoscopy	1	5
lung biopsy	1	5
lung testing (pulmonary function studies) - closed system	1	5
manipulation of bilevel positive airway pressure mask	1	121
manipulation of oxygen mask	2	1, 121
manual ventilation after intubation	2	1, 121
mechanical ventilation	1	121
mechanical ventilation circuit nebulizer	1	107
mechanical ventilation using physical proning - closed system	1	5
mechanical ventilation, filtered air - closed system	1	5
medication administration and titration (routine patient care that does not involve patient movement)	1	101
nasoendoscopic procedures Including fiberoptic endoscopic evaluation (FEE) of swallowing	1	5
nasogastric intubation	1	1
nasogastric tube insertion in children less than 1 year of age	1	101
nasopharyngeal aspirate	3	5, 6, 7
nasopharyngeal swab	8	5, 7, 16, 24, 27, 49, 66, 99
nasopharyngeal and throat swabs	1	16
nasopharyngeal sampling	1	32
nasopharyngeal swab (adults)	1	19

nasopharyngoscopy or flexible laryngoscopy procedures - without high pressure irrigation or suction	1	5
nebulization	3	43, 45, 90
nebulization therapy	2	1, 23
nebulization therapy (adult and children)	1	19
nebulizer treatment	1	121
NG & NJ tube placement	1	5
non-invasive ventilation	1	75
non-surgical extractions	1	83
oral suctioning	2	6, 7
oral suctioning or suctioning of the oropharynx	1	5
orogastric tube placement	1	5
oxygen delivered via nasal prongs and/or non-rebreathe masks regardless of flow rate	1	101
patient bathing	1	75
pediatric chest tube placement	1	5
phlebotomy	1	5
pleural drains	1	5
pleurex insertions, removals, & drainage procedures	1	5
postural drainage with percussion (adult and children)	1	19
postural drainage with percussion (clapping)	1	23
pouring liquids into a hopper	1	75
removable denture stages	1	83
removal of caries using hand excavation or slow speed handpiece	1	83
routine patient care that does not involve patient movement (e.g., IV pump check, medication administration and titration, assessments and examinations)	1	101
sputum collection	1	1
suction after intubation	2	1, 121
suction before intubation	2	1, 121
suction of body fluid	1	121
taking a nasopharyngeal or a throat swab for a patient being treated in the community	1	67
thoracentesis	1	5
throat swab	2	99, 124
transesophageal echocardiography (TEE)	1	5
video fluorographic swallowing study (VFSS)	1	5

Appendix 12

Categorization Challenges

In Judson and Munster (all references in Appendix 3), Siegel et al., and Prince Edward Island Department of Health, the procedure in question is listed plainly as "suctioning," but the context in each paper is discussing production of respiratory droplets, production of aerosols from the respiratory tract, or influenza droplets, respectively.^{52, 84, 102} These context clues suggest that the suctioning, as presented in the aforementioned papers, can appropriately be categorized under "airway suctioning." While these situations have clear indications in the surrounding text as to how to categorize the procedure, other situations are not so easily interpreted. Often "suctioning" or similar variants, were part of a longer list of procedures, but because of the other procedures with which it was listed, we decided to include it as "airway suctioning." An example of this can be found where Bolton et al. list "open suctioning" after "intubation and extubation" and "manual ventilation" and before "tracheostomy and tracheostomy procedures."¹⁷ In this case, the procedure was listed among other respiratory procedures, and so we inferred that open suctioning should also be classified as "airway suctioning." In another situation, Ministère de la Santé et des Soins de longue durée listed "suction" before "intubation," but after "autopsy," and here we could not comfortably assume that "suction" would be limited to airway suctioning.⁶⁵ Finally, where authors listed "suction of body fluids" as a procedure, as in two publications by Tran et al.,^{114, 115} World Health Organization,¹²¹ and Agence canadienne des médicaments et des technologies de la santé,¹ we could not find any context clues indicating which body fluids were being suctioned and therefore we categorized those procedures as "suction of body fluids (not further specified).