

# International scoping report on aerosol generating medical procedure listings

## Background

As a supplement to the Independent High-Risk Aerosol Generating Procedures (AGP) Panel systematic review, a report was prepared to examine which medical procedures other countries with similar health care systems to the United Kingdom (UK) categorise as aerosol generating.

Given the lack of definitive evidence for which medical procedures generate potentially infectious aerosols, it is not surprising the expert-based recommendations produced in different healthcare systems across the world vary (1, 2). Defining a procedure as an AGP presents implications for clinical care and public health planning.

## Methods

Contacts of the report writing team from 32 countries were collated. An email was sent to each of these contacts by members of the Independent Panel in August 2020, with a request for information on which AGPs were classified as high risk for coronavirus (COVID-19) in each country's list of AGP procedures. Individual country data was collected from mid-August to September. Information requested included the list of medical procedures defined as high-risk AGPs in relation to patients with COVID-19, the precautions applied for high risk AGPs in known or suspected COVID-19 cases and the precautions applied to all patients regardless of COVID-19 status. Responses were received from 14 countries: UK, South Korea, Singapore, Denmark, Canada, the Kingdom of Saudi Arabia, South Africa, Ireland, the United States, Australia, Thailand, Ireland, Sweden, Norway and Israel. For each country, data describing the procedures considered high risk was extracted. If provided, information on procedures under consideration for moving from a low to a high-risk category, procedures considered low risk or of concern and those procedures in which there was uncertainty regarding aerosol production were also recorded. Country lists were tabulated alongside the World Health Organisation (WHO) and the European Centre for Disease Control (ECDC) list of AGPs to give a total of 16 AGP lists for comparison.

Procedures that had similar components were grouped together: for example, upper Ear Nose Throat (ENT) airway procedures and nasopharyngeal procedures. Aerosol source for each procedure was classified into respiratory or non-respiratory. This is a simplified approach of that taken by Jackson and others (2). In total, 47 procedure groups were reported, with these divided into 9 acute procedure groups, 13 subacute groups and 25 elective or specialist groups (Supplementary table). Eight groups were classified as having a non-respiratory aerosol source. Procedures that were considered high risk by at least 4 AGP lists are shown in Table 1.

**Table 1. List of AGPs considered high risk by at least 4 countries or by the WHO or ECDC and comparison to UK list of high risk AGPs**

Procedure (considered high risk by at least 4 countries)	Number of countries or international bodies (WHO, ECDC) considering procedure as high risk	Number of countries or groups considering procedure as low risk	Number of countries or groups considering procedure as uncertain or concerning risk	Procedure on UK list of high risk AGPs (x/✓)
Cardiopulmonary Resuscitation (CPR) and basic life support	13	1	0	x
Nebulizer treatment	4	1	1	x
Intubation (including extubation)	16	0	0	✓
Non-invasive ventilation (NIV) Bilateral Positive Airway Pressure (BiPAP) and Continuous Positive Airway Pressure (CPAP)	15	0	0	✓
Open suctioning where a single-use catheter is inserted into endotracheal tube (ETT) or tracheostomy	12	0	1	✓
Bronchoscopy and other upper ear nose and throat (ENT) airway procedures including laryngoscopy	15	0	0	✓

<b>Procedure (considered high risk by at least 4 countries)</b>	<b>Number of countries or international bodies (WHO, ECDC) considering procedure as high risk</b>	<b>Number of countries or groups considering procedure as low risk</b>	<b>Number of countries or groups considering procedure as uncertain or concerning risk</b>	<b>Procedure on UK list of high risk AGPs (* / ✓)</b>
Induction of sputum using nebulised saline	11	0	1	✓
Manual ventilation including bag or mask ventilation	14	0	0	✓
Tracheostomy or tracheotomy	13	1	0	✓
Autopsy or post mortem	9	0	0	✓†
High frequency oscillation ventilation	7	0	0	✓
High-flow nasal oxygen (HFNO), high flow nasal cannula (HFNC) 30 to 60 l/min	8	1	2	✓
Dental procedures requiring use of high speed drills	6	0	0	✓
Upper ear nose and throat (ENT) airway procedures including nasopharyngeal procedures	8	0	0	✓

† UK COVID AGP list specifies high speed cutting involving respiratory or paranasal sinuses

This indicates that the United Kingdom (UK) AGP list is comprehensive in comparison to other countries, and broader in its inclusions than the WHO and European Centre for Disease Prevention and Control (ECDC) lists. However, 2 procedures - nebulisation and cardiopulmonary resuscitation (CPR) - were common to 4 or more countries' high risk AGP lists and are not on the UK list currently. The only high-risk AGP group for which there was unanimous consensus among countries was endotracheal intubation. At the time of writing, nebuliser treatment was considered a high risk AGP by the WHO, along with South Korea, Singapore and Israel; the CDC considered the procedure an uncertain source of infectious aerosols and Canada classified it as a low risk AGP. Non-invasive ventilation (NIV), Bilateral Positive Airway Pressure (BiPAP) and Continuous Positive Airway Pressure (CPAP) (classified as one AGP group) were considered AGPs for all countries except Thailand. High flow nasal oxygen (HFNO) (30-60L/min) was added to the UK list of high risk AGPs in March 2020 based on clinical expert opinion and consensus. HFNO flow rate is much higher than routine oxygen supplementation, and it is plausible that this procedure causes an increased proportion of aerosolised particles (3). There was a marked difference in consensus for HFNO; the UK, Denmark, Singapore, Saudi Arabia, South Africa, Ireland, Australia, and Norway classified HFNO as a high risk AGP, while the remaining countries, the WHO and ECDC did not classify the procedure as high risk.

Respiratory tract suctioning is currently considered a high risk AGP in the UK, and the UK Infection Prevention and Control (IPC) cell considers suctioning only beyond the oro-pharynx as high risk. A Health Protection Scotland review reported that respiratory tract suctioning is only a high risk AGP if it is associated with ventilation (3). Part of the challenge in evaluating respiratory tract suctioning has been a varying definition or lack of definition in studies regarding the procedure itself. With the exception of Canada, Australia and Thailand, all countries including the WHO and ECDC considers open suctioning with a catheter into an endotracheal tube or tracheostomy a high risk AGP. The AGPs considered as high-risk in the UK and the consensus of these procedures with other countries' lists is shown in Table 2, below.

**Table 2. List of AGPs considered high risk in the UK and whether classified as high-risk by WHO and other countries as of August 2020**

AGPs considered high risk in the UK	WHO†	ECDC	SK	SNG	DK	CA	KSA	SA	IRL	US	Aus	THA	SE	NO	ISR
Tracheal Intubation (including extubation)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Manual ventilation	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓
Tracheotomy and tracheostomy (insertion or removal)	✓	✓	✓	✓	✓	✗*	✓	✓	✓	✗	✓	✗	✓	✓	✓
Bronchoscopy	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dental procedures requiring use of high-speed drills	✗	✗	✗	✓	✗	✗	✗	✓	✓	✗	✓	✗	✗	✓	✗
Non-invasive Ventilation (NIV) Bilateral Positive Airway Pressure (BiPAP) and Continuous Positive Airway Pressure (CPAP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓
High-flow nasal oxygen (HFNO), High flow nasal cannula (HFNC)) 30-60 l/min	✗	✗*	✗	✓	✓	✗*	✓	✓	✓	✗*	✓	✗	✗	✓	✗
High frequency oscillation ventilation	✗	✓	✗	✗	✓	✓	✗	✓	✓	✗	✗	✗	✗	✓	✗
Induction of sputum using nebulised saline	✓	✗	✓	✗*	✓	✓	✗	✓	✓	✓	✓	✗	✗	✓	✓

AGPs considered high risk in the UK	WHO†	ECDC	SK	SNG	DK	CA	KSA	SA	IRL	US	Aus	THA	SE	NO	ISR
Open suctioning where a single-use catheter is inserted into endotracheal tube (ETT) or tracheostomy	✓	✓	✓	x*	✓	x	✓	✓	✓	✓	x	x	✓	✓	✓
Upper ear nose throat (ENT) airway procedures that involve respiratory tract suctioning	x	x	x	✓	✓	✓	✓	✓	x	x	x	x	x	✓	x
Upper gastrointestinal instrumentation that involves open suctioning of upper respiratory tract (URT)	x	x	x	x*	x	x	x	x	x	x	✓	✓	✓	✓	x
Autopsy, post mortem or surgeries if respiratory tract or paranasal sinuses involved)	x	x	✓	✓	✓	✓	✓	✓	✓	x	✓	x	x	✓	x

✓ included on country AGP list

x not included on country AGP list

x\* procedure currently classified as a low risk AGP/uncertainty whether infectious aerosol generated

† WHO guidance

SK - South Korea, SNG - Singapore, DK - Denmark, CA - Canada, KSA - Kingdom of Saudi Arabia, SA - South Africa, IRL - Ireland, US - United States, Aus - Australia, THA - Thailand, SE - Sweden, NO - Norway, ISR - Israel

Several procedures (such as nebulisation and CPR) do not currently have a strong evidence base linking them with an increased risk of infection transmission. However, these procedures are still considered high-risk by some due to the likelihood of being performed with other high-risk procedures such as intubation or manual ventilation (4). CPR exemplifies some of the challenges of classifying a procedure as a high-risk AGP.

## Risks of aerosol generation during CPR

CPR is currently not considered a high-risk AGP in the United Kingdom. Basic CPR comprises of several steps, including chest compression and defibrillation, while advanced CPR may involve several other procedures such as airway management and ventilation, delivery of cardiac drugs and potentially cricothyroidectomy. It is particularly challenging to assess whether the condition of a patient requiring basic CPR will deteriorate, requiring more complex procedures with a higher risk of aerosol generation. Theoretically, chest compressions may potentially generate an aerosol similar to an exhalation breath, which is not considered a high-risk AGP. A systematic review of aerosol generating procedures and transmission of Severe Acute Respiratory Syndrome (SARS) to healthcare workers identified limited low quality data relevant to chest compressions and defibrillation (5) and concluded these procedures might be associated with an increased risk of transmission, but the odds ratios were not statistically significant. Manual ventilation and intubation, both potentially procedures associated with CPR, are currently on the UK list of high-risk AGPs. Personal protective equipment (PPE) would reduce the risk of infection to those administering CPR, however consideration of the delay that may result due to donning respiratory protective equipment and the effects of this on patient outcomes needs to be considered.

## Conclusion

There is a clear lack of consensus among countries regarding what is considered a high-risk AGP. This is reflective of the sparse evidence landscape: there are many challenges when studying aerosol generation and currently no standardised methods of researching potential high risk AGPs. The existing evidence is substantially heterogeneous, leading to difficulty in interpreting findings and forming recommendations. Much of the variation in countries AGP list content may be attributable to a reliance on expert opinion in the absence of evidence. A stronger evidence base and standardised recommendations would inform health policy and practice, improve resource allocation and help to ensure optimum patient care. Co-ordination of research responses and funding mechanisms is needed in order to develop high quality evidence regarding AGPs and transmission risk, and could be achieved through an international coordinated research programme.

## References

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