RCOA
Royal College of Anaesthetists

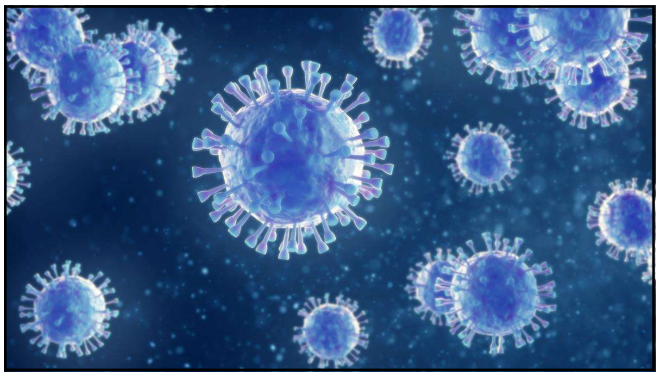
WINTER SYMPOSIUM
3–4 December 2020

COVID-19 Chair: Dr Jamie Strachan

What Intensive Care Medicine has learned
Dr Alison Pittard OBE

PPE
Professor William Harrop-Griffiths

Risks to healthcare workers
Professor Tim Cook



PPE

and FFP3s and AGPs and other things

Will Harrop-Griffiths

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Professor of Practice (Anaesthesia), Imperial College, London
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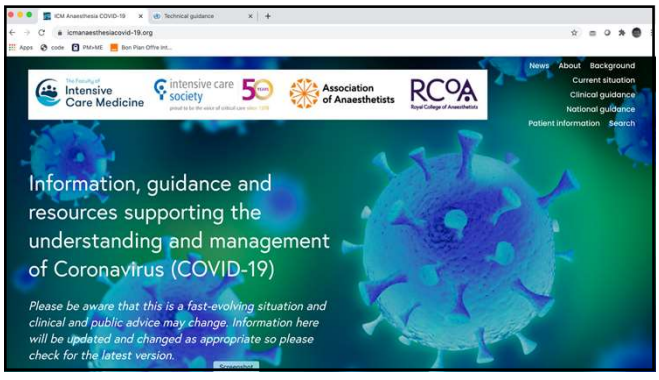
Competing interests

- No relevant competing financial or other interests

Disclaimers

- I am not a PPE expert
- Not like that Professor Cook from Bath is
- However, I have worn it a lot
- And I have read and written quite a lot about it



The Health and Safety Executive

HSE

"PPE is equipment that will protect the user against health or safety risks at work"

Three ways to catch COVID-19

- Contact
- Droplet
- Aerosol

Senator Mike Lee at the Rose Garden Party on 26/9/20

Contact spread

- Direct contact with an infected patient or with their immediate environment
- "SARS-CoV-2 can be spread by this route"

Droplet spread

- Droplets: particles >5 µm generated mostly by gas acceleration
- Ballistic trajectory: travel up to 2 metres
- "This is thought to be the predominant mode of spread"

Airborne spread

- Aerosols: particles <5 µm generated mostly by high velocity gas flow across a thin liquid film
- Can stay suspended for some time before desiccation increases density
- "There is the potential for spread by this route"

PPE and precautions should match the risk

- Standard Infection Control Precautions (SICPs)
- Transmission-Based Precautions (TBPs)
  - Contact
  - Droplet
  - Airborne

SICPs

- Patient placement and assessment for infection risk
- Hand hygiene
- Respiratory and cough hygiene
- Safe management of the care environment
- Safe management of healthcare linen
- Safe management of blood and body fluids
- Safe disposal of waste (including sharps)
- Occupational safety: prevention and exposure management
- PPE

Masks

- Type I
  - 95% Bacterial Filtration Efficiency (BFE)
  - Not fluid resistant
- Type IR
  - 95% BFE
  - Fluid resistant
- Type II
  - 98% BFE
  - Not fluid resistant
- Type IIR = FRSM
  - 98% BFE
  - Fluid resistant

Filtering Face Pieces (FFPs)

- FFP2 mask filters ≥94% of aerosols
- FFP3 mask filters ≥99% of aerosols
- N95 mask filters ≥95% of aerosols
- PROVIDED THEY FIT!
- PROVIDED THEY ARE USED PROPERLY!
- Valved masks only protect the wearer

PPE is the source of much confusion

- Particularly for surgeons
- PHE and NHSEI partly responsible for the confusion
- The Griffiths Guide

THEATRE CONTEXT	SICP	TBP CONTACT	TBP DROPLET	TBP AIRBORNE
GLOVES*				
EYE/FACE PROTECTION				
APRON or GOWN*				
MASK				

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GLOVES*	Single use Single pair	Single use Single pair	Single use Single pair	Single use Single pair
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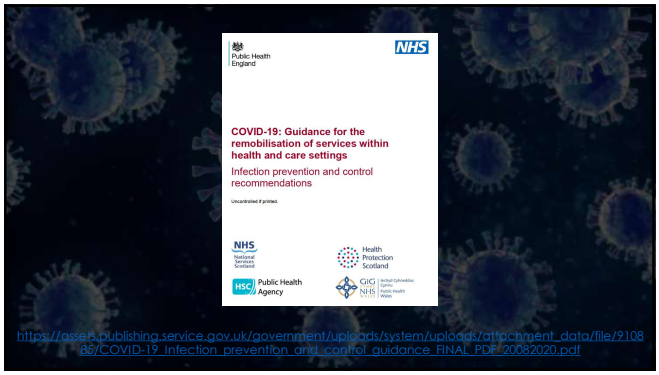
MASK	Type IIR Single use if splashy	Type IIR Single use if splashy	Type IIR Single use	FFP3 or hood

Aerosol-generating procedures (AGPs)

- The increased risk of infection only exists if these are related to the respiratory tract
- AGPs not associated with the respiratory tract are not considered to produce increased risk
  - Diathermy
  - Drills, burrs and saws
  - Suction
  - Laparoscopy
  - Laparotomy



https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910885/COVID-19_Infection_prevention_and_control_guidance_FINAL_PDF_20082020.pdf

- tracheal intubation and extubation
- manual ventilation
- tracheotomy or tracheostomy procedures (insertion or removal)
- bronchoscopy
- dental procedures (using high speed devices, for example ultrasonic scalers/high speed drills
- non-invasive ventilation (NIV); Bi-level Positive Airway Pressure Ventilation (BiPAP) and Continuous Positive Airway Pressure Ventilation (CPAP)
- high flow nasal oxygen (HFNO)
- high frequency oscillatory ventilation (HFOV)
- induction of sputum using nebulised saline
- respiratory tract suctioning
- upper ENT airway procedures that involve respiratory suctioning
- upper gastro-intestinal endoscopy where open suction of the upper respiratory tract occurs
- high speed cutting in surgery/post-mortem procedures if respiratory tract/paranasal sinuses involved

Notably absent from the list

- Coughing
- Sneezing
- Singing
- Talking
- Breathing

ARHAI Scotland

Antimicrobial Resistance and Healthcare Associated Infection

NHS National Services Scotland

Assessing the evidence base for medical procedures which create a higher risk of respiratory infection transmission from patient to healthcare worker

Version 1.1, 16 October 2020.

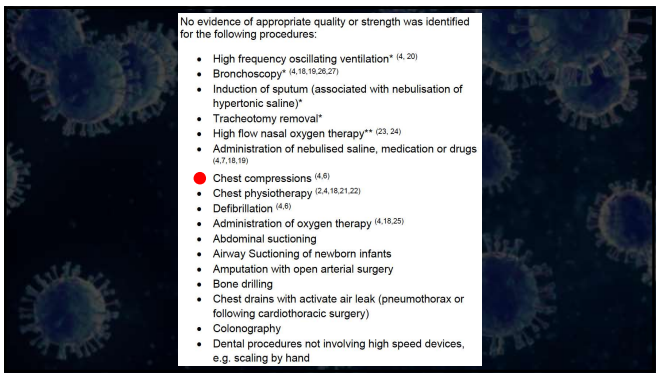
https://hpspubsrepo.blob.core.windows.net/hps-website/nss/3055/documents/1_agp-sbar.pdf

Weak evidence

- open suctioning of the respiratory tract of mechanically ventilated patients (2-7)
- dental procedures using high speed devices such as ultrasonic scalers and drills (8-12)
- high speed cutting in surgery/post mortem procedures[1] (13-16)
- manual ventilation (4,6,17)
- non-invasive ventilation (4,18-20)
- performing a tracheotomy (4)
- performing tracheal intubation (2,4-7,20)

No evidence of appropriate quality or strength was identified for the following procedures:

- High frequency oscillating ventilation* (4, 20)
- Bronchoscopy* (4,18,19,26,27)
- Induction of sputum (associated with nebulisation of hypertonic saline)*
- Tracheotomy removal*
- High flow nasal oxygen therapy** (23, 24)
- Administration of nebulised saline, medication or drugs (4,7,18,19)
- Chest compressions (4,6)
- Chest physiotherapy (2,4,18,21,22)
- Defibrillation (4,6)
- Administration of oxygen therapy (4,18,25)
- Abdominal suctioning
- Airway Suctioning of newborn infants
- Amputation with open arterial surgery
- Bone drilling
- Chest drains with activate air leak (pneumothorax or following cardiothoracic surgery)
- Colonography
- Dental procedures not involving high speed devices, e.g. scaling by hand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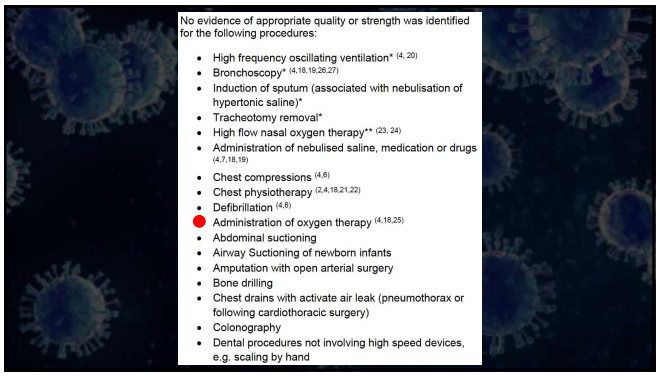
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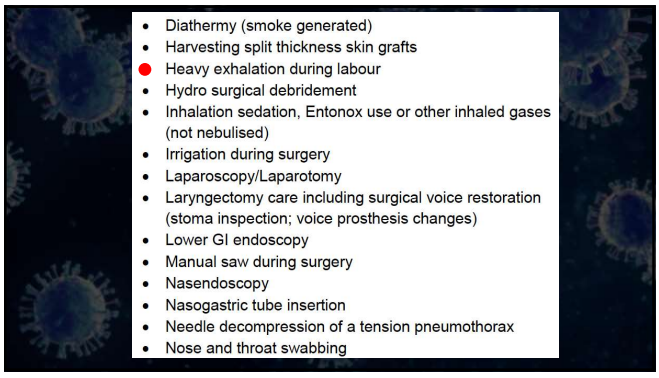
Diathermy (smoke generated)
Harvesting split thickness skin grafts
Heavy exhalation during labour
Hydro surgical debridement
Inhalation sedation, Entonox use or other inhaled gases (not nebulised)
Irrigation during surgery
Laparoscopy/Laparotomy
Laryngectomy care including surgical voice restoration (stoma inspection; voice prosthesis changes)
Lower GI endoscopy
Manual saw during surgery
Nasendoscopy
Nasogastric tube insertion
Needle decompression of a tension pneumothorax
Nose and throat swabbing

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- Harvesting split thickness skin grafts
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- Peak flow device meter use
- Percutaneous lung biopsy
- Phaecoemulsification
- Pulsed lavage during surgery
- Supraglottic airway insertion
- Surgical procedures in head and neck area not involving the respiratory tract, paranasal sinuses or oral cavity
- Swallowing assessments (SALT)
- Thoracoscopy
- Tracheostomy care and management without suctioning procedures, with and without connection to mechanical ventilator
- Trans Oesophgeal Echo (TOE)
- Upper GI endoscopy
- VAC dressing application
- Vitrectomy

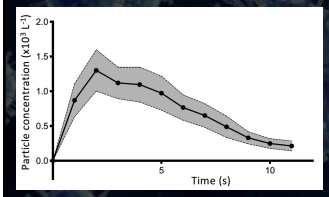
Absence of evidence is not evidence of absence

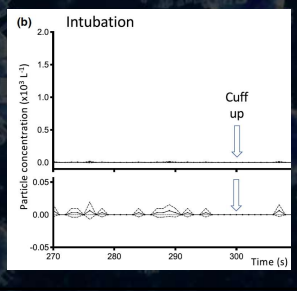
Anaesthesia 2020 doi:10.1111/anae.15292

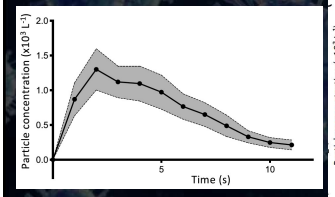
Original Article

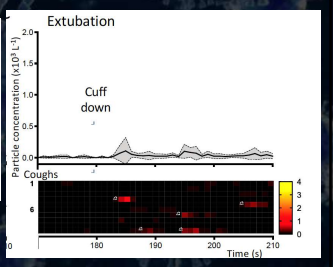
A quantitative evaluation of aerosol generation during tracheal intubation and extubation

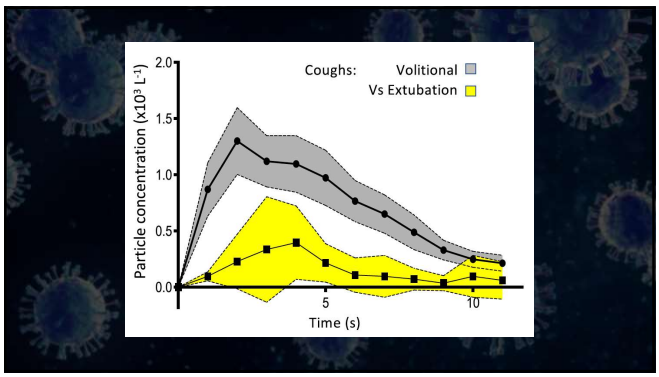
J. Brown,[1] F. K. A. Gregson,[2] A. Shrimpton,[3] T. M. Cook,[4] B. R. Bzdek,[6] J. P. Reid[5] and A. E. Pickering[6,7]











Anaesthesia 2020 doi:10.1111/anae.15301

Original Article

Aerosolisation during tracheal intubation and extubation in an operating theatre setting

R. S. Dhillon,[1] W. A. Rowin,[2] R. S. Humphries,[3] K. Kevin,[4] J. D. Ward,[5] T. D. Phan,[6] L. V. Nguyen,[7] D. D. Wynne[8] and D. A. Scott,[9] on behalf of the Clinical Aerosolisation Study Group*

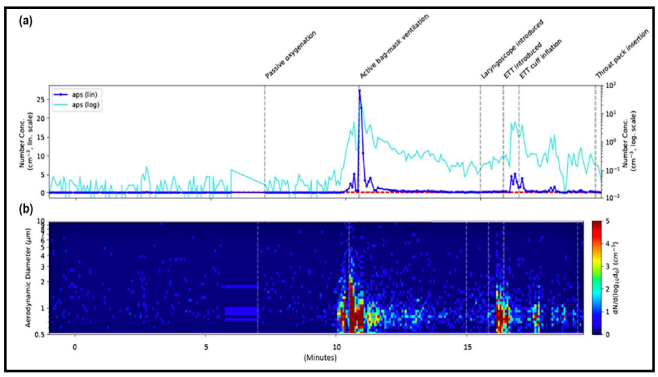


Table 1 Disturbances above background levels caused by specific procedural steps from combined Aerodynamic Particle Sizer (0.09 cm^{-3}) and Mini Wide Range Aerosol Spectrometer (60 cm^{-3}) data.

Procedure	Procedural step	Peak increase (multiples of background concentration)	Particle size (μm)
Intubation	Bag and mask ventilation	200–300	0.05–2
Intubation	Tracheal tube insertion	30–50	0.15–2
Intubation	Tracheal tube cuff inflation	30–50	0.15–2
Extubation	Bag and mask ventilation	10–25	0.1–3
Extubation	Throat pack removal	5	0.75–3
Extubation	Patient cough	15–125	0.05–4

The debate is now switching to HFNO

- High flow = 30 – 60 $l.min^{-1}$
- A good cough can generate 1000 $l.min^{-1}$
- Evidence suggests that HFNO does not increase aerosol and droplet formation
- HFNO does not affect the generation and dispersal of aerosol during coughing
- High oxygen flow rates may help aerosol dispersion

Will NERVTAG and PHE declassify?

- Don't hold your breath
- With adequate supplies of PPE and the peak of the second surge likely passing
- There is arguably nothing to be gained
- For there is politics in PPE

TBPs go beyond just PPE

- Cannot use the anaesthetic room
- "Downtime" or aerosol clearance time (ACT) after AGPs at the beginning of anaesthesia
- Removal of invasive airway adjunct in theatre
- Recovery in theatre
- "Downtime" or aerosol clearance time (ACT) after AGPs at the end of anaesthesia
- Cleaning processes

Aerosol clearance times to better communicate safety after aerosol-generating procedures

Anaesthesia 2020, 75, 1114–1123

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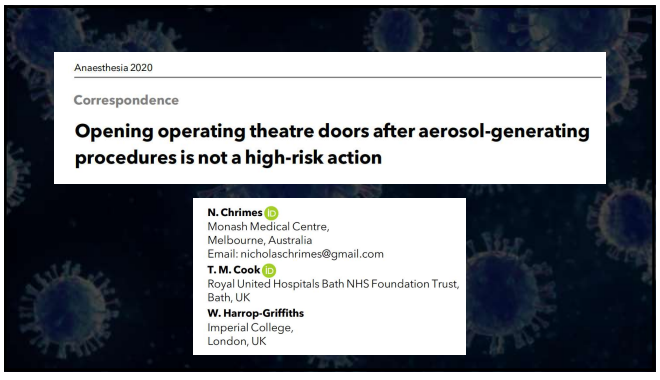
Aerosol clearance time = ACT

- Each air exchange clears 63% of aerosol (in theory)
- Five air exchanges (ACT5) clears >99% of aerosol
- Operating theatre air exchange data
  - Must be measured by NHS estates rules
  - Are around 20 per hour (or more) for operating theatres
  - Which is one every 3 minutes
  - Which means that ACT5 = 15 minutes

Surely when you open the doors from the operating theatre to the corridor, there will be a big rush of air that will contain aerosols?



Anaesthesia 2020

Correspondence

Opening operating theatre doors after aerosol-generating procedures is not a high-risk action

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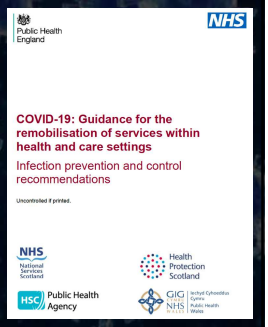
London, UK

Some calculations

- Gas leakage from one theatre often around 700 $l.s^{-1}$
- Gas leakage from one nine-theatre suite = 100 000 $l.s^{-1}$
- Theatres pressurized to 3 – 30 Pa
- If you do the math with the gas laws, this means that the gas escaping from the theatre due to pressure equalization is…
- 8 – 80 l
- Compared to the 700 $l.s^{-1}$ leaving the theatre
- And the howling gale in the corridor

Surgical pathways

- Low-risk
  - Negative test + self-isolation
  - Regular negative tests
  - SICPs only
- Medium-risk
  - Risk-assessed and awaiting test result
- High-risk
  - Positive test
  - Symptoms
  - Not yet risk-assessed


Public Health England

NHS

COVID-19: Guidance for the remobilisation of services within health and care settings

Infection prevention and control recommendations

Uncontrolled if printed.

NHS National Services Scotland

Health Protection Scotland

HSC Public Health Agency

GIG NHS

Risk is not binary; it is a continuum

- Low-risk is not synonymous with no-risk
- Can any pathway be low-risk in times of high local prevalence?
- Particle size is a continuum
- Whether something is an AGP is not binary
- Theatre team members are not all the same

A terrible balancing act

- Risk to lives
- Risk to the economy
- Risk to theatre team members
- Risk to patients through delayed surgery
- An impossible and unenviable task

PPE = Politicised Protective Equipment

- Shortages during COVID-1
- Pressure groups demanding "full PPE" for all
- Interpretation of guidance changes as "downgrading"
- Politics meets science meets public health

PPE

- Wear the appropriate PPE
- Too little protection will pose a risk to you
- Too much protection will pose a potential risk to supplies
- And therefore to others
- It may be nerdy, but someone in theatre needs to know the details of which PPE is appropriate for which patient and which procedure
- The briefing is a good time to share this knowledge


The End
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