

To use spirometry or not use spirometry that is the question? – a relatively detailed review of current opinion by a generalist

Steve Holmes (July 2020)

There is debate at the current time over the last three months since the lockdown due to COVID19 with many specialist advisory groups suggesting spirometry is a potential aerosol generating procedure (AGP) and hence precautions required and full personal protective equipment (PPE), whilst Public Health England (PHE) and Scotland indicating informally (as not in their formal guideline) that spirometry should not be considered an AGP – **but in several of the comments from PHE suggesting individual providers should evaluate the procedure and take appropriate protection as they deem appropriate.**

There has been considerable debate at CCG level (personal communications) NHS regional level and national level.

Lets look at the evidence rather than rhetoric and as the famous Monty Python sketch highlighted a debate or discussion is not just a contradiction – it should involve a connected series of evidence based statements intended to establish a good foundation.

What is an aerosol generating procedure?

Public health England suggest (<https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/covid-19-personal-protective-equipment-ppe>) “ Certain work environments and procedures convey higher risk of transmission and aerosol generating procedures (AGPs) present risk of aerosolised transmission” and highlight that filtering face piece respirators should be used. There are also implications for cleaning after a procedure.

Setting	Context	Disposable Gloves	Disposable Plastic Apron	Disposable fluid-repellent coverall/gown	Surgical mask	Fluid-resistant (Type IIR) surgical mask	Filtering face piece respirator	Eye/face protection ¹
Any setting	Performing an aerosol generating procedure ² on a possible or confirmed case ³	✓ single use ⁴	✗	✓ single use ⁴	✗	✗	✓ single use ⁴	✓ single use ⁴

Public Health England quote” The highest risk of transmission of respiratory viruses is during AGPs of the respiratory tract, and use of enhanced respiratory protective equipment is indicated for health and social care workers performing or assisting in such procedures.” And provide a reference to their review of the literature.

- And suggest AGPs are:
- respiratory tract suctioning
- bronchoscopy
- manual ventilation
- tracheal intubation and extubation

- tracheotomy or tracheostomy procedures (insertion or removal)
- upper ENT airway procedures that involve suctioning
- upper gastro-intestinal endoscopy where there is open suctioning of the upper respiratory tract
- high speed cutting in surgery/post mortem procedures if this involves the respiratory tract or paranasal sinuses
- dental procedures using high speed devices such as ultrasonic scalers and high speed drills
- non-invasive ventilation (NIV); Bi-level Positive Airway Pressure Ventilation (BiPAP) and Continuous Positive Airway Pressure Ventilation (CPAP)
- High Frequency Oscillatory Ventilation (HFOV)
- induction of sputum using nebulised saline
- high flow nasal oxygen (HFNO)

This is based on the WHO definition (2014) of an AGP “any medical and patient care procedure that results in the production of airborne particles (aerosols)” The literature review from PHE clarifies by suggesting “On discussion of procedures listed as AGPs, this definition is frequently cited, however, if taken out of this context, it can be misinterpreted to suggest that all procedures or activities which create any level of aerosol require enhanced (airborne) infection control precautions. The frequently cited AGP definition lies within the WHO document section entitled ‘high-risk aerosol-generating procedures’ where the guidance specifically defines AGPs, in the context of the procedure i.e. “medical procedures that have been reported to be aerosol-generating and consistently associated with an increased risk of pathogen transmission”.⁽¹⁾

PHE’s literature review <https://hps.scot.nhs.uk/web-resources-container/sbar-assessing-the-evidence-base-for-medical-procedures-which-create-a-higher-risk-of-respiratory-infection-transmission-from-patient-to-healthcare-worker/> also suggests Coughing, sneezing and even breathing will generate aerosols. However, what must be determined is which procedures, demonstrated through evidence, generate a significantly high number of respirable aerosols/droplets; and are associated with a higher incidence of healthcare worker acute respiratory infection.

The review found the following with weak evidence for an increased risk of respiratory infection transmission associated with the following procedures

- 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 procedures¹ ⁽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 other procedures found had even weak evidence (but spirometry is not mentioned, nor is lung function or peak flow).

The review suggests that “those procedures for which no or very weak evidence was found, but are currently included in the HPS AGP list, are based on historic expert opinion and have not been removed, as absence of evidence for transmission may be influenced by the effect of healthcare workers currently wearing respirators for these procedures.” This review

(available at https://www.who.int/csr/bioriskreduction/infection_control/publication/en/) from the WHO in 2014 is a 100 plus page document that is referenced. The guidance published in 2014 was indeed in preparation for a virus similar to SARS and more severe influenza – so highly relevant. Again a recognition that little good evidence in 2014. This suggests (p36)

High-risk aerosol-generating procedures

Aerosols are produced when an air current moves across the surface of a film of liquid, generating small particles at the air–liquid interface. The particle size is inversely related to the velocity of air. Therefore, if a procedure causes air to travel at high speed over the respiratory mucosa and epithelium, the production of aerosols containing infectious agents is a potential risk.

The original review had the consensus meeting that provided the updated list in 2007.

Fundamentally in science and evidence base it is vital to remember that a lack of evidence does not mean either safety or danger – it means there is not strong evidence either way – hence though PHE feel sure that spirometry cannot be an AGP because they have not found evidence this does not mean that it is safe.

So what do expert professional clinical groups consensus groups feel (acknowledging that WHO and PHE have been unable to isolate evidence) and relate back to a meeting in 2007?

Well

1. the NHS England National Respiratory Clinical Lead (Andrew Menzies Gow) has indicated on at least occasions that spirometry is a AGP and has emailed PHE to ask for clarification over the last two months.

2. British Thoracic Society;

<https://www.brit-thoracic.org.uk/about-us/covid-19-information-for-the-respiratory-community/> (under advise for those conducting lung function tests) linking to ARTP and also quoting this in much of their guidance and in their renovation of services documentation <https://www.brit-thoracic.org.uk/about-us/covid-19-resumption-and-continuation-of-respiratory-services/> reiterates this. They suggest full PPE / use of viral filters (which cost £20 per test) and recommend deep cleaning between patients

3. The ARTP (Association of respiratory technology and physiologists) <https://www.artp.org.uk/News/artp-covid19-update-18th-march-2020> again hazard caution and are the teams that perform this in general in a hospital setting - suggest full PPE / use of viral filters (which cost £20 per test) and recommend deep cleaning between patients

4. the Primary Care Respiratory Society (UK) - <https://www.pcrs-uk.org/resource/pragmatic-guidance-crisis-management-asthma-and-copd-during-uk-covid-19-epidemic>
support ARTP / BTS view

5. the European Respiratory Society (similar) <https://ers.app.box.com/s/zs1uu88wy51monr0ewd990itoz4tsn2h>

6. AAAAI (American Asthma and Allergy Association) (similar) <https://www.aaaai.org/ask-the-expert/spirometry>

7. American Thoracic Society (similar though don't express extent of PPE used)

<https://www.thoracic.org/professionals/clinical-resources/disease-related-resources/pulmonary-function-laboratories.php>

Conclusion

Hence PHE are using a consensus meeting in 2007 for the majority of their evidence and an updated review commissioned as well as the WHO guideline in 2014, and a lack of evidence to suggest that spirometry must be safe and is not an AGP. All consensus professional expert groups in Europe, US and in UK suggest that spirometry (and hence peak flow) is an AGP on the basis of the technique used (maximal forced expiratory testing resulting in airflow speeds over the respiratory mucosa of 200 – 600 litres per minute (peak flow rates) hence with this speed likely to be aerosol generating more so than many others. Equally most clinicians and physiologists who regularly undertake spirometry note that maximal forced expiration commonly results in coughing – and though many of the droplets from cough are large the imaging is clear that small droplets are produced.

Suggestion

Until clear careful advice provided, and specialist colleagues engaged (RCP, PCRS, ARTP, BTS in UK) I would suggest that practices carefully consider whether they can undertake spirometry in the clinical environment with full PPE (as defined by PHE for an AGP), they should also use viral / bacterial filters (£20 per filter) (rather than a one way valve as commonly used in primary care) . There should be an assessment of droplet dispersion in the room (depending on airflow, room size) to determine how long the room should remain empty prior to deep cleaning between every patient. Hence this is not particularly feasible at the current time.

Background

Steve Holmes has been a GP in Somerset since 2002 and a GP since 1989, he has recognised his duties as a doctor under the GMC guidelines to maintain patient safety, and also his responsibilities as a clinical leader to ensure the safety of clinicians. He has worked in a rural environment undertaking full NHS level clinical workload for more than 30 years – and recognises the importance of ensuring patients safety is maintained. He was involved in the most widely cited primary care spirometry guidelines published (cited in more than 230 peer reviewed articles) which took a year to produce , and has more than 300 published papers to his name. He has been involved in a variety of guidelines nationally and world wide, as well as COVID guidance produced by the BTS / RCGP / PCRS and the International Primary Care Respiratory Society.

PHE have remained convinced that spirometry is
Spirometry in the COVID Era – SH Emails June 2020 after rejection from Somerset CCG to alert to problems with Spirometry as AGP

Dear Julia,

Thanks for this - and the link (which was another of the areas I looked at as I explored the supplementary evidence - indicating as I know you are aware of such a lack of evidence for any of this (to say either safe or dangerous) and again did not search for spirometry, lung function, nor in the methodology specifically for peak flow). As I said, the other bodies do not quote an evidence base to substantiate their view either - (as I presume it does not exist) but comment from a position of regularly undertaking the procedures.

I think there were some subtle misinterpretations of the messages that I was trying to get over so felt it best to put this in writing for you:

My concern is not that there is no evidence (I think that is clear) but the assumption that because there is no evidence of safety or danger - as per the NHS Scotland review - this means it must be safe. (I presume the SBAR document is the background NHS Scotland review that informed PHE advise; that didn't search for spirometry and found no evidence for many areas for safety or danger). You did indicate that the the interpretation of this advise (supported by infection control by yourself, and Wendy Grey as SW regional lead) is that any other procedure not discussed must be safe because PHE indicate it is.

I suggested that several organisations suggest that spirometry should only be undertaken after very careful evaluation (and in full PPE) - and that to my knowledge no hospital is currently undertaking spirometry except under ARTP guidance in the UK but some colleagues in specialist care were horrified to hear that some practices were doing spirometry. (I do not think in Somerset, but wished to alert my GP and nurse colleagues to ensure patient safety and clinician safety).

1. the NHS England National Respiratory Clinical Lead (Andrew Menzies Gow) has indicated that spirometry is a AGP on three meetings that several of us have attended in the last three weeks when this has been discussed.

2. the British Thoracic Society;

<https://www.brit-thoracic.org.uk/about-us/covid-19-information-for-the-respiratory-community/> (under advise for those conducting lung function tests) linking to ARTP and also quoting this in much of their guidance and in their renovation of services documentation <https://www.brit-thoracic.org.uk/about-us/covid-19-resumption-and-continuation-of-respiratory-services/> reiterates this.

3. The ARTP (association of respiratory technology and physiologists)

<https://www.artp.org.uk/News/artp-covid19-update-18th-march-2020> again hazard caution and are the teams that perform this in general in a hospital setting (where there are a few being undertaken for people to evaluate with lung cancer pre operatively but about 5% of previous output.

4. the Primary Care Respiratory Society (UK) -

<https://www.pcrs-uk.org/resource/pragmatic-guidance-crisis-management-asthma-and-copd-during-uk-covid-19-epidemic>

5. the European Respiratory Society

<https://ers.app.box.com/s/zs1uu88wy51monr0ewd990itoz4tsn2h>

6. AAAAI (American Asthma and Allergy Association) I didn't mention but their link is here

<https://www.aaaai.org/ask-the-expert/spirometry>

7. American Thoracic Society - this I didn't mention and suggests appropriate PPE without being specific

<https://www.thoracic.org/professionals/clinical-resources/disease-related-resources/pulmonary-function-laboratories.php>

I thought it would be useful to have the links (but don't look for the evidence which is not there).

Of course, the body of respiratory expert clinicians, and expert physiologists in UK and world in hospital and primary care are recommending do not do - unless absolutely essential and then with full PPE; PHE appears to be saying no problem (though Julia I think you suggested that each practice should do its own evaluation... like acute trusts (who are in line with BTS, ARTP, PCRS national guidance).

My concern to raise is that if practices are undertaking this they should be fully aware of what every acute trust in England and as far as I am aware every unit in Europe is doing. My responsibility as a clinician is to alert other clinicians to what every professional body is suggesting in UK, Europe and America. I am alarmed that PHE advise (which didn't actual comment on spirometry or lung function testing) and suggested no evidence (so no safety or danger evidence) in the literature review either way for peak flow meter measurement (again A&E and ambulance services have stopped this) could lead clinicians into increasing risk to patients and practices to practice staff if they are not aware of this.

It was a good discussion and helped me to understand some of the decision making and I hope that you can see why I am alarmed for the safety of my colleagues and the people in Somerset who put their trust in us.

Steve

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BLOOMFIELD, Julia (NHS SOMERSET CCG)

Wed 03/06/2020 17:42

Dear Steve and Rachael

https://hpspubsrepo.blob.core.windows.net/hps-website/nss/3055/documents/2_agp-supplementary-document.pdf

Thank you for our conversation earlier, as discussed please see the link above for the supplementary evidence to the SBAR document on aerosol generating procedures.

In summary, we discussed that you are concerned that there is no evidence around peak flow and spirometry causing aerosols and you wanted to advise general practice not to undertake this procedure at present due to safety issues. You had also wanted to advise that staff undertaking this procedure wear Level 3 PPE which includes gowns and FFP3 masks which require fit testing for APGs. I have advised that the latest review by NERVTAGE and PHE in the SBAR AGPs guidance and the main AGPs list from PHE (included in the COVID 19 IP&C guidance) does not include spirometry or peak flow and therefore it is not considered to be an aerosol generating procedure. We discussed that there is evidence in the SBAR document on coughing and sputum induction which can be applied to spirometry and peak flow. I also advised that SWNHSE&I IP&C team have advised that spirometry and peak flow are not an AGP. We discussed that Level 2 PPE could be used for this procedure and that it was for healthcare providers to make their own risk assessment whether or not to undertake peak flow and spirometry.

Steve you explained that primary care and acute trusts nationally and internationally are not undertaking spirometry at present due to safety concerns for both staff and patients. I suggested you talk to Michael Bainbridge and Tanya Whittle from a contracting & commissioning point of view going forward, as I could not advise that you advise general practices to use Level 3 PPE to reduce the risk when spirometry is not considered to be an AGP.

Many thanks for a great discussion and I hope Michael and Tanya can advise further.

Kind regards

Julia

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