Appendix - Aerosol generation from nebulisation - rapid review (1 April 2020)

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Public Health England guidance: “Certain other procedures/equipment may generate an aerosol from material other than patient secretions but are not considered to represent a significant infectious risk. Procedures in this category include:

- administration of pressurised humidified oxygen;
- administration of medication via nebulisation.”


The aim of this rapid review is to evaluate whether this is applicable to nebulisation procedures in children. The objectives are to examine evidence around

1. Aerosol generation from nebulisation
2. Risk of healthcare worker infection from nebulisation of patients with viral infections especially SARS or COVID-19, and influenzae
3. Protective effects of fit-tested masks for HCW (outcome = proven or suspected infection [viral illness + LRTI])

Identification of studies:

Rapid literature search (01/04/20)

i) (from Web of Science Core Collection)
You searched for: TITLE: (aerosol or environmental or airborne or suspension or environment* or nosocomial) AND TITLE: (nebulis*) – 55 abstracts
Does nebulisation generate aerosols?

In one study of 21 adult patients with chronic respiratory illness, 11 coryzal patients, and 12 fit and well subjects, various procedures were performed, including physiotherapy, non-invasive ventilation and nebulisation (1). Particle spread was examined by use of a counter near the patient’s face and one metre away and differences between pre- and post- procedure counts were analysed. Nebulisation generated aerosols <5 nanometre but not >5 nanometre. These were presumed to originate from the nebuliser itself, rather than the participants.

However, this is presumed rather than proven as it was not possible to analyse nebuliser vs participant-generated aerosols. The researchers examined droplets rather than viral particles. The experiments were carried out in single rooms. This is relevant because small particle dispersion is affected by several environmental factors. No participants were children. Asymptomatic upper respiratory carriage of SARS-CoV-2 is common in children. It is likely that children receiving nebulisation have asthma or acute viral wheeze, and may cough during the procedure. This would increase the participant-generated aerosol concentration.

In one study particle deposition 1 metre from patients’ faces were measured using a Biosampler, after 7 types of patient care activity (2). Of these, only nebulisation, and nebulisation during bronchoscopy (not bronchoscopy without nebulisation) were associated with an increase in particle dispersion at 1 metre from the patient’s face. These were small particle (<3 micron) aerosols. There is no description of the patients but the methods imply they were adults.

**Interpretation:** Nebulisation does seem to generate aerosols up to at least 1 metre away from a patient’s face. It is only presumed that these do not represent viral particles from patients. There is no data around viral aerosol particle formation when nebulisation procedures are used in children, or children with SARS or COVID-19.

Does nebulisation of patients increase the risk of LRTI in HCW?

This was examined in one systematic review/meta-analysis (3) of observational studies comparing risk of transmission of acute respiratory infections (ARIs) to HCWs caring for patients undergoing aerosol generating procedures (AGPs) compared with the risk of transmission to HCWs caring for patients not undergoing AGPs. Three cohort studies were included (4–6). All evaluated risk of ARI in HCW caring for people during the SARS pandemic. In two studies, HCW were asked about ARI
symptoms and exposure to AGPs (4,5); in one study the presumed transmission of SARS to medical students, from one patient, was examined (6). In all three studies serological testing of HCW and medical students was conducted. There was variability in PPE and infection control procedures across the centres, and individual HCW. The pooled OR estimate from these studies was 0.9 (95% 0.1, 13.6). there was significant heterogeneity (I² 73%). OR (95%CI) for individual studies suggested a trend towards increased risk of ARI in HCW: 6.6 (0.9, 50.5) (5); 0.1 (0.0*, 1.0) (6); 1.2 (0.1, 20.7) (4).

**Interpretation:** Low quality evidence precludes confident conclusions around whether nebulisation increases the risk of ARI in HCW. There is no evidence that nebulisation does not increase the risk of ARI in HCW.

**Do fit-tested N95 masks reduce the risk of HCW ARI compared with surgical masks?**

This was examined in one meta-analysis of RCTs comparing N95 masks versus surgical masks (7). Three RCTs were included (8–10). Subsequently one cluster RCT was published (11). The results of the meta-analysis (and the subsequent cluster RCT) suggest that N95 masks did not confer better protection than surgical masks. The pooled results showed no difference between the masks with regards laboratory-proven RCTs (OR 0.89 [0.64-1.24]; I² 0%). The review authors concluded that there “were insufficient data to determine definitively whether N95 respirators are superior to surgical masks in protecting health care workers against transmissible acute respiratory infections in clinical settings”.

**Interpretation:** There is insufficient evidence around whether N95 masks reduce the risk of HCW developing ARI compared with surgical masks when performing nebulisation procedures with patients with viral illness.

**Summary:** It is likely that nebulisation is an aerosol-generating procedure. It is unclear whether the aerosols come from the patient’s airway. It is unclear whether performing nebulisation procedures increases the risk of HCW developing ARI but there is no evidence to refute this suggestion. It is unknown whether fit-tested masks reduce the risk of HCW ARI when performing nebulisation to adults or children.

**References**


