

Colleagues,

The simulation team along with our infection control and occupational health teams have been conducting in situ-simulation activities in preparation for a COVID-19 patient requiring intubation in our ED and ICU. Our simulations have been an instructive exercises and I'd like to share our findings. I would also like to share what I've gathered from ongoing literature review, social media and conversations with other airway enthusiasts. In the interest of expediency, this paper has not been thoroughly peer reviewed nor approved by my hospital or any of the other courses, agencies or universities with which I am affiliated. The opinions expressed may not reflect the opinions of any of those organizations. There is a vulnerability in sharing a document in this way, but I have been encouraged by others who have shared their documents however imperfect in the hopes they may be helpful. Take from this what you wish and discard that you do not. This document will serve as a discussion paper and I will produce a paired down version to be used as a clinical reference should you find yourself needing to intubate a COVID-19 patient. This document is changing daily and I will include the date in all versions. Clinical experience with COVID-19 is novel and health care workers are sharing their experiences, rapidly expanding our knowledge and understanding. I'm also keen to hear your feedback and will incorporate it into this living document.

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Caveats and Assumptions

This document is derived for use here in Collingwood. It's applicability to other hospitals will be variable. I am not an infection control specialist nor a public health specialist. I've based this summary on current recommendations by Ontario public health, consensus opinion, expert opinion and personal opinion in that order. This is not a binding protocol and as individual clinicians we need to decide what we believe is best for our patients, ourselves and our families. Particularly with respect to PPE, please think through your personal approach and make decisions ahead of time about what you plan to use. Practice and commit.

I have not gone into detail about airway plans, backup plans etc as that is outside of my scope here. The assumption is that you have made plans for intubation with backup plans for oxygenation via BMV, Supraglottic airway and Front of the Neck Access and that you feel the patient is an appropriate candidate for RSI and that you are the most experienced available intubator.

The suggestions assume one critically ill patient requiring intubation with ED rooms 8 and 9 available for this patient or transfer to the ICU negative pressure room is available. We believe that the use of the negative pressure rooms is ideal and we wanted to test feasibility given the smaller size of room 8. We used room 9 as our donning and doffing anteroom. The assumption was that infection continues to be limited and that maintaining the patient in this isolation room was beneficial. If over the course of the outbreak, containment is no longer a realistic goal, treating such a patient in our usual resuscitation room would bring ergonomic benefits at the cost of likely contamination of surfaces which could prove difficult or impossible to sterilize. The negative pressure room in our ICU is an excellent alternative that should be considered in any cases requiring intubation. It is spacious, has monitoring equipment and a staging/ anteroom.

Key Findings and Suggestions

- **PPE requires some practice and definitely requires a donning and doffing coach using a written checklist**
- **PPE is HOT. Make equipment and drug preparations and detailed airway plan before donning PPE so that once you are in PPE you can quickly enter the patient room and proceed to intubation**
- **The intubation team should don together so that one person is not left overheating while the rest are getting dressed**
- **Rooms 8/9 are adequate for the required procedure, the ICU negative pressure room may be preferable if available.**
- **We recommend a team of 1 MD, 1 RN and 1 RT in the room during intubation with the primary RN and ER MD (if an anesthetist is available) stepping into the anteroom to act as an equipment runner/passers and backup.**
- **The period between intubation and connection of BMV is crucial. Plan and prepare the sequence of cuff inflation, connection of the BVM with filter and CO2 monitor inline, prior to entering the room.**
- **All of the literature suggests that the most experienced available airway person attempt intubation. Our anesthetists anticipate getting called for these cases and unless otherwise occupied by patient care, will plan to attend.**

PPE

COVID-19 is thought to be primarily spread through large droplets. Most agencies and experts including Ontario's Public Health agency recommend surgical masks, isolation gowns, eye protection and gloves for routine patient care.

Intubation is considered an Aerosol Generating Procedure (AGP) and as such a higher level of PPE is recommended. After reviewing many agencies' recommendations and testing available equipment we make the following recommendation for PPE for AGPs.

- **2 sets of gloves, 1 under the gown, and one over top of the gown (consider long cuffed gloves over the gown).**
- **Impervious gowns such as our standard OR gowns**
- **fit tested N95 respirators**
- **goggles**
- **face shield**
- **head covering (bouffant or hood)**
- **shoe covers if desired**



2 issues arose with respect to available PPE

- 1) Some groups have expressed concerns about neck exposure with this type of setup. You can consider a “surgeon’s hood” type head gear which offers some neck coverage but it is incomplete and extra care must be taken to remove it without contaminating one’s face. In this picture, I am wearing a bouffant and Jessica and Greg are wearing hoods.
- 2) Available boot covers may be too small for those of us with bigger feet and the doffing of tight boot covers was also identified as concern for potential contamination. You may consider removing your shoes to fit into the covers recognizing this brings a risk of stepping on a sharp or other hazardous item.

We are trying to source some other solutions to these issues but our current setup without neck and foot covering is inline with Public Health and other agency recommendations.

We are working with Infection Control and Occupational Health to ensure that everyone is getting the opportunity to practice donning and doffing under supervision. You can watch this video <https://youtu.be/syh5UnC6G2k> for details of donning and doffing though our sequence will look a bit different.

There is no consensus on exactly what PPE should be worn. A balance needs to be struck between protection and usability. Further, multiple layers of PPE used incorrectly are probably more likely to foster contamination than less layers worn correctly. During the SARS outbreak, Health Care Workers (HCWs) wearing airborne PPE were infected with a cluster likely occurring during intubation. Lack of fit testing and lack of training in proper techniques were identified as likely contributory causes. Conversely, a recent case report from Singapore describes a total of 41 Health Care Workers with exposure to AGPs in a COVID patient not yet identified as such. Only 15% of these HCWs wore N95s as the patient was under contact precautions only. Despite at least 10 minutes within 6 feet of the patient during AGPs, none of these HCWs developed symptoms or positive PCR on serial testing.

My approach will be to assume that even with the most vigilant PPE, some contamination may occur particularly around the neck and I will try to get into a shower with soap and water as soon as is feasible. It is reassuring to hear that Health Care Workers with appropriate PPE do not seem to be getting infected at high rates.

Here is the most current version of our donning and doffing checklist. I cannot recommend strongly enough that donning and doffing be done in the presence of a spotter/coach using the written checklist. Particularly when stressed, the sequence can be challenging to remember and spotter can watch for inadvertent contamination.

Personal Protective Equipment (PPE)

Sequence for Putting on and Removing PPE for AGP

COVID 19

Procedure for Putting on PPE ❖ <i>A second Healthcare provider must observe the putting on and taking off of PPE to ensure self contamination does not occur.</i>	Completed
Immediately prior to entering the patients room or in the anteroom:	
1. Remove all hand and wrist jewelry, necklaces, lanyards and pagers. Empty pockets Tie back hair.	
2. Perform hand hygiene	
3. Put on shoes covers, and disposable scrub pants (if required)	
4. Perform Hand Hygiene	
5. Put on first pair of gloves	
6. Put on Impermeable gown (level 3-4) <ul style="list-style-type: none"> Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back. Fasten ties in back of neck and waist. 	
7. Put on Mask/Respirator (N95) [if required]. <ul style="list-style-type: none"> Secure ties or elastic bands at middle of head and neck. Fit flexible nose piece to bridge of nose. Fit snug to face and chin. Fit check respirator [Mask should collapse inward slightly on inhaling and does not leak on exhale] 	
8. Put on Goggles (if required) <ul style="list-style-type: none"> Place over face and eyes and adjust to fit 	
9. Put on head cover, bouffant or hood	
10. Put on second set of Gloves- Nitrile <ul style="list-style-type: none"> Extend to cover wrist and isolation gown Should be no exposed skin Tape vertically to prevent gloves from slipping (wrist to elbow, 2 pieces, front and back) 	
11. Put on face shield, fully cover face and forehead	
PPE is not to be worn outside of patient room/area	
Procedure for Removing PPE ❖ <i>A second Healthcare provider must observe the putting on and taking off of PPE to ensure self-contamination does not occur.</i> ❖ <i>Second health care provider must be wearing Droplet or Contact PPE to assist in taking off PPE</i>	Completed All PPE is regular waste
1. Inside patient room. <ul style="list-style-type: none"> Outside of gloves are contaminated. Disinfect gloved hands with disinfecting wipes or perform hand hygiene 	
2. Exit patient room.	

<p>3. Remove Gown and first pair of gloves (Observer to assist with gown)</p> <ul style="list-style-type: none"> Gown front and sleeves are contaminated Unfasten ties, observer can assist and push gown down arms Pull away from neck and shoulders Turn gown inside out, outside gloves are removed with gown as it reaches the wrists, peeling off from the inside Try to keep your inside gloves on as you roll the gown and outside gloves off. Fold or roll into a bundle and discard in waste receptacle 	
<p>4. Perform Hand Hygiene on first pair of gloves using ABHR or soap and water</p> <ul style="list-style-type: none"> Use soap and water if hands are visibly soiled 	
<p>5. Remove Face Shield</p> <ul style="list-style-type: none"> Outside of face shield is contaminated To remove handle by head band or ear pieces Place in waste receptacle 	
<p>6. Take off head covering, grasp from behind and lift from back of head, place in waste receptacle</p> <p>7. If wearing hood, spotter will undo ties and hold them out for you to grasp. Use the ties to pull the hood up and over your head being careful not to allow the ties to touch your face.</p>	
<p>8. Perform Hand Hygiene on first set of gloves using ABHR or soap and water</p>	
<p>9. Remove Goggles</p> <ul style="list-style-type: none"> Use elastic headband or ear pieces 	
<p>10. Perform Hand Hygiene using ABHR or soap and water</p>	
<p>11. Sit on chair and observer/coach assist in removing the foot covers by rolling down legs and off feet if applicable</p>	
<p>12. Remove Mask or Respirator (N95)</p> <ul style="list-style-type: none"> Front of mask/respirator is contaminated Grasp bottom ties or elastic, then top ones and remove Discard in waste receptacle 	
<p>*Except for Respirator (N95), remove PPE at doorway or in anteroom. Remove respirator (N95) after leaving patient room and closing door.</p>	
<p>13. Remove gloves and perform Hand Hygiene- using soap and water</p>	
<p>Safe Practices to Protect Yourself and Limit Spread of Contamination:</p>	Completed
<p>Safe Practices:</p> <ul style="list-style-type: none"> Remove any personal accessories (watch, ID, etc) Keep hands away from face Hands must be cleaned before contact with face Once tasks with the patient are underway, PPE is not touched or adjusted Limit surfaces touched Change gloves when torn or heavily contaminated. 	

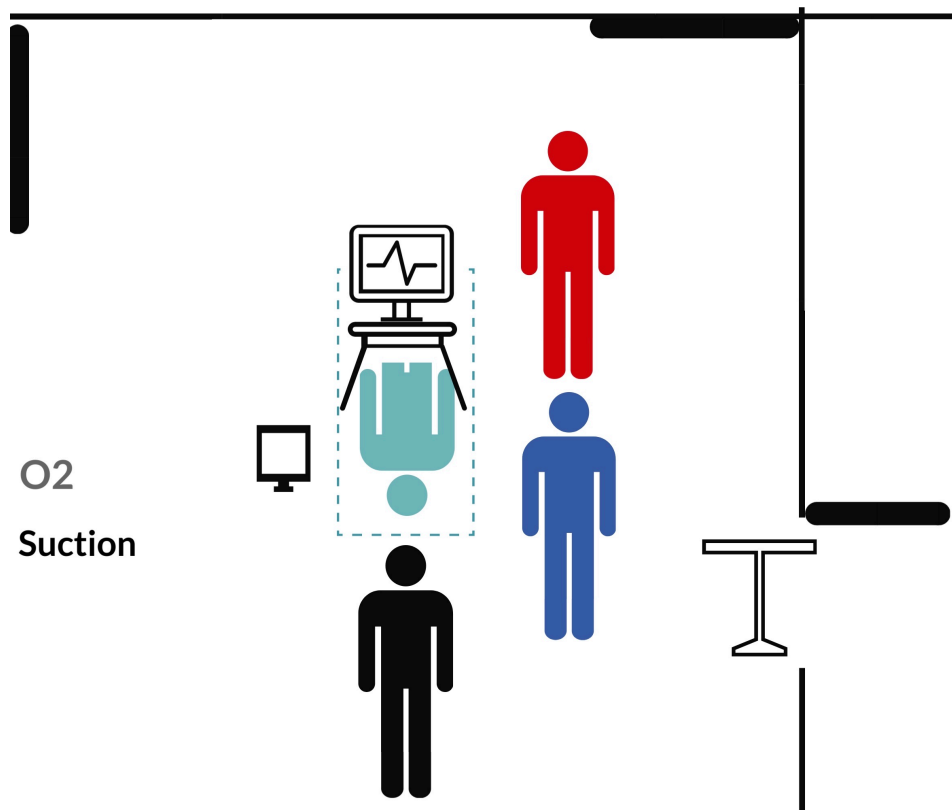
Personnel

We recommend a 3 person intubation team with the most experienced available MD available to intubate, an RN and an RT. In our simulated scenario, the primary nurse and attending ED doc are caring for the patient while the intubation team is preparing. The intubation team needs to be dressed in Airborne PPE while the care team is in droplet PPE. The intubation team should prepare the equipment and review the plan before donning and entering the room. When the intubation team is ready they would receive handover from the care team who would then step into the anteroom. We believe given our negative Air Changes/Hour (ACH) rates of our negative pressure rooms that the room should be considered aerosolized for at least 30 minutes.

Equipment

As room 8 is not typically a monitored bed with resuscitation equipment, one of our aims was to test the feasibility of bringing the necessary equipment to room 8. With the appropriate room setup, we found the space adequate for the necessary equipment. With the goal of thorough preparation and minimizing entry and exit from both the patient room and the anteroom I have attached a checklist that can be used for equipment preparation. The same checklist can be used in the ICU though you would not require the monitor. Note that our CGMH intubation trays are equipped with ETTs, Laryngoscopes, LMAs and oral airways in multiple adult sizes. If not using CGMH intubation trays all of these pieces of equipment need to be added to the equipment checklist.

I have provided a schematic of the physical arrangement we found ideal. With the intubator at the head of the bed, an RT on their right with the Glidescope screen positioned on the left where they can both visualize it. We put a tray table at the entrance to the washroom to hold the intubation equipment/tray and put the monitor on a tray table over the patient's lower extremities.



Technique

Our competing goals are to minimize the generation of aerosols, maximize patient oxygenation and minimize apnea time. High gas flows such as High Flow Nasal Oxygen, BiPap and bag mask ventilation are thought to generate aerosols. [The relative contraindication of their use in COVID is debated. Most airway experts and consensus statements strongly discourage them, however some Critical Care and WHO guidelines allow for their use in hypoxemic patients. It appears that HFNO in particular can be considered as a treatment for COVID related hypoxia but not as means of preoxygenating for intubation.](#) How to preoxygenate and/or reoxygenate a hypoxic patient with COVID will pose challenges. We would discourage “MacGyvering” of equipment in high stress situations and suggest we keep things as familiar as possible. Based on a review of current opinion, I would offer the following suggestions.

- **Use the most experienced available intubator in order to maximize the likelihood of first pass success**
- **Try to avoid Bag Mask Ventilation, Bipap, Highflow Nasal Oxygen (HFNO) and apneic oxygenation if not required.**
- **Low flow nasal oxygen <6Lpm can be used and apneic oxygenation at these flow rates can be considered in patients at high risk of desaturation.**
- **A surgical mask should be put on the patient over top of the nasal cannula**
- **A BVM with cuffed mask, PEEP valve, HME filter and inline CO2 can be used to preoxygenate the spontaneously breathing patient.**
- **Avoid active bagging in the spontaneously breathing patient as asynchronous breaths may promote aerosol generation**
- **The patient should be at least 45 degrees upright during preoxygenation and intubation to maximize oxygenation**
- **Configure waveform capnography during the preoxygenation period.**
- **Ensure a viral filter is in place at all times**
- **Videolaryngoscopy with the Glidescope will allow the intubator to maintain a greater distance from the patients face, reducing the risk of contamination. The intubator should consider whatever intubation technique is most likely to result in rapid first pass success.**
- **If VL is used, especially with a hyperangulated blade, remember to employ a deliberately restricted “50:50” view to decrease the time taken to deliver the ETT.**
- **Rapid Sequence Intubation using an induction agent with high dose rocuronium (1.2-1.5 mg/kg) will decrease the risk of patient coughing and will ensure tone is not regained during airway management.**
- **There is a timer on the Zoll as well as the Glidescope which can be used to time medications.**
- **Be prepared for post intubation cardiovascular collapse with push pressors and/or vasopressor infusion hanging.**
- **Re-oxygenate with BVM or LMA with a viral filter and EtCO2 if dangerous desaturation occurs during intubation attempt. Use two handed BVM technique with low flow, low pressure, low tidal volumes.**
- **Visualization of the tube markings through the cords combined with waveform capnography are preferred to auscultation in order to decrease risk of contamination.**
- **The period between intubation and connection of BMV is crucial. Plan and prepare the sequence of cuff inflation, connection of the BVM with filter and CO2 monitor inline, prior to entering the room.**

- **Ensure cuff is inflated and filter is inline before bagging the patient. Cover or dispose of laryngoscope blade immediately after use.**
- **Leave filter attached to the endotracheal tube during any required disconnections and consider clamping the endotracheal tube.**
- **Ventilation parameters will be ARDS goals. Tidal volume of 6-8 ml/kg of ideal body weight. ARDSnet guides are attached.**
- **Plan and provide post intubation sedation and paralysis.**
- **Place a gastric tube**

COVID Intubation Equipment Checklist

Equipment to brought into the negative pressure room

- ☐ Zoll Cardio-respiratory monitor with inline EtCO2 connected
- ☐ CGMH Intubation tray or the necessary items selected from this tray.
- ☐ Bougie
- ☐ Front of the neck airway kit
- ☐ Pre-drawn Induction drugs. Suggest Ketamine and/or PPF and high dose Rocuronium
- ☐ Push/Infusion Vasopressors (consider setting up infusion prior to procedure)
- ☐ Glidescope with preferred blade loaded and backup blades in anteroom
- ☐ BVM with PEEP valve attached to supplemental O2 tank under patient stretcher
- ☐ Nasal prongs/ NRB connected to wall O2
- ☐ IV pumps with adequate channels for infusions
- ☐ Gastric tube
- ☐ Foley catheter

Equipment to brought into the anteroom

- ☐ Pressure bags
- ☐ Backup glidescope blades
- ☐ PPE Cart
- ☐ Chair for doffing and donning
- ☐ Ventilator
- ☐ Code blue meds
- ☐ Waste receptacle for discarded PPE
- ☐ Remaining items from the intubation tray if you have chosen to take in only selected pieces.

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