Simulation in Preparation for the COVID-19 Pandemic

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Introduction

Healthcare simulation is widely utilised for education at all stages of clinical training and practice, across cognitive, procedural, communication and teamwork domains. Therefore, in anticipation of the uncharted and impending COVID-19 pandemic, we embarked *ad-lib* on a mission to best prepare our clinical staff and systems.

By testing and honing how local and national policies were applied among various professionals in a range of scenarios, we aimed for a proactive and constructive approach to help manage risk, improve patient safety and foster staff morale, at a time of great uncertainty.

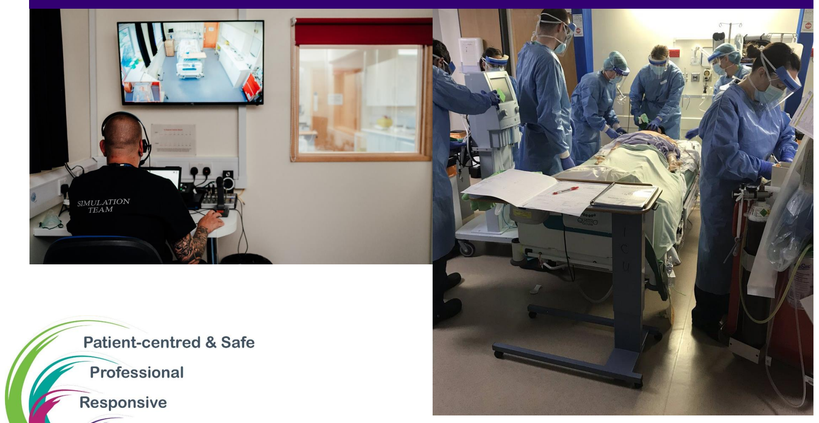
Methods

The initial plan was to simulate, video and disseminate a scenario of a COVID-19 patient that required anaesthesia and intubation for severe hypoxaemic respiratory failure.

This soon progressed to planning, running and debriefing a wide range of COVID-oriented scenarios, including:

- Management of cardiac and respiratory arrests
- Intra-hospital transfers of critically-ill patients
- Donning and doffing of PPE
- Ventilator training
- Inserting surgical tracheostomies
- Proning patients

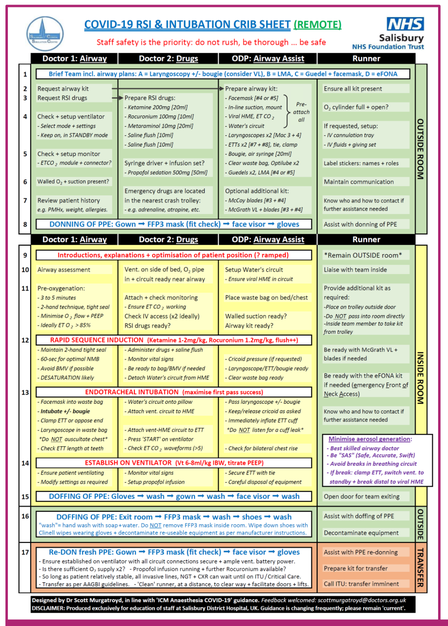
Plus: obstetric and paediatric specialty-focused scenarios.



Patient-centred & Safe
Professional
Responsive
Friendly

Results

Over a two month period during the COVID-19 'first wave', 62 simulation sessions were conducted, incorporating 501 participants in total. The extensive consequential learning helped create three instructional videos, improve six clinical guidelines, engineer six clinical action cards/algorithms and nine educational resources (such as checklists and crib sheets).


COVID-19 RSI & INTUBATION CRIB SHEET (REMOTE)

Staff safety is the priority: do not rush, be thorough … be safe

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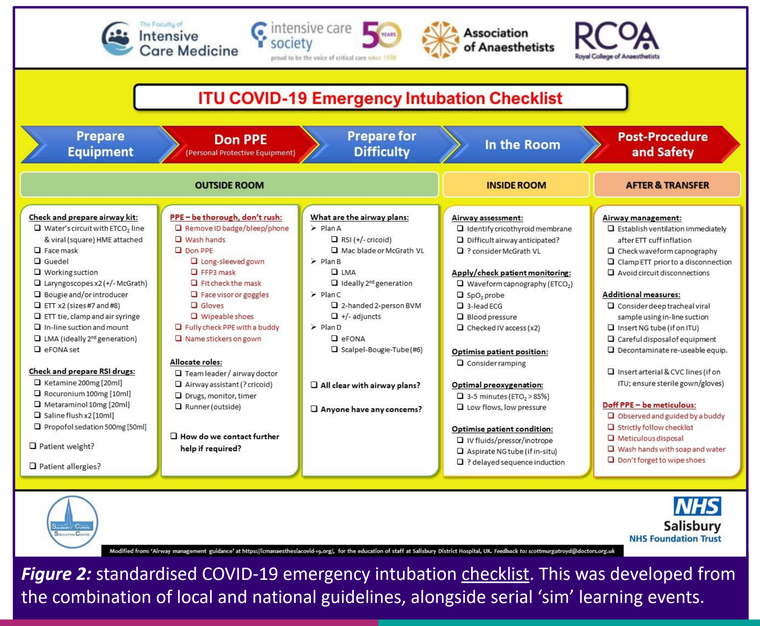
	Doctor 1: Airway	Doctor 2: Drugs	ODP: Airway Assist	Runner	
1	Brief Team Incl. airway plans: A = Laryngoscopy +/- bougie (consider VL), B = LMA, C = Guedel + facemask, D = eFONA				
2	Request airway kit		Prepare airway kit: - Facemask [#4 or #5] - In-line suction, mount - Viral HME, ET CO_2 - Water's circuit - Laryngoscopes x2 [Mac 3 + 4] - ETTs x2 [#7 + #8], tie, clamp - Bougie, air syringe [20ml] - Clear waste bag, Optilube x2 - Guedels x2, LMA [#4 or #5]	Ensure all kit present	OUTSIDE ROOM
3	Request RSI drugs	Prepare RSI drugs: - Ketamine 200mg [20ml] - Rocuronium 100mg [10ml] - Metaraminol 10mg [20ml] - Saline flush [10ml] - Saline flush [10ml]		O_2 cylinder full + open?	
4	Check + setup ventilator - Select mode + settings - Keep on, in STANDBY mode			If requested, setup: - IV connulation tray - IV fluids + giving set	
5	Check + setup monitor - ETCO $_2$ module + connector?	Syringe driver + infusion set? - Propofol sedation 500mg [50ml]		Label stickers: names + roles	
6	Walled O_2 + suction present?			Maintain communication	
7	Review patient history e.g. PMHx, weight, allergies.	Emergency drugs are located in the nearest crash trolley: - e.g. adrenaline, atropine, etc.	Optional additional kit: - McCoy blades [#3 + #4] - McGrath VL + blades [#3 + #4]	Know who and how to contact if further assistance needed	
8	DONNING OF PPE: Gown ➞ FFP3 mask (fit check) ➞ face visor ➞ gloves			Assist with donning of PPE	
	Doctor 1: Airway	Doctor 2: Drugs	ODP: Airway Assist	Runner	
9	Introductions, explanations + optimisation of patient position (? ramped)			*Remain OUTSIDE room*	
10	Airway assessment	Vent. on side of bed, O_2 pipe in + circuit ready near airway	Setup Water's circuit - Ensure viral HME in circuit	Liaise with team inside	
11	Pre-oxygenation: - 3 to 5 minutes - 2-hand technique, tight seal - Minimise O_2 flow + PEEP - Ideally ET O_2 > 85%	Attach + check monitoring - Ensure ET CO_2 working Check IV access (x2 ideally) RSI drugs ready?	Place waste bag on bed/chest Walled suction ready? Airway kit ready?	Provide additional kit as required: *Place on trolley outside door* *Do NOT pass into room directly - inside team member to take kit from trolley*	
12	RAPID SEQUENCE INDUCTION (Ketamine 1-2mg/kg, Rocuronium 1.2mg/kg, flush++) - Maintain 2-hand tight seal - 60-sec for optimal NMB - Avoid BMV if possible - DESATURATION likely	- Administer drugs + saline flush - Monitor vital signs - Be ready to bag/BMV if needed - Detach Water's circuit from HME	- Cricoid pressure (if requested) - Laryngoscope/ETT/bougie ready - Clear waste bag ready	Be ready with McGrath VL + blades if needed Be ready with the eFONA kit if needed (emergency Front of Neck Access)	INSIDE ROOM
13	ENDOTRACHEAL INTUBATION (maximise first pass success) - Facemask into waste bag - **Intubate +/- bougie** - Clamp ETT or oppose end - Laryngoscope in waste bag *"Do NOT auscultate chest"* - Check ETT length at teeth	- Water's circuit onto pillow - Attach vent. circuit to HME - Attach vent-HME circuit to ETT - Press 'START' on ventilator - Check ET CO_2 waveforms (>5)	- Pass laryngoscope +/- bougie - Keep/release cricoid as asked - Immediately inflate ETT cuff *"Do NOT listen for a cuff leak"* - Check for bilateral chest rise	Know who and how to contact if further assistance needed Minimise aerosol generation: - Best skilled airway doctor - Be "SAS" (Safe, Accurate, Swift) - Avoid breaks in breathing circuit - If break: clamp ETT, switch vent. to standby + break distal to viral HME	
14	ESTABLISH ON VENTILATOR (Vt 6-8ml/kg IBW, titrate PEEP) - Ensure patient ventilating - Modify settings as required	- Monitor vital signs - Setup propofol infusion	- Secure ETT with tie - Careful disposal of equipment		
15	DOFFING OF PPE: Gloves ➞ wash ➞ gown ➞ wash ➞ face visor ➞ wash			Open door for team exiting	OUTSIDE
16	DOFFING OF PPE: Exit room ➞ FFP3 mask ➞ wash ➞ shoes ➞ wash "wash" = hand wash with soap + water. Do NOT remove FFP3 mask inside room. Wipe down shoes with Clinell wipes wearing gloves + decontaminate re-usable equipment as per manufacturer instructions.			Assist with doffing of PPE Decontaminate equipment	
17	Re-DON fresh PPE: Gown ➞ FFP3 mask (fit check) ➞ face visor ➞ gloves - Ensure established on ventilator with all circuit connections secure + ample vent. battery power. - Is there sufficient O_2 supply x2? - Propofol infusion running + further Rocuronium available? - So long as patient relatively stable, all invasive lines, NGT + CXR can wait until on ITU / Critical Care. - Transfer as per AAGBI guidelines. - "Clean" runner, at a distance, to clear way + facilitate doors + lifts			Assist with PPE re-donning Prepare kit for transfer Call ITU: transfer imminent	TRANSFER

Designed by Dr Scott Murgatroyd, in line with 'ICM Anaesthesia COVID-19' guidance. Feedback welcomed: scottmurgatroyd@doctors.org.uk
DISCLAIMER: Produced exclusively for education of staff at Salisbury District Hospital, UK. Guidance is changing frequently; please remain 'current'.

Figure 1: remote (i.e. non-ITU) version of the crib sheet developed for the four specific members of the COVID-19 intubation/arrest team. An alternative version for ITU events was also produced.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ITU COVID-19 Emergency Intubation Checklist

Prepare Equipment → Don PPE (Personal Protective Equipment) → Prepare for Difficulty → In the Room → Post-Procedure and Safety

OUTSIDE ROOM

Check and prepare airway kit:
- ☐ Water's circuit with $ETCO_2$ line & viral (square) HME attached
- ☐ Face mask
- ☐ Guedel
- ☐ Working suction
- ☐ Laryngoscopes x2 (+/- McGrath)
- ☐ Bougie and/or introducer
- ☐ ETT x2 (sizes #7 and #8)
- ☐ ETT tie, clamp and air syringe
- ☐ In-line suction and mount
- ☐ LMA (ideally 2nd generation)
- ☐ eFONA set

Check and prepare RSI drugs:
- ☐ Ketamine 200mg [20ml]
- ☐ Rocuronium 100mg [10ml]
- ☐ Metaraminol 10mg [20ml]
- ☐ Saline flush x2 [10ml]
- ☐ Propofol sedation 500mg [50ml]

☐ Patient weight?

☐ Patient allergies?

PPE – be thorough, don't rush:
- ☐ Remove ID badge/bleep/phone
- ☐ Wash hands
- ☐ Don PPE
  - ☐ Long-sleeved gown
  - ☐ FFP3 mask
  - ☐ Fit check the mask
  - ☐ Face visor or goggles
  - ☐ Gloves
  - ☐ Wipeable shoes
- ☐ Fully check PPE with a buddy
- ☐ Name stickers on gown

Allocate roles:
- ☐ Team leader / airway doctor
- ☐ Airway assistant (? cricoid)
- ☐ Drugs, monitor, timer
- ☐ Runner (outside)

☐ **How do we contact further help if required?**

What are the airway plans:
- ➢ Plan A
  - ☐ RSI (+/- cricoid)
  - ☐ Mac blade or McGrath VL
- ➢ Plan B
  - ☐ LMA
  - ☐ Ideally 2nd generation
- ➢ Plan C
  - ☐ 2-handed 2-person BVM
  - ☐ +/- adjuncts
- ➢ Plan D
  - ☐ eFONA
  - ☐ Scalpel-Bougie-Tube (#6)

☐ **All clear with airway plans?**

☐ **Anyone have any concerns?**

INSIDE ROOM

Airway assessment:
- ☐ Identify cricothyroid membrane
- ☐ Difficult airway anticipated?
- ☐ ? consider McGrath VL

Apply/check patient monitoring:
- ☐ Waveform capnography ($ETCO_2$)
- ☐ SpO_2 probe
- ☐ 3-lead ECG
- ☐ Blood pressure
- ☐ Checked IV access (x2)

Optimise patient position:
- ☐ Consider ramping

Optimal preoxygenation:
- ☐ 3-5 minutes (ETO_2 > 85%)
- ☐ Low flows, low pressure

Optimise patient condition:
- ☐ IV fluids/pressor/inotrope
- ☐ Aspirate NG tube (if in-situ)
- ☐ ? delayed sequence induction

AFTER & TRANSFER

Airway management:
- ☐ Establish ventilation immediately after ETT cuff inflation
- ☐ Check waveform capnography
- ☐ Clamp ETT prior to a disconnection
- ☐ Avoid circuit disconnections

Additional measures:
- ☐ Consider deep tracheal viral sample using in-line suction
- ☐ Insert NG tube (if on ITU)
- ☐ Careful disposal of equipment
- ☐ Decontaminate re-useable equip.

☐ Insert arterial & CVC lines (if on ITU; ensure sterile gown/gloves)

Doff PPE – be meticulous:
- ☐ Observed and guided by a buddy
- ☐ Strictly follow checklist
- ☐ Meticulous disposal
- ☐ Wash hands with soap and water
- ☐ Don't forget to wipe shoes

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Modified from 'Airway management guidance' at https://icmanaesthesiacovid-19.org/, for the education of staff at Salisbury District Hospital, UK. Feedback to: scottmurgatroyd@doctors.org.uk

Figure 2: standardised COVID-19 emergency intubation checklist. This was developed from the combination of local and national guidelines, alongside serial 'sim' learning events.

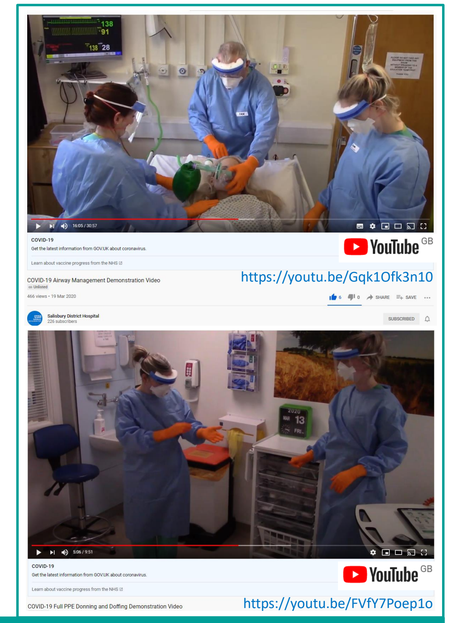

Figure 3: "Print Screens" of two (of the three) instructional videos produced and shared on staff intranet and YouTube. *Upper:* intubation video (466 views), *Lower:* donning and doffing (572 views).

Discussion and Conclusions

What started off as an idea for one simulated scenario, soon amplified into a huge undertaking of a broad range of simulations and educational resources. Observed project strengths included: overall scale achieved, problem-based in-situ sim scenarios (rather than task-oriented), multidisciplinary and inter-department approach, reactive faculty focused on debriefing/learning, easily accessible resources and the implementation of a daily simulation for the on-call COVID-19 intubation/arrest team.

Feedback: "extremely proactive in the build up to our pandemic response. Took leadership to facilitate various educational videos, algorithms and lots of simulation scenarios which really contributed to the whole department's preparedness."

Project limitations comprised: *ad-lib* approach, lack of quantitative participant feedback, and finite sim faculty and resources.

Conclusions: Simulation proved pivotal in preparing and testing a multitude of staff and clinical systems, facilitating ongoing evaluation and improvements in advance of being needed for real. In contributing significantly to the Trust's COVID-19 preparedness, simulation helped bridge the gap between policy and practice, empowering staff with safety and assurance when both were hard to come by.