Getting 'Crative' in the Time of Covid

It's 3pm and I'm finally sitting down for lunch. After reviewing 12 ward patients on high flow oxygen or continuous positive airway pressure ventilation to fight COVID-19, I'm desperate for some water, a bathroom visit, and much-needed nourishment. As I tuck into my pasta, the emergency bleep sounds with the announcement: "Adult emergency. Covid. Blue resus". I put my lunch aside, don personal protective equipment (PPE), and run to the emergency department (ED). However, this time, the patient is not fit enough for non-invasive ventilation; with an obvious blue hue, a worryingly fast respiratory rate, and a frightening oxygen saturation level, he needs to be intubated and ventilated straightaway.

This scenario has become all too familiar over the past year, with routine anaesthetic procedures cancelled and emergency cases complicated by working in highly infectious COVID-19 areas.

The Royal Free Hospital is a high consequence infectious disease treatment unit and a regional surge centre in London. Inevitably, it rapidly became overwhelmed with COVID-19 patients, many of whom required intubation and admission to the intensive care unit (ICU). Like other institutions, our hospital was re-structured to accommodate this[1]. A pandemic rota was created to include a central communications hub, emergency intubation teams[2] and, to support ICU, proning, transfer, and lines teams. Consultants and trainees worked together ensuring experience, support, and opportunities for learning in each area.

To streamline and standardise hospital-wide intubations, anaesthetic, ICU, and ED clinicians joined forces to develop a standardised operating procedure (SOP) to safely secure the airway of patients in extremis (**Figures 1&2**). Our aim was to minimise waste and maximise resources, leading to the creation of 'COVID crates' containing equipment for emergency intubation and anaesthesia on the ward or in the ED when no ICU bed was immediately available. Intubation teams (consultant, trainee, operating department practitioner) underwent in-situ simulation training to drill down the minimum equipment necessary for remote videolaryngoscope-guided intubations, lines, and maintenance of anaesthesia[3].

To facilitate the speed with which intubation teams were deployed, we re-organised the theatre environment to incorporate a designated remote site intubation preparation room. Here packs of PPE, refrigerated drugs, 'COVID crates', infusion pumps, transport ventilators, and monitoring equipment were ready to go. The intubation teams were responsible for preparing sufficient packs of emergency and anaesthetic drugs, as well as cleaning and charging the ventilator and monitoring equipment ready for their next outing. Medical student volunteers received supervision on how to pack the 'COVID crates' utilising a checklist (**Figure 3**). Each crate contained 3 sealed grab bags: airway, lines, and infusions (**Figure 4**). The airway bag included a disposable videolaryngoscope and we gained pharmacy permission to include Propofol and Metaraminol in the infusion bag. Once the crates were completed, they were closed with a pharmacy-approved breakable seal. After use, unopened grab bags and the crate could be wiped clean and re-stocked.

In addition to our preparation room in theatres, sealed crates were also kept in ICU, and in ED. Thus, when an emergency intubation was required, the team could don, place ventilator, monitoring, and drugs on a trolley and quickly attend to the patient knowing everything else would be provided in the 'COVID crate' (**Figure 5**). Team members communicated with ED and ICU via walkie-talkies which could be disinfected after use.

From March – May 2020, 156 COVID-19 positive patients were admitted to our ICU, with 136 mechanically ventilated[4]. A survey was conducted in May 2020 to review the use of 'COVID crates' (**Figure 6**). A total of 43 intubating staff responded (approximately 70% of recipients), of whom 55% were on the intubation team at least once per week. The majority confirmed that they used 'COVID crates' for >80% of intubations (**Figure 7A**), mostly on the ward, in ED, and in ICU (**Figure 7B**). An overwhelming 97.5% confirmed that 'COVID crates' improved intubations with reasons listed in **Figure 8**.

Overall feedback on the drug packs and 'COVID crates' was unanimously positive; 100% stated that they would recommend using both in another pandemic. Specific comments included: "*drug packs are terrific*", "*it helped to maintain teamwork*", "*a brilliant resource that made life much easier and less stressful*", "*impressive how quickly it was put together*", "*proactive organisation and thanks to the medical students too*".

Throughout both waves of the pandemic, anaesthetic and ICU staff met online every morning to debrief on the events of the previous 24-hours, with the 'COVID crate' faculty meeting weekly to consolidate feedback, address issues, and make changes. For example, to minimise circuit breaks in ICU, we moved to securing standard ICU endotracheal tubes with AnchorFast fasteners and immediately connecting in-line suction. Initial suggested ventilator settings were added based on ICU experience. We also inserted ICU nasogastric feeding tubes. As we continued to learn from experience, the SOP was regularly updated on our departmental COVID-19 website (rfanaesthesia.org) amongst other supportive materials[5].

Further feedback identified wastage of unused equipment or drugs as a priority. Despite our efforts to encourage wiping clean the unused grab bags, this was inadequate as the contents could easily be contaminated should they be damaged. To improve our future workflow, we aim to promote green anaesthesia.

Should we win the prize generously donated to the Royal College of Anaesthetists, we endeavour to use it to address the following issues:

1. Provide sufficient bins and appropriate lining bags in *all* clinical areas to correctly categorise waste.
2. Replace the plastic grab bags in 'COVID crates' with wipeable and re-useable containers in preparation for a third wave.
3. Organise regular education on practical ways to reduce anaesthetic pollution.

In the interim, we have purchased re-useable mugs for anaesthetists and delivered two teaching sessions on the environmental impacts of anaesthesia.

In summary, our 'crative' endeavours became cemented into the COVID-19 response at the Royal Free Hospital. The entire production and utilisation process of our 'COVID crates' flattened hierarchy and enhanced communication, teamwork, and collaboration between all multidisciplinary team members during a challenging time. It also highlighted important and specific areas to propel the global movement towards green anaesthesia.

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References:

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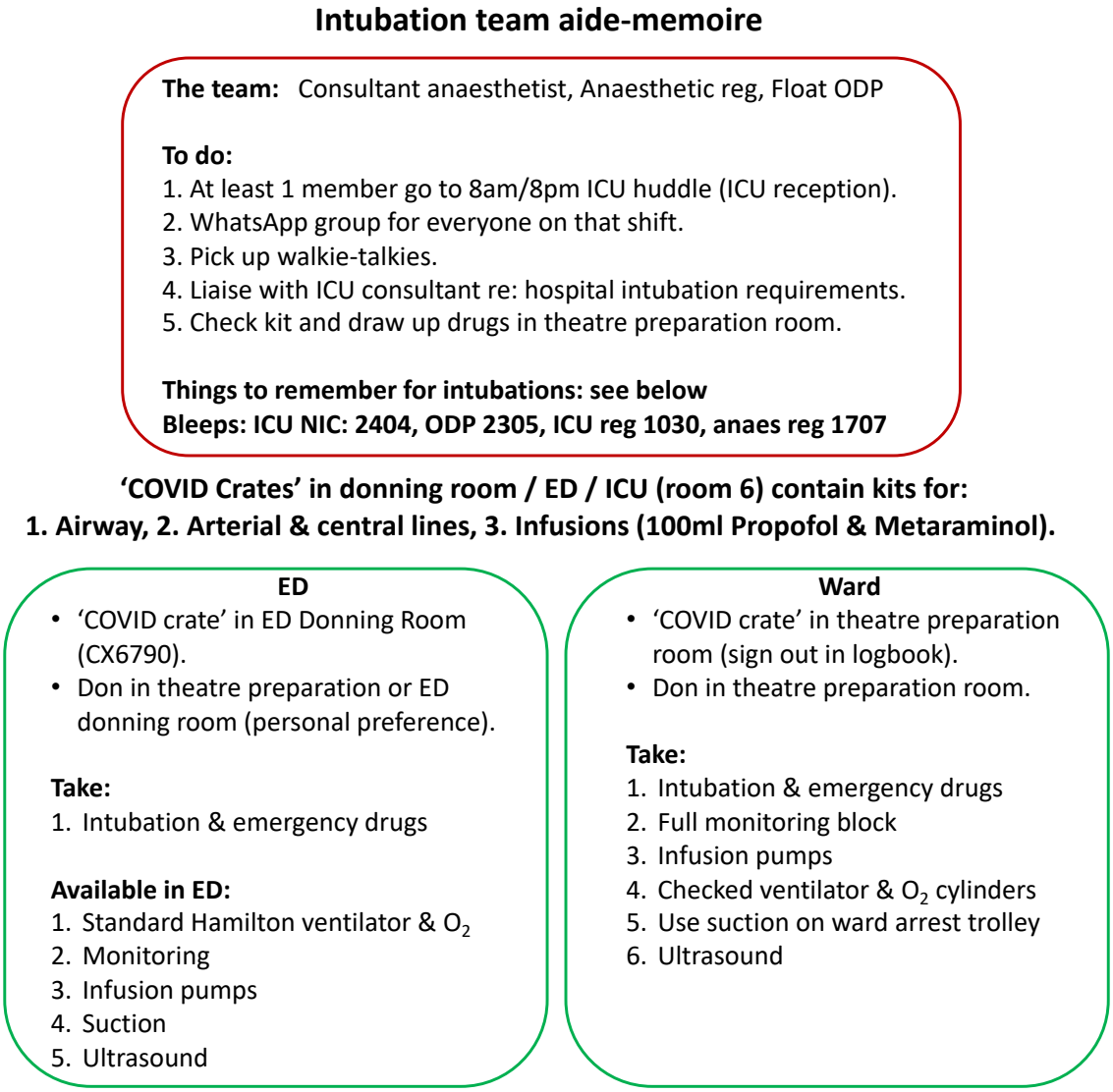


Figure 1. Intubation aide-memoire. An aide memoire and equipment required for emergency intubations in ED and on the ward. Abbreviations: anaes, anaesthetic; ED, emergency department; ICU, intensive care unit; NIC, nurse in charge; O_2, oxygen; ODP, operation department practitioner; reg, registrar.

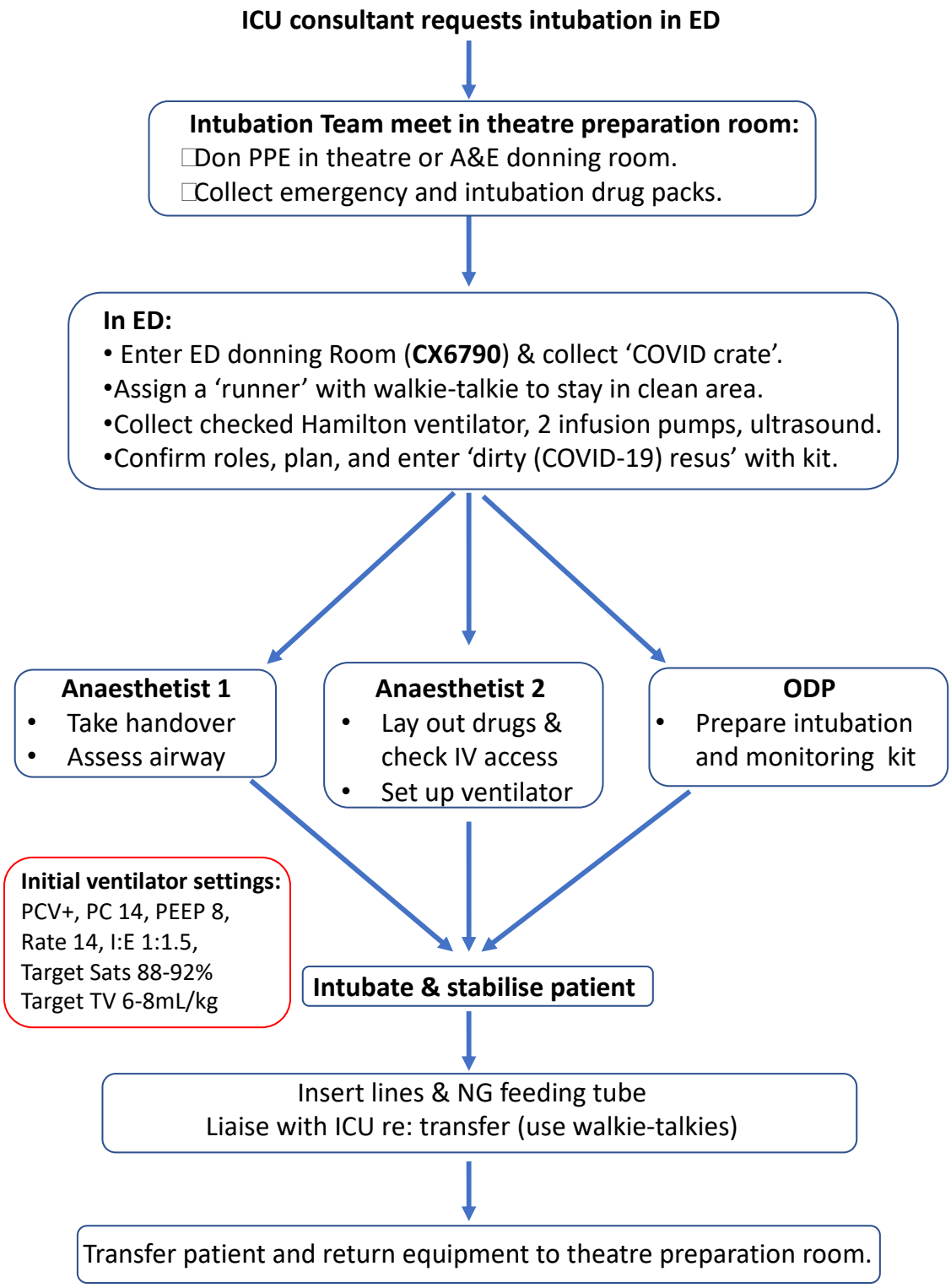


Figure 2. ED intubation flow chart. An intubation flow chart for emergency intubations in ED. Abbreviations: ED, emergency department; I:E, inspiratory:expiratory ratio; IV, intravenous; NG, nasogastric; ODP, operating department practitioner; PCV+, pressure controlled ventilation +; PC, pressure control; PEEP, positive end expiratory pressure; Sats, O_2 saturation; TV, tidal volume.

'COVID Crate' checklist

Item	Quantity	Checked	Item	Quantity	Checked
Airway Bag			***Infusions Bag***		
Mapleson C circuit (Water's circuit)	1		50ml syringes	2	
Anaesthetic face mask 4 (Green)	1		Syringe infusion lines	2	
Anaesthetic face mask 5 (Orange)	1		Yellow infusion drugs stickers	2	
Standard catheter mount with HME	1		Drawing up needles	2	
Guedel airway (Green)	1		1% Propofol 100ml bottle (or 2 x 50ml bottles 1% Propofol)	1	
Guedel airway (Orange)	1		Metaraminol 2.5mg/5ml –10 Vials	1	
Guedel airway (Red)	1				
Mac 4 disposable laryngoscope	1		***Lines Bag***		
Disposable videolaryngoscope	1		Arterial line pack (includes 2-0 silk suture)	1	
ETT - Size 6 – SACETT	1		Double transducer	1	
ETT - Size 7 – SACETT	1		0.9% saline 500ml bag	1	
ETT - Size 8 – SACETT	1		1L pressure bag	1	
OptiLube	2		Stitch cutter	1	
20ml syringe	1		Central venous line pack	1	
AnchorFast oral ETT fastener	1		16cm Quad-lumen central line	1	
Tube tie	1		Double lumen IV attachments	4	
iGel Size 4	1		0.9% saline 100ml bag	1	
iGel Size 5	1		2-0 silk suture (straight needle)	1	
Yankauer sucker	1		Central venous line BioPatch	1	
Suction tubing (Male-Female)	1		Sterile gloves – Size 7	1	
Suction tubing (Female-Female)	1		Sterile gloves – Size 8	1	
NG feeding tube	1		Sterile gloves – Size 9	1	
Magills forceps	1				
Scalpel Size 10 blade	1		***Loose Items***		
Closed suction 54cm 12G	1		Hamilton ventilator circuit	1	
Microstream filterline $EtCO_2$ adaptor	1		Medium non-sterile gloves	4	
Tube clamp	1		Large non-sterile gloves	4	
Bougie/Frova intubation catheter	1		Emergency COVID-19/HCID intubation checklist, observations chart, pen	1	
			Donning & doffing poster - laminate	1	

Date Assembled ___ / ___ / _____ Assembled By _____

PLEASE NOW SEAL BOX

Figure 3. 'COVID crate' checklist. The crates were packed according to this checklist with equipment divided into airway, infusions, and lines grab bags, as well as some loose items. Abbreviations: $EtCO_2$, end-tidal carbon dioxide; ETT, endotracheal tube; HCID high consequence infectious disease; HME, heat and moisture exchange filter; IV, intravenous; NG, nasogastric; SACETT, suction above cuff endotracheal tube.

Figure 4. Equipment, grab bags, and the completed 'COVID crate'. Lines, infusion, airway equipment, ventilator tubing, and gloves were packaged into grab bags and placed into 'COVID crates', which could be wiped clean after use. Abbreviations: Inf, infusions; L, large; M, medium.

Figure 5. The intubation team with the complete equipment before attending to an emergency COVID-19 intubation. The intubation team included a consultant anaesthetist (left), an experienced operating department practitioner (middle), and an anaesthetic registrar (right). They attended emergency intubations with drug packs, walkie-talkies, and a trolley containing the 'COVID crate', ventilator, monitoring equipment, and oxygen. Photo included with permission.

‘COVID crates’ Survey

1. During the pandemic, on average, how many shifts did you have on the intubation team?
   - More than twice per week
   - Once-twice per week
   - Once every two weeks
   - Once a month
   - Rarely

2. During intubation shifts, how often did you use the ‘COVID crates’ to facilitate intubation?
   - >80% of intubations
   - 50-80% of intubations
   - < 50% of intubations
   - <10% of intubations

3. Where did you use the ‘COVID crates’ for intubations? Tick all that apply.
   - Ward
   - ICU
   - ED
   - Interventional radiology
   - Elsewhere (please specify)

4. Do you think the ‘COVID crates’ improved your intubation process?
   - Definitely yes
   - Sometimes yes, sometimes no
   - Definitely no (please state why)

5. If yes, how did the ‘COVID crates’ help? Tick all that apply.
   - It saved time
   - It contained everything
   - Easy to transport
   - Easy to find things
   - Other (please specify)

6. If you did not find it useful, or you used the ‘COVID crates’ for <10% of intubations, why?
   - It was too big
   - It had too much stuff in it
   - It was disorganised
   - It was unnecessary
   - Other (please specify)

7. Did you find the intubation and emergency drug packs useful?
   - Yes
   - No (please state why)

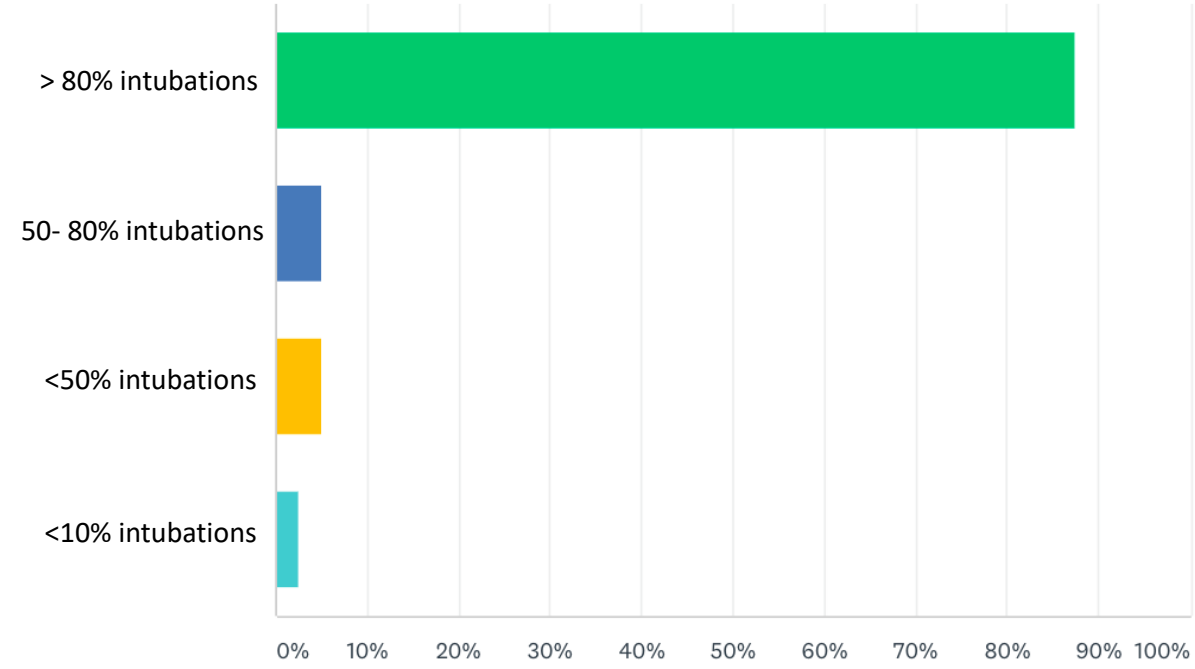
8. What would you add or remove from the ‘COVID crates’ or drug packs to improve them?

9. Would you recommend ‘COVID crates’ and drug packs for future COVID-19 intubations?
   - Yes
   - No (please state why)

10. Any other comments or feedback?

Figure 6. ‘COVID crates’ survey. This survey was sent to all staff involved in COVID-19 intubations in May 2020, after the first wave of the pandemic.

A.



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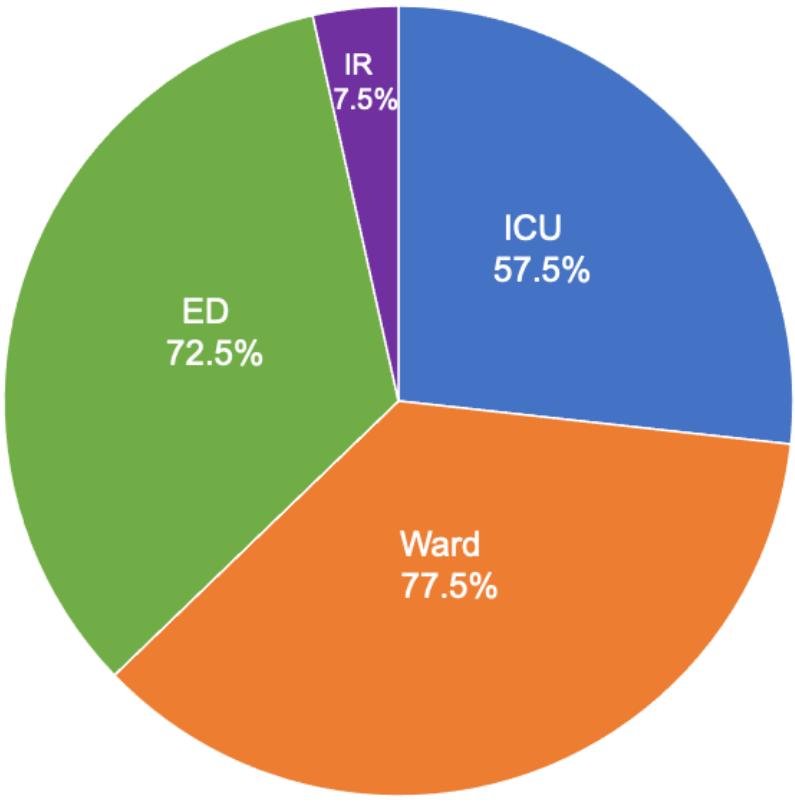

Figure 7. Intubations which utilised the 'COVID crates' and the locations in which they were used. A: The majority of the survey responders (87%) used 'COVID crates' for over 80% of intubations. **B:** The 'COVID crates' were mostly used in ED, ICU, and the ward, with a small percentage in IR. Abbreviations: ED, emergency department; ICU, intensive care unit; IR, interventional radiology.

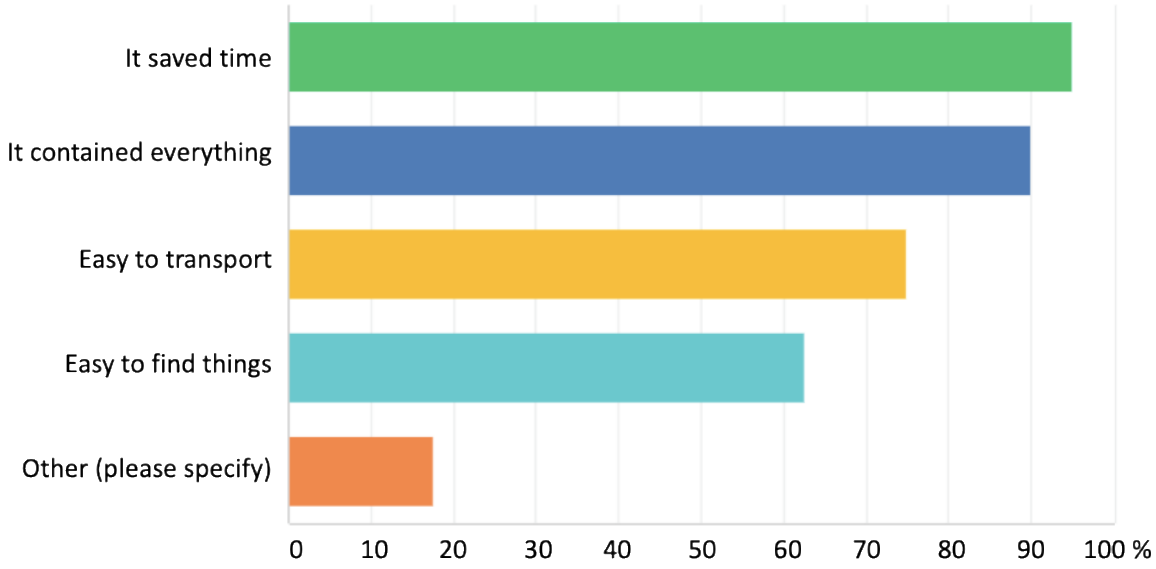

Figure 8. How the 'COVID crates' improved the intubation process. Most responders found that the 'COVID crates' were comprehensive and saved time at emergency intubations. Other specified reasons were: "*all of the above and reassurance that you're fully mobile to take care of the patient*", "*the overwhelming benefit was knowing the boxes were complete and thoroughly checked*", "*Absolutely lovely work, it helped clarify thought process in a frantic and high anxiety atmosphere*", "*organised inside, airway, lines, drugs*", "*it contained things that I didn't realise I would / might need*", "*I found it incredibly reassuring that the kit was going to be readily available if I needed it*", "*reassuring that we had everything necessary with us*".