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## Highlights

- Successful in situ simulation – tremendous buy-in from the start from team members across all disciplines, professions and services
- Participants were fully engaged in the debriefing process
  - Excellent idea to create WebEx meeting (Stacy) – helped to enable physical distancing during huge debrief
- As a simulation planning team, we rose to the last-minute challenge of no PPE usage – see *ideas section for thoughts about how to optimize this aspect next time*
- Notifying many participants in advance about this simulation exercise was helpful in decreasing overall stress responses
- By (inadvertently) using the actual Code Cart, we identified key latent safety threats that will enable us to create safer patient care

## In Situ Simulation Summary

### Participants:

Perimeter screening staff, OBCU and triage nurses, PSWs, OB consultant and residents, Anesthesia consultant and fellow, NICU resuscitation team, CCTC consultant and Brenda Morgan (playing role of nurse)

### Case Summary:

#### What we planned

Grace Aspen is a 25y G2P1 at 36+0 with 2 d history of fever, cough and increasing shortness of breath (possible COVID) with no previous antenatal care at LHSC. She speaks Polish – and presents for care at B1 entrance/perimeter accompanied by her sister (confederate) with threatened preterm labour. Patient progresses to preterm labour and experiences respiratory compromise immediately postpartum necessitating intubation and transfer to CCTC.

## What actually happened

what we need to keep doing
what we plan to do differently next time
ϕ = latent safety threat
AGMP = aerosol generating medical procedures
PUI = person under investigation

### STAGE 1: Entering hospital perimeter

- Patient + confederate reported to B1 perimeter where patient was screened and failed ARI screen
- Perimeter screening staff had to leave desk (and patient – who did not yet have a mask on) to notify OB team using INFO desk phone ϕ
  - Initially B5 was contacted (through switchboard) as neither INFO desk or screening staff knew that delivery room/triage was on B4 ϕ(1)
  - Once screening staff reached OB Triage, communication breakdown led to the laboring simulated patient waiting at B1 entrance for Triage staff (while Triage staff was awaiting patient to present on B4)
  - Screening staff recommended patient don a mask, once prompted by confederate
- When triage nurses received notification about possible COVID patient, they donned appropriate PPE and readied the equipment they anticipated they would need (incl. bloodwork, IV, etc.)
  - Information about the possible COVID patient remained with triage staff and was not yet disseminated to other team members

### STAGE 2: Possible COVID patient arrives in triage for assessment

- Registration clerk repeated the screening questions and when the patient failed the screen, hand hygiene was recommended, (mask was already on)
  - Clear succinct communication from clerk to triage nurse led to prompt assessment by triage nurse
- Patient and partner brought immediately into Isolation Room in Triage
  - OB resident was called and arrived immediately to assess patient for possible preterm labour
  - Patient and support person were not advised to repeat hand hygiene
  - OB triage nurses worked well together, providing clear handover to the OB resident, sharing mental models aloud, and speaking up to confirm that the OB resident had donned PPE (sim artifact)
  - Clean supplies were accessed at the triage (and PPE was put on) with dirty gloves
  - People were coming in and out of the triage room wearing dirty PPE

- Wheelchair was brought out of triage room and up against clean supply cart, thereby contaminating it
- No signage was placed on triage door to indicate Droplet and Contact Precautions needed
- OB resident quickly identified risk of imminent delivery and advised admission with transfer to COVID OR#7 given that it was a preterm infant (*See section on “Critical questions arising from simulation” re: location of preterm deliveries*)
  - OB consultant and chief resident were notified (at resident’s request) by triage nurse
- Bloodwork and IV access were obtained in triage but patient did not undergo COVID testing likely due to the urgency of the situation (baby was nearly crowning)
- Neither NICU or Anesthesia/RT yet notified of possible COVID patient being admitted to OBCU; unclear if Charge Nurse was aware at this point

### STAGE 3: Possible COVID patient admitted for preterm labour + delivery of preterm baby

- Patient was brought to OBCU Negative Pressure Rm 228 along the back hallway (*simulation team intervened to avoid admission directly to OR#7 due to unnecessary contamination*) which limited exposure to other patients and staff
  - Transport team from triage was all wearing dirty PPE (IPAC advises having at least one clean person who can open doors, etc.)
  - Room was not actually set to “Negative pressure”  $\phi$  (2)
- OB senior resident and consultant arrived while OB resident and nurses worked to apply monitors and assess fetal heart rate, maternal vitals
  - Team demonstrated good situational awareness in noting that the patient appeared septic based on initial presentation and that mental model was shared with present team members
  - Anesthesia and RT still unaware of possible COVID patient
- Breakdown in closed-loop communication meant that it was unclear whether NICU had been notified and were on route – baby delivered just as NICU was arriving and thus the team was unable to prepare for preterm infant’s arrival
  - Baby fortunately did not require any resuscitation; however, there was a lack of clarity regarding who was responsible for baby following delivery and no plan for disposition
  - Formal handover to NICU did not occur (*See Neonatal Insights for further details*)

### STAGE 4: Possible COVID patient experiences respiratory compromise postpartum necessitating intubation and transfer to CCTC

- OB team maintained situational awareness and correctly identified patient respiratory compromise, performed initial steps to attempt stabilization, but notification of anesthesia and RT was delayed

- RT never presented to the scenario (*unclear if technical issue or simulation artifact*); so OB staff stepped up to fulfil this role post-delivery
- Neither Anesthesia consultant nor RT reported actually receiving pages  $\phi$  (3)
- OB team was proactive by requesting that the code cart be brought into the room while awaiting anesthesia; however, this meant that the entire cart would have been contaminated  $\phi$  (4)
- Once anesthesia arrived (through word of mouth), there was a delay in intubation as the patient was non-english speaking and the support person/translator had been excluded from attending the delivery; pertinent anesthetic risk information was not known by the team
- Some fixation error on missing history related to malignant hyperthermia/pseudocholinesterase deficiency
- High flow O2 was applied by face mask as the patient's oxygen saturation dropped; non-rebreather mask with filter was not requested  $\phi$  (5)
- Initial steps in intubation were restricted due to unfamiliarity with key equipment in the code cart
- Intubation protocol:
  - Excellent coordination of the team and clearing of unnecessary personnel from the room
  - Drugs for airway management required runners; PSW were utilized but they are not able to transport medications
  - Appropriate monitors applied
  - No etCO2 monitoring capabilities in any birthing room  $\phi$  (6)
  - Preoxygenated with AMBU (*simulated*)
  - Utilized Glidescope VL for intubation
  - Succinylcholine for muscle relaxation – introducing possibility of coughing as paralysis wears off
  - Maintained anesthesia with intermittent bolus of propofol (pump might be useful)
- Post-intubation, good followership from OB senior and OB nurse who facilitated initial steps needed for CCTC transfer
- Discussion with CCTC consultant – who is best to handle the transfer? Requested that CCTC carry out the transfer
- After focusing room's attention, clear and pertinent handover given to CCTC consultant by OB senior and Anesthesia fellow
- NP swab obtained under direction of the CCTC nurse
- Patient stability confirmed before transport
- Transfer was complicated by cognitive overload  $\phi$  (7)
  - Some uncertainty about when to change PPE prior to transfer (considerations included limiting PPE usage) and who absolutely needed to attend the transfer
  - Contaminated airway blade sheathed and transported with the patient, but no Glidescope making it ineffective
  - PSW called and held 4<sup>th</sup> floor elevator

- PSW and OB resident were stationed to direct CCTC team to correct room
- Elevator crowded
- There was no clean person assigned to hold doors/press buttons along the way, to clear the hallway/route to CCTC and to retrace steps to disinfect areas post-transfer (e.g. elevator buttons)  $\phi$  (8)

## Key Latent Safety Threats + Solutions

Observed Safety Threat	Recommended Solution(s)	Implementation plan
(1) Lack of clear information/communication pathway for OB patients who fail ARI screening	Post TRIAGE phone number and location at each screening entry point  Provide screening staff with portable phone so they do not have to leave their desk to reach help/notify team in the event of a labouring patient	L. Sovran has already created signs and posted at B1 level entry points  Unclear who is responsible for the screening staff and thus should be notified about the need for enhanced communication
(2) Negative pressure room was not switched to “negative pressure” despite performing AGMP during scenario	Switch key to enable negative pressure as the “default” option rather than tasking team to switch it on as needed	Support from D. Wiseman to proceed with this solution
(3) Broken chain of communication led to serious delays in patient care	Recommend a central paging system (imminent delivery team) that includes a text page to all providers (NICU/OB/Anes/RT) e.g. “COVID pos patient admitted to room 228”	TBD
(4) Presence of Code Cart in COVID room means that the whole cart is contaminated	Leave Code Cart outside of room and assign clean “runner” to provide medications/equipment as needed	TBD
(5) Code Cart missing key equipment needed for resuscitation of possible COVID patient including: filter for BVM, or nonrebreather mask with filter, clamp (to allow switching to vent)	Create a COVID airway management cart Print COVID airway management flowsheet, laminate and affix to the cart Keep clean supplies at least 2 meters away from patient/patient space under droplet/contact precautions Consider marking 2m radius with tape on the floor in 228 and OR7	Resolved – COVID airway cart has been created and now lives outside of OR#7
(6) No etCO <sub>2</sub> monitoring capabilities in any birthing room	Add CO <sub>2</sub> detector to COVID airway carts	Done – Mar 25 2020
(7) Transfer had many moving parts (related to reducing contamination risk) that led to cognitive overload for the team	Creation of a “COVID Transfer Checklist” posted in OR, Triage Isolation room, Negative Pressure Room and Charge Nurse station ( <i>see appendix for suggested checklist items</i> )	TBD

<p>(8) Many hospital patients were potentially exposed during transfer of patient to CCTC</p>	<p>As part of the new “Transfer Checklist” there will be a role for assigning a “clean” person to be sent ahead of the transport team to (1) open doors and (2) clear as many patients from the route as possible to limit exposure/contamination and (3)</p>	<p>TBD</p>
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## IPAC insights

### PPE

- Ensure gowns are fully tied in the back
- HCW who have donned PPE should not come and go from the room while wearing PPE
- PPE doffing in anteroom -- not everyone followed sequence

### Additional Precautions

- Important to place signage on delivery room door to indicate Droplet/contact precautions

### Clean Supply Management

- Hallway needs to be emptied and traffic minimized
- Clean supply to be kept closed/zipped/covered
- Clean supplies in room were being accessed by contaminated gloves/hands
- As much as possible, keep supplies at least 2 metres away from patient/patient space (droplet splash zone)

### Hand Hygiene

- Several instances of staff contaminating their face and hair with dirty gloves (Suggest hair tied back as per Attire Policy)

### Family

- Sister would need to be located outside of the anteroom for translation/other updates (HH and masked)

### Traffic

- Entering and exiting should be done through the anteroom
- Only the patient bed going in and out of large main doors

## CCTC insights

- For a person who fails ARI/Unable to Assess or with confirmed COVID-19, consider early intubation prior to patient decompensation (e.g. 50% venti-mask to maintain SpO2 greater than 90% with decompensation). Place on 100% O2 via non-rebreather mask with filter and prepare to intubate



- CCOT may not be available and able to transport patient imminently, particularly if patient is stable and successfully intubated; will need to triage on a case-by-case to determine if more appropriate to have OBCU team transport patient when CCTC is able to accommodate admission
- If patient needs an OB-specific med, send it down with the patient, as medications like oxytocin or magnesium sulfate do not come pre-mixed in CCTC, unlike OBCU
- If patient is likely to benefit from central line access as well, consider performing central line insertion following intubation (change gown/gloves post-AGMP but can likely leave N95 mask/goggles/visor) if possible
- Important to perform COVID swab as early as possible upon admission; Brenda provided clear guidance on how to perform swab properly (link: <https://www.youtube.com/watch?v=DVJNWefmHjE>)
- Minimum baseline precautions for AGMP include Droplet + Contact + Enhanced PPE (N95 + full face shield + level 2 gown + gloves)
  - if intubating or performing CPR -- also need: negative pressure room (if available), level 3 or 4 impermeable gown, sterile gloves that cover wrists, Fit tested N95 mask, eye covering (face shield AND disposable goggles) and blue hairbouffant\* *as per Guidelines for Aerosol Generating Medical Procedures (AGMP) for Failed ARI Screen or Unable to Assess or Confirmed COVID-19, CCTC Resource*
- avoid high flow or high humidity oxygen; prefer non rebreather for oxygen

## Neonatal insights

- NICU team must be notified early in the event of COVID/PUI admission to enable proper preparations
- Droplet/contact required for baby – there has been no vertical transmission documented so no need to enhance PPE for neonatal AGMP
- Staff need to maintain PPE when caring for baby
- If baby is well, and mom is not, may need to rely on support person (+/- extra nurse) in the interim if NICU cannot accommodate NICU admission for well-baby

## Critical questions arising from simulation

### Maternal

Q: What PPE needs to be worn by patient and support person while in isolation room and where should the support person go if AGMP is to be performed?

A: According to LHSC Management of labour, birth and postpartum care for PUI or confirmed COVID infection mother and partner are only to wear masks during transfer and do not need to maintain masks while in isolation room. **It remains unclear where the support person should go while AGMP is performed.** Rm 226 was discussed as a possible nearby option (since public waiting room, etc. not advisable) that would remain under droplet precautions.

Q: Do we have appropriate and sufficient supplies for central line access in OBCU?

A:

Q: Where should COVID patient deliver if low risk of C/S but possibility of needing intubation eventually because of COVID?

A: Consensus was that this decision is best discussed with OB/Anesthesia as soon as possible when patient initially presents to OBCU to balance the likelihood of needing intubation (best done in OR) with the logistic challenge of having used up the COVID OR for what is likely to be a vaginal delivery (takes a few hours to clean/prep for another case).

### Neonatal

Q: Where to place well baby when mom is transferred to CCTC?

Discussion: According to LHSC Management of labour, birth and postpartum care for PUI or confirmed COVID infection baby is transferred to NICU with droplet/contact precautions in the event that patient is unwell. It's unclear if this also applies to babies who are well and there is a support person present to care for baby.

Q: Where should preterm/complex deliveries take place when we are anticipating vaginal delivery and low risk of maternal intubation?

Discussion: Given that all neonatal resuscitations are presently expected to take place in the same room as the delivery, it may not be necessary to deliver these infants the OR. We only have one COVID OR and it takes up to 2-3 hours to clean/re-stock. However, NICU expressed the following concerns about having to conduct a neonatal resuscitation in the Negative Pressure Room:

- Not enough space to resuscitate multiples
- Cost prohibitive to use the Kangaroo Board, due to the automatic contamination
- Unlikely that the equipment will fit through the anteroom door while transporting the baby to NICU
- Things could get quite problematic if maternal condition postpartum necessitates an intubation (AGMP) and the NICU team is still in the delivery room resuscitating baby – so should there be consideration for conducting neonatal resuscitation outside the anteroom in the next door LBR under droplet/contact precautions?

Q: Where would the baby have been resuscitated (if indicated) had the delivery taken place in COVID OR#7?

Discussion: Current LHSC Management of labour, birth and postpartum care for PUI or confirmed COVID infection indicates that baby must remain in location of delivery. NICU likely cannot remain in OR until C/S closure as this is unrealistic. Clarity is needed regarding what NICU resuscitation supplies need to be discarded if they were in the room during a maternal AGMP. There is also a need to clarify how best to exit the OR or delivery room with neonate on route to NICU; this is constrained by space (e.g. ante-room has narrow door) and need to limit dissemination of aerosolized particles, particularly if maternal AGMP has been performed around delivery.

## IPAC/Contamination

Q: How long does it take to remove aerosolized particles from a negative pressure room?

A: from Roy Khalaf –and this resource:

<https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1>

You need a minimum of 15 air exchanges per hour in a Positive Pressure OR, and 12 changes per hour in a negative pressure isolation room. Based on those air changes, their table says 18-28 min with 15 changes/hr and 23-35min with 12 changes/hr for 99-99.5% efficiency in removal of aerosolized particles. Really only relevant if we are intubating in a negative pressure room (because with a positive pressure room you're pumping it out to the surrounding areas anyways). So in theory if you intubate in a negative pressure room, it should stay closed for at least 25-35 min before you can leave and have made any difference in environmental contamination. Not sure the relevance of this number for a positive pressure room, other than to say nobody should be in that room without aerosol level protection for 20-30 minutes after the last aerosol generating procedure.

Practically speaking, however, none of our ICU colleagues who make use of negative pressure wait to leave the environment.

## Resources

<https://www.lhsc.on.ca/media/8476/download> for details re: AGMP (very helpful CCTC resource)

NEJM clip – how to perform NP swab – <https://www.youtube.com/watch?v=DVJNWefmHjE>

<https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1>

## Ideas for Future In Situ Simulation Exercises

- Use coloured stickers to delineate which PPE has been applied and when it has been donned/doffed (great idea Roy!) - *it was difficult to know who was wearing what and when they donned or doffed*
- Need fake medications that are labeled to assist in the simulation fidelity
- Utilize airway equipment, especially ambu bag
- Identify touched surfaces by spotters with stickers – suggested by nurse participant

## Appendix

### COVID Transfer Checklist (draft)

#### Preparing for transfer

1. If patient is NOT intubated, ensure bag-valve mask has a filter and oxygen is delivered by non-rebreather with filter.
2. Don additional precautions if patient is at risk for imminent intubation or may need manual ventilation.
3. Sending team should review patient's travel from point of entry to transfer to critical care and initiate appropriate cleaning precautions.
4. If patient is intubated – limit number of persons at the bedside. Limit disconnects. If necessary to disconnect – clamp ETT and disconnect above the filter.
5. Who needs to complete doffing and then donning again?
6. Send (clean) runner to obtain any critical medications that may be needed on transport
7. Assess risk of extubation on transport to inform whether additional equipment necessary (\* ideally all dirty equipment will remain in original COVID room)
8. Determine safest method for transport of patient on case-by-case basis that considers urgency, provider expertise and activity level in sending and receiving units. Decisions should also consider PPE conservation strategies by limiting the number of healthcare providers who will need to don PPE. Clear communication with CCTC/CCOT is critical.
9. Send necessary infusion medications (pre-mixed) that are not readily available in CCTC (oxytocin, MgSO<sub>4</sub>)
10. O<sub>2</sub> supply and transport monitor – discuss/decide who supplies and supports (CCTC vs. needing transport monitor available in OBCU)

#### During transfer

11. Bring antiseptic wipes to clean elevator buttons, door entries and other areas of contact.

#### Post transfer

12. Conduct a debrief the transfer process – document any suggested process or equipment improvements
13. Notify cleaning staff to decontaminate elevator or other areas along pathway