

**Supplemental Material A:
Assessment Tools**

1. Itemized Checklist

Subject:

Reviewer:

Procedure Step	Successfully Completed?	
	Yes	No
1. Appropriately applies sterile solution (At least two passes with sterile solution in circular fashion, moving from centre outwards, new swab per pass)	<input type="checkbox"/>	<input type="checkbox"/>
2. Correctly drapes patient in a sterile fashion (Appropriate use of sterile drapes, with appropriate field of view)	<input type="checkbox"/>	<input type="checkbox"/>
3. Appropriately utilizes anatomic landmarks for technique (Clearly utilizes landmarks)	<input type="checkbox"/>	<input type="checkbox"/>
4. Competently inserts angiocatheter or steel needle into IJ vein (Needle advanced at 30-45 degrees, towards ipsilateral nipple)	<input type="checkbox"/>	<input type="checkbox"/>
5. Safely inserts guide wire (Advances J-wire into vein, J-tip first, avoids excess pressure, maintains control of the wire, maintains control of needle)	<input type="checkbox"/>	<input type="checkbox"/>
6. Effectively uses scalpel to make skin incision (Single appropriate sized stab incision, dull side of blade along wire)	<input type="checkbox"/>	<input type="checkbox"/>
7. Smoothly passes dilator over wire and dilates IJ vein	<input type="checkbox"/>	<input type="checkbox"/>
8. Effectively inserts central venous catheter over wire (Maintains direct visualization of wire at all times)	<input type="checkbox"/>	<input type="checkbox"/>
9. Adequately flushes all catheter lumens (This may be done at start or end of procedure or combination)	<input type="checkbox"/>	<input type="checkbox"/>

Lord JA, Zuege DJ, Mackay MP, Roze des Ordons A, Lockyer J. Picking the right tool for the job: a reliability study of 4 assessment tools for central venous catheter insertion. *J Grad Med Educ.* 2019;11(4):422–429.

2. Critical Error Tool

Subject:

Reviewer:

Please indicate whether any of the following critical errors were identified:

- i. Inadequate/inappropriate application of sterile solution
- ii. Inadequate/inappropriate application of sterile drapes
- iii. Critical mishandling of needle
(e.g. no syringe, inappropriate depth, grossly incorrect direction)
- iv. Critical mishandling or loss of guidewire
- v. Not flushing all catheter lumens
- vi. Other (please identify) _____

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3. OSATS Tool

Subject Number:

Reviewer:

Specific components of technical ability:	Not competent to perform independently	Borderline competent to perform independently	Competent to perform independently	Above average to perform independently
Time & Motion	<input type="checkbox"/> Many unnecessary movements	<input type="checkbox"/>	<input type="checkbox"/> Efficient but some unnecessary movements	<input type="checkbox"/> Economy of movement and maximum efficiency
Instrument handling	<input type="checkbox"/> Repeated awkward or tentative handling of instruments	<input type="checkbox"/>	<input type="checkbox"/> Competent, occasionally appeared stiff or awkward	<input type="checkbox"/> Fluid handling of instruments; no stiffness or awkwardness
Knowledge of Instruments	<input type="checkbox"/> Frequently used inappropriate instrument	<input type="checkbox"/>	<input type="checkbox"/> Used appropriate instrument for task	<input type="checkbox"/> Obviously familiar with required instruments
Flow of Procedure	<input type="checkbox"/> Frequently stopped and seemed unsure of next step	<input type="checkbox"/>	<input type="checkbox"/> Demonstrated reasonable progression of procedure	<input type="checkbox"/> Obviously planned procedure; smooth flow
Knowledge of Specific Procedure	<input type="checkbox"/> Would have needed instruction to complete most steps	<input type="checkbox"/>	<input type="checkbox"/> Seemed to know most steps of procedure	<input type="checkbox"/> Demonstrated familiarity with all aspects of procedure

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4. O-SCORE Tool

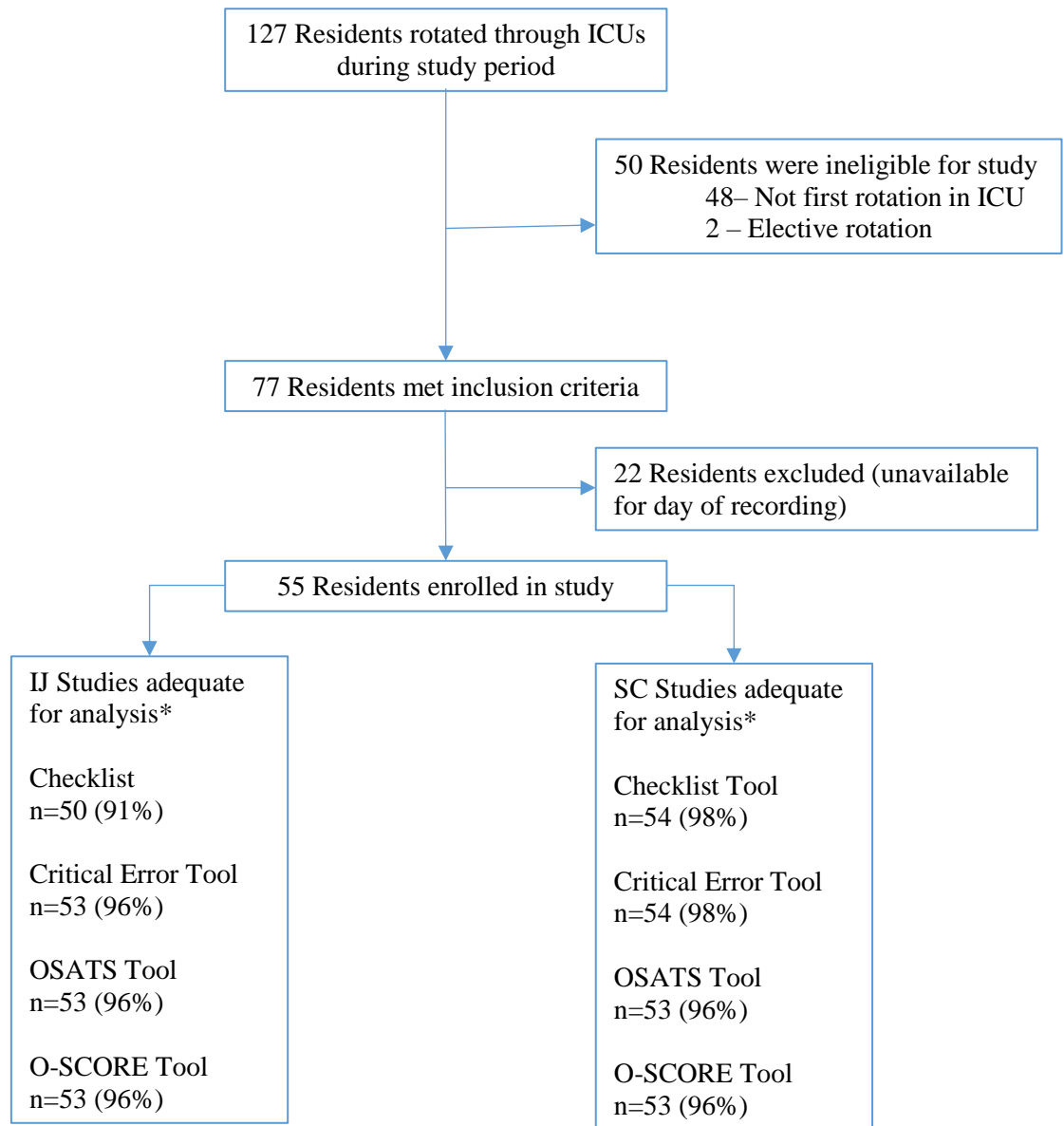
Subject Number:

Reviewer:

Overall Ability to Perform Procedure – Please circle candidate’s overall score	
Score	Descriptor:
1	“I would have had to do it” (would have required complete hands on guidance) = NOT COMPETENT
2	“I would have had to talk them through it” (able to perform tasks but would require constant direction and supervision) = NOT COMPETENT
3	“I would have had to prompt them from time to time” (some independence but with intermittent direction) = NOT COMPETENT
4	“I would have needed to be in the room just in case” (independence but still required some supervision for safe practice) = BORDERLINE COMPETENT
5	“I would not have needed to be in the room” (complete independence; performs safely; practice ready) = COMPETENT

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Supplemental Material B: Study Design Layout



*Proportion of video recordings that were adequate for analysis. Technical difficulties with the task-trainers or video recording procedure excluded some residents for analysis at each anatomical site