Supplementary Table - Variance Matrix for Decontamination

Task	Performance shaping factors	Failure	Process variance	Outcome variance	Observed controls
Perform point of use reprocessing	OR staff KSAs (Person) OR production pressure (Organization) Enzymatic spray availability (Organization)	Tray not sprayed	Prolonged or different cleaning required	Reduced throughput Tray defect (bioburden)	• Develop feedback mechanism to capture and communicate state of trays received in decontamination (Tools/Technology & Task) • Include time in SPD as part of scrub nurse and technician training (Organization) • Assign technician to point of use area to assist with reprocessing (Organization) • Create point of use reprocessing instructions for OR, clinics, and ambulatory centers (Tools/Technology)
	OR staff KSAs (Person) OR production pressure (Organization)	Tray not organized	Prolonged time removing instruments from tray	Reduced throughput Staff injury (sharp)	
		Instruments in wrong trays	Prolonged assembly process	Reduced throughput Staff injury (sharp) Tray defect (wrong instrument)	
		Instruments lost	Prolonged assembly process	Reduced throughput Tray defect (missing instrument) Inventory costs	
Retrieve case	Demand variation (Task) SPD staffing (Organization)	Task interruption and fragmentation	Reprocessing paused to retrieve new carts and trays	Reduced throughput Tray defect (bioburden)	• Delegate experienced technician to manage decontamination area (Person)

Task	Performance shaping factors	Failure	Process variance	Outcome variance	Observed controls
carts	OR production pressure (Organization)	Contaminants dried on instruments	Prolonged or different cleaning required	Inventory costs Instrument damage	• Assign technician to point of use area to assist with reprocessing and flow of case carts into SPD (Organization) • Designate specific receiving times for trays (Task)
		Lack of space for case carts and trays	Time spent rearranging carts	Reduced throughput	
Run case carts through washer	Cart washer design (External) SPD staff KSAs (Person)	Carts and containers inappropriately arranged in washer	Less effective cleaning of cart and containers	Reduced throughput	• Display proper orientation of carts into cart washer (Tools/Technology) • Assign technician to point of use area to control flow of case carts into SPD (Organization)
	No. of cart washer (Organization)	Insufficient capacity	Delays and backup of case carts		
Setup workstation	Workstation (Tools/Technology) Instrument IFU (External) SPD staff KSAs (Person)	Incorrect water temperature	Less effective cleaning	Tray defect (bioburden)	• Display soaking procedures (fill level, temperature, time, etc.…) (Tools/Technology)
		Incorrect dosage of cleaning fluid			
		Did not collect all the correct tools	Excessive physical movement	Reduced throughput	
Manually wash instruments (For hand-wash and	Workstation (Tools/Technology)	Surfaces insufficient for unpacking, washing, soaking, rinsing and repacking	Excessive physical movement	Reduced throughput	• Design or redesign decontamination area (lighting, layout, workstations) (Environment)
			Mixing of cleaned and uncleaned instruments	Tray defect (bioburden)	

Task	Performance shaping factors	Failure	Process variance	Outcome variance	Observed controls
manual wash instrument)		Insufficient task lighting	Reduced ability to identify bioburden		
	Instrument design (External) Instrument IFU (External) SPD staff KSAs (Person) SPD Production pressure (Organization)	Instrument not disassembled Incorrect cleaning strategy	Ineffective cleaning of instrument	Instrument damage Inventory costs Tray defect (bioburden)	• Ensure easy accessibility of IFUs (Tool/Technology & Environment) • Remedial training (Person) • Provide all necessary cleaning tools for manual wash (Tools/Technology)
Soak instruments in trays (Manual wash instruments only)	Workstation (Tools/Technology) Instrument IFU (External) SPD staff KSAs (Person)	Incorrect water temperature Incorrect dosage of cleaning fluid Insufficient soaking time Contaminated water	Ineffective or less effective cleaning of instrument	Tray defect (bioburden)	• Remedial training (Person) • Display soaking procedures (fill level, temperature, time, etc.…) (Tools/Technology) • Replace sinks with shallower sinks, and adjustable or appropriate percentile height (Environment) • Ensure trays adhere to weight limits (Organization)
	Workstation (Tools/Technology)	Sink height too low Sink depth too deep	Prolonged cleaning time Staff fatigue	Reduced throughput Staff Injury (MSD)	

Task	Performance shaping factors	Failure	Process variance	Outcome variance	Observed controls
Run trays through ultrasonic cleaner	Instrument design (External) Ultrasonic cleaner design (External) SPD Staff KSAs (Person)	Wrong cycle chosen	Less effective cleaning	Tray defect (bioburden)	• Remedial training (Person) • Display cycle selection guidelines near ultrasonic (Tools/Technology) • Display sample or descriptions of instruments that should not undergo ultrasonic cleaning (Tools/Technology) • Develop preventative maintenance schedule with biomedical engineering services (Organization)
	Tray composition (Organization) SPD staff KSAs (Organization)	Wrong instruments	Inappropriate exposure to immersion, vibration, temperature etc.	Tray defect (bioburden)	
	No. of ultrasonic cleaner (Organization) Tray composition (Organization) Instrument design (External) SPD production pressure (Organization) Maintenance schedule (Organization)	Insufficient capacity	Less effective cleaning	Tray defect (bioburden)	
Run trays through washer-disinfector	No. of washer-disinfectors (Organization) Washer-disinfector design (External) Tray composition (Organization)	Instruments run through wrong washer	Inappropriate exposure to enzymatic fluid; ineffective cleaning	Instrument damage Inventory costs Reduced throughput Patient injury	• Remedial training (Person) • Display samples or descriptions of instruments that should not undergo machine wash (Tools/Technology)
		Wrong cycle chosen	Less effective cleaning	Tray defect (bioburden)	

Task	Performance shaping factors	Failure	Process variance	Outcome variance	Observed controls
	Instrument design (External)	Tray oriented incorrectly	Less effective cleaning	Tray defect (bioburden) Damaged washer	• Use washer racks that force correct tray orientation (Tools/Technology) • Use double-check procedure to verify orientation and allowable exposure (Task)
		Wrong instruments put in washer	Inappropriate exposure to immersion	Instrument damage Inventory costs	
	Maintenance schedule (Organization)	Drying cycle ineffective	Prolonged assembly	Reduced throughput	
		Lubrication failure	Increased risk of rust on instruments	Instrument damage Inventory costs	
Test washers	SPD Staffing (Organization) Communication (Organization)	Failure to run routine test cycles	Less effective cleaning	Tray defect (bioburden)	• Remedial training (Person) • Incorporate verification of equipment testing into supervisor workflow (Task) • Develop preventative maintenance schedule with biomedical services (Organization) • Secure maintenance contract with vendor (Organization & External Environment)
	Biomedical staffing (Organization) Biomedical staff KSAs (Person)	Technology out of service	Prolonged cleaning time	Reduced throughput Tray defect (bioburden)	