3PC-002

27th EAHP Congress
Lisbon
22-24 March 2023

Hazardous Drug and Antibiotic Residue Surface Contamination Is there a need to reduce exposure?

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Surface Contamination with Hazardous Drugs

Fig 1. Pass Thru Window sampled during evaluation

Background

- Exposure to Hazardous Drugs (HD) occurs during compounding and administration activities and is an established risk.
- Guidance involving enhanced cleaning procedures have been established.
- Despite guidance, HD surface contamination continues to be detected during routine and exploratory evaluations.
- Closed System Transfer Devices (CSTDs) have been demonstrated to reduce or eliminate the potential for HD surface contamination.
- HD surface contamination monitoring by surface wipe sampling is an accepted process for evaluating presence of HD surface contamination.

Objective

- The objective of this study was to measure the presence of HD surface contamination on multiple surfaces in three departments in order to determine the effectiveness of current cleaning procedures and enhanced controls (CSTDs).

Methods

- Multiple surfaces were sampled and analyzed for paclitaxel (PAC), cyclophosphamide (CP), gemcitabine (GEM), doxorubicin (DOX), methotrexate (MTX), and 5-fluorouracil (5FU).
- Surfaces were sampled at multiple timepoints (Trial 1 and 2: April 22nd, Trial 3: July 2nd, Trial 4: December 29th, 2021).
- Following Trial 1 and 2, additional cleaning measures were added to clean the "scanner" surface.
- A CSTD (ChemoClave, ICU Medical) was used in the preparation of HDs.
- HD surface contamination is presented with color indication: (< 0.1 ng/cm², Alert level*: 0.1-1 ng/cm² and 1-10 ng/cm², Action level*: > 10 ng/cm²).

Discussion and Conclusion

- HD surface contamination was low or not detected in 280/288 samples tested during the evaluation (indicated in green).
- Previous and current cleaning procedures, along with the use of a CSTD (ChemoClave, ICU Medical), were effective in maintaining a low level of HD surface contamination.
- Guidance, involving the use of a CSTD and effective cleaning, has proven to be effective measures to minimize or prevent the unintentional exposure of healthcare workers to HD surface residues.

Results

HD surface contamination in three departments during four trials (ng/cm²)

Department	Description surface	PAC				CP				GEM				DOX				MTX				5FU			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pharmacy	Touch screen pneumatic system	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pharmacy	Scanner	ND	ND	ND	0.30	0.04	ND	ND	0.07	0.12	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
Pharmacy	Pass-thru window	ND	ND	ND	ND	ND	ND	0.05	2.90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pharmacy	Front airfoil grate of BSC	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND	0.01	0.09	ND	ND	ND	ND	0.04	0.01	0.70	ND	ND	ND	ND	ND
Pharmacy	BSC inside front window	ND	ND	ND	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pharmacy	Touch screen Diana	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.38	ND	ND	0.79
Ward 1	Preparation table	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ward 1	Keyboard computer nursing department	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ward 1	Door refrigerator	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ward 2	Preparation table	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12
Ward 2	Keyboard computer nursing department	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ward 2	Door refrigerator	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Surface Contamination with Antibiotics

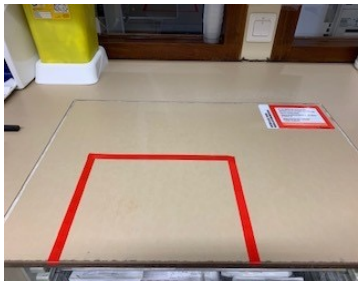

Fig 2. Prep Table (ward E) sampled during evaluation

Background

- Antibiotics (ABs) usage and preparation occurs in many departments, including hospital pharmacies and the areas of administration.
- Guidance involving the enhanced cleaning procedures, or use of secondary controls by CSTDs have not been established.
- Prolonged or repeated exposure to ABs have been demonstrated to possibly cause a range of adverse effects.
- Publications are limited in the evaluation of the extent of AB surface contamination throughout hospital systems.
- AB surface contamination may lead to the proliferation of potentially drug resistant organisms in the pharmacy and administration areas.

Objective

- The objective of this study was to measure the presence of AB surface contamination on multiple surfaces in six wards in order to determine if there was a need to incorporate enhanced cleaning procedures and potentially the implementation of a CSTD.

Methods

- Multiple surfaces were sampled and analyzed for vancomycin (VAN), cefotaxime (CEFO), ceftriaxone (CEF), benzylpenicillin (BEN), amoxicillin (AMO), meropenem (MER), piperacillin (PIP), and flucloxacillin (FLU).
- Surfaces were sampled at multiple timepoints (Trial 1 and 2: April 22nd, Trial 3: July 2nd, Trial 4: December 29th, 2021).
- Following Trial 1 and 2, enhanced cleaning measures were introduced to address the widespread AB surface contamination throughout.
- A CSTD was not used in the preparation or administration of ABs.
- For comparison, AB surface contamination is presented with the same color indication as for HD surface contamination. However, Alert and Action levels for ABs are not set yet and could differ from the HDs.

Discussion and Conclusion

- High levels of AB surface contamination were detected consistently in all wards.
- Contamination was generally in line with the utilization of the respective AB.
- It should be noticed that the amount of ABs handled (dosages and numbers) are higher than for HDs.
- The results illustrate that current institutional cleaning may not be sufficient and controls or guidance require to be updated to reduce healthcare workers and patients to potentially harmful AB surface residues.

Results

AB surface contamination in six wards during four trials (ng/cm²)

Ward	Description surface	VAN				CEFO				CEF				BEN				AMO				MER				PIP				FLU			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
A	Preparation table	2.45	1.55	155	1.14	ND	ND	ND	973	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.18	ND	19	293	0.31	0.09	0.03	ND	44	ND	ND	ND	ND	ND
A	Floor around waste bin	4.36	1.28	299	96	0.07	0.10	0.14	49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	0.33	1.83	2.32	1.48	3.06	0.15	0.20	1.61	0.05	0.01	0.01	2.53	0.15
B	Preparation table	1.13	0.14	14	4.56	ND	ND	ND	0.04	0.04	ND	ND	ND	ND	ND	ND	ND	14	6.24	ND	0.74	0.07	0.03	0.74	0.07	12	12	0.31	10	ND	ND	ND	16
B	Floor around waste bin	1.79	0.70	16	3.16	ND	ND	ND	0.06	0.04	ND	0.11	ND	ND	ND	ND	ND	122	3.40	ND	44	74	1.64	3.13	44	159	47	1.27	44	0.62	0.12	ND	194
C	Preparation table	2.63	2.63	1.17	0.24	ND	ND	ND	0.01	0.09	0.11	ND	ND	ND	ND	ND	ND	5.43	1.52	0.07	0.06	0.39	0.21	0.03	0.01	1.08	0.85	0.42	0.55	0.01	0.01	0.01	0.02
C	Floor around waste bin	0.26	0.21	0.19	0.30	ND	ND	ND	0.03	0.04	ND	ND	ND	ND	ND	ND	ND	347	101	0.43	0.93	7.36	3.70	ND	0.04	26	18	0.81	2.92	0.19	0.09	0.03	0.02
D	Preparation table	0.53	0.26	16	68	ND	ND	1.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	ND	0.33	0.03	0.38	0.15	0.20	0.66	0.12	0.11	0.40	0.12	0.03	ND	ND	12
D	Floor around waste bin	4.63	1.52	7.26	1.25	0.03	ND	0.41	ND	0.11	0.06	0.25	ND	ND	ND	ND	ND	1.04	0.38	0.81	ND	2.70	0.80	0.23	1.27	1.75	1.47	0.57	0.24	ND	ND	ND	0.69
E	Preparation table	0.74	3.41	2.97	1.53	0.51	ND	0.65	53	0.11	ND	1.51	ND	ND	5.73	1.94	665	9.16	2.61	9.76	40	0.09	0.03	0.74	0.04	26	22	21	8.15	9.60	0.13	11	1.21
E	Floor around waste bin	ND	1.49	12	4.68	ND	ND	ND	22	ND	ND	0.09	53	ND	2.80	0.13	119	ND	0.75	7.59	1291	ND	ND	0.56	0.90	0.07	26	0.89	1178	0.30	1.13	3.28	0.25
F	Preparation table	8.12	0.24	45	22	ND	0.21	ND	ND	ND	0.11	ND	8.98	63	ND	ND	0.50	17	2.44	4.34	0.30	0.04	0.04	0.52	2.66	16	15	0.53	8.73	0.37	7.95	30	0.31
F	Floor around waste bin	14	0.14	14	191	ND	ND	ND	ND	0.05	ND	ND	0.37	59	ND	ND	21	7.23	0.09	1.14	0.36	ND	ND	0.22	0.53	140	57	4.86	158	5.20	1.05	115	0.56

References
*Alert and action levels for surface contamination with HDs in The Netherlands
(https://www.dokterhoe.nl/fileadmin/user_upload/documents/cytostatica/meetstrategie-werkinstructie.pdf)

Disclosures
This study was financially supported by ICU Medical USA
Paul Sessink is receiving an honorarium from ICU Medical for his presentation.