Multicenter Study of Environmental Contamination with Hazardous Drugs in Quebec Hospitals

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INTRODUCTION

- A *National Institute for Occupationnal Safety and Health* (NIOSH) Alert on Hazardous Drugs was published in 2004 and updated in 2010
  - The NIOSH list of drugs considered to be hazardous was updated in 2010
- Environmental contamination by cyclophosphamide (CP), ifosfamide (IF) and methotrexate (MTX) can be measured by a kit developed by the Institut national de santé publique du Québec (INSPQ)
- Occupational exposure may occur on many levels when handling, compounding or administering a drug considered to be hazardous, from storage to waste management
- A Prevention guide on safe handling of hazardous drugs was published in 2008 by the Association paritaire pour la santé et la sécurité au travail - secteur affaires soociales (ASSTSAS)

OBJECTIVE

To describe environmental contamination with CP, IF and MTX in Quebec healthcare centers

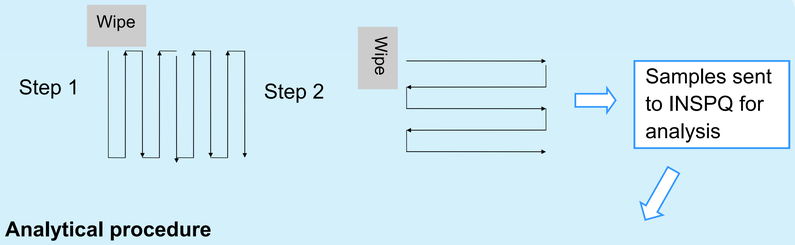
METHODS

Study sites

- Descriptive, prospective, multicenter study
- Directors of pharmacy departments from hospitals with at least 50 acute care beds were contacted between December 2007 and June 2008 (n=68)

Sampling technique

- Standardized sampling sites (standardized surface of 600 cm²):
  - Six sites in pharmacy areas
  - Six sites in patient care areas
- Samples collected between April 2008 and January 2010



Analytical procedure

- Adapted from Larson et al. (2002)[1] and validated by the INSPQ
- Samples were analysed for the presence of the cytotoxic agents by UPLC-MS-MS
- Limits:

	LOQ	LOD
CP	0.005 ng/cm² (0.27 ng/mL)	0.015ng/cm² (0.008ng/mL)
IF	0.004 ng/cm² (0.22 ng/mL)	0.0012 (0.06 ng/mL)
MTX	0.02 ng/cm² (1.09 ng/mL)	0.006 (0.33 ng/mL)

LOQ: Limit of quantification; LOD: Limit of detection

RESULTS

- 25/68 Quebec hospitals participated in the study (37% response rate)
- No hospital used a closed-system drug transfer device (CTSD) at the time of the study
- 259 samples were collected:
  - 147 samples from pharmacy areas and 112 samples from patient care areas

Tab.I Number of positive, contaminated samples and concentration of cyclophosphamide in pharmacy and patient care areas

Sample site (n samples)	Positive samples* n (%)	Contaminated samples** n (%)	Concentration (ng/cm²) median [min-max]
Pharmacy areas			
Front grille inside the hood (25)	23 (92)	3 (12)	0.09 [<LOD - 3.30]
Floor in front of the hood (25)	16 (64)	1 (4)	0.01 [<LOD - 4.20]
Storage shelf (25)	14 (56)	2 (8)	0.002 [<LOD - 11.00]
Service hatch or counter or post-preparation validation (22)	9 (41)	0 (0)	<LOD [<LOD - 0.31]
Trays used for drug delivery (25)	7 (28)	0 (0)	<LOD [<LOD - 0.91]
Shipment reception counter (25)	5 (20)	0 (0)	<LOD [<LOD - 0.70]
Total (147)	**74 (50)**	**6 (4)**	**0.0029 [<LOD - 11.00]**
Patient care areas			
Counter used for priming (16)	12 (75)	1 (6)	0.075 [<LOD - 15.00]
Arm rest (16)	12 (75)	0 (0)	0.02 [<LOD - 0.50]
Exterior surface of hazardous drugs container (24)	15 (63)	1 (4)	0.0195 [<LOD - 28.00]
Storage shelf (23)	11 (48)	0 (0)	<LOD [<LOD - 0.16]
Patient room counter (17)	7 (41)	0 (0)	<LOD [<LOD - 0.13]
Outpatient clinic counter (16)	4 (25)	0 (0)	<LOD [<LOD - 0.40]
Total (112)	**61 (52)**	**2 (2)**	**0.0049 [<LOD - 28.00]**
Total (259) (pharmacy & patient care areas)	**135 (52)**	**8 (3)**	**0.0035 [<LOD - 28.00]**

*Positive sample: measured concentration above the limit of detection

Sampling site with the highest CP concentration (28 ng/cm²)

Sampling sites with the highest surface contamination

Proportion of positive samples (Tab.I):
- CP: 52% (135/259)
- IF: 20% (53/259)
- MTX: 3% (7/259)

Median [range] concentration (Tab.I):
- CP: 0.0035 [<LOD-28.0] ng/cm²
- IF: <LOD [<LOD-8.6] ng/cm²
- MTX: <LOD [<LOD-0.58] ng/cm²

Overview of the 25 participating centers (Fig.1)

- All participating hospitals had at least one positive sample for at least one of the three hazardous drugs evaluated
- 6 [1-12] (median [range]) sites with at least one positive sample*
- 0 [0-3] (median [range]) sites with at least one contaminated sample**

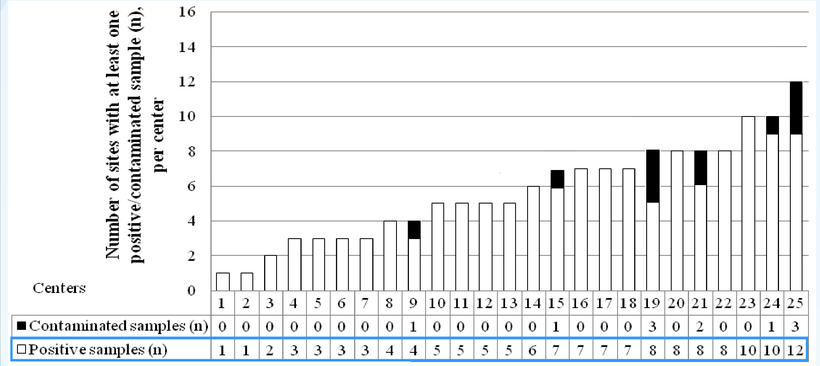


Fig.1 Number of positive and contaminated sites (pharmacy and patient care areas) for a least one hazardous drug (either CP, IF, or MTX) per center

DISCUSSION / CONCLUSION

- Our results from 25 Quebec hospitals indicated that it is feasible to have a similar (and in some cases, lower) level of surface CP contamination without the use of a CTSD;
  - however, the use of a CTSD is recognized as an effective way to reduce surface contamination to hazardous drugs[2,3]
- A similar CP surface contamination was found in pharmacy and patient care areas
- Periodic surface contamination measurements are necessary to ensure that current practices limit occupational exposure to hazardous drugs

REFERENCES

1-Larson RR, Khazaeli MB, Dillon HK. (2002). Monitoring method for surface contamination caused by selected antineoplastic agents. Am J Health Syst Pharm; 59(3): 270-7.

2-Sessink et al. Reduction in surface contamination with antineoplastic drugs in 22 hospitals pharmacies in the US following implementation of a CTSD. J Oncol Pharm Pract 2011;17(1):39-48.

3-Siderov et al. Reducing workplace cytotoxic surface contamination using a CTSD. J Oncol Pharm Pract 2010;16(1):19-25

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