Characteristics of North American Providers of Antineoplastic Drug Dosage

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Introduction

- The International Society of Oncology Pharmacy Practitioners (ISOPP) makes no recommendations on the frequency of environmental monitoring.(1)
- The United State Pharmacopeia recommends taking surface samples every 6 months or more if needed. (2)
- The *Association paritaire pour la santé et la sécurité du travail du secteur affaires sociales (ASSTSAS)* and the *Ordre des pharmaciens du Québec* recommend that monitoring should be carried out at least every 6 months. (3)(4)
- Several service providers have marketed tests for dosing antineoplastic drugs on surfaces.

Objectives

- Compare the characteristics of antineoplastic drug dosages from North American service providers.

Method

- Study conducted between June 3-15th, 2020
- Websites of different providers were searched
- Providers were contacted by email

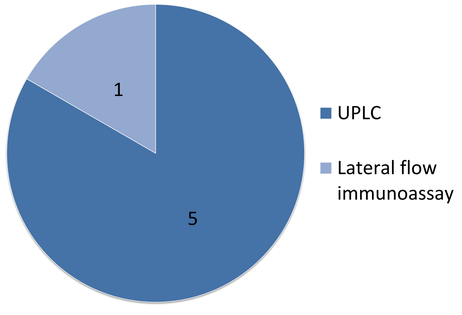

Figure 1. *Analytical methods*
UPLC-MSMS : Ultra performance liquid chromatography coupled to tandem mass spectrometry

References :
(1) Connor T, McLauchlan R, Vandenbroucke J. Preface. J Oncol Pharm Pract. sept 2007;13(3_suppl):1-2
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(3) Association paritaire pour la santé et la sécurité du travail S "Affaires sociales.". Manipulation sécuritaire des médicaments dangereux guide de prévention. [Internet]. Montréal: ASSTSAS; 2008 [cité 16 sept 2020]. Disponible sur:http://www.irsst.qc.ca/files/documents/PubIRSST/CG-001.pdf
(4) Ordre des pharmaciens du Québec. Normes 2014.02 - Préparation de produits stériles dangereux en pharmacie.pdf [Internet]. 2014. Disponible sur: https://www.opq.org/doc/media/1847_38_fr-ca_0_norme201402_prod_striles_dang_oct2017.pdf

Results

- Our research team identified 6 antineoplastic dosage service providers in Canada and in the United States
- They dose between 3 and 18 antineoplastic drugs each (Tab I).
- Limits of detection (LOD) vary significantly between providers (Fig2) and LODs per drug are often unavailable.

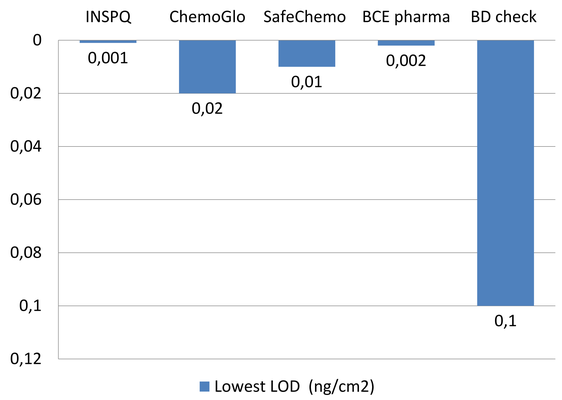

Figure 2. *Lowest limit of detection (LOD) of an antineoplastic drug per service provider (ng /cm²). Note: the lowest LOD is used for this comparison, as LODs per drug were not obtained from several providers.*

- The sampling techniques are similar, however the wipes and the size of the sampling surface differed (100 cm² to 930 cm²).
- The number of samples per kit are fixed for some, therefore the prices are less adjustable.
- The costs are difficult to compare (fixed kits, fixed costs and packages). The least expensive are around $CA 70 for 1 samples (+), and up to $CA 3200 for 12 samples (+++)
- The majority of providers offered mass-coupled high performance liquid chromatography (UPLC-MSMS) analysis and one offered an immunoassay method (Fig 1)
- One provider offered a rapid detection test, which can be useful in the event of a spill; however, the high LOD prevents its use in a monitoring program.
- In addition to performing the dosage, a public provider offers the possibility of sampling 12 predetermined sites and participating in the Unité de recherche en pratique pharmaceutique (URPP) canadian monitoring program. This allows the aggregated data to be shared and serve as a guide (centers' contamination is compared with the median contamination of the other participants).
- Limitations: data was collected from providers' websites and they were contacted for clarification; however, several pieces of information were difficult to compare or not obtained.

Table 1. *Summary profile of the 6 north American antineoplastic drug dosage providers*

Methods	INSPQ	ChemoGLO™	SafeChemo™	BCE Pharma™	BD®	ChemoAlert
Country	Canada	Canada and United States	Canada and United States	Canada	Canada and United States	Canada and United States
Type of provider	Public organization	Private society	Private society	Private society	Private society	Private society
Antineoplastic drug tested (n)	9	17	15	18	3	14
Antineoplastic drugs tested	5-FU, Cyclophosphamide, Docetaxel, Gemcitabine, Ifosfamide, Irinotécan, Méthotrexate, Paclitaxel, Vinorelbine.	5-Azacytidine, 5-FU, Busulfan, Cyclophosphamide, Cytarabine, Docetaxel, Etoposide, Gemcitabine, Ifosfamide, Irinotécan, Méthotrexate, Mytomycine C, Paclitaxel, Platines, Vincristine, Vinorelbine.	5-FU, Busulfan, Cyclophosphamide, Cytarabine, Daunorubicine, Docetaxel, Doxorubicine, Etoposide, Ifosfamide, Méthotrexate, Platines, Vincristine.	5-FU, Cyclophosphamide, Cytarabine, Daunorubicine, Docetaxel, Doxorubicine, Epirubicine, Etoposide, Gemcitabine, Ifosfamide, Irinotécan, Melphalan, Méthotrexate, Paclitaxel, Permetrexed, Platines, Vinblastine.	Cyclophosphamide, Doxorubicine, Métothrexate.	5-FU, Doxorubicine, Epirubicine, Etoposide, Ifosfamide, Irinotécan, Métothrexate, Paclitaxel, Platines, Vincristine.
Samples per kit	1 to 13	6	1 to 12	10	1 to 20	1 to 10
Wipe	WypAll X-60, 6 cm x 8 cm	Cotton swabs are saturated in a proprietary blend containing IPA	Sampling pads (plastic mounted rod with polyester fabric tip)	Round wipes 55mm in diameter	Wipe	Polyester swabs Texwipe TX714A
Surface sampled (cm²)	600	930	465	225	930	100
Analytical method	UPLC-MSMS	UPLC-MSMS	UPLC-MSMS	UPLC-MSMS	Lateral flow immunoassay	UPLC-MSMS
Price range	+	+++	+++	++	++	+++
Planned delay for obtaining results	10 to 15 days	30 days	10 to 15 days	3 to 4 weeks	Less than 10 minutes	10 to 15 days
ISO certified	yes	no	Yes	no	no	yes

Legend: INSPQ: Institut National de santé publique du Québec ; UPLC-MSMS: Ultra performance liquid chromatography coupled to tandem mass spectrometry, IPA: isopropyl alcohol.
Note: this table summarizes the information obtained from the service providers during the study and the research team may not have been informed of all details about the methods.

Discussion/Conclusion

- There was a lack of uniformity in terms of information, price, methodology, drug dosed, limits of detections.
- A low limit of detection is essential to obtain a rigorous portrait of surface contamination; rapid tests may be used periodically in case of a spill.
- The procedure for implementing one of these dosage remains at the discretion of the centers. Official recommendations exist to guide the choice of frequency of surface dosage and choice of surfaces to be sampled. However, there are less recommendations as to the actions to be done by the centers and there is no safe exposition limit for the healthcare workers.
- Further research could identify more service providers, including in other countries.

Contact: jf.bussieres@ssss.gouv.qc.ca; Conflict of interst: collaboration with the INSPQ for the environmental monitoring program. The dosage are independent from the Unité de recherche en pratique pharmaceutique ; Funding: None; Poster presented at the virtual Gerpac conference, November 23-24, 2020