



Cost Effectiveness of International Shipment of Dried Plasma for HIV Resistance Testing

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BACKGROUND

Introduction: Antiretroviral (ARV) resistance testing generally requires sample shipment under controlled frozen conditions, which is expensive and cumbersome. We previously demonstrated that dried blood plasma, using SampleTanker® (ST®) as a collection and transport device, can be successfully used for HIV genotyping. We evaluated the feasibility and cost of international shipment of SampleTanker® dried ambient samples for genotyping.

METHODS

One milliliter of frozen plasma specimens were generated for this study from consecutive blood samples arriving in clinical virology laboratories in UK (International Clinical Virology Centre Charitable Trust) and Israel (Israel National HIV Reference Laboratory – NHRL) to audit the provision an economic alternative to international transport of frozen plasma specimens. These samples had previously been genotyped by the TRUGENE® HIV-1 Genotyping Kit in Israel and the United Kingdom for clinical support of patient care.

Samples were added to the SampleTanker® matrix, or air-dried for > 5 hours, and shipped ambient temperature from representative countries to Atlanta, GA, USA using standard first class mail. ST specimens were recovered with reconstitution buffer, HIV-1 RNA extracted and genotype analysis performed using the TRUGENE HIV-1 Genotyping Kit and HIV-1 GeneTanker® PR/RT Select Assay. MuTanker™ independently compared the IAS RAM sites and the overall sequence similarity for all paired sequences.

Costs for frozen bio-hazardous sample shipping using commercial carriers were compared to costs for ambient shipment using commercial carriers and national/international postal services.

Table 1: International Shipping Costs (Conventional Dry Ice Shipment Including Consumables and Customs) from ICVC Charitable Trust, Buckinghamshire, UK to Alpharetta, Georgia, USA

Item	Date shipped	Date received	Number of samples	Cost in \$USD	Cost/sample
1	22-Aug-06	24-Aug-06	21	\$ 511.10	\$ 24.34
2	19-Sep-06	21-Sep-06	12	\$ 375.86	\$ 31.32
3	14-Nov-06	16-Nov-06	9	\$ 316.12	\$ 35.12
4	28-Nov-06	28-Nov-06	22	\$ 504.30	\$ 22.92
Average Cost/Sample				\$ 26.68	

Table 2: International Standard Shipping Costs (SampleTanker®)

Item	Date shipped	Date received	Number of Samples	Cost in \$USD	Days in Transit	Cost/Sample
From Sheba Medical Center, Tel-Hashomer, Israel to Buford, Georgia, USA						
1	5-Apr-2004	13-Apr-2004	5	\$ 5.60	8	\$ 1.12
2	5-Apr-2004	13-Apr-2004	36	\$ 11.10	8	\$ 0.31
3	29-Jul-2004	13-Aug-2004	20	\$ 5.80	15	\$ 0.29
4	9-Sep-2004	18-Sep-2004	20	\$ 5.40	8	\$ 0.27
5	10-Oct-2004	19-Oct-2005	25	\$ 6.95	8	\$ 0.28
6	12-Jan-2005	31-Jan-2005	20	\$ 5.51	19	\$ 0.28
7	1-May-2005	10-May-2005	20	\$ 3.03	9	\$ 0.15
From ICVC Charitable Trust, Buckinghamshire, UK to Buford, Georgia, USA						
1	14-May-09	20-May-09	25	\$ 15.00	6	\$ 0.60
Average				10.1	\$ 0.41	

Table 3: International 2 Day Courier Shipping Cost Comparison (Including Consumables and Customs) for Specimen Transport of SampleTanker® vs Frozen Plasma

Shipping Logistics	Specimen Type	Quantity	Package Weight (in lbs.)	FedEx	Dry Ice*	Insulated Box**	Customs Invoice	Total Cost
From ICVC Buckinghamshire, UK to Buford, Georgia, USA	SampleTanker® Ambient Temperature	20	2.2	\$ 57.60	NA	NA	\$100.00	\$157.60
	Frozen Plasma (shipped on dry ice)	30	60	\$ 292.25	\$ 42.00	\$ 26.00	\$100.00	\$460.25
From Sheba Medical Center, Tel-Hashomer, Israel to Buford, Georgia, USA	SampleTanker® Ambient Temperature	20	2.2	\$ 90.78	NA	NA	\$100.00	\$190.78
	Frozen Plasma (shipped on dry ice)	30	60	\$ 292.25	\$ 42.00	\$ 26.00	\$100.00	\$730.97

* Dry Ice cost @ \$0.70 per pound ** LM-4 Insulated box

RESULTS

Shipments containing dried ambient SampleTanker® specimens from Israel (n= 166) and the United Kingdom (n= 109) were shipped to the testing facility located in Buford, Georgia USA. SampleTanker® dried specimen sequencing results had mean similarity scores of > 99% and > 98.5% concordance at the nucleic acid and amino acid level for RAMS and polymorphic fingerprints compared to results obtained from the referral laboratory.

CONCLUSIONS

- SampleTanker® is a cost-effective alternative to conventional frozen or refrigerated sample shipment.
- Ambient shipment costs were approximately 1.5% of the cost of frozen shipments during international shipment.
- Volume for volume the SampleTanker® System is < 3.3% the cost of dried blood spot (DBS) processing.
- SampleTanker® provides 20 times the volume for multi-analyte testing.
- SampleTanker® has utility for sample transport for ARV resistance testing in resource limited countries.
- Accuracy and reproducibility of TRUGENE® HIV-1 genotype results using dried SampleTanker® dried ambient shipped plasma were directly comparable to frozen paired samples.

Acknowledgements & Comments

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