Dry Storage of Biospecimens for an East Asian Glioma GWAS Study

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Overview

An international consortium was formed to collect biospecimens in East Asia from 4,000 glioma and 4,000 control participants to identify genetic variants associated with glioma risk. The study will collect biospecimens supportive of post-GWAS experiments to identify how these genetic variants affect tumor biology.

A pilot study was initiated at four sites in three Asian countries to demonstrate performance of biospecimen collection, preservation, and shipment to the Translational Genomics Research Institute (TGen) or a collaborating Chinese laboratory.

Results show that sample quality of all biospecimens collected at the various sites and shipped either by frozen storage or dry-storage are similar. However, a clear difference is observed in costs between samples shipped frozen versus using dry storage technology. Over the next 4 years, we estimate that the use of ambient biospecimen storage and shipping technology will result in total savings of $124,000 compared to using cold freezing sample storage and shipping.

GWAS Study Goals

1. Validate current genetic variant candidates and identify new genetic variants associated with glioma susceptibility in an East Asian population.

2. Use repository of tumor and blood specimens to link genetic susceptibility risks to biology of glioma.

Methodology

Blood from up to 10 glioma cases and 10 controls at each site is stabilized frozen in cryovials or at ambient temperature (Qiagen/Biomatrica's QIAsafe DNA Blood) then shipped. Glioma tissue samples are split for flash freezing (-80C) or stored at ambient temperature (Biomatrica's DNAgard Tissue).

Biospecimens were shipped to TGen (USA) for quality control assays. A cost analysis of shipping and storage costs for frozen versus ambient temperature biospecimen preservation was determined .

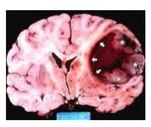
Whole Blood Samples

Cryoport vials
- Frozen shipment

QIAsafe DNA Blood
- Dry storage

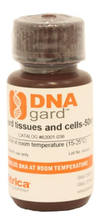
Blood samples are packaged and shipped frozen in 1.8mL cryovials (cryoport) or at room temperature in a dry-down format using QIAsafe DNA Blood plates (Qiagen; 150µl).

Glioma Tissue Samples



Cryoport vials
- Frozen shipment

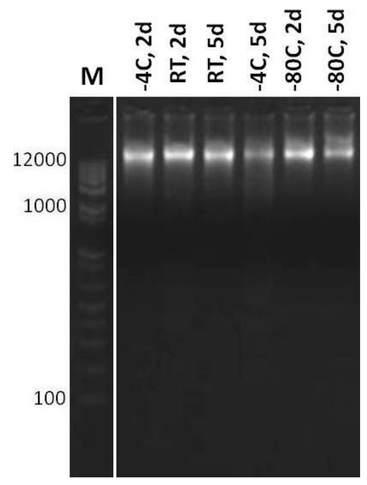
DNAgard Tissue
- Ambient storage



Glioma tissue samples are packaged and shipped frozen in 1.8mL cryovials (cryoport) or at room temperature in DNAgard Tissue (Biomatrica; 500µL).

Results

Pre-pilot validation of "dry" storage of whole blood



Gel images showing quality of recovered DNA from whole blood samples after storage in cold (-4C & -80C) or in ambient conditions (RT = QIAsafe DNA Blood).

Storage condition	A260/A280	Yield (ug)
RT, 2 days	1.7	8.07
RT, 5 days	1.7	11.55
-4C, 2 days	1.6	9.99
-4C, 5 days	1.7	13.23
-80C, 2 days	1.8	11.31
-80C, 5 days	1.6	11.85

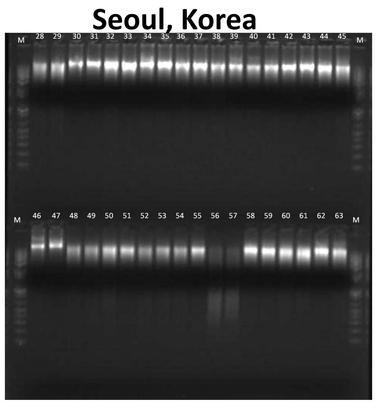
Yield of recovered DNA from whole blood samples after storage in cold (-4C & -80C) and RT (= QIAsafe DNA Blood).

Pilot Study

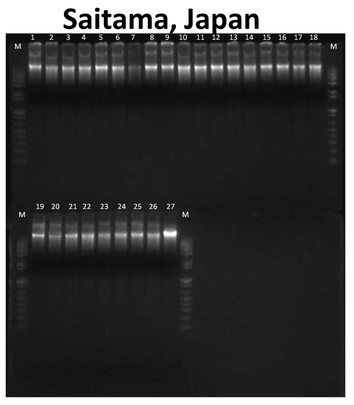
Quality Control – DNA in whole blood

	Average	Range
Yields (N = 84)	19.40 µg ± 10.08 µg	8.7 – 48.21 µg
A260/A280	1.84 ± 0.10	1.64 – 2.17

Seoul, Korea



Saitama, Japan



Gel images of recovered DNA from whole blood samples collected from two different sites , Seoul (South Korea) and Saitama (Japan), stored & shipped in QIAsafe DNA Blood plates.

Dry Storage Savings (Blood & Tissue shipments)

Biospecimen	Shipment type	Form	Number of shipments	Single Shipment Cost	Estimated shipping cost
Whole blood	Commercial Cryoport	1.8 mL cryovial	106	$750	$79,500
	DNAstable Blood	48-well plate	17	$146	$2,482
				Difference	**$77,018**
Glioma Tissue	Commercial Cryoport	1.8 mL cryovial	67	$750	$50,250
	DNAgard	1.8 mL cryovial	17	$146	$2,482
				Difference	**$47,768**
Savings					**$124,786**

Our estimated costs using ambient storage shipment saves $124,786 versus frozen shipment over a 4-yr period.

Discussions

Dry Storage Savings

/	One time costs			Annual Costs				
	Purchase Price	Racks	Installation	Electricity	Heat discharge	Space	Maintenance	**TOTAL (4 yrs)**
Freezer	$7,900	$1,500	$2,900	$942	$440	$1,055	$200	$25,485
Dry Storage	$0	$0	$0	$0	$0	$0	$0	$0
Savings								**$25,485**

Combined savings – shipping and storage: $150,271

Dry Storage Supply Savings

Supply	Per sample cost	Number of units	Total cost
1.8 mL Cryovial: blood	$0.56	8,000 cryovials	$4,480
QIAsafe DNA Blood 48-well plate	$3.00	340 plates	$24,718
Difference			**$20,238**
DNAgard	$1.21	5,000 (500 µL aliquots)	**$6,050**
TOTAL COST			**$26,288**

Total savings:
Shipping/Storage savings
– Supply costs
= **$150,271 - $26,288**

$123,983

Conclusions

- International collaborative study of brain tumor genetic epidemiology and biology necessitates web-based site coordination.
- Biospecimen collection, annotation, processing, shipping and repository performance is feasible and enabled by coordinated SOPs.
- Use of dry storage technology (Biomatrica) provides excellent preservation of quality of blood and tissue.
- Use of dry storage technology (Biomatrica) saves $124,000 over 4 years in shipping & storage costs.
- Use of dry storage technology (Biomatrica) may save up to 4% costs of launch & operations of biorepository.

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