



Cost Analysis of EcoScreen v. RTube

Scope

The below chart and attachments detail the steps involved on collecting a sample with the RTube™ (Respiratory Research, Inc.) and the EcoScreen (Viasys Inc.). This is a time study based on estimates and actual experience. Labor costs, depreciation of assets, and cost of consumables are factored into the study. The study model is that of a NIH-funded multi-center trial currently underway in the US.

Assumptions

- Samples will be taken serially with one patient at a time to baseline on a lab-based serial testing model although the RTube supports multiple simultaneous collections in the clinic or field.
- 3000 total samples over 10 centers over 3 years
- Cost of research nurse is \$30.00/hr.
- Study using 10 infinite-use EcoScreen with purchase price of \$9,200 USD each (estimated with discount)
- Study using 3000 single-use disposable RTubes with purchase price of \$23.25
- Study using RTube Cooling sleeves (30) at \$145.00 USD each
- Study using RTube Plunger (10) at \$135.00 USD each
- Depreciation based on 3 years with 100 samples/center/year for all durable components

Conclusion

The remaining asset value of the 10 EcoScreens left over after the study is greatly offset by the direct costs of operating the EcoScreen. The RTube is the lower cost alternative up to a total break-even sample collection of 7500 samples, after which the EcoScreen is the lower cost alternative. Break-even is the total number of collections at which the economics of either system are equal and is calculated below. The 3000 samples are the stated study goal and it is assumed all equipment is fully depreciated over the study period in addition to recurring costs of collection, hence the higher per-collection cost. The following X samples are free of any equipment cost burden and represent only the recurring costs of collection.

$$(300 \text{ EcoScreen samples @ } \$44.59 \text{ ea.}) + (X \text{ EcoScreen samples @ } \$13.92 \text{ ea.})$$

equals

$$(300 \text{ RTube samples @ } \$29.32 \text{ ea.}) + (X \text{ RTube samples @ } \$27.42 \text{ ea.})$$

Do the algebra and the break-even point is 750 sample collections per center. In this case, the 10-center study would perform 7500 samples before the EcoScreen would compete economically with the RTube. Put differently, the RTube is the lower cost solution for any number of samples up to about 750; the EcoScreen is the lower cost solution only if you plan to do 750 collections or more over the service life of the equipment.

The assumes a serial usage model which does not take full advantage of the RTube's parallel sampling capability nor the ability to easily gather large number of samples in the field. If these factors are weighed in, it is unlikely there is ever a break-even point and the RTube emerges as the low-cost device over any number of samples. The additional consistency of the RTube cleaning process and the ability to collect, store, transport, and plunge all in the same collection tube greatly reduces the risk of sample contamination. The disposable patient-specific design eliminates any cross-contamination risks.

Analysis

Step	EcoScreen	Time/Freq	Notes	RTube	Time/Freq	Notes
1	Turn on (1/day) to cool (NOT INCLUDED IN LABOR COSTING BELOW)	30 min/ day	Assume machine turned on/off daily	Not required	N/A	Multiple cooling sleeves always immediately available in lab/clinic freezer
2	Clean collection tube (to reduce risk of patient cross-contamination)	5 min/ collection	Inhalation through 1-way valve presents inter-patient contamination risk	Not required	N/A	Disposable device is patient-specific and cleaned a manufacture.
3	Clean condensation chamber insert	4 min/ collection	Condensation chamber must be free of contaminants. Possible variation in cleaning technique between centers and users with no documented standard. Infrastructure and ~\$1.00 in consumable chemicals required.	Not required: Disposable device is cleaned and packaged in class 10,000 cleanroom with alcohol and reagent-grade deionized water	N/A	Strictly controlled cleaning procedure is documented and executed by ISO9000 certified medical device manufacturer.
4	Retrieve cooling sleeve from freezer	N/A	Refrigeration is built into the machine itself and requires no external cooling source.	Multiple cooling sleeves can be stored in the same freezer for fast swap	1 min/ collection	Cooling sleeve is 100% aircraft aluminum and rapidly cools to ambient freezer conditions.
5	Sample collection	7 min/ collection	Requires electrical power, nurse supervision, and laboratory or clinic space. Only one sample can be collected at a time	Sample collection	7 min/ collection	Hand-held self-contained device can be used anywhere by the unsupervised patient. A single research nurse can easily monitor 50 simultaneous collections.
6	Sample storage and transport (before removal from condensate chamber)	N/A	EcoScreen has no provision for this other than removing the sample and placing in separate storage container. This increased handling increases exposure of sample to contamination.	RTube condensation cartridge doubles as a storage tube simply by capping the ends.	1 min/ collection	Since sample is stored in the same chamber it was collected in, the opportunities for handling-induced contamination are minimized.

7	Removal of sample	13 min/ collection	Sample often freezes in chamber and must thaw. Centrifuge is needed to effectively drive droplets inside cooling chamber to collection point. Manually swinging the chamber in a circle can also aid collection but with much lower efficiency and reduced condensate yield. This also increases exposure to handling-induced contamination.	RTube utilizes syringe-style plunging to rapidly and easily wipe chamber walls clean even when frozen. Simple design provides nearly complete condensate yield in any condition.	.5 min/ collection	Since plunging and collection are done in the original collection chamber, opportunities for handling contamination are minimized.
8	Sample Storage and transport (after removal)	2 min/ collection Collected droplets are poured into a separate container.	This is a manual process where the condensate is transferred from one container to another.	This step can also be done with the RTube but is not required since the sample is easily stored in the original collection chamber.	N/A	

Analysis

EcoScreen			RTube		
TOTAL TIME	31 min/ collection		TOTAL TIME	9.5 min/ collection	Assuming one collection at a time
Labor cost/sample (one patient at a time)	\$15.50		Labor cost/sample (one patient at a time)	\$4.75	
Labor cost/sample (10 patients at a time) <i>FOR REFERENCE ONLY: NOT CALCULATED INTO COSTS BELOW</i>	N/A	Can not be done. The EcoScreen is a lab-based device that is only designed to be used by one patient at a time.	Labor cost/sample (10 patients at a time) <i>FOR REFERENCE ONLY: NOT CALCULATED INTO COSTS BELOW</i>	\$0.38	The RTube allows the researcher to collect a large number of samples simultaneously in the clinic or in the field
Total Consumables	\$1.00/ collection	Chemicals for cleaning	Total Consumables	\$23.25	The disposable RTube assembly

Depreciation of capitol equipment assets over life of study	\$30.67/ collection	\$9,200 purchase price per center spread over 300 samples	Depreciation of capitol equipment assets over life of study	\$570 purchase price per center spread over 300 samples. (3 cooling sleeves, plunger)	More cooling sleeves enable simultaneous collection. This analysis assumes only 1 patient at a time for comparison
TOTAL EcoScreen USAGE COSTS PER COLLECTION (with depreciation)	\$47.17/ collection		TOTAL EcoScreen USAGE COSTS PER COLLECTION (with depreciation)	\$29.90/ collection	