M-TRAP Virus Capture Efficiency Evaluation

Conducted at the CDC/NIOSH unit in Morgantown West Virginia

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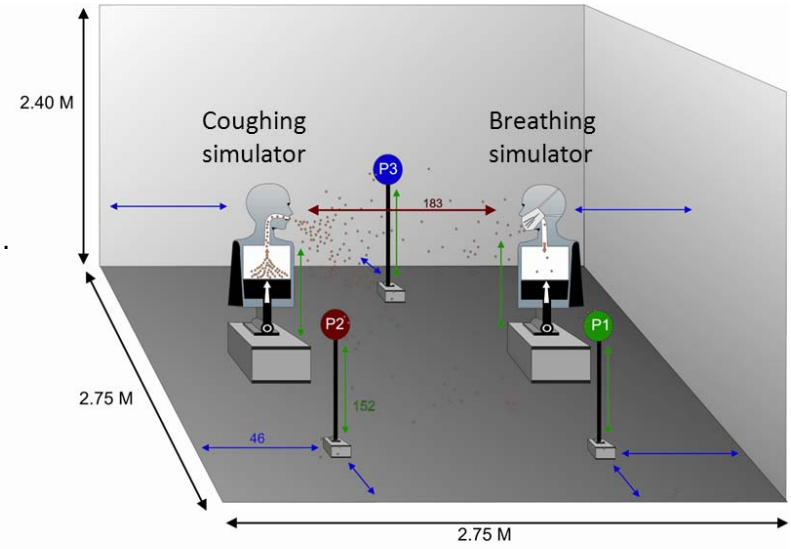
Study Objective: Determine the efficacy of M-TRAP® to capture Influenza virus.

Methods: Six experimental trials where conducted using "coughed" influenza into a simulated exam room (figure 1.). Air was sampled for 60 minutes from two NIOSH samplers positioned on either side of the breathing manikin's mouth. Air was sampled for 15 min with The M-TRAP®, which was positioned approximately 0.3 m from the mouth. After collection, the M-TRAP® capture matrix was removed and placed into 1 ml of Hank's buffered salt solution containing 0.25% BSA and the virus was allowed to elute for 24 h at 4 degrees F. The amount of total virus (dead and alive) collected by the NIOSH and M-TRAP® samplers was determined using a quantitative PCR assay to detect the viral Matrix gene and assayed for viability using a standard plaque assay.

3D View of the Simulated Examination Room

Figure 1.



NIOSH aerosol samplers collect air from the mouth and at various positions (P1,P2,P3) within the room. All inside dimensions in centimers.

Results. No significant differences were detected between the NIOSH and M-TRAP® samplers in their ability to capture viable virus particles (Table 1.), nor in the capture efficiency of total viral particles as measured by qPCR (Table 2.)

Table 1. Viability retention following release of Influenza A virus.

Experiments	Starting Viability	M-TRAP® Viability (*PFU/Total Virus)	NIOSH Viability (PFU/Total Virus)
Trial 1	2.80%	1.6% (2.45E+04/1.51E+06)	2.3% (1.2E+04/5.19E+05)
Trial 2	1.30%	3.3% (1.49E+03/4.53E+04)	0.8% (9.2E+02/1.15E+05)
Trial 3	2.00%	0.8% (3.13E+03/3.7E+05)	1.3% (9.4E+02/7.1E+04)
Trial 4	0.40%	0.7% (9.25E+03/1.4E+06)	0.5% (2.71E+03/5.5E+05)
Trial 5	1.50%	0.8% (6.13E+03/7.4E+05)	1.3% (5.72E+03/4.52E+05)
Trial 6	2.20%	0.8% (1.53E+04/1.81E+06)	1.3% (7.41E+03/5.65E+05)
	Mean Viability	**1.4%**	**1.3%**

T-test (t=2.02, 10 d.f., P=0.84)

*Plaque forming units enumerated on mammalian cell culture.

Table 2. Total Influenza A virus captured by two air samples in the exposure chamber.

		*Virus Particles/Liter of Chamber Air	
Experiments		M-TRAP®	NIOSH
Trial 1		1677	2471
Trial 2		50	547
Trial 3		411	338
Trial 4		1556	2638
Trial 5		822	2152
Trial 6		2011	2690
	Mean	1088	1806

T-test (t=1.33, 10 d.f., P=0.21)

*Particles were quantified by DNA-qPCR analysis.

Conclusions: The M-TRAP® technology is an inexpensive and easy to use capture matrix to detect airborne virus particles for a variety of downstream molecular diagnostics. Its ability to retain viable virus allows for study of infectious particles. Moreover, the M-TRAP® capture efficiency provides end users with a reliable technology to investigate the epidemiology of important viral diseases in both agriculture and health care.