An Evaluation of Faecal Transport Swabs Using the Swab Elution Method in Accordance With Approved Standard CLSI M40-A2.

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INTRODUCTION

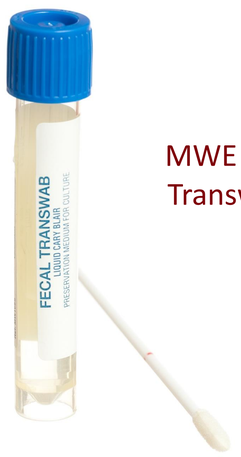
Specimen collection using medical devices such as swabs are an integral part of patient infection diagnosis. Faecal swabs can be used for bacterial cultures in place of traditional stool samples. Efficient absorption, transportation and release of specimens without overgrowth, are essential features that faecal transport swabs must possess. The Clinical and Laboratory Standards Institute's most recent update of their document outlining quality control (QC) of microbiological transport systems included QC testing for faecal transport systems using *Enterobacteriaceae* associated with gastrointestinal diseases; *Escherichia coli, Salmonella typhimurium and Shigella sonnei.* QC testing encompasses conditions which reflect that of actual use with storage conditions, including cold (2 to 8°C) and controlled room temperature (20 to 25°C) and testing time intervals up to 72 hours. For Recovery of samples to be considered acceptable, plate counts should remain stable and be within 2 $\log_{10}$ of the initial count of microorganisms.

The aim of this study was to evaluate and compare the recovery efficacy of three faecal transport swabs using the quantitative elution method of CLSI M40-A2 adapted for enteric bacteria.

METHODS

Methods were adapted from the CLSI M40-A2 quantitative elution method for faecal transport swabs and enteric bacteria. The performance of three medical devices were evaluated and compared. MWE Fecal Transwab®, a polyurethane foam tip with 2 mL vial of Cary-Blair medium; MWE Fecal Transwab Purflock, a multifilament polyester flocked fibre tip with 2 mL Cary-Blair medium; and Copan FecalSwab™ , a Nylon® flocked swab with 2 mL of Cary-Blair medium.

- Organisms used in this study included *E.coli* ATCC 11775*, S. typhimurium* ATCC 14028 and *S. flexneri* ATCC 12022*.*
- Culture suspensions were prepared in phosphate buffered saline (PBS) via direct colony inoculation method from an 18-24 hour agar plate of each organism to achieve approximately 1.5 x 10^8 CFU/ml (0.08-1.2 OD at 600nm) and then further diluted 1/5 in PBS to give approximately 3.0x10^7 CFU/ml.
- For each swab tested, 3 time points (0, 24, 48 & 72h) and two temperatures (RT & 4°C) were used as holding conditions.
- For each swab to be tested, and each organism/holding temperature/holding time, 50µl aliquots of the suspension was dispensed into wells of a microtitre plate and used to inoculate the swab.
- Swabs were replaced in their transportation vial. For time zero, devices were vortexed for 15 seconds, swab removed and discarded, and the transport medium was used to prepare serial dilutions. Dilutions were then spiral plated (100µl) on tryptone soya agar using an Neutec™ Eddy Jet™ 2 Spiral Plating System.
- For each swab/organism/temperature, at each holding time, the sampling procedure outlined above was used. Plate counts were used to calculate CFU/ml of recovered bacteria.



MWE Fecal Transwab®

DISCUSSION/CONCLUSION

The number of viable organisms remained stable when stored at 4°C and there was less than 1 log change over the 72 hour period for all test organisms and swab types.
At RT, the MWE Fecal Transwab® also maintained viable counts of all three organisms with less than 1 log change in CFU/ml. For the MWE Fecal Transwab PF, at RT, there was a >2 log increase in CFU/ml increase for *E. coli*, approximately 2 log reduction for *S. typhimurium*, whilst no change in log CFU/ml was observed for *S. flexneri*. At the same storage condition i.e. RT, there was an increase in viable count for all three organisms with the Copan FecalSwab™ with 3.02 log CFU/ml increase in recovery for *E. coli*, and an increase of 2.51 log and 2.61 log respectively for *S. flexneri* and *S.typhimurium*.

At 4°C, the recovery of microorganisms was maintained for 72 h for all three swabs, compared to swabs stored at RT, thus all three swabs were compliant with the M40-A2 protocol at the cold temperature.
AT RT, M40-A2 compliance was observed with MWE Fecal Transwab® (for all organisms) and MWE Fecal Transwab PF with *S. typhimurium* and *S. flexneri* with less than 2 log change in CFU/mL between 0 and 72 hours. The Copan FecalSwab™ at RT was not M40-A2 compliant for any of the tested organisms.

Table 1. Recovery CFU/ml of *E.coli* ATCC 11775, *S. typhimurium* ATCC 14028, and *S. flexneri* ATCC 12202 at time 0, 24, 48 and 72 h with all swabs and temperatures.
RT- room temperature TNTC – too numerous to count. FTPF - MWE Fecal Transwab PF. FT - MWE Fecal Transwab®. CF – Copan FecalSwab™

Organism	Time (h)	FTPF 4°C	FTPF RT	FT 4°C	FT RT	CF 4°C	CF RT
E. coli ATCC 11775	0	N/A	2.08E+05	N/A	2.07E+05	N/A	1.79E+05
	24	1.66E+05	1.08E+06	1.10E+05	9.17E+05	1.91E+05	TNTC
	48	1.30E+05	1.88E+07	8.53E+04	2.77E+06	1.66E+05	2.35E+08
	72	8.13E+04	5.86E+07	5.94E+04	8.82E+06	5.81E+04	1.88E+08
S. typhimurium ATCC 14208	0	N/A	8.56E+05	N/A	6.93E+05	N/A	6.95E+05
	24	7.62E+05	1.92E+05	6.33E+05	5.13E+05	3.87E+05	TNTC
	48	5.87E+05	1.49E+05	3.84E+05	1.71E+06	4.99E+05	TNTC
	72	3.13E+05	1.30E+04	3.06E+05	TNTC	5.27E+05	2.74E+08
S. flexneri ATCC 12022	0	N/A	2.20E+05	N/A	2.30E+05	N/A	2.50E+05
	24	2.23E+05	1.65E+05	1.34E+05	1.27E+05	1.88E+05	1.45E+07
	48	1.51E+05	7.52E+04	1.17E+05	7.23E+04	1.82E+05	5.99E+07
	72	4.55E+04	2.14E+05	8.51E+04	3.17E+04	2.30E+05	8.05E+07

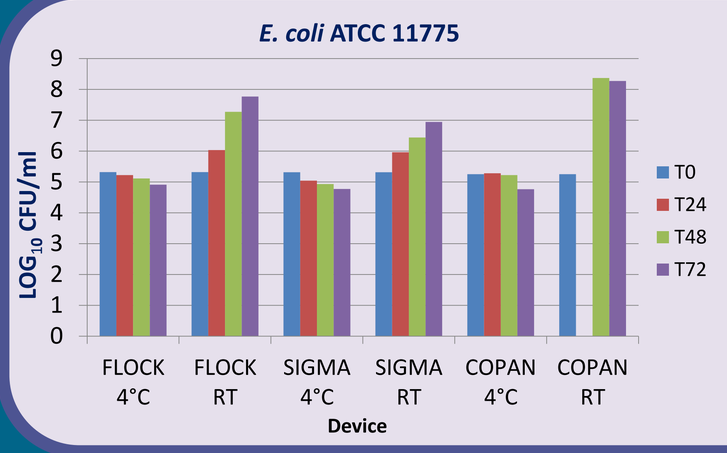


Figure 1. Log_{10} CFU/mL of *E.coli* ATCC 11775 at time points 0, 24, 48 and 72 hours for all swab devices and temperatures tested. FTPF - MWE Fecal Transwab PF. FT - MWE Fecal Transwab®. CF – Copan FecalSwab™

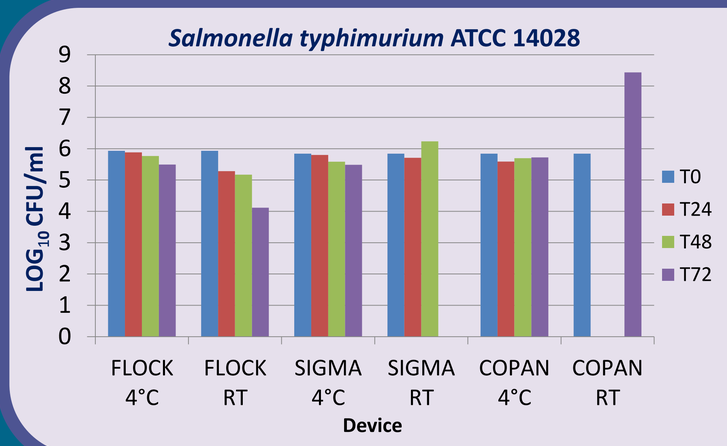


Figure 2. Log_{10} CFU/mL of *S. typhimurium* ATCC 14028 at time points 0, 24, 48 and 72 hours for all swab devices and temperatures tested. FTPF - MWE Fecal Transwab PF. FT - MWE Fecal Transwab®. CF – Copan FecalSwabTM

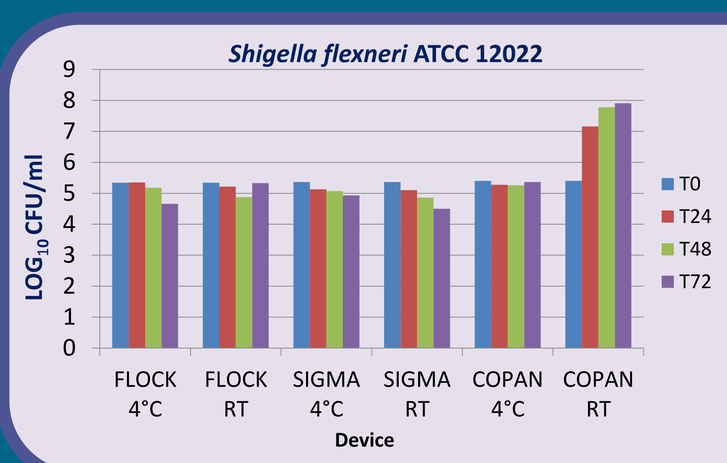


Figure 3. Log_{10} CFU/mL of *S. flexneri* ATCC 12022 at time points 0, 24, 48 and 72 hours for all swab devices and temperatures tested. FTPF - MWE Fecal Transwab PF. FT - MWE Fecal Transwab®. CF – Copan FecalSwab™

REFERENCES
Clinical and Laboratory Standards Institute (CLSI). *Quality Control of Microbiological Transport Systems; Approved Standard- Second Edition*. CLSI document M40-A2. Wayne, PA: CLSI; 2014.