

**Appendix D: Review of Published Data - Table 1 : Alcohol
Enveloped Viruses**

Virus/ Strain	Statement of Identity	Active Ingredient/ Concentration	Active Conc. Tested	Viral Diluent	Test Type/ Carrier	Test Method/Description	Contact Time	Virucidal Results	Ref
Fowl Plague Virus	Hand disinfectant	74.5% Ethanol 10% Isopropanol 0.1% 2,3,4,5- tetrabrome-6- methylphenol	Not available	Allantoic Fluids + Fetal Bovine Serum	Suspension	Time Kill Method. 0.3mL viral suspension was mixed with 2.7mL test material. After contact time, virus diluted in PBS with 1% NCS and inoculated in chick embryos.	0.5–2 minutes	~5 log ₁₀ reduction	Schürmann & Eggers, 1983
Fowl Plague Virus	Hand disinfectant	74.5% Ethanol 10% Isopropanol 0.1% 2,3,4,5- tetrabrome-6- methylphenol	Not available	Allantoic Fluids + Fetal Bovine Serum	Hand Wash	Handwash Study. Viral suspension inoculated onto fingertips, rubbed for 90 seconds and air dried 30 seconds. Test material applied, rubbed on hands 1 minute and air dried 1 minute. "Wash" procedure repeated 4 times. Virus recovered in PBS with 3% NCS and inoculated in chick embryos.	10 minutes	>2.5 log ₁₀ reduction	
HBV	Disinfectant	70% Isopropanol	Undiluted	None	Suspension	Time Kill Method. Approximately 6 log ₁₀ virus was dried and exposed to 1mL test material then neutralized with 10mL homologous chimpanzee plasma. Chimpanzees then inoculated with mixture.	10 minutes	6 log ₁₀ reduction or No chimpan- zees became infected	Bond <i>et al.</i> , 1983
HBV HCV HIV	Not available	80% Ethanol and/or glutaraldehyde	Not available	None	Not available	Clinical Study. 573 ultrasound guided abdominal punctures were performed on 456 patients. 302 patients were positive for HCV, HBV or HIV antibodies prior to testing. The transducer was cleaned with ethanol between procedures and soaked in glutaraldehyde when contaminated with body fluids. HBV surface antigens and HCV and HIV antibodies were measured in 6 month follow up among 388 patients and 3 operators.	ethanol, Not available glutar- aldehyde, 30 minutes.	No subjects previously negative yielded HBV, HCV or HIV markers	Caturelli <i>et al.</i> , 1996
Herpes Simplex I (VR-733)	Instant hand sanitizer	62% ethanol	Not available	Not available	Suspension	Time Kill Method. Challenge inoculum was introduced to the product, a portion was removed and placed in neutralizing media.	30 seconds	>99.999%	Gojo Industries, Inc., 1999, 2000
Herpes Simplex I (Strain F(1) ATCC VR- 733)	Health care personnel hand wash	70% ethanol	Undiluted	Undiluted	Suspension	Time Kill Method. 0.2mL viral inoculum was added to 1.8mL test material and mixed. Following contact time, the mixture was neutralized by dilution in FBS and ten fold serial dilutions in cell culture media and plated on Vero cells.	15 seconds	≥99.94%	Brady <i>et al.</i> , 1995
Herpes Simplex-I (ATCC VR-733)	Antimicrobial hand gel	60% Ethanol	Undiluted	Not available	Suspension	Time Kill Method. Viral inoculum was added to test material and mixed. Following contact time, the mixture was neutralized by dilution in appropriate growth media and quantitated.	15 seconds	99.97%	Johnson & Johnson Medical, 1998a
							30 seconds	99.98%	
							1 minute	99.98%	

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Herpes Simplex	Germicide	Ethanol	30%	Maint. media in EBSS	Suspension	Time Kill Method. 0.1mL viral inoculum was added to 0.9mL test material and mixed. Following contact time, the virus was grown in rabbit kidney cells.	10 minutes	Inactivated virus	Klein and Deforest, 1963a
Herpes Simplex	Germicide	Isopropanol	20%	Maint. media in EBSS	Suspension	Time Kill Method. 0.1mL viral inoculum was added to 0.9mL test material and mixed. Following contact time, the virus was grown in rabbit kidney cells.	10 minutes	Inactivated virus	
Herpes Simplex I	Hand sanitizer	62% Ethanol	Not available	Not available	Not available	Time Kill	15 seconds	"effective"	The Dial Corp., 1997
Herpes Simplex-II	Surgical scrub & Health care personnel handwash	62% ethanol	Not available	Not available	Not available	Time Kill Method In the presence of 10%serum	15 seconds	100%	Calgon Vestal, Undated b
Herpes simplex-II (ATCC VR-734)	Antimicrobial hand gel	60% Ethanol	Undiluted	Not available	Suspension	Time Kill Method. Viral inoculum was added to test material and mixed. Following contact time, the mixture was neutralized by dilution in appropriate growth media and quantitated.	15 seconds	99.97%	Johnson & Johnson Medical, 1998a
							30 seconds	99.98%	
							1 minute	99.98%	
Herpes Simplex II	Hand sanitizer	62% Ethanol	Not available	Not available	Not available	Time Kill	15 seconds	"effective"	The Dial Corp., 1997
HIV-1 (Strain HTLV IIIB)	Health care personnel handwash	70% ethanol	Undiluted	Undiluted	Suspension	Time Kill Method. 0.2mL viral inoculum was added to 1.8mL test material and mixed. Following contact time, the mixture was neutralized by dilution in FBS and ten fold serial dilutions in cell culture media and plated on MT-2 cells.	15 seconds	≥99.99%	Brady et al., 1995
HIV	Not available	Ethanol	50%	Tissue culture fluid	Not available	Not available	2-10 minutes	>3.52 log ₁₀ reduction	Sattar and Springthorpe, 1991
HIV	Not available	Ethanol	70%	50% human plasma	Not available	Not available	1, 5 minutes	>7.0 log ₁₀ reduction	
HIV	Not available	Ethanol	19%	Tris	Not available	Not available	5 minutes	99%	
HIV	Not available	Ethanol	19%	Tris	Not available	Not available	60 minutes	All detectable virus inactivated	
HIV	Not available	Ethanol	70%	Tissue culture fluid	Carrier	Not available	0.5 - 10 minutes	>2000 pg/mL remaining	

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HIV	Not available	Ethanol + alcohols in proprietary forms	70%	10% Fetal calf serum	Carrier	Not available	Not available	>4 log ₁₀ reduction	Sattar and Springthorpe, 1991
HIV	Not available	Industrial methylated spirits	70%	Tissue culture fluid	Carrier	Not available	1-20 minutes	>2000 pg/mL remaining	
HIV	Not available	Industrial methylated spirits	70%	Infected cells	Carrier	Not available	0.5 - 10 minutes	>2000 pg/mL remaining	
HIV	Not available	Isopropanol	35%	Tissue culture fluid	Not available	Not available	2-10 minutes	>3.78 log ₁₀ reduction	
HIV-1 (Vanderbilt University)	Antimicrobial hand gel	60% Ethanol	Undiluted	Not available	Suspension	Time Kill Method. Viral inoculum was added to test material and mixed. Following contact time, the mixture was neutralized by dilution in appropriate growth media and quantitated.	15 seconds	99.9%	Johnson & Johnson Medical, 1998a
							30 seconds	99.9%	
							1 minute	99.9%	
HIV	Hand sanitizer	62% Ethanol	Not available	Not available	Not available	Time Kill	15 seconds	"effective"	The Dial Corp., 1997
HPIV-3	Not available	Ethanol	70%	feces or bovine mucin	Stainless steel	Carrier Method. 10µL viral suspension inoculated on carrier and dried 1 hour. 20µL test material placed on carrier. After contact time mixture neutralized by dropping carrier in 1mL TPB. Virus assayed in MA-104 cells.	1 minute	≥ 3 log ₁₀ reduction	Sattar <i>et al.</i> , 1989
HTLV-III (H9)	Not available	Alcohol	70%	50% Human Plasma	Suspension	Time Kill Method. Virus infected cells were mixed with test material. After contact time, cells cocultivated with uninfected H9 cells. Infectivity assays were measured by microscopic examination of cytopathic effects and reverse transcriptase activity in supernatant fluid.	1 minute	≥ 7 log ₁₀ reduction TCID ₅₀	Resnick <i>et</i> <i>al.</i> , 1986
							5 minutes	≥ 7 log ₁₀ reduction TCID ₅₀	
HTLV-III (H9)	Not available	1:1 Alcohol/ Acetone	None	50% Human Plasma	Suspension	Time Kill Method. Virus infected cells were mixed with test material. After contact time, cells cocultivated with uninfected H9 cells. Infectivity assays were measured by microscopic examination of cytopathic effects and reverse transcriptase activity in supernatant fluid.	20 minutes	~5.7 log ₁₀ reduction TCID ₅₀	

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HTLV-III/ LAV	Not available	Ethanol	50%	Media	Suspension	Time Kill Method. Virus suspension was mixed with test material. After contact time, virus serially diluted in media, inoculated onto PHA blasts and assayed for ID ₅₀ .	2-10 minutes	≥4.52 log ₁₀ reduction ID ₅₀	Martin <i>et al.</i> , 1985
			95%				2-10 minutes	18 log ₁₀ reduction ID ₅₀ based on linear regression	
HTLV-III/ LAV	Not available	Isopropanol	35%	Media	Suspension	Time Kill Method. Virus suspension was mixed with test material. After contact time, virus serially diluted in media, inoculated onto PHA blasts and assayed for ID ₅₀ .	2-10 minutes	≥4.78 log ₁₀ reduction ID ₅₀	
Human coronavirus (229E)	Not available	Ethanol	70%	feces or bovine mucin	Stainless steel	Carrier Method. 10μL viral suspension inoculated on carrier and dried 1 hour. 20μL test material placed on carrier. After contact time mixture neutralized by dropping carrier in 1mL TPB. Virus assayed in L-132 cells.	1 minute	≥3 log ₁₀ reduction	Sattar <i>et al.</i> , 1989
Influenza (A & B), Respiratory, Syncytial, Coronavirus (OC43 & 229E), Para-influenza, Rhinovirus, Other unidentified respiratory viruses	Not available	Alcohol foam	Not available	Not available	Handwash	Handwashing Study. An educational program taught subjects the importance of handwashing and modes of respiratory virus transmission. Staff with patient contact were given test material and instructed to use it on their hands after patient contact and after sneezing or coughing as a supplement to handwashing. Infection rates during alcohol foam use and before the intervention were compared.	Not available	~1.8 to 2.5 fold decrease in rate of infection vs. preintervention years (p<0.001) attributed to combined effects of education and alcohol foam use	Falsey <i>et al.</i> , 1999
Influenza (Asian)	Germicide	Ethanol	30%	Maint. media in EBSS	Suspension	Time Kill Method. 0.1mL viral inoculum was added to 0.9mL test material and mixed. Following contact time, the virus was grown in the allantoic cavity of the chick embryo.	10 minutes	Inactivated virus	Klein and Deforest, 1963a
Influenza (Asian)	Germicide	Isopropanol	30%	Maint. media in EBSS	Suspension	Time Kill Method. 0.1mL viral inoculum was added to 0.9mL test material and mixed. Following contact time, the virus was grown in the allantoic cavity of the chick embryo.	10 minutes	Inactivated virus	
Influenza (Type A ₂ VR-544)	Instant hand sanitizer	62% ethanol	Not available	Not available	Suspension	Time Kill Method. Challenge inoculum was introduced to the product, a portion was removed and placed in neutralizing media.	30 seconds	>99.999%	Gojo Industries, Inc., 1999, 2000

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Influenza (A2)	Surgical scrub & Health care personnel handwash	62% ethanol	Not available	Not available	Not available	Time Kill Method In the presence of 10% serum	15 seconds	100%	Calgon Vestal, Undated b
Influenza (Type A Strain A2/ Hong Kong ATCC VR- 544)	Health care personnel handwash	70% ethanol	Undiluted	Undiluted	Suspension	Time Kill Method. 0.2mL viral inoculum was added to 1.8mL test material and mixed. Following contact time, the mixture was neutralized by dilution in FBS and ten fold serial dilutions in cell culture media and plated on Rhesus monkey kidney cells.	15 seconds	≥99.68%	Brady <i>et al.</i> , 1995
Influenza (Type A ₂ ATCC VR- 544)	Antimicrobial hand gel	60% Ethanol	Undiluted	Not available	Suspension	Time Kill Method. Viral inoculum was added to test material and mixed. Following contact time, the mixture was neutralized by dilution in appropriate growth media and quantitated.	15 seconds	99.99%	Johnson & Johnson Medical, 1998a
							30 seconds	99.994%	
							1 minute	99.997%	
Influenza A (WSN)	Hand disinfectant	74.5% Ethanol 10% Isopropanol 0.1% 2,3,4,5- tetrabrome-6- methylphenol	Not available	Allantoic Fluids + Fetal Bovine Serum	Suspension	Time Kill Method. 0.3mL viral suspension was mixed with 2.7mL test material. After contact time, virus diluted in PBS with 1% NCS and inoculated in chick embryos.	0.5–2 minutes	~4.5 log ₁₀ reduction	Schürmann & Eggers, 1983
Influenza A (WSN)	Hand disinfectant	74.5% Ethanol 10% Isopropanol 0.1% 2,3,4,5- tetrabrome-6- methylphenol	Not available	Allantoic Fluids + Fetal Bovine Serum	Hand Wash	Handwash Study. Viral suspension inoculated onto fingertips, rubbed for 90 seconds and air dried 30 seconds. Test material applied, rubbed on hands 1 minute and air dried 1 minute “Wash” procedure repeated 4 times. Virus recovered in PBS with 3% NCS and inoculated in chick embryos.	10 minutes	>2.5 log ₁₀ reduction	
Influenza A	Hand sanitizer	62% Ethanol	Not available	Not available	Not available	Time Kill	15 seconds	“effective”	The Dial Corp., 1997
Respiratory Syncytial (Long strain)	Not available	Isopropanol	35%	2% bovine plasma albumin	Suspension	Time Kill Method. 1mL viral inoculum was added to 1mL test material and mixed Following contact time, the mixture was neutralized by 1:10 dilution and further serial dilutions in tissue culture maintenance medium. Virus was assayed in HEP2 cells.	1 minute	≥4.3 log ₁₀ reduction	Platt and Bucknall, 1985

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Respiratory Syncytial	Hand rub	Alcohol (Amphisept 80)	Not available	Not available	Not available	Prospective study of infection rates were compared to previous years' data to determine the effect of cohorting infected babies and staff as well as education on handwashing and use of an alcohol based hand rub in reducing nosocomial RSV infections	Not available	While the authors could not link improvements to one single factor, a 66% reduction of nosocomial RSV infections was effected during the intervention period. In addition, the number of babies with congenital heart disease hospitalized for more than 14 days who acquired the infection fell from 73% to 4%.	Isaacs et al., 1991
Vaccinia (Elstree)	Hand disinfectant	95% Ethanol, 4% Glycerol, 1% Ricinus oil	Undiluted	1:1 Distilled water	Suspension	Time Kill Method 1 part viral inoculum was added to 8 parts test material and mixed. Following contact time, the mixture was neutralized by dilution in PBS and assayed in Vero cells.	2 minutes	$\geq 3.27 \log_{10}$ reduction vs. control	Eggers, 1990
							5 minutes	$\geq 3.27 \log_{10}$ reduction vs. control	
Vaccinia	Germicide	Ethanol	40%	Maint. media in EBSS	Suspension	Time Kill Method. 0.1mL viral inoculum was added to 0.9mL test material and mixed. Following contact time, the virus was grown in HeLa cells.	10 minutes	Inactivated virus	Klein and Deforest, 1963b
Vaccinia	Germicide	Isopropanol	30%	Maint. media in EBSS	Suspension	Time Kill Method. 0.1mL viral inoculum was added to 0.9mL test material and mixed. Following contact time, the virus was grown in HeLa cells.	10 minutes	Inactivated virus	
Vaccinia (Strain MVA)	Hand disinfectant	74.5% Ethanol, 10% Isopropanol, 0.1% 2,3,4,5- tetrabromo-6- methylphenol	Not available	Cell associated Fetal bovine serum	Suspension	Time Kill Method. 0.3mL viral suspension was mixed with 2.7mL test material After contact time, virus diluted in PBS with 1% NCS and assayed in CEF cells.	0.5–2 minutes	$\sim 3.8 \log_{10}$ reduction	Schürmann & Eggers, 1983

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Vaccinia (Strain MVA)	Hand disinfectant	74.5% Ethanol, 10% Isopropanol, 0.1% 2,3,4,5- tetrabrom-6- methylphenol	Not available	Cell associated Fetal bovine serum	Hand Wash	Handwash Study. Viral suspension inoculated onto fingertips, rubbed for 90 seconds and air dried 30 seconds. Test material applied, rubbed on hands 1 minute and air dried 1 minute. "Wash" procedure repeated 4 times. Virus recovered in PBS with 3% NCS and inoculated in chick embryos.	10 minutes	>1.4 log ₁₀ reduction	Schürmann & Eggers, 1983

µL microliter
 ATCC American Type Culture Collection
 EBSS Earle's balanced salt solution
 FBS Fetal bovine serum
 HBV Hepatitis B virus
 HCV Hepatitis C virus
 HIV Human immunodeficiency virus
 HPIV Human parainfluenza virus
 HTLV Human T-cell lymphotropic virus
 ID₅₀ Infectious dose 50%
 Maint. Maintenance
 mL milliliter
 NCS Newborn calf serum
 PBS Phosphate buffered saline
 pg/mL picograms/milliliter
 SV40 Simian virus 40
 TCID₅₀ Tissue culture infectious dose 50%
 TPB Tryptose phosphate buffer
 Tris Tris (hydroxymethyl) aminomethane