1 A	ppendix -	Supplemental	ry material
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2	Append	lix Search strategy
3		
4	Medline	2
5		
6	1.	(exp Bacterial Infections/ or exp Virus Diseases/ or ((exp Bacteria/ or exp Viruses/) and exp Infection/)
7		or hospital infection/ or ((bacteria* or vir*) adj3 (infect* or disease*)).ab,ti.) not (exp HIV/ or exp HIV
8		Infections/ or exp SARS Virus/ or (HIV or SARS).ti,ab.)
9	2.	exp disease transmission, infectious/ or exp Cross Infection/ or exp Infection Control/ or (transmission
10		or transfer).ab,ti. or ((cross or control or spread) adj3 (infection or disease)).ab,ti.
11	3.	1 and 2
12	4.	exp Bacterial Infections/tm or exp Virus Diseases/tm or ((bacteria* or vir* or microorganism* or micro-
13		organism* or microbial) adj6 (transmission or transfer or spread)).ab,ti.
14	5.	3 or 4
15	6.	exp Physical Examination/ or exp hand hygiene/ or exp decontamination/ or exp Protective Clothing/ or
16		exp Equipment Contamination/ or hygiene/ or exp skin care/ or ((skin or physical) adj3 examin*).ab,ti.
17		or (contaminat* or decontaminat* or glove* or gown* or cloth* or hygien* or hand* or finger* or skin
18		or surface*).ab,ti.
19	7.	(health personnel/ or exp medical staff/ or exp nurses/ or exp nursing staff/ or exp personnel, hospital/
20		or (operating adj3 room).ab,ti. or ((health care or hospital or medical or nursing or healthcare) adj3
21		(personnel or staff or worker*)).ab,ti. or (physician* or doctor* or surgeon* or nurse* or
22		practitioner*).ab,ti. or ((patient* or hospital) and room*).ti.) not (exp dental staff/ or exp dentists/ or exp
23		dental staff, hospital/ or exp Prisons/ or (dental adj3 (facility or office or home)).ab,ti. or prison*.ab,ti.)
24	8.	5 and 6 and 7
25	9.	((transfer or contamination or transmission or spread) adj6 (bacteria* or vir* or microorganism* or
26		micro-organism* or microbial or clone* or surface* or hand* or finger* or glove* or cloth*)).ti. and
27		(model* or method* or experiment* or study or observation*).ti,ab.
28	10.	5 and 9
29	11.	((contamination or transmission or transfer or spread) and (hand* or finger* or glove* or cloth* or
30		gown* or uniform* or surface*)).ti. and (microbial or microorganism* or micro-organism* or bacteria*
31		or vir* or infection*).mp.
32	12.	8 or 10 or 11
33	13.	('gene transfer' or 'transfer RNA').ab,ti.
34	14.	12 not 13
35	15.	14 not (animals not humans).sh.
36	16.	limit 15 to (english or french or german)

37	The Coc	chrane Library
38		
39	1.	((bacteria* or vir*) near/3 (infect* or disease*)) not (HIV or SARS):ti,ab,kw and (transmission or
40		transfer) or ((cross or control or spread) near/3 (infection or disease)):ti,ab,kw
41	2.	((bacteria* or vir* or microorganism* or micro-organism* or microbial) near/6 (transmission or transfer
42		or spread)):ti,ab,kw
43	3.	#1 or #2
44	4.	((skin or physical) near/3 examin*) or (contaminat* or decontaminat* or glove* or cloth* or hygien* or
45		hand* or finger* or skin or surface*):ti,ab,kw
46	5.	((operating or patient* or hospital*) and room*) or (('health care' or hospital or medical or nursing or
47		healthcare) near/3 (personnel or staff or worker*)) or (physician* or doctor* or surgeon* or nurse* or
48		practitioner*):ti,ab,kw not (dental or residential) near/3 (facility or office or home) or dentist* or
49		prison*:ti,ab,kw
50	6.	#3 and #4 and #5
51	7.	(transfer or contamination or transmission) near/6 (bacteria* or vir* or surface* or microbial or
52		microorganism* or clone*):ti and model* or method* or experiment* or study or observation*:ti,ab,kw
53	8.	(contamination or transmission or transfer or spread) and (hand* or finger* or glove* or cloth* or
54		gown* or uniform* or surface*):ti and (microbial or microorganism* or micro-organism* or bacteria*
55		or vir* or infect*):ti,ab,kw
56	9.	#3 and (#7 or #8)
57	10.	#6 or #9 241
58	11.	'transfer rna' or 'gene transfer':ti,ab,kw (Word variations have been searched) 536
59	12.	#10 not #11
60		
61		
62	<u>Embase</u>	
63		
64	1.	'bacterial infection'/exp OR 'virus infection'/exp OR ('bacteria'/exp OR 'virus'/exp AND 'infection'/exp)
65		OR hospital infection'/exp OR ((bacteria* OR vir*) NEAR/3 (infect* OR disease*)):ab,ti NOT ('human
66		immunodeficiency virus'/exp OR 'human immunodeficiency virus infection'/exp OR 'sars
67		coronavirus'/exp OR hiv:ab,ti OR sars:ab,ti)
68	2.	'disease transmission'/exp OR 'cross infection'/exp OR 'infection control'/exp OR transmission:ab,ti OR
69		transfer:ab,ti OR ((cross OR control OR spread) NEAR/3 (infection OR disease)):ab,ti
70	3.	#1 AND #2"
71	4.	'virus transmission'/exp OR 'bacterial transmission'/exp OR ((bacteria* OR vir* OR microorganism*
72		OR 'micro organism' OR 'micro organisms' OR microbial) NEAR/6 (transmission OR transfer OR
73		spread)):ab,ti
74	5.	#3 OR #4

75	6.	'skin examination'/exp OR 'physical examination'/exp OR 'hand washing'/exp OR 'protective
76		clothing'/exp OR 'medical device contamination'/exp OR 'hygiene'/exp OR ((skin OR physical)
77		NEAR/3 examin*):ab,ti OR contaminat*:ab,ti OR decontaminat*:ab,ti OR glove*:ab,ti OR gown*:ab,ti
78		OR cloth*:ab,ti OR hygien*:ab,ti OR hand*:ab,ti OR finger*:ab,ti OR skin:ab,ti OR surface*:ab,ti
79	7.	#5 AND #6
80	8.	'bacterium contamination'/exp OR 'viral contamination'/exp
81	9.	#7 OR #8
82	10.	'health care personnel'/exp OR (operating NEAR/3 room):ab,ti OR (('health care' OR hospital OR
83		medical OR nursing OR healthcare) NEAR/3 (personnel OR staff OR worker*)):ab,ti OR (patient*:ab,ti
84		OR hospital:ab,ti AND room*:ab,ti) OR physician*:ab,ti OR doctor*:ab,ti OR surgeon*:ab,ti OR
85		nurse*:ab,ti OR practitioner*:ab,ti NOT ('dental facility'/exp OR 'residential home'/exp OR 'prison'/exp
86		OR 'dentist'/exp OR ((dental OR residential) NEAR/3 (facility OR office OR home)):ab,ti OR
87		prison*:ab,ti)
88	11.	#9 AND #10
89	12.	((transfer OR contamination OR transmission OR spread) NEAR/6 (bacteria* OR vir* OR microbial
90		OR microorganism* OR clone* OR surface* OR hand* OR finger* OR glove* OR cloth*)):ti AND
91		(model*:ab,ti OR method*:ab,ti OR experiment*:ab,ti OR study:ab,ti OR observation*:ab,ti)
92	13.	contamination:ti OR transmission:ti OR transfer:ti OR spread:ti AND (hand*:ti OR finger*:ti OR
93		glove*:ti OR cloth*:ti OR gown*:ti OR uniform*:ti OR surface*:ti) AND (microbial:de,ab,ti OR
94		microorganism*:de,ab,ti OR 'micro organism':de,ab,ti OR 'micro organisms':de,ab,ti OR
95		bacteria*:de,ab,ti OR vir*:de,ab,ti OR infect*:de,ab,ti)
96	14.	#9 AND #12
97	15.	#11 OR #13 OR #14
98	16.	'transfer rna':ab,ti OR 'gene transfer':ab,ti
99	17.	#15 NOT #16 NOT ([animals]/lim NOT [humans]/lim) NOT [conference abstract]/lim AND
100		([english]/lim OR [french]/lim OR [german]/lim) #15 NOT #16 NOT ([animals]/lim NOT
101		[humans]/lim) NOT [conference abstract]/lim AND ([english]/lim OR [french]/lim OR [german]/lim)
102		

103 Appendix Figure 1. Estimated proportions (ES) of transfer of bacterial pathogens to hands and gloves.

104 Data markers indicate estimated proportions and error bars indicate 95% confidence intervals (95% CI).



105

106 Abbreviations: AB = Acinetobacter baumannii; CI = Confidence interval; ES = Estimated proportion; MDR =

107 multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE

108 = Vancomycin resistant Enterococci

- 109 Appendix Figure 2. Estimated proportions (ES) of transfer of bacterial pathogens to gowns. Data markers
- 110 indicate estimated proportions and error bars indicate 95% confidence intervals (95% CI).



112 Abbreviations: AB = Acinetobacter baumannii; CI = Confidence interval; ES = Estimated proportion; MDR =

113 multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE

114 = Vancomycin resistant Enterococci

115

- 116 Appendix Figure 3. Estimated proportions (ES) of transfer of bacterial pathogens to hands after glove
- 117 removal. Data markers indicate estimated proportions and error bars indicate 95% confidence intervals
- 118 (95% CI).

						%
Study					ES (95% CI)	Weight
Hands after glove removal						
Tenorio, VRE (2001)	+				0.14 (0.05, 0.27)	6.79
Snyder, MRSA (2008)					0.03 (0.00, 0.09)	9.39
Snyder, VRE (2008)	←				0.00 (0.00, 0.04)	10.26
Morgan, MDR AB (2010)	-				0.05 (0.02, 0.08)	13.50
Morgan, MDR PA (2010)	←				0.01 (0.00, 0.04)	11.87
Morgan, MDR AB (2012)	-				0.04 (0.02, 0.08)	12.81
Morgan, MDR PA (2012)	—				0.03 (0.01, 0.10)	9.85
Morgan, MRSA (2012)	+				0.03 (0.01, 0.08)	12.42
Morgan, VRE (2012)	←				0.02 (0.00, 0.05)	13.11
Subtotal (I^2 = 61.03%, p = 0.01)	\diamond				0.03 (0.01, 0.05)	100.00
	0	.25	.5	.75	1 1	

120 Abbreviations: AB = Acinetobacter baumannii; CI = Confidence interval; ES = Estimated proportion; GNS =

121 Gram-negatives; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA =

122 *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

123

- 124 Appendix Figure 4. Estimated proportions (ES) of transfer of bacterial pathogens to hands and gloves
- 125 <u>only including studies with 100% quality score</u>. Data markers indicate estimated proportions and error
- 126 bars indicate 95% confidence intervals (95% CI).

Study		ES (95% CI)	% Weight
Gloves			
Hayden, VRE (2008)		0.69 (0.55, 0.81)	8.29
Hayden, VRE (2008)		0.66 (0.46, 0.82)	7.71
Morgan, MDR AB (2010)		0.36 (0.30, 0.43)	8.83
Morgan, MDR PA (2010)		0.07 (0.03, 0.12)	8.72
Stiefel, MRSA (2011)		0.40 (0.25, 0.57)	8.03
Stiefel, MRSA (2011)		0.45 (0.29, 0.62)	8.03
Guerrero, C.difficile (2012)		0.50 (0.31, 0.69)	7.75
Guerrero, C.difficile (2012)		0.50 (0.31, 0.69)	7.75
Morgan, MDR AB (2012)		0.40 (0.32, 0.47)	8.78
Morgan, MDR PA (2012)		0.17 (0.10, 0.27)	8.55
Morgan, MRSA (2012)		0.11 (0.07, 0.17)	8.76
Morgan, VRE (2012)		0.10 (0.06, 0.15)	8.80
Subtotal (I^2 = 94.70%, p < 0.01)		0.34 (0.22, 0.47)	100.00
Hands			
Hayden, VRE (2008)	•	0.75 (0.19, 0.99)	22.50
Hayden, VRE (2008)	_	0.27 (0.08, 0.55)	77.50
Subtotal (I^2 = .%, p = .)	>	0.35 (0.14, 0.60)	100.00
0 .25 .5	.75	1	

128 Abbreviations: AB = Acinetobacter baumannii; CI = Confidence interval; ES = Estimated proportion; GNS =

129 Gram-negatives; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA =

130 *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

- 131 Appendix Figure 5. Estimated proportions (ES) of transfer of bacterial pathogens to gowns only including
- 132 <u>studies with 100% quality score</u>. Data markers indicate estimated proportions and error bars indicate
- 133 95% confidence intervals (95% CI).



135 Abbreviations: AB = Acinetobacter baumannii; CI = Confidence interval; ES = Estimated proportion; MDR =

136 multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE

137 = Vancomycin resistant Enterococci

138

- 139 Appendix Figure 6. Estimated proportions (ES) of transfer of bacterial pathogens to hands after glove
- 140 removal only including studies with 100% quality score. Data markers indicate estimated proportions and
- 141 error bars indicate 95% confidence intervals (95% CI).



- 143 Abbreviations: AB = Acinetobacter baumannii; CI = Confidence interval; ES = Estimated proportion; GNS =
- 144 Gram-negatives; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA =
- 145 *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

- 146 Appendix Figure 7. Estimated proportions (ES) of transfer of microorganisms stratified according to type
- 147 of behaviour (standardized vs. non-standardized). Data markers indicate estimated proportions and error





150 Abbreviations: AB = Acinetobacter baumanii; CI = Confidence interval; ES = Estimated proportion; GNS =

151 Gram-negatives; HPV = human papillomavirus; KPC = Klebsiella pneumonia carbapenemase; MDR =

- 152 multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE
- 153 = Vancomycin resistant Enterococci

- 154 Appendix Figure 8. Estimated proportions (ES) of transfer of microorganisms stratified according to
- 155 surface of origin. Data markers indicate estimated proportions and error bars indicate 95% confidence
- 156 intervals (95% CI).



- 158 Abbreviations: AB = Acinetobacter baumanii; CI = Confidence interval; ES = Estimated proportion; GNS =
- 159 Gram-negatives; HPV = human papillomavirus; KPC = Klebsiella pneumonia carbapenemase; MDR =
- 160 multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE
- 161 = Vancomycin resistant Enterococci

162 Appendix Figure 9. Estimated proportions (ES) of transfer of microorganisms stratified according to

163 microorganism. Data markers indicate estimated proportions and error bars indicate 95% confidence intervals

164 (95% CI).



- 166 Abbreviations: AB = Acinetobacter baumanii; CI = Confidence interval; ES = Estimated proportion; GNS =
- 167 Gram-negatives; HPV = human papillomavirus; KPC = Klebsiella pneumonia carbapenemase; MDR =
- 168 multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE
- 169 = Vancomycin resistant Enterococci

- 171 Appendix Figure 10. Estimated proportions (ES) of transfer of microorganisms stratified according to
- 172 microbiological sampling method. Data markers indicate estimated proportions and error bars indicate





- 175 Abbreviations: AB = Acinetobacter baumanii; CI = Confidence interval; ES = Estimated proportion; GNS =
- 176 Gram-negatives; HPV = human papillomavirus; KPC = Klebsiella pneumonia carbapenemase; MDR =
- 177 multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE
- 178 = Vancomycin resistant Enterococci

180 Appendix Table 1. Assessment of study quality

- 181 **Bold text** points out modifications necessary to make the quality assessment applicable to the non-interventional
- 182 studies included in our analysis. Items considered not applicable (n.a.) to our non-interventional studies were not
- 183 included in the quality assessment but listed in the table.

			Original quality items by Downs and Black ¹³	Adapted quality items for this study	Studies meetin g quality item (%)
Denorting	veputuig	1	Is the hypothesis/aim/objective of the study clearly described?	Is the hypothesis/aim/objective of the study clearly described?	32/32 (100)
		2	Are the main outcomes to be measured clearly described in the Introduction or Methods section?	Are the outcomes of interest for our review (frequency or quantity of transfer/contamination) to be measured clearly described in the Introduction or Methods section?	28/32 (88)*
	•	3	Are the characteristics of the patients included in the study clearly described?	Is the colonisation status of the surface of origin clearly described?	22/32 (69)
	•	4	Are the interventions of interest clearly described?	Is the behaviour (interaction) leading to transfer clearly described?	31/32 (97)
		5	Are the distributions of principal confounders in each group of subjects to be compared clearly described?	n.a.	
	-	6	Are the main findings of the study clearly described?	Are the findings of interest for our review (frequency or quantity of transfer/contamination) of the study clearly described?	30/32 (94)
		7	Does the study provide estimates of the random variability in the data for the main outcomes?	Does the study provide estimates of the random variability in the data	13/32 (41)

			for the outcomes of interest for our review (frequency or quantity of transfer/contamination) ?	
	8	Have all important adverse events that may be a consequence of the intervention been reported?	n.a.	
	9	Have the characteristics of patients lost to follow-up been described?	n.a.	
	10	Have actual probability values been reported(e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the risk factor analysis except where the probability value is less than 0.001?	11/12 (92)†
External validity	11	Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	n.a.	
	12	Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	n.a.	
	13	Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?	Were the staff, places, and facilities where the interaction leading to transfer occurred, representative of the interactions that typically occur during patient interactions ?	32/32 (100)
dity - bias	14	Was an attempt made to blind study subjects to the intervention they have received ?	n.a.	
Internal vali	15	Was an attempt made to blind those measuring the main outcomes of the intervention?	n.a.	
	16	If any of the results of the study were based on "data dredging", was this made clear?	n.a.	
	17	In trials and cohort studies, do the analyses adjust for diVerent lengths of follow-up of	n.a.	

		patients, or in case-control studies, is the time				
		period between the intervention and outcome				
		the same for cases and controls ?				
	18	Were the statistical tests used to assess the main outcomes appropriate?	Were the statistical tests used to assess the outcomes of interest appropriate?	32/32 (100)		
	19	Was compliance with the intervention/s reliable?	Was compliance with the behaviour (interaction) planned to study reliable ?	32/32 (100)		
	20	Were the main outcome measures used accurate (valid and reliable)?	Were the outcomes measures of interest for our review (frequency or quantity of transfer/contamination) used accurate (valid and reliable)?	32/32 (100)		
Internal validity - confounding	21	Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	n.a.			
	22	Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?	n.a.			
	23	Were study subjects randomised to intervention groups?	n.a.			
	24	Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?	n.a.			
	25	Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	n.a.			
	26	Were losses of patients to follow-up taken into account?	n.a.			

wer	Did the study have sufficient power to detect a	n.a.
Po	clinically important effect where the probability	
	value for a difference being due to chance isless	
	than 5%?	

- 184 * Frequency or quantity of transfer was not the primary outcome in the four studies not meeting this quality item
- *†* This quality item was not applicable to 20 study and was eliminated from the denominator in these studies.