Appendix - Supplementary material

Appendix Search strategy

Medline

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

The Cochrane Library

1. ((bacteria* or vir*) near/3 (infect* or disease*)) not (HIV or SARS):ti,ab,kw and (transmission or transfer) or ((cross or control or spread) near/3 (infection or disease)):ti,ab,kw
2. ((bacteria* or vir* or microorganism* or micro-organism* or microbial) near/6 (transmission or transfer or spread)):ti,ab,kw
3. #1 or #2
4. ((skin or physical) near/3 examin*) or (contaminat* or decontaminat* or glove* or cloth* or hygien* or hand* or finger* or skin or surface*):ti,ab,kw
5. ((operating or patient* or hospital*) and room*) or (('health care' or hospital or medical or nursing or healthcare) near/3 (personnel or staff or worker*)) or (physician* or doctor* or surgeon* or nurse* or practitioner*):ti,ab,kw not (dental or residential) near/3 (facility or office or home) or dentist* or prison*:ti,ab,kw
6. #3 and #4 and #5
7. (transfer or contamination or transmission) near/6 (bacteria* or vir* or surface* or microbial or microorganism* or clone*):ti and model* or method* or experiment* or study or observation*:ti,ab,kw
8. (contamination or transmission or transfer or spread) and (hand* or finger* or glove* or cloth* or gown* or uniform* or surface*):ti and (microbial or microorganism* or micro-organism* or bacteria* or vir* or infect*):ti,ab,kw
9. #3 and (#7 or #8)
10. #6 or #9 241
11. 'transfer rna' or 'gene transfer':ti,ab,kw (Word variations have been searched) 536
12. #10 not #11

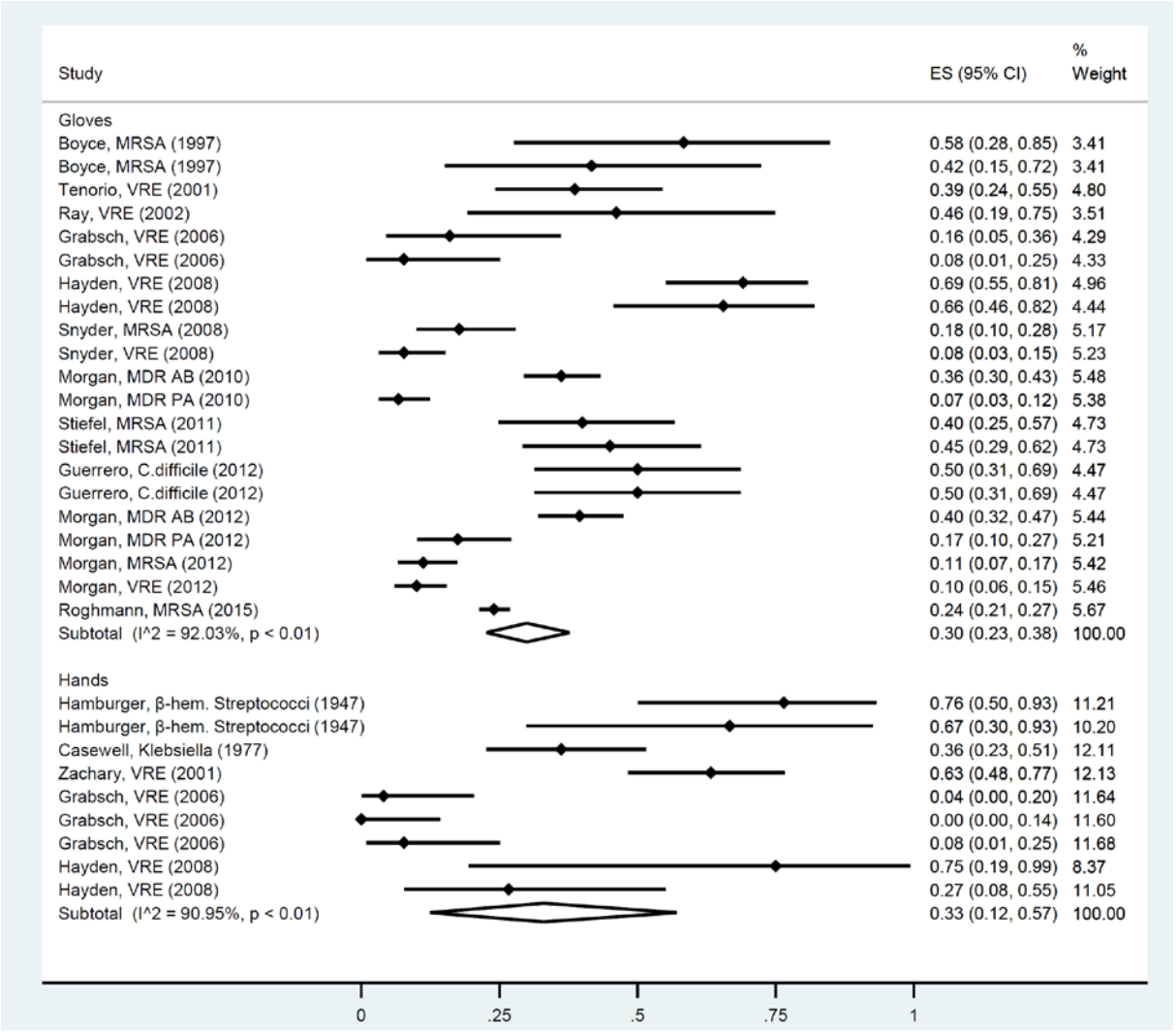
Embase

1. 'bacterial infection'/exp OR 'virus infection'/exp OR ('bacteria'/exp OR 'virus'/exp AND 'infection'/exp) OR hospital infection'/exp OR ((bacteria* OR vir*) NEAR/3 (infect* OR disease*)):ab,ti NOT ('human immunodeficiency virus'/exp OR 'human immunodeficiency virus infection'/exp OR 'sars coronavirus'/exp OR hiv:ab,ti OR sars:ab,ti)
2. 'disease transmission'/exp OR 'cross infection'/exp OR 'infection control'/exp OR transmission:ab,ti OR transfer:ab,ti OR ((cross OR control OR spread) NEAR/3 (infection OR disease)):ab,ti
3. #1 AND #2¨
4. 'virus transmission'/exp OR 'bacterial transmission'/exp OR ((bacteria* OR vir* OR microorganism* OR 'micro organism' OR 'micro organisms' OR microbial) NEAR/6 (transmission OR transfer OR spread)):ab,ti
5. #3 OR #4

6. 'skin examination'/exp OR 'physical examination'/exp OR 'hand washing'/exp OR 'protective clothing'/exp OR 'medical device contamination'/exp OR 'hygiene'/exp OR ((skin OR physical) NEAR/3 examin*):ab,ti OR contaminat*:ab,ti OR decontaminat*:ab,ti OR glove*:ab,ti OR gown*:ab,ti OR cloth*:ab,ti OR hygien*:ab,ti OR hand*:ab,ti OR finger*:ab,ti OR skin:ab,ti OR surface*:ab,ti
7. #5 AND #6
8. 'bacterium contamination'/exp OR 'viral contamination'/exp
9. #7 OR #8
10. 'health care personnel'/exp OR (operating NEAR/3 room):ab,ti OR (('health care' OR hospital OR medical OR nursing OR healthcare) NEAR/3 (personnel OR staff OR worker*)):ab,ti OR (patient*:ab,ti OR hospital:ab,ti AND room*:ab,ti) OR physician*:ab,ti OR doctor*:ab,ti OR surgeon*:ab,ti OR nurse*:ab,ti OR practitioner*:ab,ti NOT ('dental facility'/exp OR 'residential home'/exp OR 'prison'/exp OR 'dentist'/exp OR ((dental OR residential) NEAR/3 (facility OR office OR home)):ab,ti OR prison*:ab,ti)
11. #9 AND #10
12. ((transfer OR contamination OR transmission OR spread) NEAR/6 (bacteria* OR vir* OR microbial OR microorganism* OR clone* OR surface* OR hand* OR finger* OR glove* OR cloth*)):ti AND (model*:ab,ti OR method*:ab,ti OR experiment*:ab,ti OR study:ab,ti OR observation*:ab,ti)
13. contamination:ti OR transmission:ti OR transfer:ti OR spread:ti AND (hand*:ti OR finger*:ti OR glove*:ti OR cloth*:ti OR gown*:ti OR uniform*:ti OR surface*:ti) AND (microbial:de,ab,ti OR microorganism*:de,ab,ti OR 'micro organism':de,ab,ti OR 'micro organisms':de,ab,ti OR bacteria*:de,ab,ti OR vir*:de,ab,ti OR infect*:de,ab,ti)
14. #9 AND #12
15. #11 OR #13 OR #14
16. 'transfer rna':ab,ti OR 'gene transfer':ab,ti
17. #15 NOT #16 NOT ([animals]/lim NOT [humans]/lim) NOT [conference abstract]/lim AND ([english]/lim OR [french]/lim OR [german]/lim) #15 NOT #16 NOT ([animals]/lim NOT [humans]/lim) NOT [conference abstract]/lim AND ([english]/lim OR [french]/lim OR [german]/lim)

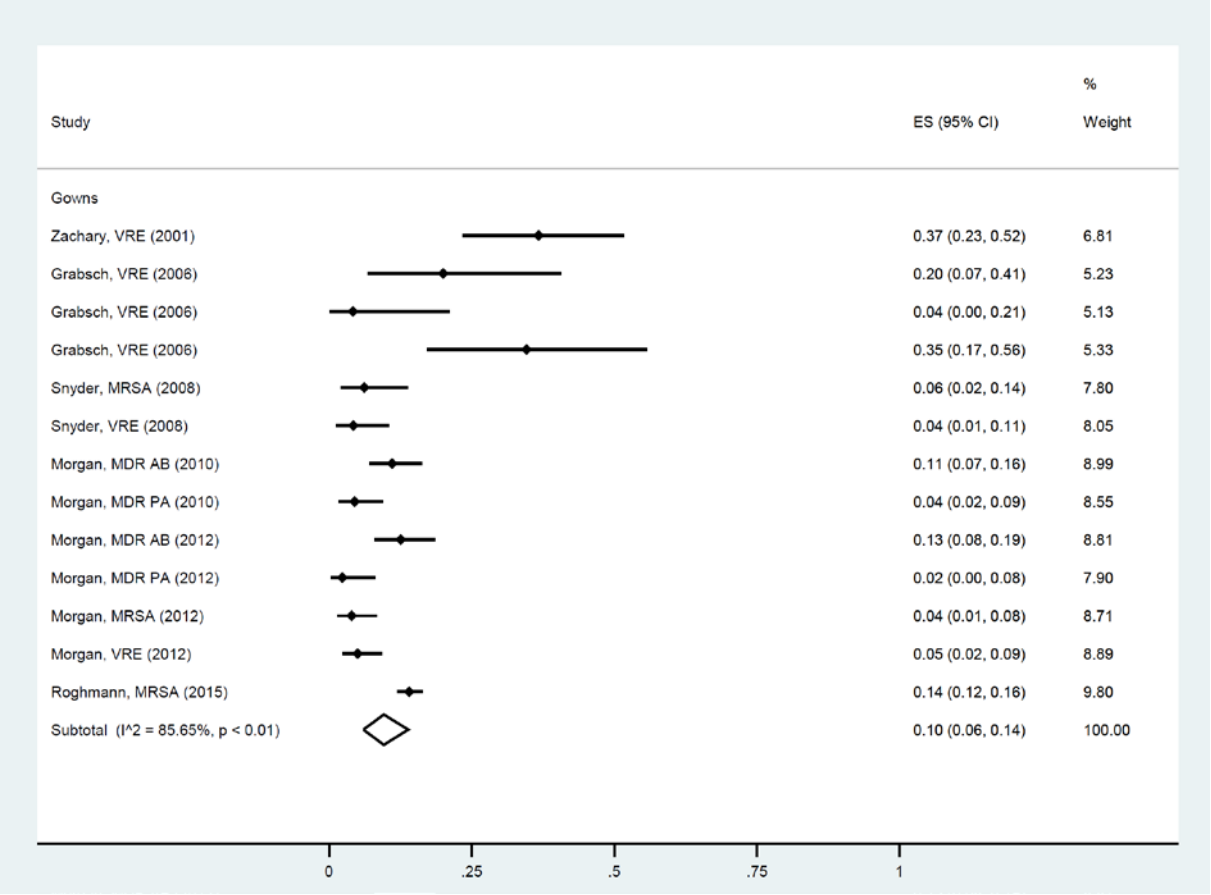
Appendix Figure 1. Estimated proportions (ES) of transfer of bacterial pathogens to hands and gloves.

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



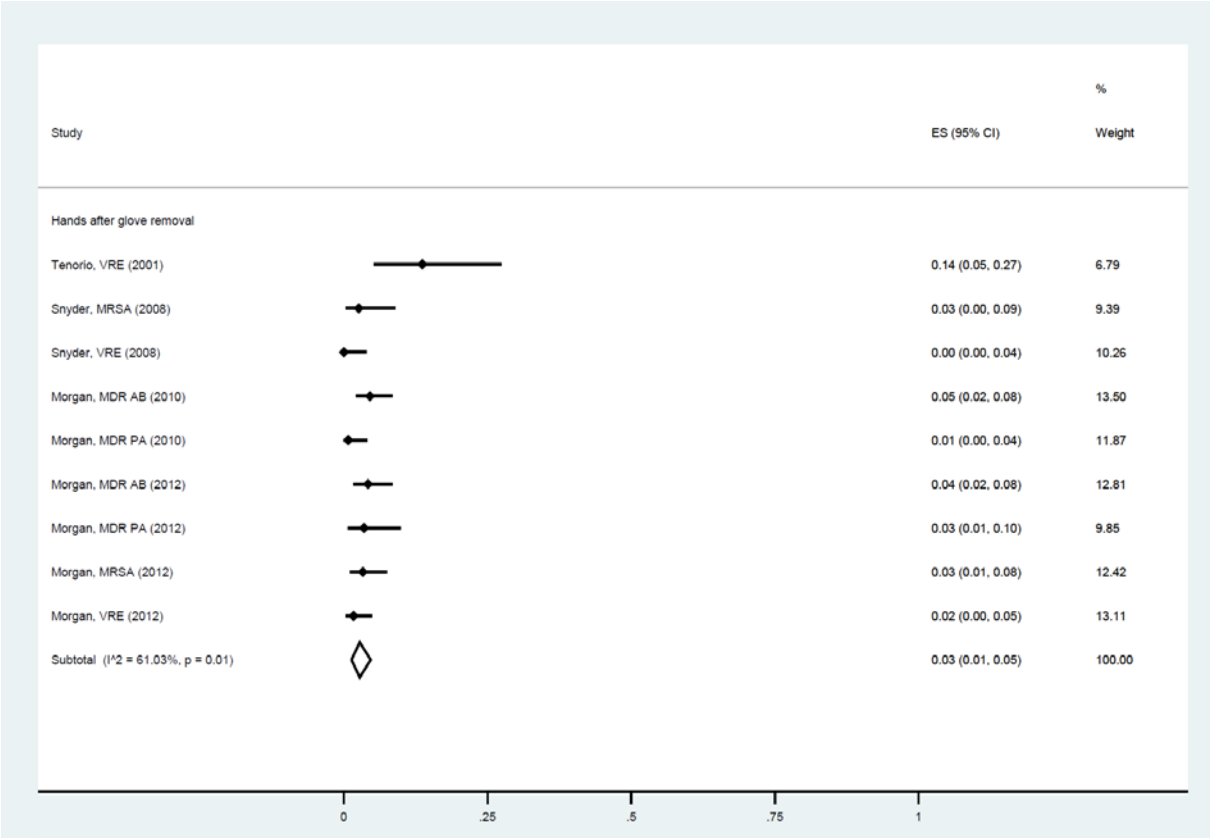
Abbreviations: AB = *Acinetobacter baumannii*; CI = Confidence interval; ES = Estimated proportion; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

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



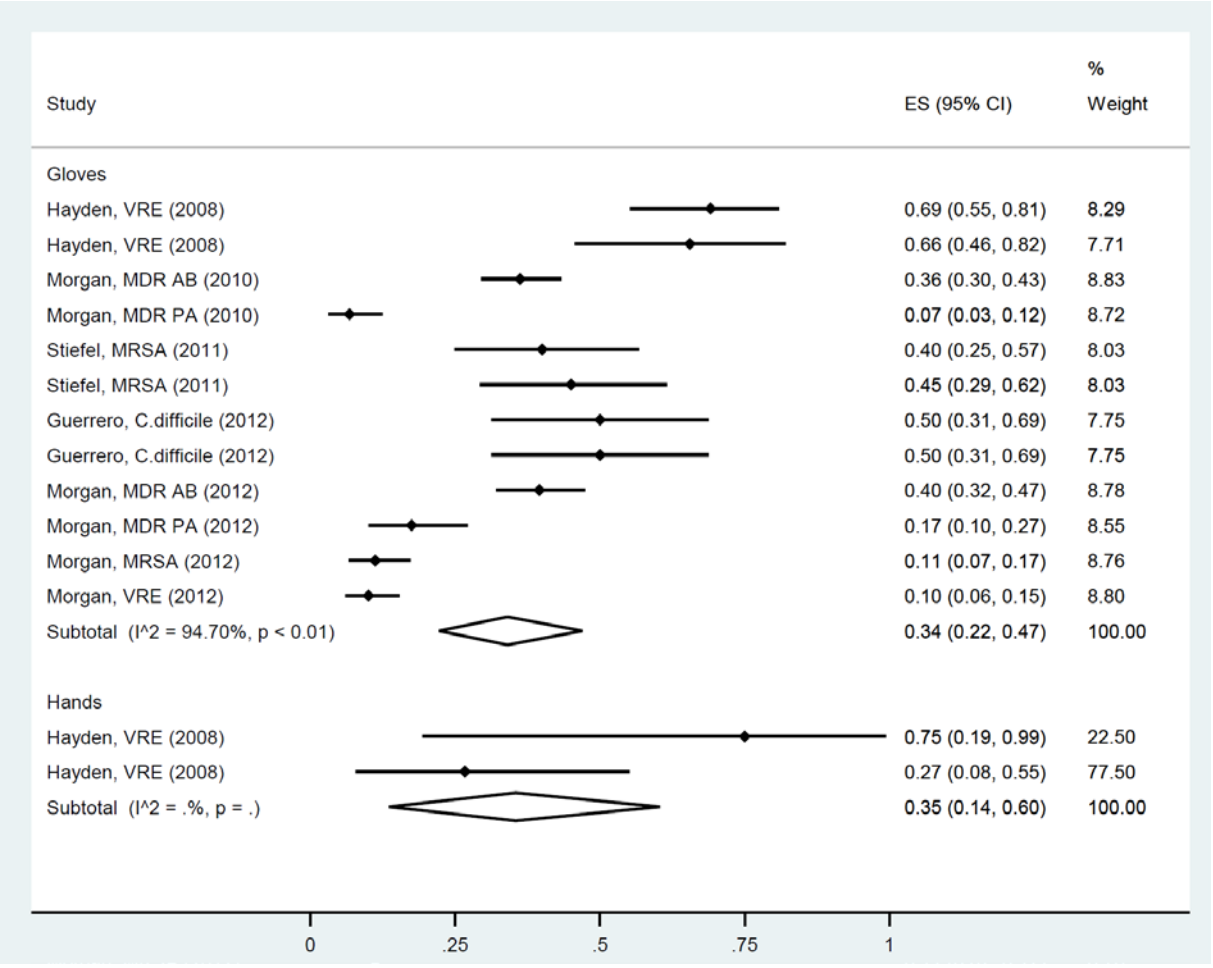
Abbreviations: AB = *Acinetobacter baumannii*; CI = Confidence interval; ES = Estimated proportion; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

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



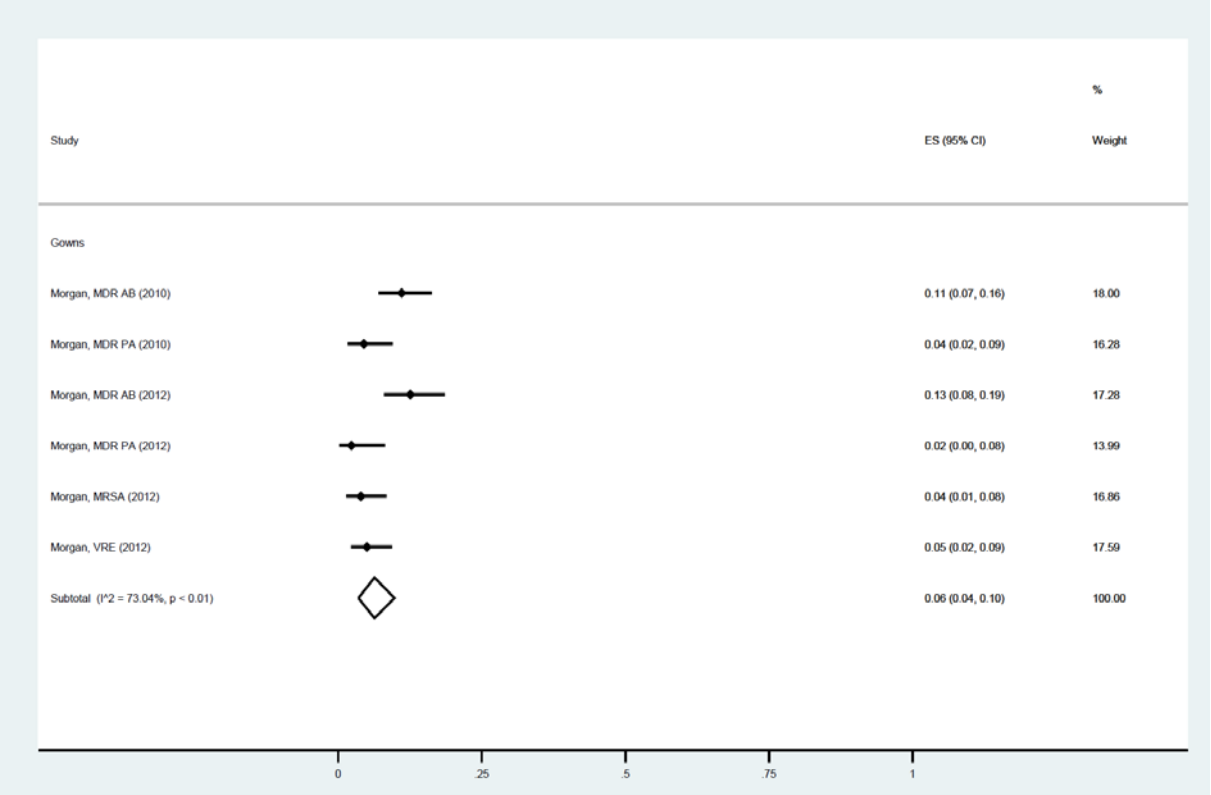
Abbreviations: AB = *Acinetobacter baumannii*; CI = Confidence interval; ES = Estimated proportion; GNS = Gram-negatives; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

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



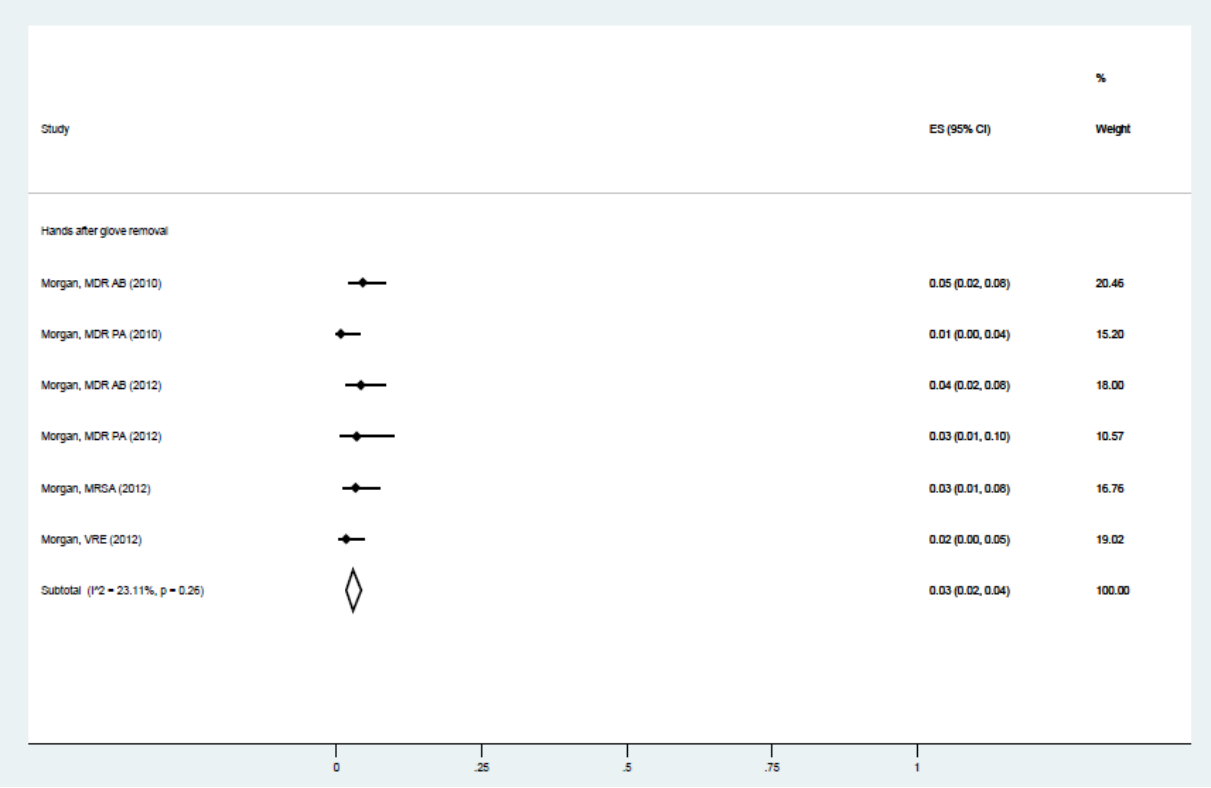
Abbreviations: AB = *Acinetobacter baumannii*; CI = Confidence interval; ES = Estimated proportion; GNS = Gram-negatives; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

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



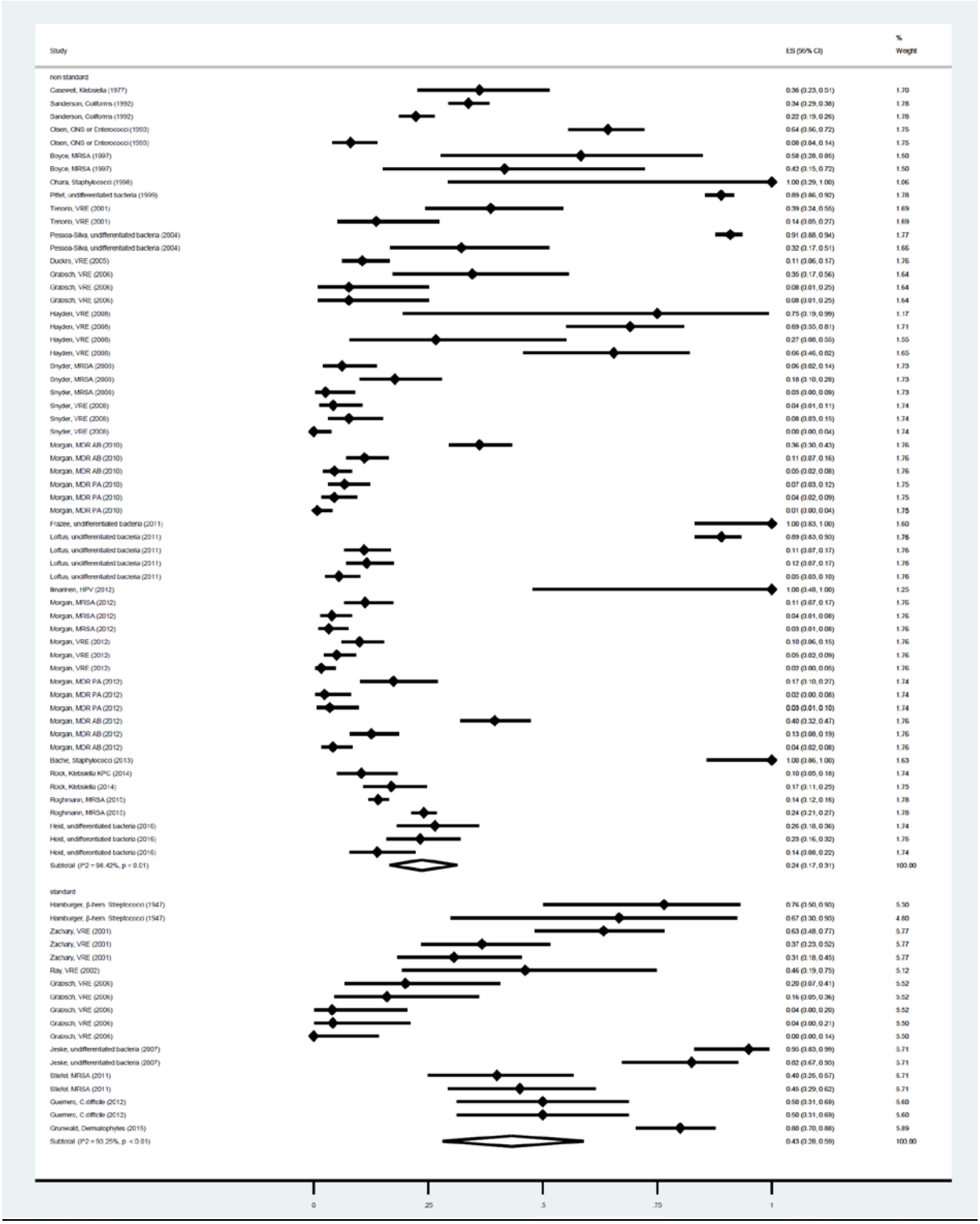
Abbreviations: AB = *Acinetobacter baumannii*; CI = Confidence interval; ES = Estimated proportion; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

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



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

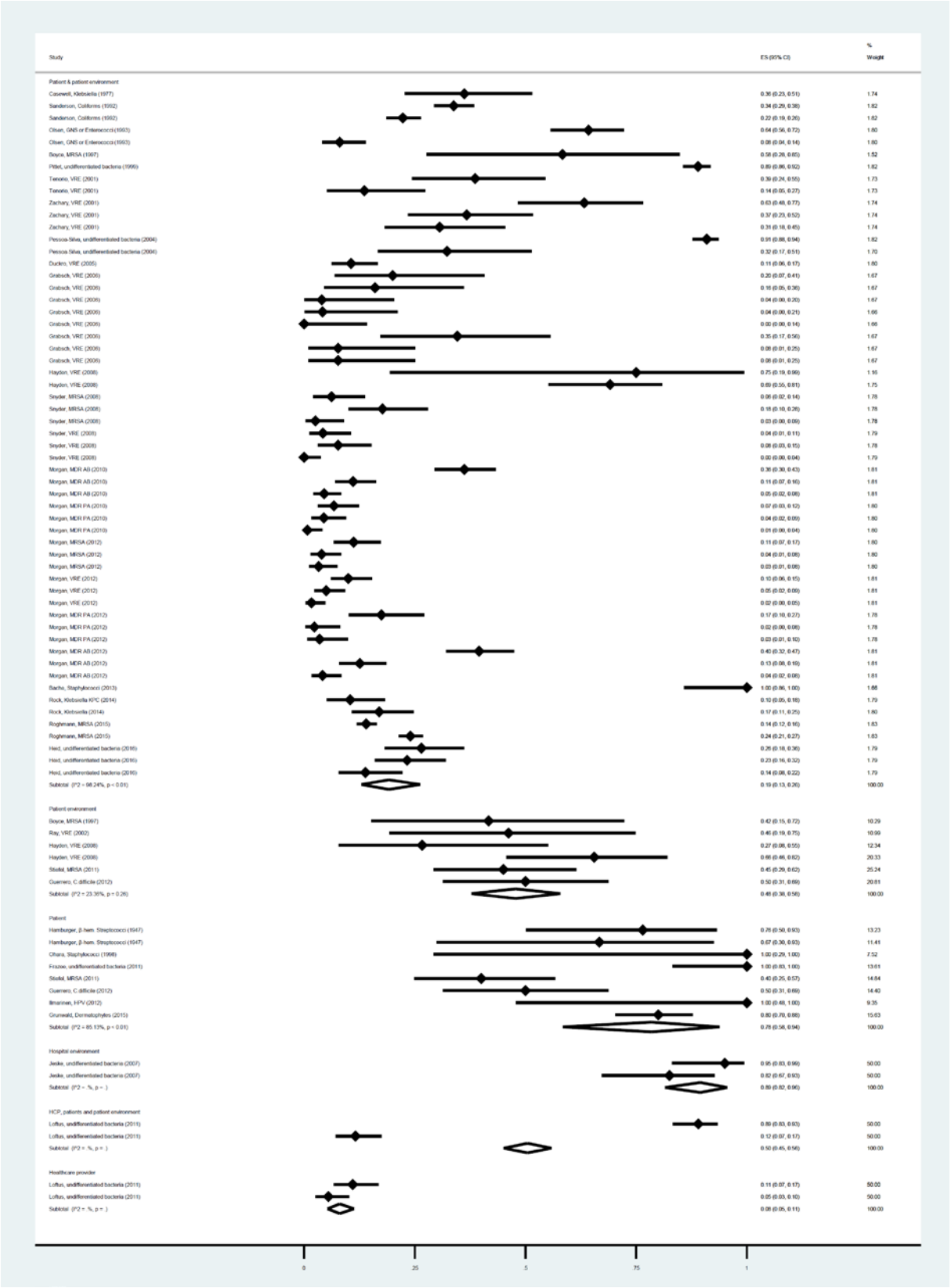
Appendix Figure 7. Estimated proportions (ES) of transfer of microorganisms stratified according to type of behaviour (standardized vs. non-standardized). Data markers indicate estimated proportions and error bars indicate 95% confidence intervals (95% CI).



Abbreviations: AB = *Acinetobacter baumanii*; CI = Confidence interval; ES = Estimated proportion; GNS = Gram-negatives; HPV = human papillomavirus; KPC = Klebsiella pneumonia carbapenemase; MDR =

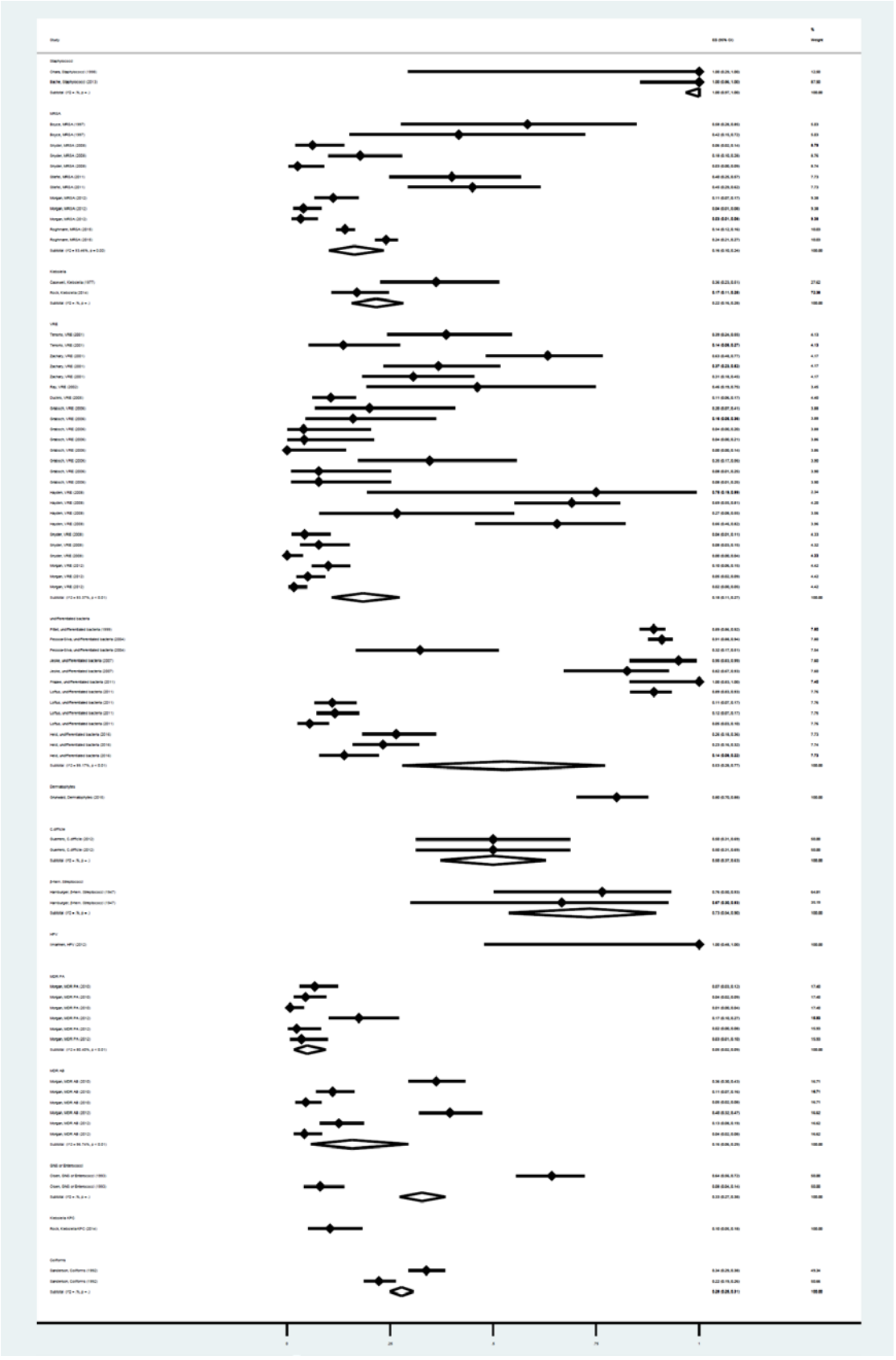
multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*; VRE = Vancomycin resistant Enterococci

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



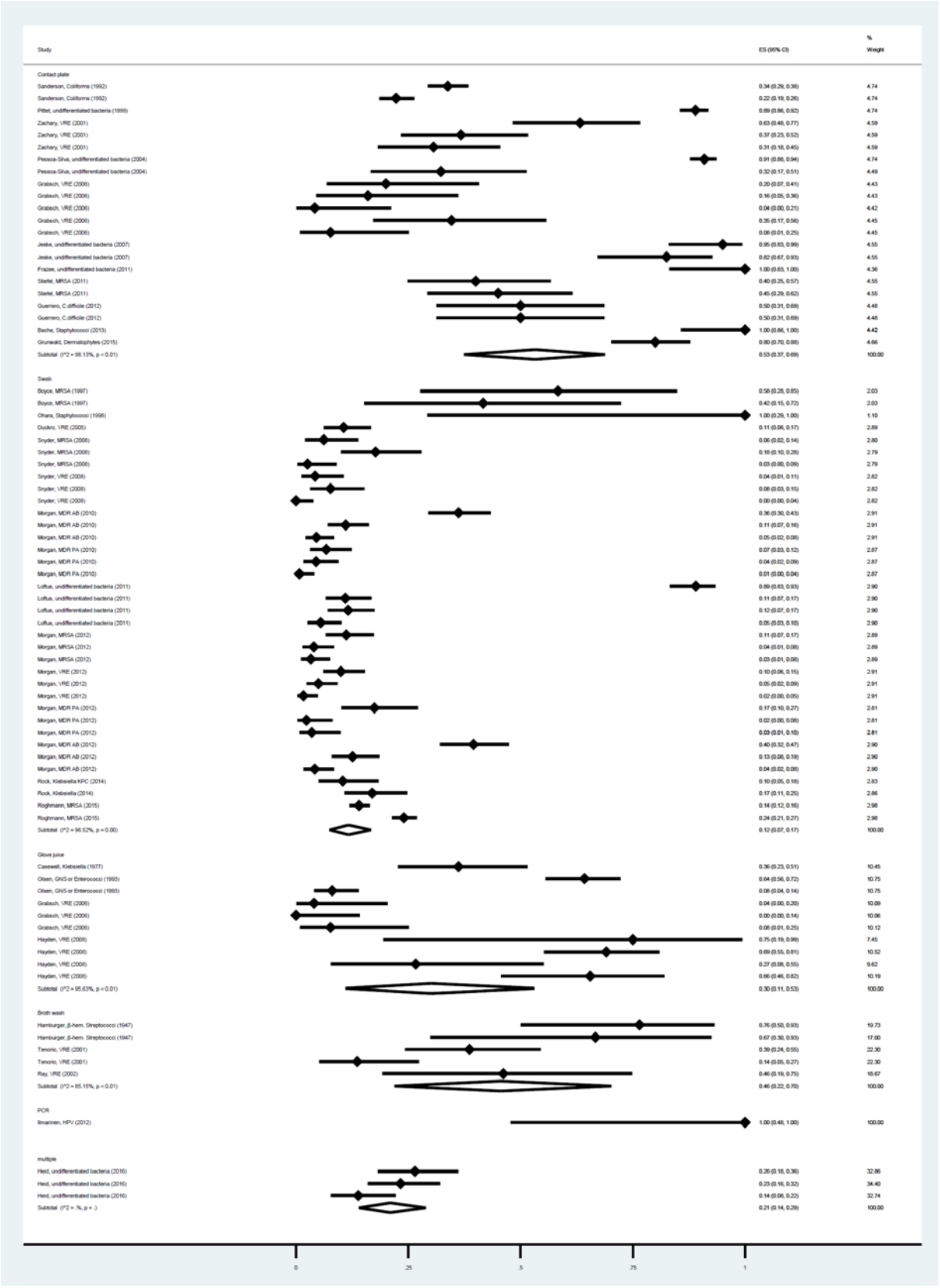
Abbreviations: AB = *Acinetobacter baumanii*; CI = Confidence interval; ES = Estimated proportion; GNS = Gram-negatives; HPV = human papillomavirus; KPC = Klebsiella pneumonia carbapenemase; MDR = multidrug resistant; MRSA = Methicillin resistant *Staphylococcus aureus*; PA = *Pseudomonas aeruginosa*;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

Appendix Figure 9. Estimated proportions (ES) of transfer of microorganisms stratified according to microorganism. Data markers indicate estimated proportions and error bars indicate 95% confidence intervals (95% CI).



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

Appendix Figure 10. Estimated proportions (ES) of transfer of microorganisms stratified according to microbiological sampling method. Data markers indicate estimated proportions and error bars indicate 95% confidence intervals (95% CI).



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

Appendix Table 1. Assessment of study quality

Bold text points out modifications necessary to make the quality assessment applicable to the non-interventional studies included in our analysis. Items considered not applicable (n.a.) to our non-interventional studies were not 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 meeting quality item (%)
Reporting	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)
Internal validity - bias	14	Was an attempt made to blind study subjects to the intervention they have received ?	n.a.	
	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.	

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

184 * Frequency or quantity of transfer was not the primary outcome in the four studies not meeting this quality item

185 † This quality item was not applicable to 20 study and was eliminated from the denominator in these studies.