ARHAI Scotland
Antimicrobial Resistance and Healthcare Associated Infection

NHS National Services Scotland

Evidence table – SICPs - literature identified April – June 2020

Titles and abstracts are reviewed for subject relevance. Additional exclusion criteria are also applied i.e. exclusion of laboratory focussed studies such as molecular typing etc.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
Patient Placement, Isolation and Cohorting	The Effects of Private Rooms on Hospital-Associated Infections Rosenberg K; Todd B. American Journal of Nursing. 119(11):53, 2019 11.	This short report describes the effects of switching to single-patient rooms on hospital-associated infections following the relocation of a hospital in Montreal, Canada. The old hospital rooms were a mixture of three- and four-bed units and a few private rooms. The new hospital includes 350 single-patient rooms with dedicated handwashing sinks, new beds and furniture, and, except for two critical care units, private bathrooms and showers. The rates of vancomycin-resistant *Enterococcus* (VRE) and methicillin-resistant *Staphylococcus aureus* (MRSA) colonization and infection of *Clostridioides difficile* infection (CDI) were examined with surveillance cultures using a time-series analysis. Results show in the 36 months of follow up a reduction in the incidence of VRE and MRSA colonisation, VRE infections were also reduced but not with MRSA or CDI.	None. Adds to evidence base.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
Routine cleaning of the care environment	Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. [Review] Kampf G; Todt D; Pfaender S; Steinmann E. Journal of Hospital Infection. 104(3):246-251, 2020 Mar. VI 1	This systematic review summarises all available data on the persistence of all coronaviruses (human and veterinary) including emerging SARS-CoV and MERS CoV on different types of inanimate surfaces and on the efficacy of commonly used biological agents used for chemical disinfection e.g. in healthcare facilities. Results from the 22 analysed studies show that human coronaviruses such as SARS, MERS or endemic human coronaviruses (HCoV) can persist on inanimate surfaces like metal, glass or plastic for up to 9 days but can be efficiently inactivated by surface disinfection procedures with 62-71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite within 1 minute. Other agents such as 0.05-0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate are less effective.	None. Adds to evidence base.
	Norovirus recovery from floors and air after various decontamination Ciofi-Silva CL; Bruna CQM; Carmona RCC; Almeida AGCS; Santos FCP; Inada NM; Bagnato VS; Graziano KU Journal of Hospital Infection. 103(3):328-334, 2019 Nov. VI 1	This experimental study aims to assess residual norovirus (NoV) particles on floor and airborne particles following various floor decontamination procedures. 2 types of floor (vinyl and granite) were intentionally contaminated with 10% human faeces positive for NoV-GII, the floors were cleaned following 2 decontamination protocols: cleaning followed by disinfection with 1% sodium hypochlorite and cleaning followed by disinfection using a manual ultraviolet C	None. Adds to evidence base.

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		(UV-C) light device. Swab samples were taken from the floors, and air samples were obtained using an air sampler. Their findings show that disinfection protocol using 1% sodium hypochlorite after cleaning was more effective than cleaning followed by UV-C light ($P<0.001$). Viral particles were detected in 27 of 36 air samples after cleaning with no significant difference between the 2 floor types. The authors conclude that NoV can be aerosolised during floor cleaning and its particles may be inhaled and then swallowed or settle on surfaces. Cleaning followed by 10min disinfection with 1% sodium hypochlorite disinfection proved to be superior to cleaning followed by UV-C light disinfection.	
HH – Hand washing	Risks and benefits of using chlorhexidine gluconate in handwashing: A systematic literature review. Baraldi MM; Gnatta JR; Padoveze MC. American Journal of Infection Control. 47(6):704-714, 2019 06	This systematic review investigated whether the continuous use of antimicrobial soaps containing chlorhexidine gluconate (CHG) for hand hygiene (HH) affects the reduction of healthcare-associated infections (HAI), the selection of microorganisms resistant to CHG or hands skin damage. The search was conducted via PubMed, Medline, CINAHL, LILACS, Embase, Cochrane Library, Scopus, Web of Science, ProQuest, Google Scholar, and gray literature. Their results show no significant difference in HAI rates when using CHG for hand hygiene; 10/13 studies suggested an association with	None.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
		use of and tolerance to CHG; and the use of CGH was associated with skin reaction events. The authors concluded that evidence is still lacking regarding risks and benefits of CHG for HH and advised to reserve the use of CGH for purposes other than HH to prevent antibiotic resistance..	
HH – Use of ABHR	Product dose considerations for real-world hand sanitiser efficacy. Kenters N; Eikelenboom-Boskamp A; Hines J; McGeer A; Huijskens EGW; Voss A. American Journal of Infection Control. 48 (5) (pp 503-506), 2020	This paper undertook a series of studies to investigate the optimal dose of alcohol based hand rub (ABHR) for use in health care settings; it had 4 objectives: (1) establishing ABHR drying time as function of dose in a laboratory setting which was followed by (2) establishing the amount of ABHR needed for complete hand coverage; (3) dispenser usage at 2 hospitals; and (4) real-world evaluation of ABHR use by healthcare workers at the 2 hospitals (US & UK). Regarding dispense usage in clinical wards, results indicate that in 86% (24,446,397/28,280,383) of events a single dose of ABHR was used. 24 HCWs expected hand hygiene to take 7.5s (median range 3-30s); 43 HWCs show that 1.5ml ABHR dose achieves desired drying time according to WHO guidelines but is consistently perceived to have a longer drying time than expected (av median 18s). Laboratory results (n=10) show that 2.25ml ABHR is required to adequately cover 82-90% of coverage of both sides of the hand.	None. Adds to evidence base.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
		The authors concluded that set standards for the use of ABHR do no match real time behaviour of HCWs; HCWs also perceived drying times to be shorter than actual drying time. The authors recommend a minimum of 2.25ml for gels ABHR and 1.5ml for products in foam form for better hand coverage which could be achieved by intelligent dispensers.	
	Vancomycin-resistant *Enterococcus faecium* sensitivity to isopropylalcohol before and after implementing alcohol hand rubbing in a hospital. Tinajero et al. American Journal of Infection Control 47(9):e27-e29, 2019	This in vitro study assessed the effect of alcohol used for hand antisepsis on susceptibility of vancomycin-resistant *Enterococcus* (VRE) to isopropyl alcohol.The minimum inhibitory concentration (MIC) of isopropyl alcohol against 55 VRE clinical isolates was found. 29 isolated were from before the introduction of a 0.5% chlorhexidine alcohol-based hand rub, and 26 were from after introduction. Isolates were formulated into suspension and tested against alcohol concentrations of 36.8 mg/mL (46%), 18.4 mg/mL (23%), 9.2 mg/mL (11.5%), 4.6 mg/mL (5.57%), and 2.3 mg/mL (2.87%). It was found that the MIC of 12 isolates was 2.87%, for another 26 MIC was 5.75%, and for the final 17 MIC was 11.5%. There was no significant difference found between isolates collected before and after the introduction of 0.5% chlorhexidine hand rub.	None.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
		It is concluded that using alcohol-based hand rub as a method of hand hygiene does not impact upon the susceptibility of VRE.	
	Comparison of estimated norovirus infection risk reductions for a single fomite contact scenario with residual and nonresidual hand sanitisers. Wilson et al. American Journal of Infection Control 48(5): 538-544, 2020	This experimental in-vivo efficacy study compared reduction of human norovirus infection risk for 60% ethanol (nonresidual) and a quarternary ammonium-based (residual) hand sanitizer under different scenarios. Human norovirus log10 reductions for both sanitizers were measured using the ASTM International Standard E1838-10 method. Scenarios included product application to: (1) inoculated fingers pads with 30 and 60 second contact times and (2) hands followed by inoculation with human norovirus immediately and 4 hours later. Results show the largest log10 reduction for both sanitizers were achieved during 60 second contact time; infection risk was reduced by approximately 99% for residual sanitizer and 85% for nonresidual sanitizer. Four hours post application, the residual sanitizer reduced infection risk by 78.5% under high contamination conditions but there was no effective reduction for the nonresidual hand sanitizer. Results suggest that residual hand sanitizers may reduce human norovirus infection risks for up to 4 hours.	None.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
HH – Surgical Hand antisepsis	Surgical hand rubbing versus surgical hand scrubbing: Systematic review and meta-analysis of efficacy Feng W; Lin S; Huang .; Huang J; Chen L; Wu W; Hu S; Wei Z; Wang X. Injury. (no pagination, article in Press), 2020	This paper carried out a systematic review and meta-analysis comparing the efficacy of surgical hand rubbing (SHR) versus surgical hand scrubbing (SHS) in effectively controlling surgical site infections (SSI). Databases were searched for the review which included Pubmed, Embase, Cochrane library, Ovid and Google scholar for studies published 1980-April2019. Analysis focused on primary outcomes that included colony-forming unit (CFU) counts and logarithmic reduction of CFU after hand antisepsis and after surgery. A total of 7 clinical trials met the inclusion criteria. The authors found no statistically significant differences between the two methods with regards to CFU counts and logarithmic reduction of CFU after hand antisepsis and surgery as well as antisepsis and surgery times. The authors conclude that SHR had similar efficacy to SHS and can be recommended as a cost-effective alternative for managing SSIs.	None. Adds to evidence base.
HH – Indications for hand hygiene	Contamination of health-care workers' hands with *Escherichia coli* and *Klebsiella* species after routine patient care: a prospective observational study.	This prospective observational study was carried out to compare the frequency of healthcare worker (HCW) hand contamination by *E. coli* vs *Klebsiella spp* after patient care and what activities are associated with contamination. HCWs from 2 tertiary care centres were observed caring for patients colonized/infection with *E. coli*	None. Adds to evidence base.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
	Puig-Asensio M; Diekema DJ; Boyken L; Clore GS; Salinas JL; Perencevich EN. Clinical Microbiology & Infection. 26(6):760-766, 2020 Jun. VI 1	or *Klebsiella*; HCW hands were cultured before room entry and after patient care and contamination was defined as detection of either *E. coli* or *Klebsiella* on HCW hands as confirmed by pulsed-field gel electrophoresis (PFGE). 466 HWC observations were performed (290 from patients with *E. coli*; 149 with *Klebsiiella*; 27 with both species); HCW contamination rates were similar between *E.coli* & *Klebsiella* (6.2%,18/290 vs 7.4%, 11/149; p=0.6). High risk activities associated with contamination were: toilet assistance (OR 9.34; 95%CI 3.10-28.16), contact with moist secretions (OR 6.93; 95%Ci 2.82-17.00) and hygiene/bed-bathing (OR 3.80; 95%CI 1.48-9.80). Authors concluded that hand hygiene should be reinforced after high-risk activities.	
	Effects of hand disinfection with alcohol hand rub, ozonized water, or soap and water: time for reconsideration?. Breidablik H.J.; Lysebo D.E.; Johannessen L.; Skare A.; Andersen J.R.; Kleiven O.	This experimental study investigated the efficacy of alcohol hand rub vs hand wash using ozonized tap water vs soap and water in removing *E. coli* from contaminated hands. Results show that alcohol eradicated bacteria in 10 out of 35 participants but with an average (SD) of 2330 (4227) cfu/ml left after disinfection whereas ozonized water removed all bacteria in 10 out of 55 participants, average of only 538 (801)	None. Adds to evidence base.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
	Journal of Hospital Infection. 105 (2) (pp 213-215), 2020. Date of Publication: June 2020.	cfu/ml left (P=0.045). The most effective was soap washing with total removal of bacteria in six out of 20 participants with an average of 98 (139) cfu/ml (P=0.048 & 0.018 vs ozonized water and alcohol respectively). Results show that hand washing with soap and water was the best method followed by ozonized water however standard alcohol disinfection is more flexible. Further studies required to validate efficacy of ozonized water.	
HH – Skincare	Skin barrier function after repeated short-term application of alcohol-based hand rub following intervention with water immersion or occlusion. Plum F.; Yuksel Y.T.; Agner T.; Norreslet L.B. Contact dermatitis. (no pagination), 2020. Date of Publication: 01 May 2020	This experimental study set out to evaluate if increased skin hydration changes skin barrier response to alcohol-based hand rub (ABHR) compared to application on dry skin. Twenty healthy volunteers took part in a three-day setup: intervention areas on forearms were exposed to either water immersion or occlusion followed by repeated exposures to ABHR; skin barrier function was assessed by transepidermal water loss (TEWL), electrical conductance, pH and erythema at baseline and day three. Results show that areas exposed to water immersion preceding ABHR showed significant increase in TEWL from baseline vs day 3 (P=0.04); significant decrease in electrical conductance was found for occluded areas (P=0.03); all other tests showed no difference including for the control area. The study has limitations:	None.

Literature review	Papers identified	Summary of Findings	Impact on Recommendations
		ABHR product use has glycerol which might affect results, no explanation given on why outcomes were measured on day 3 and although results show that ABHR may compromise skin barrier following skin hydration, further studies required to explore this topic.	
PPE - Gloves	Association between universal gloving and healthcare-associated infections: A systematic literature review and meta-analysis. Chang NN; Kates AE; Ward MA; Kiscaden EJ; Reisinger HS; Perencevich EN; Schweizer ML; CDC Prevention Epicenters Program Infection Control & Hospital Epidemiology. 40(7):755-760, 2019 07	This systematic review and meta-analysis paper set out to identify whether implementation of universal gloving is associated with decreased incidence of healthcare associated infections (HAI) in clinical settings. A systematic literature search ware carried out using search terms for universal gloving and HAIs with pooled incidence ratios (IRRs) and 95% confidence intervals (CIs) & heterogeneity calculated. 8 studies in total were included that were moderately to substantially heterogeneous (I2=59%0 and had varied results. Their analysis showed a nonsignificant association between universal gloving and incidence of MRSA and VRE. Those that implement universal gloving alone showed significant association with decreased HAI (IRR 0.77; 95% CI 0.67-0.89) but studies that implemented universal gloving as part of intervention bundles showed no significant association with incidence of HAI (IRR 0.95; 95% CI 0.86-1.05). The authors concluded that universal gloving may be	None.

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		associated with a small protective effect against HAI however this is based on limited data and requires further researcher on a broader range of pathogens.	
Management of patient care equipment	Methods of disinfecting stethoscopes: Systematic review. Napolitani M; Bezzini D; Moirano F; Bedogni C.; Messina G. International Journal of Environmental Research and Public Health. 17 (6) (no pagination), 2020. Article Number:1856	This systematic review set out to investigate the effectiveness of various disinfection methods for stethoscopes. PubMed and Scopus were searched in march 2019 using relevant search terms. After screening a total of 17 papers were included in the review. Results show that 90% Ethanol, Ethanol-based hands sanitizer (EBHS), triclosan, chlorhexidine, isopropyl alcohol, 66% ethyl alcohol, sodium hypochlorite and benzalkonium chloride have been proven to lower the presence of bacteria on the surfaces of stethoscopes. Alcohol wipes were also shown to be effective. The authors concluded that there are many valid methods to disinfect stethoscopes and the choice depends on various factors such as cost, availability and practicality.	None. Adds to evidence base.
HH – Use of ABHR	Product dose considerations for real-world hand sanitiser efficacy. Kenters N; Eikelenboom-Boskamp A; Hines J; McGeer A; Huijskens EGW; Voss A.	This paper undertook a series of studies to investigate the optimal dose of alcohol based hand rub (ABHR) for use in health care settings; it had 4 objectives: (1) establishing ABHR drying time as function of dose in a laboratory setting which was followed by (2) establishing the amount of ABHR needed for complete hand coverage;	None. Adds to evidence base.

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PPE - Gloves	Association between universal gloving and healthcare-associated infections: A systematic literature review and meta-analysis. Chang NN; Kates AE; Ward MA; Kiscaden EJ; Reisinger HS; Perencevich EN; Schweizer ML; CDC Prevention Epicenters Program	This systematic review and meta-analysis paper set out to identify whether implementation of universal gloving is associated with decreased incidence of healthcare associated infections (HAI) in clinical settings. A systematic literature search ware carried out using search terms for universal gloving and HAIs with pooled incidence ratios (IRRs) and 95% confidence intervals (CIs) & heterogeneity calculated. 8	None.

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	Infection Control & Hospital Epidemiology. 40(7):755-760, 2019 07	studies in total were included that were moderately to substantially heterogeneous (I2=59%0 and had varied results. Their analysis showed a nonsignificant association between universal gloving and incidence of MRSA and VRE. Those that implement universal gloving alone showed significant association with decreased HAI (IRR 0.77; 95% CI 0.67-0.89) but studies that implemented universal gloving as part of intervention bundles showed no significant association with incidence of HAI (IRR 0.95; 95% CI 0.86-1.05). The authors concluded that universal gloving may be associated with a small protective effect against HAI however this is based on limited data and requires further researcher on a broader range of pathogens.	
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Literature review	Papers identified	Summary of Findings	Impact on Recommendations
		were also shown to be effective. The authors concluded that there are many valid methods to disinfect stethoscopes and the choice depends on various factors such as cost, availability and practicality.	

Evidence table – TBPs - literature identified April – June 2020

Literature review	Papers identified	Abstract	Summary of scientific findings
Patient Placement, Isolation, and Cohorting	Cohorting to prevent acquisition of multidrug-resistant bacteria: An interrupted time series study. Arruda MC, de Aguiar RS,Jardim WM, Melo LH Mendonca T, Cavalvanti AB, de Franca PHC. *American Journal of Infection Control* 42(2): 180-185, 2019	An interrupted time series analysis on isolation and cohorting of patients with hospital acquired multidrug-resistant bacterial infections. The study ran for 2 years with different methods in each. In the first year (phase 1) patients were isolated in the wards they were already admitted to, without physical transfer. In the second year (phase 2), cohorting of infected patients was implemented and they were transferred to a specific isolation ward. 81 patients were included in the first stage, and 106 in the second. The first stage of the study saw an MDR bacteria acquisition rate of 2 cases per 1000 patient days, and the second phase a rate of 2.8 cases per 1000 patient days. The incidence density ratio was 1.35 (95% CI: 1.01-1.81, p=0.04). The incidence of acquisition of specific bacteria were similar between the phases for most bacteria. However, there was an increase in E.coli in the second phase which was not significant. From these results the authors concluded that cohorting in a specific isolation ward	None.

Literature review	Papers identified	Abstract	Summary of scientific findings
		may not reduce the incidence of MDR bacterial infections.	
	The effects of Private Rooms on Hospital-Associated Infections. Rosenberg K, Todd B. *American Journal of Nursing* 199(11): 53, 2019	Full text not available. Narrative article on a time-series analysis of the effect of private rooms on hospital-associated infections. The hospital studied contained 350 single-patient rooms. Cultures were collected from each patient on admittance and weekly during their stay in hospital and the surveillance ran for 36 months. Reduction was observed in the infection rates of VRE and MRSA. No significant trend was seen in the rates of CDI.	None.
PPE	Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff. Verbeek et al. *Cochrane Database of Systematic Reviews* 4:CD011621, 2020	This Cochrane review update included all controlled studies that evaluated the effect of full-body PPE used by HCW exposed to highly infectious diseases, on the risk of infection, contamination, or noncompliance with protocols. Earlier versions of this review were published in 2016 and 2019. In this update, 24 studies were included with 2278 participants, of which 14 were randomised controlled trials (RCT), one was a quasi-RCT and nine had a non-randomised design. 18 of these 24 studies used	None.

Literature review	Papers identified	Abstract	Summary of scientific findings
		simulated exposure with fluorescent markers or harmless microbes. The authors identified a small amount of evidence that showed covering more parts of the body leads to better protection but usually comes at the cost of more difficult donning or doffing and less user comfort, and may therefore even lead to more contamination. More breathable types of PPE may lead to similar contamination but may have greater user satisfaction. Modifications to PPE design, such as tabs to grab, may decrease the risk of contamination. Almost all findings within this study are based on one or at most two small simulation studies. Therefore, certainty of the evidence is judged as very low or low. There were no studies that investigated goggles or face shields. It remains unclear what the best way to remove PPE after use and the best type of training in the long term.	

Evidence table – Healthcare Infection Incidents, Outbreaks and Data Exceedance - literature identified April – June 2020

Literature review	Papers identified	Abstract	Summary of scientific findings
Management of incidents and outbreaks in a neonatal unit (NNU).	Methicillin resistant *Staphylococcus aureus* outbreak in a neonatal intensive care unit. Irfan S; Ahmed I; Lalani F; Anjum N; Mohammad N; Owais M; Zafar A. Eastern Mediterranean Health Journal. 25(7):514-518, 2019 Oct 04	This study reports a methicillin resistant *Staphylococcus aureus* (MRSA) outbreak in a neonatal intensive care unit (NICU) in Pakistan. Infection control team from the parent hospital visited the facility and infection control measures were taken to control the outbreak. Screening of the neonates, NICU staff and the environment were obtained for the presence of MRSA. 5 neonates were positive for MRSA; one HCW was found to be colonized with MRSA that matches the antibiogram pattern with that of the outbreak strain. The HCW was decolonized and re-deployed from NICU to outpatient department. The outbreak was declared over once no further MRSA cases were identified.	None. Adds to evidence base.
	A Cluster of *Bacillus cereus* Infections in the Neonatal Intensive Care Unit: Epidemiologic and Whole-genome Sequencing Analysis Bar-Meir M; Kashat L; Zeevi DA; Well YW; Assous MV. Pediatric Infectious Disease Journal. 38(11):e301-e306, 2019 11. VI 1	This study describes an outbreak of *Bacillus cereus* in a neonatal intensive care unit which coincided with construction work performed in an adjacent site. Using whole-genome sequencing, the authors found the outbreak to be polyclonal however it did not correlate with the virulence in vivo. Severe/lethal infections and colonization were associated with isolates from environmental contamination. The authors recommend the integration of genomics to	None.

		augment understanding of pathogen transmission and virulence and highlights environmental bacterial load as a protential major determinant of infection in high-risk patients.	
	Control of *Acinetobacter baumannii* outbreak in the neonatal intensive care unit in Latvia: whole-genome sequencing powered investigation and closure of the ward. Gramatniece A; Silamikelis I; Zahare I; Urtans V; Zahare I; Dimina E; Saule M; Balode A; Radovica-Spalvina I; Klovins J; Fridmanis D; Dumpis U. Antimicrobial Resistance & Infection Control. 8:84, 2019.	This study describes the investigation and containment of *Acinetobacter baumannii* outbreak in a neonatal intensive care (Pauls Stradins Clinical University Hospital, Latvia 01/09/2012) unit using whole-genome sequencing and multi-model infection control measures. Case definitions for A*. baumanni* blood stream infection (BSI) and colonization were implemented; surveillance cultures were obtained from all admitted patients; an infection prevention and control (IPC) team was formed and IPC interventions implemented which included environmental sampling of the NICU and labour ward. A total of 17 neonates had *A.baumannii*; Rectal screening samples were positive for *A.baumannii*-complex in 182 neonates. All 298 environmental cultures were negative and while adherence to stringent infection control measures decreased BSI cases, colonization persisted. The outbreak was ongoing for 4 years with several relapses and was contained after the ward was temporarily closed, relocated and renovated.	None.