ARHAI Scotland

Antimicrobial Resistance and Healthcare Associated Infection

NHS National Services Scotland

Evidence table – SICPs - literature identified July - September 2021

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
Cough Etiquette / Respiratory Hygiene	Efficacy of universal masking for source control and personal protection from simulated cough and exhaled aerosols in a room. Lindsley WG et al. Journal of Occupational & Environmental Hygiene. 1-15, 2021 Jun 23.	Experimental study performed under laboratory conditions investigating effects of universal cloth masking, orientation and distance on the exposure of individuals to respiratory aerosols in indoor spaces. A respiratory aerosol simulator manikin (source) and a digital breathing simulator (recipient) was placed inside a sealed room-sized (3m x 3m) environmental chamber (mean temperature 74.8 °F; 26.7% relative humidity). Coughing and breathing experiments were performed with the source and recipient simulator at 0.9m or 1.8m apart and oriented at either (1) front-to-front (2) front-to-back, (3) side-by-side. Face masks (3 layers cotton fabric) were placed on source and recipient prior to the experiments with 4 masking conditions: (1) no mask on source or receiver (no mask/no mask), (2) mask on receiver only (no mask/cloth mask), (3) mask on source only (cloth mask/no mask (and (4) masks on both (cloth mask/cloth mask). Aerosol particle concentrations (0.3 – 3 µm) were monitored using optical particle counters (OPC Model 1.108) during experiments. Findings show that face masks reduced aerosol concentration during both coughing and breathing experiments at both separation	None.

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		distances (0.9m and 1.8m) compared with corresponding no masks tests. When simulators were front-to-front during coughing, masks on both reduced the 15-minute mean aerosol concentration at the recipient by 92% at 0.9m and 1.8m distance ($p<0.0001$); at side-by-side, masks reduced concentration by 81% at 0.9m and 78% at 1.8m ($p<0.0001$ for both). During breathing, masks reduced aerosol concentration by 66% when front-to-front ($p=0.0061$) and 76% when side-to-side at 0.9m ($p<0.0001$); similar results seen at 1.8m separation. When both simulators were unmasked, cough aerosol concentration was reduced by 59% at 0.9m and 60% at 1.8m ($p<0.0001$ for both) when orientation was changed from front-to-front to side-by-side. When both were masked, there was no significant change in concentration at either distance during coughing or breathing. Increasing the distance from 0.9m to 1.8 during coughing reduced aerosol concentration by 25% with no masks ($p<0.0001$) but little effect was observed when both were masked (4% decrease, $p=07084$). Study findings suggest that regardless of orientation and separation between source and recipient, universal masking reduces exposure to respiratory aerosol particles.	
Surgical Masks	Masks for prevention of viral respiratory infections among health care workers and the public: PEER umbrella systematic review. Dugre N. et al. Canadian Family Physician. 66(7):509-517, 2020 07.	Systematic review investigating if masks and mask type can influence or reduce the risk of viral respiratory infections in healthcare workers (HCWs) and members of the public. PRISMA guidelines were used with 2 authors carrying a search of MEDLINE, Cochrane Library, Medrxiv. Search was limited to randomised controlled trials (RCTs) included in at least 1 published systematic review comparing the use of masks with a control group, either in community or healthcare settings, on the risk of viral respiratory infections. 11 systematic reviews were included and 18 RCTs of 26,444 participants were	Adds to evidence base.

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		found (12 community; 6 HCWs); all had limitations and were judged at high risk of bias. Findings show that in HCWs, surgical masks were superior to cloth masks for preventing influenza-like illness (RR=0.12; 95%CI: 0.02-0.98) but event rates were low. Four RCTs compared surgical masks vs N95 masks in HCWs. No difference was found between surgical and N95 masks for confirmed influenza (RR=1.10; 95%CI: 0.91-1.32; I^2=0%) or confirmed viral respiratory infections (RR=0.95; 95%CI: 0.83-1.07; I^2=0%). N95 were likely superior to surgical masks for preventing influenza-like illness (RR=0.78; 95%CI: 0.61-1.00) and any clinical respiratory infections. (RR=0.95; 95%CI: 0.90-1.00). Findings from this systematic review suggest no difference between N95 masks and surgical masks on the risk of confirmed influenza or other confirmed viral respiratory infections however N95 might prevent influenza-like illness or other clinical respiratory infections. Surgical masks might be superior to cloth masks however data was limited to 1 trial.	
Surgical Masks	The defects of lace-up surgical masks and related solutions in operating rooms. Wang X et al. The Journal of hospital infection. 115: 64-70, 2021 09	This experimental study completed Nov 2020 - Feb 2021 tested two new wearing methods (3-knots method and elastic band method) for tying-up surgical masks and investigated user satisfaction, manoeuvrability and effect on isolation of microbes during mock operations. 3-knots method: involves donning surgical mask in conventional way then pulling the lower knot up and tying it with the upper strings so that the knot of the lower two strings can be moved up to the occipital bone. Elastic band method: an elastic band (e.g. hair band) is used to link the lower 2 strings to make them elastic. 100 participants including surgeons, anaesthesiologists, nurses and interns from Beijing Shijitan Hospital, China were enrolled and instructed to don masks as close fitting to the face as possible at normal speed following conventional method (Conventional group),	None.

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		the 3-knots method (3-knots group) and elastic band method (elastic band group). Each participant lowered and raised their head 10 times. Time to don the mask, close fitting rates and satisfaction were measured. The Mock operation experiment involved 3 groups: conventional, 3-knots and elastic band group. All variables were strictly controlled including operation performed in same operating room (OR) with standard laminar flow (ISO 14644-class 6 standard), all personnel used same batch equipment including lace-up masks, disposable surgical caps, sterilised fabric surgical coats and disposable shoe covers. 5 staff entered the OR (1 surgeon, 2 assistants, 1 anaesthesiologist and 1 instrument nurse) and performed 10 mock operations per group each lasting for 2 h simulating real operations; each operation was at least 2 h apart; OR was thoroughly cleaned after each operation. Total of 5 (9cm) petri dishes were placed on sterile area and instrument table after laying sterile drapes and were collected at end of operation, cultured and number of colony-forming units (cfu) was enumerated. Findings from the participants' experience show that close-fitting rates are 47.0%, 92.0% and 100.0% in the conventional, 3-lmpts and elastic band groups respectively (P<0.001); satisfaction scores by numerical rating score from 0-10 were 5.06 ± 2.22, 6.89 ± 1.86 and 7.10 ± 1.72, respectively (P<0.001); the required times were 14.32 ± 2.20, 25.76 ± 5.13 and 27.37 ± 5.11 s, respectively (P<0.001). In the mock operation experiments, there were statistically significant difference in microbial contamination of the sterile area between the conventional group and 3-knots group (37.5 (13) vs 18 (8) cfu, P<0.001), as well as between the conventional and elastic band groups (37.5 (13) vs 17(10) cfu, P<0.001). Findings from this study suggest that compared with the conventional method, the 2 new methods (3-knots and elastic band methods) achieved closer fit, higher satisfaction rates and led to lower contamination of	

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		sterile field however, both methods required more time to don. Further studies are required in real surgeries (e.g. RCTs with patient outcomes) to explore protective effect of the 2 methods.	
Safe Management of the Care Environment	Does enhanced environmental cleaning reduce carbapenem-resistant *Acinetobacter baumannii* colonization in the intensive care unit? Seok H. et al. International Journal of Infectious Diseases. 109 (pp 72-76), 2021	This prospective intervention study evaluated whether enhanced environmental cleaning reduces acquisition of carbapenem-resistant *Acinetobacter baumannii* (CRAB). Study population was ICU patients admitted between July 2018 – June 2019) at a tertiary teaching hospital in Ansan, Republic of Korea. The intervention consisted of alternating enhanced environmental cleaning and routine cleaning every 3 months during study period in the surgical ICU (SICU; n=18 beds). Routine cleaning of bed area and equipment were carried out with quaternary ammonium disposable wipes by nurse aid on night shift once daily or after patient discharge. Enhanced cleaning was cleaning and disinfection of high touch surfaces (including bed rails, bed frames, tray tables, bedside tables, handles, IV poles, blood pressure cuffs, deep vein thrombosis prevention pumps and patient monitors) with quaternary ammonium and cleaning of floors with sodium hypochlorite twice daily by trained cleaning staff during the day time in addition to routine cleaning. Incidence, prevalence and colonization pressure of CRAB were assessed. Over the 1-year study period, 848 patients were admitted to the SICU and 131 patients had CRAB. Findings show incidence rates of CRAB with and without enhanced cleaning were 16.3 and 13.9 cases per 1000 population respectively; prevalence rates were 66.9 and 61.7 cases/1000 population respectively; colonization pressure was 53.3% and 51.3% respectively. No significant association was found between enhanced environmental cleaning and the incidence (P=0.156), prevalence (P=0.888) and colonization pressure (P=0.825) of CRAB	None.

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		acquisition. The rate of new nurses with <3 years clinical experience was positively correlated with the incidence (P=0.049) and prevalence (P=0.003) of CRAB acquisition but showed no correlation with colonization pressure (P=0.327). Ventilator utilization ratio increased the colonization pressure of CRAB acquisition (P=0.010). This study showed enhanced environmental cleaning is unlikely to reduce CRAB acquisition in this ICU setting; acquisition may be influenced by ventilator utilization ratio and the skill of medical staff than environmental cleaning however further studies are required to confirm findings.	
Safe Management of the Care Environment	Combining pulsed xenon ultraviolet disinfection with terminal manual cleaning helps reduce the acquisition rate of methicillin-resistant Staphylococcus aureus. Kitagawa H et al. American Journal of Infection Control. 49 (8) (pp 1048-1051), 2021.	This before and after pilot study investigated the clinical effect of adding pulsed-ultraviolet light (PX-UV) disinfection to the terminal cleaning protocol of selected ICU (n=6 rooms), emergency ICU (n=20 rooms) and high care ICU (HCU; n=10 rooms) private rooms on the rate of methicillin-resistant *Staphylococcus aureus* (MRSA) acquisition at a Japanese tertiary care hospital. Before intervention (March 2018 – February 2019), patient rooms were terminally cleaned with quaternary ammonium wipes (Safe keep, Kao Corporation, Japan) while sodium hypochlorite disinfectant (JIAEN Foam, Kenei Ltd, Japan) was used on rooms occupied by patients with known *Clostridioides difficile* infection (CDI). During the intervention period (March 2019 – February 2020), two 5-min cycle of PX-UV (UV-B 280-315 nm and UV-C 200-280 nm; >60 Hz frequency) disinfection per room was performed in addition to the manual terminal cleaning protocol after patient discharge or transfer. During the intervention period, 85.7% rooms were terminally disinfected with PX-UV device according to the protocol however PX-UV disinfection was not completed in 5.4% of the rooms and not performed at all in 8.9% of the rooms (mainly due to device unavailability). In the intervention units,	None.

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		the incidence of MRSA acquisition decreased from 3.56 to 2.21 per 1,000 patient-days during the intervention period (no p-value provided). A regression model showed implementation of PX-UV disinfection decreased the risk of MRSA acquisition (Incidence rate ratio [IRR]: 0.556, 95%CI: 0.309-0.999, P=0.0497). The study authors concluded that the addition of PX-UV disinfection to terminal cleaning reduced the rate of MRSA acquisition however further multi-centre high quality studies are required with sufficient power calculations to confirm findings.	
Eye/Face Protection	Efficacy of personal protective equipment against coronavirus transmission via dental handpieces. Ionescu AC et al. Journal of the American Dental Association. 152(8):631-640, 2021 08.	This laboratory study evaluated the efficacy of surgical mask IIR, KN95/FFP2 respirator, FFP3 respirator and reusable face shield (Dental World) and high-volume evacuation (HVE) against human coronavirus type 229E (HCoV-229E) during a simulated standard dental procedure. Manikins were used as patient and operator to recreate a dental setting inside a custom-built class III cabinet-chamber (100x40x40 cm). A 1 mL suspension of HCoV-229E with viral load (SD) 6.03 (0.04) gene copies/mL prepared in an artificial saliva solution was inoculated into the mouth of the patient manikin during a dental procedure lasting 10 s using an air turbine handpiece and HVE. The efficacy of PPE worn by operator manikin in different combinations (surgical mask, no HVE; surgical mask, HVE; FFP2 HVE; FFP3 HVE; surgical mask, face shield, HVE; FFP2, face shield, HVE) was tested by detecting presence of HCoV-229E via qRT-PCR. Results show that without a face shield, mean viral loads from external surfaces of masks and respirators ranged from 1.2 - 1.4 $\log_{10}$ gene copies/cm^2. When face shield was worn, viral loads dropped below the detection limit (<0.317 $\log_{10}$ gene copies/cm^2) for all PPE. Viral loads were 0.6 – 0.8 $\log_{10}$ gene copies/cm^2 on the operator's forehead while inside	None.

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		the operator manikin's mouth, viral loads were under the detection limit when using any PPE ± face shield. HVE did not significantly change viral loads in any experimental run (all P>0.05). Findings from this laboratory study show that surgical mask or respirator combined with face shield reduced viral loads below the detection limit and decreases risk of PPE and operator contamination. Further clinical studies are required with longer AGPs duration to confirm findings.	

Evidence table – TBPs - literature identified

Literature review	Papers identified	Summary of scientific findings	Impact on recommendations
	None identified.		

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

Literature review	Papers identified	Summary of scientific findings	Impact on Recommendations
Management of incidents and outbreaks in a neonatal unit (NNU)	None identified.		