

Sink interventions in the ICU to reduce risk of infection or colonization with gramnegative pathogens? A systematic review of the literature

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INTRODUCTION

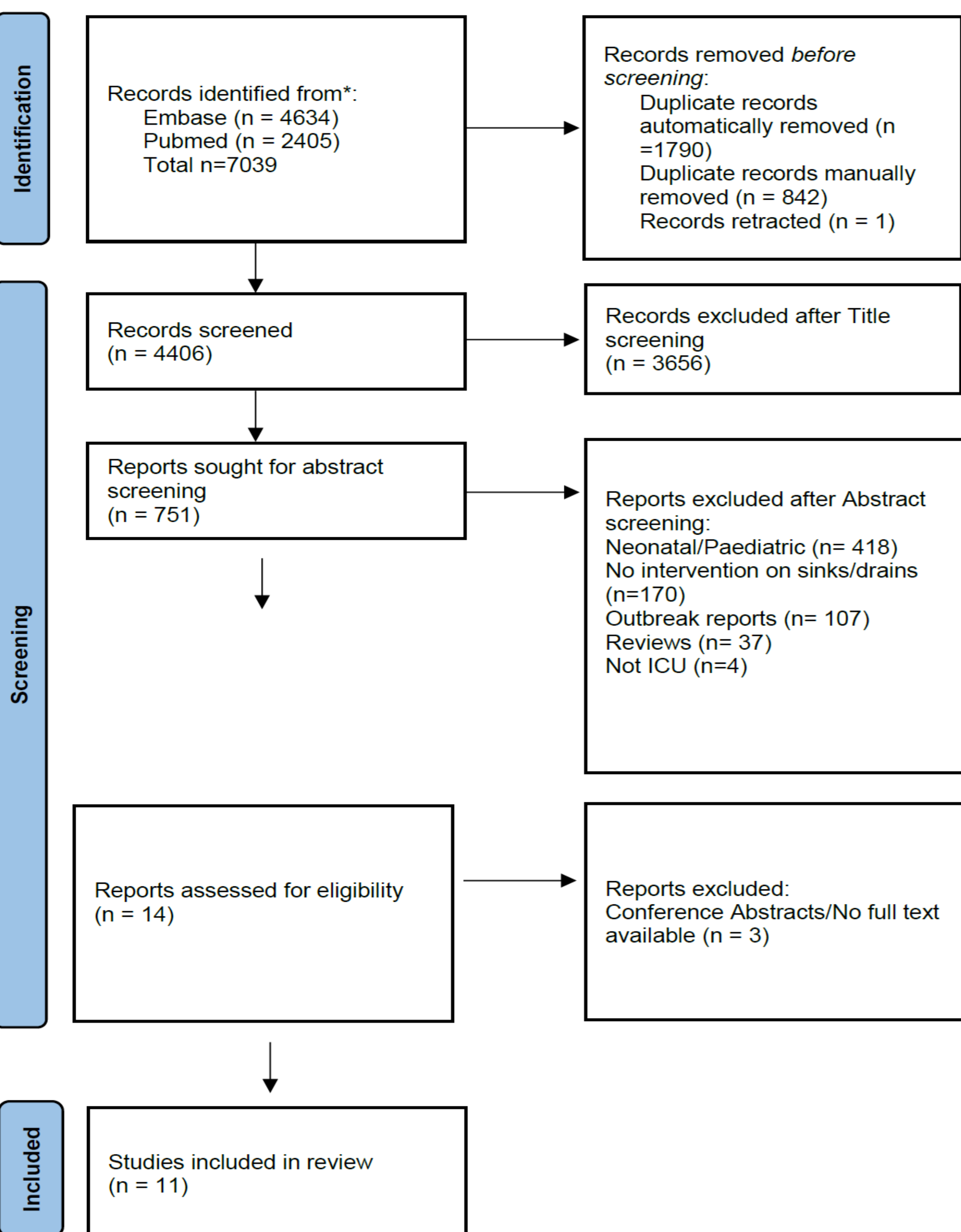
Nosocomial infections are a major problem in intensive care units (ICU)(1). The hospital water environment is a potential reservoir for gramnegative bacteria (GNB) and it has been shown that contaminated sinks contribute to the spreading of GNB in outbreak settings (2). Anyway, the relative contribution of sinks to nosocomial infection and the best approach to risk mitigation remains unclear.

AIM

Aim of this review was to look for evidence and evaluate the effectiveness of interventions on sinks and drains in the intensive care as a preventive measure to reduce endemic infection and colonization rates with GNB.

METHOD

We searched two online Databanks (Medline via PubMed and Embase via Ovid) and ClinicalTrials.gov without language or date restrictions. Studies of any design were included if they described an intervention on the water outlets in patient rooms and presented data about nosocomial infection or colonization rates. Acquisition (infection and/or colonization) rates of GNB and of *Pseudomonas aeruginosa* (PA) were analyzed as outcomes. Studies reporting outbreaks or focusing on *Legionella* species were excluded.



RESULTS

No randomized controlled trial (RCT) were included and all the studies were reported to have a moderate to serious risk of bias with the ROBINS-I-Tool. Investigated interventions included sink removal (n=3), water filters (n=3) and sink trap heating and vibration devices (n=2). Six studies reported *P. aeruginosa* infection or colonization as an outcome. Ten out of eleven studies reported a lower rate of colonization or infection with GNB after intervention. Strong differences in reported outcomes and sample size resulted in high heterogeneity among studies therefore metaanalysis was not possible.

Interventions involving sinks and sink use in the included studies.

First author, Year of publication	Main interventions					Co-Interventions			
	Water filters	Sink removal	New taps	Syphon heater and vibration device	Hopper covers (waste water interventions)	Intensified cleaning	Stop discharging water in sinks	Water-free daily hygiene	2% CHX Bathing
Barna, 2014	X								
Chico-Sánchez, 2022	X								
De-las-Casas-Cámara, 2019		X							
Garvey, 2017	X		X			X	X		
Garvey, 2019	X		X			X	X		
Hopman, 2017		X						X	
Mathers, 2018				X	X				
Shaw, 2018	X	X				X	X		X
Sissoko, 2004				X					
Trautmann, 2008	X						X		
Wolf, 2014				X					

Studies analysis. *Classification based on Cochrane Handbook for Systematic Reviews

First author, Year of publication	Study location	Study design*	Study setting	Sample size, patients	Intervention	Pathogen	Conclusions
Barna, 2014	Hungary	follow-up study	12-bed ICU	82	Water filters	PA, Legionella sp.	No new PA acquisitions when filters in place. Overall infection rates were unchanged.
Chico-Sánchez, 2022	Spain	controlled before-after-study	two 6-bed medical ICUs, two 6-bed CCRU	2,156	Water filters	PA, S. maltophilia	Filters in the water taps in critical care units did not modify the incidence of PA infections.
de-las-Casas-Cámara, 2019	Spain	uncontrolled before-after-study	8 single patients rooms	951	Sink removal	non-fermenting GNB	The removal of sinks contributed to a significant reduction of GNB isolates.
Garvey, 2019	UK	uncontrolled before-after-study	100-bed ICU	-	Multiple interventions	PA	Installation of appropriately designed tap outlets and cleaning methods were effective in reducing PA infections
Garvey, 2017	UK	uncontrolled before-after-study	100-bed ICU	-	Multiple interventions	PA	The introduction of filters, holistic interventions and new taps was associated with a sustained decrease in the acquisition of PA
Hopman, 2017	Nether-lands	uncontrolled before-after-study	34-bed ICU	2,940	Sink removal, water free patient care	GNB, yeast	The removal of sinks in patient rooms and implementation of water-free patient care is associated with a significant reduction of GNB acquisition. The difference was more pronounced for patients with longer LOS.
Mathers, 2018	USA	uncontrolled before-after-study	60 ICU single patients rooms	15,210	Hopper covers, sink trap heating and vibration device	K. pneumoniae	Hopper covers and sinks trap devices in patient rooms decreased nosocomial acquisition of multispecies KPCOs
Shaw, 2018	Spain	uncontrolled before-after-study	Two 12-room ICU wards	-	Multiple interventions	PA, K. pneumoniae	Removing sinks from patients' rooms and implementing other water-safe measures can be effective in reducing MDR-GNB acquisition in highly endemic ICU settings
Sissoko, 2004	Germany	uncontrolled before-after-study	Inter-disciplinary ICU	-	sink trap heating and vibration device	-	A reduction in the incidence of nosocomial infections was noted with the use of sink trap devices
Trautmann, 2008	Germany	uncontrolled before-after-study	three 1-bed, four 2-bed surgical ICU rooms	1,234	Water filters	PA	Water filtration reduced PA infections on a surgical ICU.
Wolf, 2014	Nether-lands	uncontrolled before-after-study	15-bed ICU	-	sink trap heating and vibration device	ESBL-Bacteria	No new acquisition of ESBL-Bacteria after implementing sink trap devices

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CONCLUSIONS

The interventions observed in our review were mostly effective in reducing colonization/infection rates with GNB in the ICU. Differences in reported outcomes, sample size and baseline incidence rates for GNB acquisition resulted in high heterogeneity. This strongly limits transferability of results to other settings. There is a need for more studies which should including prospective screening of patients and the environment, complete analysis of confounders, use of whole-genome sequencing, and before- after or cluster randomization to achieve a higher grade of evidence.

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