Descriptors of included studies

	Author/date/ country	Theme	Aim/research question	Study design/ population	Level of evidence*	Key findings	Conclusion/ implications	Limitations of the study
1	Ahmad et al. 2019 Pakistan	Staff behaviour/ compliance	To identify the plastic surgeons' views about the use of a surgical masks in operating theatres.	Comparative study with non-concurrent control. *n* = 200? (surveys were sent to 200 plastic surgeons but number who participated in the survey not stated)	III-3	Group A: plastic surgeons from subcontinent. Group B: plastic surgeons from USA and Europe. Wear mask in OR: (group A: 93%, group B: 83%) Use disposable mask: (group A: 96%, group B: 99%) Use reusable/washable masks (group A: 4%, group B:1%) Use masks covering the nose (group A: 59%, group B: 63%) Botox and filler infections were the most common procedures where the surgeon omitted wearing a mask (group A: 74%, group B: 68%), followed by liposuction (group A: 41%, group A: 34%). The majority of both groups believed that facemasks decrease the SSIs.	More than one third of surgeons were not covering the nose while wearing the mask in OR. Two thirds of surgeons wished not to wear the mask if given the choice. The reasons could be personal to many surgeons but generally surgeons wearing spectacles find it difficult to cope with the for effect while breathing in the mask especially if the nose is also covered. Majority of surgeons in both groups did not wear the mask when patient entered the OR to alleviate the anxiety of the patient by adding the recognisable faces in the hostile environment. Only plastic surgeons surveyed.	Low quality study methods. No data about: the countries where participants actually practice, the number of participants who replied to the questionnaire, the method of sending the questionnaire. The low quality of questionnaire. It is not possible to identify the association between the type of procedure and the use of masks from the questionnaire as documented. Ethical consideration: participants were required to write their name on the questionnaire which might have influenced the results.
2	Cook et al. 2019 USA	PPE	To identify debris in the spine surgical field that frequently rises to the level of the surgeon's face during several different elective spine procedures.	Comparative study with non-concurrent control (non-randomised experimental trial). *n* = 46 (consecutive elective spine surgeries from a single surgeon)	III-3	Debris was found on the face shields of the surgeon in 83% of cases, of the first assistants in 35% and of scrub nurses on 0%. The greatest debris exposure rates occurred with transformational lumbar interbody fusions (100%), open laminectomy (100%) and anterior cervical discectomy (93%).	High rate of blood and tissue debris contact that during spinal surgery who requires burrs, osteotome or the more aggressive instruments. Surgeons may consider using sterile shields particularly in high-risk cases to protect themselves and their patients to preventing debris rebounds back into the surgical field off a nonsterile facial covering.	Not randomised. No link to actual infection rates: contamination is not necessarily associated with a biological state of infection, as this implies the presence of a microorganism causing damage to body tissue. Small sample size: low generalisability. Non-blinded: Hawthorne effect.

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3	Dallolio et al. 2017 Italy	Staff behaviour/ compliance	To assess the microbiological quality of operating settings and the staff compliance to the SSI evidence-based control measure.	Observational comparative study with non-concurrent control. *n* = 10 for Obsercation 1 *n* = 10 for Observation 2	III-2	Caps and masks were worn correctly by 65% of theatre staff. Surgeons and scrub nurses showed the highest compliance (89.5%) compared to unscrubbed personnel (68.7%) and personnel not directly related to the procedure (47.4%)	Unscrubbed theatre staff and personnel not directly related the procedure (e.g. anaesthetists or nurses who came to ask for information) appeared to show lower compliance to best practice therefore more likely to contribute to the environmental contamination.	Not randomised. No link to actual surgical site infection rates. Small sample size: low generalisability. Non-blinded: Hawthorne effect.
4	Herron et al. 2019 UK	Staff behaviour/ compliance.	To assess whether theatre staff wear masks in accordance with manufactures'/CDC guidelines for use	Comparative study with concurrent control (non-randomised experimental trial). *n* = 1034 (surgical scrubbed staff from nine large high-performing hospitals)	III-2	Only 18% of scrubbed surgical staff fully complied with the CDC guidelines for applying of a facemask. Compliance was higher in 'clean' procedures such as orthopaedic surgery and lower in surgeries classified as 'unclean'.	Most operating theatre staff do not follow CDC guidelines when putting on a face mask, which may increase SSI rates. Staff are not aware of existing guidelines for donning a mask.	Not randomised: it would be unethical to conduct RCT (wearing/omitting a surgical mask during procedures). No link to clinical data of actual infection rate. Non-blinded: Hawthorne effect.
5	Howard et al. 2020 USA	Efficacy	To evaluate current guidance from the National Personal Protective Technology Laboratory (NPPTL) and the Association of periOperative Registered Nurses (AORN) to determine if the presumed risk to the patient or sterile field is increased by positive airflow surgical helmet usage.	Comparative study with concurrent control (non-randomised experimental trial). *n* = 4	III-2	Surgical masks and two types of surgical helmet systems significantly decreased aerosolised droplet contamination. Surgical masks decreased the contamination by 98.48% and both types of surgical helmet systems reduced contamination by 100% compared with no facial covering.	Surgical masks and positive airflow surgical helmet systems both are presumed to be effective to reduce aerosolised droplet contamination into a sterile field.	No link to clinical data of actual infection rate. Non-blinded: Hawthorne effect. Small sample size: low generalisability.
6	Kang et al. 2017 USA	Staff behaviour/ compliance	To describe the knowledge, attitudes and practices of healthcare personnel on PPE use. To assess the performance of healthcare personnel regarding PPE procedures with different types of PPE. To identify potential breaches in and barriers to PPE compliance.	Comparative study with non-concurrent control (observational descriptive study). *n* = 130 total simulated session from 65 participants	III-3	Quoted narrative survey responses from the participants specific to the use of masks: 'We need to be forthcoming about whether it truly works and what the costs are behind all the yellow gowns and mask'.	Doubting the effectiveness of PPE including masks caused by lack of knowledge or/awareness of the evidence may be a barrier to PPE compliance.	Not specified in operative environment. Non-randomised, non-blinded. High risk of Hawthorne effect.

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7	Liu et al. 2019 China	Efficacy	To investigate the factors involved in surgical masks bioburden which were identified to be a potential source of SSI.	Comparative study with concurrent control (non-randomised experimental trial). *n* = 50 (mask use cases)	III-2	Bioburden of mask A was the highest. Bioburden of mask B was the lowest. Mask C possessed the lowest filtering efficiency and the highest airflow resistance. Surgical mask bioburden was higher in the speaking group. Surgical mask bioburden showed no significant difference after washing the face, despite the finding that washing could significantly reduce facial bioburden.	Multiple factors influence surgical mask bioburden. Mask B showed the lowest bioburden and best protection effects. Mask C is not recommended to be used, especially considering that surgeons do not wash the cloth mask daily. Unnecessary talking during operation is not recommended. Washing the face before surgery is not strictly necessary.	Not randomised. No direct correlation between mask and SSI. Non-blinded: possible Hawthorne effect. The external surface of mask was the region of interest; however, the sampling operation could increase the risk of cross-contamination. Sampling operation could increase the risk of cross-contamination. There are likely various brands of masks made of different materials. Some might perform better than others in preventing microbial shed.
8	Loison et al. 2017 France	Staff behaviour/ compliance	To assess the discipline of OR staff by measuring compliance with clothing regulations and traffic flow during surgical procedures. To investigate the reasons for non-compliance.	Observational, descriptive, non-experimental study *n* = 1615 (41 health care facilities, 295 operations).	III-3	Full compliance was seen in 56 per cent of personnel with the position of a surgical mask (placed incorrectly over the nose and mouth) being the third highest contributor to non-compliance after presence of hand jewelry and position of head cover. Nurses showed higher compliance with the position of the facemask (99%) compared to surgeons (95%), anaesthetists (89%).	OR staff sometimes omit the basic rules of discipline as a matter of routine, even in the presence of clear national/local guidelines. The lack of awareness and knowledge of regulations may explain the relatively low compliance with clothing regulations observed in some cases in this study. The low level of evidence regarding the impact of surgical attire on the risk of infection is controversial among both experts and OR staff.	No randomised or blinded trial. Data was collected by direct observations and were probably subject to the Hawthorne effect. Different auditors in the different health care facilities.

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9	Palmiero et al. 2016 USA	Staff behaviour/ compliance	To assess the suitability of speech transmission index (STI) methods for testing reusable and disposable facial mask and respiratory PPE commonly used by healthcare personnel. To quantify STI levels of these devices. To contribute to the scientific body of knowledge in the area of STI.	Comparative study with concurrent control (non-randomised experimental trial). *n* = 6 (used a manikin with three different types of mask; each type of mask had two different models)	III-2	Compared to a no-mask condition protective face masks and N95 respirators both had some impact on speech intelligibilty. Protective face masks had lower impact (3% and 4% deviation for the two models tested) than N95 respirators (13% and 17% deviation for the two models tested).	Protective facemasks showed the least impact on speech intelligence followed by N95 masks and elastomeric half-mask air-purifying respirators due to the design of each mask to meet their purposes. N95 mask and elastomeric half-mask air-purifying respirators are designed to adhere firmly between the masks and face and made of thick materials to provide higher respiratory protection. However, protective masks are not intended to use for respiratory protection.	Non-human testing. Uni-directionality and difficulty to generalise findings based on the limited number of samples used for each PPE type. The manikin models did not contain exhalation valves or voicemitters, which may have influenced the results.
10	Parry et al. 2016 USA	Efficacy (beard)	To determine whether nonsterile surgical hoods reduce the risk of bacterial shedding posed by beards.	Comparative study with concurrent control (non-randomised experimental trial). *n* = 20 (10 bearded surgeons and 10 clean-shaven surgeons)	III-2	Surgical hoods did not decrease the total number of anaerobic and aerobic colony-forming units (CHUs). Unmasked surgeons shed was significantly higher than the number of CFUs shed while masked. The bearded group did not shed more than the clean-shaven group while unmasked, masked or hooded.	Bearded surgeons did not appear to have an increased likelihood of bacterial shedding compared with their non-bearded counterparts while wearing surgical masks. The addition of nonsterile surgical hoods did not decrease the amount of bacterial shedding observed.	Conflict of interest: two of the authors received financial support from several medical companies. Small sample size: low generalisability. No link between the results and the clinical infection rates. No randomised or blinded trial. This study likely underestimated the protective ability of both masks and hoods by eliminating confounding factors, such as talking and movement of the head and neck.

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11	Patel et al. 2016 USA	Efficacy	To assess the contribution of facemasks to exposure reduction when worn at the source of infection (source) relative to facepieces worn for primary (receiver) protection and the factors that contribute to each.	Comparative study with concurrent control (non-randomised experimental trial). *n* = 34 (two manikins under the various conditions)	III-2	With cough, source control (mask or respirator on source) was statistically superior to mask or unsealed respirator protection on the receiver (receiver protection) in all environments. During tidal breathing, source control was comparable or superior to mask or respirator protection on the receiver. Each mask on the source markedly reduced receiver exposure even if the mask had a poor capture efficacy. Here deflection was the important mechanism in reducing receiver exposure.	Source control via surgical masks may be an important adjunct defence against the spread of respiratory infections. The fit of the mask or respirator in combination with the airflow patterns in a given setting are significant contributors to source control efficacy. 1 Source (HCWs) wearing any type of mask can reduce receiver (patients) exposure even if the mask had a poor capture efficacy in any environment settings (no airflow room, hospital room fitted with an input and output ceiling fan, negative pressure room). 2 Filtration at the source: deflection is the important mechanism in reducing receiver exposure. Outward leakage (percentage reduction): natural fit mask with loop ties (5-20%), fitted surgical mask (50%), N95 mask (80-90%), N95 with seal (100%).	Directions of airflow and head position were fixed and changes in direction may affect the observations. In an actual hospital setting, the airflow and ventilation may vary based on room design, location of the vents and position of the patient and HCW. However, previous research showed that exposure to potentially infectious aerosols anywhere in the room was unaffected by head position. The result may differ in theatres with different kinds of ventilation systems.

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12	Spruce 2016 USA	PPE	To discuss the changes in the AORN guideline document, as compared to previous editions, and highlight some critical and challenging concepts perioperative professionals face in everyday practice.	Review of meta-analyses, RCT, non-RTC, and studies, systematic, and non-systematic reviews and opinion documents and letters. *n* = 123 articles extracted from 885 research papers	III-2	Surgical masks are not only for the patient's protection but also provide protection for the wearer from exposure to blood, body fluids or other potentially infectious materials. A study involving 8500 surgical procedures showed that 26% of exposures to blood were to the heads and necks of scrubbed personnel and 17% of blood exposures were to circulating personnel.	Unscrubbed personnel should protect themselves from potential exposure by wearing masks while in the operating room.	The articles used were out-dated.
13	Stockwell et al. 2018 Australia	Efficacy (duration)	To investigate the efficacy, tolerability and functionality of face masks as source control after extended wear.	Comparative study with concurrent control (non-randomised experimental trial). *n* = 35 (25 participants with cystic fibrosis and 10 healthy volunteers)	III-2	The amount of aerosol colony-forming unit (CFU) counts were significantly decreased when wearing any type of surgical mask compared to not wearing a mask during the cough test ($p < 0.001$). There was no significant difference of CFU counts among the different durations of wearing the surgical masks: 10 minutes, 20 minutes and 40 minutes.	The efficacy of surgical masks at reducing the release of *P. aeruginosa* cough aerosols in people with cystic fibrosis and patient tolerability and functionality of the masks as source control after 40 minutes of total wear, which was the longest duration in this study.	Actual infectious dose of *P. aeruginosa* is unknown. Non-randomised Non-blinded: Hawthorne effect. Small sample size: low generalisability. The maximal duration was 40 minutes. The efficacy of the masks worn more than 40 minutes is unknown. Inward protection of wearing a surgical mask was not assessed.
14	Wong et al. 2013 Hong Kong	Staff behaviour/ compliance	To investigate the effects of clinicians wearing facemasks on patients' perception of clinicians' empathy, patient enablement and patient satisfaction.	Randomised control trial (non-blinded). *n* = 1030 (with mask: *n* = 514, without mask: *n* = 516)	II	No significant difference in patient enablement ($p = 0.87$) and satisfaction ($p = 0.25$) between two groups. Wearing facemasks during consultations reported significant negative impact on the patient's perception of the clinician's empathy ($p = 0.04$). The fact of 'knowing the doctor well' significantly lowered the CARE score ($p = 0.03$).	Facemasks that hides clinicians' facial expressions may negative impact on the non-verbal communication that enhances relational empathy and continuity between clinicians and patients. Care must be undertaken with appropriate infection control particularly for medical physicians or other healthcare personnel where optimisation of the therapeutic relationship is essential.	Non-blinded. Small sample size (nine clinicians from two hospitals): low generalisability. Study took place in primary care clinics; the patient expectations would be different in OR.

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15	Zhiqing et al. 2018 China	Efficacy (duration)	To investigate whether surgical masks may be a potential source of bacterial shedding leading to an increased risk of surgical site infection. To answer three questions: 1. Does the mask get contaminated if the wearing time is extended? 2. What is the source of contamination of the mask surface – surgical personnel or airborne contamination? 3. Will higher filtration reduce external surface contamination of masks?	Comparative study with concurrent control (non-randomised experimental trial). *n* = 40 (total joint arthroplasty from four surgeons)	III-2	The bacterial count on the surface of surgical mask increased with extended operating times; significant difference was found between the four to six hours group and zero hours group. A significant increase was noted in the two hours group when the analysing the bacterial counts from the same surgeon. The bacterial counts were significantly higher among the surgeons than OR. The bacterial count of the external surface of the second mask was significantly higher than that of the first one.	The source of bacterial contamination in surgical masks was the body surface of the surgeons rather than the OR environment. Surgical masks could be the source of bacterial shedding when worn for extended periods of time; therefore, surgeons must change the mask in every operation interval. Bacteria on the external surface of the surgical masks are more likely from surgeons, which might be related to the surgeons' hygienic practices; therefore, surgeons must place more emphasis on face–mouth cleanliness and personal hygiene High filtration masks, such as double-layered masks, could be an effective measure in reducing mask contamination.	Not randomised No link to actual surgical site infection rates. Data was collected by direct observations and were probably subject to the Hawthorne effect. Small sample: low generalisability. Sampling operation could increase the risk of cross-contamination. There are likely various brands of masks made of different materials. Some might perform better than others in preventing microbial shed.

* The levels of evidence used are from the National Health and Medical Research Council (NHMRC) Evidence Hierarchy (www.ncbi.nlm.nih.gov/books/NBK121300/table/appb.t21/).