Appendix 3 Results

A. Home Treatment group

Study	Aim of the paper	Type of study	Sample size	Type of procedure	Skin preparation	Sampling method	Results reported as "most effective"
Dizay et al (2017)	Evaluation of effectiveness of 1.2%/5% C/BPO in decreasing *C. acnes* inoculation of shoulder. Determination of time-related effects of home treatment on *C. acnes* colonisation.	Cohort study	65 patients (43 male/22 female)	Arthroscopy	C/BPO 1.2%/5% gel Application once per day every day between pre-operative appointment and day of surgery (randomisation:1-10 applications, average 2.3 applications)	Skin swabs Tissue swabs	**C/BPO effective** Positive cultures in pre-surgical skin swab: > 1 application of C/BPO=25.8% = 1 application of C/BPO=33.3 % Positive cultures in post-surgical tissue swab: C/BPO=3.1%
Duvall et al. (2019)	Evaluation of the decrease in	Case series	34 healthy	No procedure	5% BPO gel Application once	Deep sebaceous	**BPO effective in decreasing *C. acnes* but not permanently**

	C. acnes load on the shoulder after application of 5% BPO, to determine whether the decrease in *C. acnes* load is transient, and to quantify the amount of rebound.		volunteers (23 male/11 female)		per day for 3 days (total 3 applications)	glands samples	Anterior: avg log reduction = -0.44 Avg log rebound = 0.69 (p=0.003) Posterior: avg log reduction = -0.64 Avg log rebound=0.78 (p=0.008) Lateral: avg log reduction = -0.64 Avg log rebound = 0.75 (p=0.003) Axilla: avg log reduction=-0.40 Avg log rebound=0.31 (p=0.10) Differences pre – treatment vs rebound CFU counts: Anterior: (p=0.29) Lateral: (p=0.33) Posterior: (p=0.66) Axilla: (p=0.69)
Heckman et al. (2019)	Comparison of effectiveness of 5% BPO monotherapy, 1 % clindamycin monotherapy and 5 %BPO+1 % clindamycin	Cohort study	12 healthy volunteers (10 male/2 female)	No procedure	5 % BPO gel vs 1% clindamycin vs 5% BPO+1% clindamycin Application twice per day for three	Dermal punch biopsy specimen	**None effective in eradicating *C. acnes*** **BPO in decreasing *C. acnes*** Summary of positive culture results NC= 33% BPO=8.3% CL=16.7% C/BPO=16.7% Positive biopsy cultures results:

	combined therapy in eradicating *C. acnes* in the shoulder dermal layer skin				days and with last application being the morning of specimen collection (total 6 applications).		NC vs BPO (p=0.0833) NC vs C/BPO (p=0.1573) NC vs CL (p=0.1573)
Hsu et al. (2020)	Comparison of the effectiveness of home 4 % CGH washes with 10 % BPO soap in reducing *C. acnes* levels on the skin surface and incised wound edge.	RCT	49 male patients	Arthroplasty	4 % CHG solution vs 10 % BPO soap Application the night prior to and the morning of surgery (2 applications)	Skin surface swabs Dermal edge swabs	**None** Skin swabs: SpCuV similar in both groups (CHG 1.6 ± 1.1 vs. BPO 1.5 ± 1.4, p = 0.681) with 100 % positivity Dermal edge swabs: similar in both groups (CHG 0.8 ± 1.0 vs. BPO 0.8 ± 1.4, p = 0.991) and positive cultures CHG 61% vs BPO 46%, p = 0.369]
Kolakowski et al. (2018)	Evaluation of effect of 5% BPO gel compared with 4% CHG solution on the *C. acnes* skin burden.	RCT	80 patients (37 male/43 female)	Arthroplasty (n=27) Arthroscopy (n=53)	5% BPO gel vs 4% CHG solution Application of both solutions 3 mornings prior surgery (total 3	Deep sebaceous glands samples	**BPO** Decrease of positive cultures BPO treated site > BPO non-treated site (p=0.0003) Decrease of positive cultures CHG treated site = CHG non treated site (p=0.80) Decrease of positive cultures BPO (anterior)

					applications)		> CHG (anterior) (p= 0.027) Decrease of positive cultures BPO (posterior) > CHG (posterior) (p= 0.005) Decrease of positive cultures BPO (lateral) > CHG (lateral) (p=0.081) Decrease of positive cultures BPO (axilla) = CHG (axilla) (p=0.99)
Matsen et al. (2020)	Evaluation of effectiveness of 4% CHG solution as home treatment in eliminating *C. acnes* and other bacteria in patients undergoing shoulder surgery	Cohort study	66 patients (44 male/22 female)	Arthroplasty	4% CHG solution vs no comparison Application the night before and morning of surgery (total 2 applications)	Skin surface swabs Dermal edge swabs	**None** Average SpCuV 1.0 ± 0.9 prior CHG application = 1.0 ± 1.1 post CHG application and prior surgery (p= 0.585) Positive dermal cultures: 24 % patients (vs 3% +ve cultures for CoNS)
Sabetta et al. (2015)	Evaluation of effectiveness of 5% BPO in reducing *C. acnes* in shoulder arthroscopic	Case Series	50 patients (23 male/27 female)	Arthroscopy	5% BPO vs no comparison Application twice per day 48 hrs prior trial day, totally 5 times	Skin swabs Joint fluid aspirate Deep tissue samples	**BPO** Pre-surgical skin preparation: BPO treated anterior deltoid shoulder positive skin swabs= 16% vs Non- treated anterior deltoid shoulder

	patients						positive skin swabs= 32% (p=0.001) BPO treated axilla positive skin swabs= 8% vs Non-treated axilla positive skin swabs=28% (p=0.013) Post-surgical skin preparation: Positive cultures samples=6.25% Prior skin closure positive skin swabs=10%
Sheer et al. (2018)	Evaluation of effectiveness of 5% BPO gel in reduction of *C. acnes* compared with 4% CHG shower solution	RCT	40 healthy volunteers (24 male/16 female)	No operation	5% BPO gel vs 4% CHG solution BPO: application twice per day 48 hrs prior trial day, totally 5 times CHG: application the day prior trial twice with 2 sponges each, and once with 2 sponges the day of trial (total 3	Skin swabs	**BPO** Positive cultures (post BPO application and surgical skin prep) BPO=5% CHG= 35% p=0.044

					applications)		
Van Diek et al. (2020)	Evaluation of effect of 5 % BPO gel application 5 times on the presence of *C. acnes* on the skin of the shoulder.	RCT	30 healthy volunteers (11 male/19 female)	No operation	5 % BPO gel vs placebo Application during 2.5 days (3 times in the morning and 2 times in the evening) total 5 times	Skin swabs	**BPO** Positive cultures BPO = 20% Placebo = 71.4 % p=0.003

avg log= average logarithmic BPO=Benzoyl Peroxide; C/BPO-Clindamycin/Benzoyl Peroxide; CHG = Chlorexidine Gluconate; CL= Clindamycin; CFU= Colony Forming Units; CoNs = Coagulase negative *Staphylococcus*; NC = negative control; RCT= Randomised Control Trial; SpCuV = Specimen Cutibacterium Value

B. Surgical skin preparation

Study	Aim of the paper	Type of study	Sample size	Type of procedure	Skin preparation	Sampling method	Results reported as "most effective"
Blonna et al. (2018)	Comparison of efficacy of single surgical skin preparation (1% iodine povidone/50% isopropyl alcohol) against double skin preparation (4% CHG followed by 1% iodine povidone/50% isopropyl alcohol) in patients undergoing	Cohort study	40 patients (8 male/32 female)	Proximal humeral fracture	Single surgical skin preparation vs double skin preparation (Single skin preparation=1% iodine povidone/50% isopropyl alcohol Double skin preparation=4% CHG followed by 1% iodine povidone/50% isopropyl alcohol)	Skin swabs	**Single surgical skin preparation = double skin preparation** Positive cultures: Single surgical skin preparation=17.5% vs double skin preparation=17.5% (p=1) Bacterial load *C. acnes*: Single surgical skin preparation CFU=$9.61*10^2$ vs double skin preparation=$1.61*10^2$ (p=0.07)

	surgical treatment for proximal humeral fracture.						
Chalmers et al. (2019)	Evaluation of effectiveness of 3% Hydrogen peroxide combined with standard surgical skin preparation in reducing positive culture rates in patient undergoing shoulder arthroplasty.	Case Control	61 patients (29 male/32 female)	Arthroplasty	3% H_2O_2 + standard surgical skin preparation vs standard surgical skin preparation (Standard surgical skin preparation: 70% ethyl alcohol + 2 ChloraPrep)	Skin swabs Dermis swabs Joint swabs	**3% Hydrogen peroxide + standard surgical skin preparation** Total swabs positive *C. acnes* cultures: Standard prep=27% (25/93) vs H_2O_2 = 16% (14/90) Total number of patients with 3 positive cultures: Standard prep=19% vs H_2O_2 group=0% (p=0.024) Joint positive cultures: Standard prep=35% vs H_2O_2 group=10% (p=0.031)
Hancock et al. (2018)	Evaluation of effectiveness of 5% BPO combined with standard surgical skin preparation in reduction of *C.*	RCT	22 male healthy volunteers	No procedure	5% BPO + standard surgical skin preparation vs standard surgical skin preparation (Standard surgical	Skin swabs	**None** Total number of participants with positive cultures: 5%BPO + standard prep: n=9 (20%) vs standard prep: n=6 (14%) p=0.57 Number of participants with positive cultures on the anterior deltoid: BPO + standard prep: n=5 (22%) vs

	acnes on shoulder				skin preparation: ChloraPrep)		standard prep: n=4 (18%) p=0.66 Number of participants with positive cultures on the anterior axilla: BPO + standard prep: n=4 (18%) vs standard prep: n= 2 (9%) p= 0.64
Heckman et al. (2018)	Evaluation of the effectiveness of various skin preparation methods in eradicating *C. acnes* in the dermal layer of the shoulder	Cohort study	12 male healthy volunteers	No procedure	70% isopropyl alcohol vs ChloraPrep (2% CHG and 70% isopropyl alcohol) vs 2% CHG and 70% isopropyl alcohol with a 2 minutes mechanical scrub using bristled surgical scrub vs 4% CHG and 70% isopropyl	Dermal biopsies samples	**Nil** Total positive cultures n=24: 70% isopropyl alcohol n=7 (58%) vs ChloraPrep n=5 (42%) vs 2% CHG and 70% isopropyl alcohol with a 2 minutes mechanical scrub using bristled surgical scrub n=6 (50%) vs 4% CHG and 70% isopropyl alcohol with a 2 minutes mechanical scrub using bristled surgical scrub n=6 (50%)

					alcohol with a 2 minutes mechanical scrub using bristled surgical scrub		
Hernandez et al. (2019)	*In vitro* evaluation of effectiveness of H_2O_2 as surgical skin preparation (various concentrations) in eradicating *C. acnes*	*In vitro*	N/a	N/a	0%, 1%, 3%, 4%, 6%, 8% , 10% H_2O_2 in saline or water vs 3% topical H_2O_2 solution	N/a	**3% H_2O_2 solution applied for 5 minutes** 3% H_2O_2 for 5 min vs water-only control: $p<0.0001$ 3% H_2O_2vs 3% hydrogen peroxide in water or saline: $p< 0.0001$
McLean et al. (2018)	Evaluation of effectiveness of 0.1% aqueous chlorhexidine in reduction of *C. acnes* in patients undergoing open surgery	Cohort study	50 patients (22 male/28 female)	Open shoulder surgery	0.1% aqueous chlorhexidine	Dermal swabs	**None** Total positive C. acnes cultures 38/150 (25%) Pre-prep: n=9 5 min post: n=11 60 min post: n= 18 Pre-prep vs 60 min post: p=0.043 5 min post vs 60 min post: p=0.123 Pre-prep vs 5 min post: p=0.617

Phadnis et al. (2016)	Evaluation of effectiveness of ChloraPrep (combined with standard preoperative antibiotic prophylaxis) in reducing *C. acnes* in dermal layer in patients undergoing open shoulder surgery.	Case series	50 patients (30 male/20 female)	Open shoulder surgery	ChloraPrep	Skin swabs Dermal swabs Dermal biopsy specimen	**None** Positive samples pre – prep vs post – prep vs dermal swabs vs dermal biopsy: pre-prep n= 21 (42%) vs post-prep n=7 (33%) vs dermal swabs n=26 (52%) vs dermal biopsy n=20 (40%)
Stull et al. (2020)	Evaluation of effectiveness of 3% H_2O_2 combined with standard surgical skin preparation in reducing positive culture rates in patient undergoing	RCT	140 male patients	Arthroscopy	3% H_2O_2 + standard surgical skin preparation vs standard surgical skin preparation (Standard surgical skin preparation: 2% CHG + 7.5%	Punch biopsy samples	**3% Hydrogen peroxide + standard surgical skin preparation** Positive cultures: H_2O_2 group=17.1% vs control group=34.2% (p=0.033)

	shoulder arthroscopy.				povidone-iodine solution + 2 ChloraPrep		
Yamakado (2017)	Evaluation of effectiveness of 1% CHG and 70% alcohol with drape against 1% CHG and 70% alcohol without drape and against povidone iodine with and without drape in reducing *C. acnes* contamination rate of the anchor sutures in arthroscopic procedure	RCT	126 patients (88 men and 38 women)	Arthroscopy	1% CHG and 70% alcohol with drape vs 1% CHG and 70% alcohol without drape vs povidone iodine with drape vs povidone iodine without drape	Skin swabs	**1% CHG and 70% alcohol with drape** Positive *C. acnes* cultures: 1% CHG and 70% alcohol with drape n=3/32 (9.3%) vs 1% CHG and 70% alcohol without drape n= 10/30 (33%) vs povidone iodine with drape n=11/33 (33%) vs povidone iodine without drape n=14/31 (47%)

CFU= Colony Forming Units; CHG = chlorhexidine gluconate; ChloraPrep= 2% chlorhexidine gluconate + 70% isopropyl alcohol; H_2O_2=Hydrogen Peroxide

C. Aseptic protocol

Study	Aim of the paper	Type of study	Sample size	Type of procedure	Skin preparation	Sampling method	Results reported as "most effective"
Koh et al. (2016)	Evaluation of efficacy of aseptic protocol comprised by home treatment with 4 % chlorhexidine – impregnated scrub, which patients used to shower 24 hours prior surgery, and surgical skin preparation	Cohort study	30 patients (7 male/23 female)	Arthroplasty	Home treatment + Surgical skin preparation. (Home treatment: 4 % chlorhexidine – impregnated scrub – shower 24 hrs. prior surgery. Surgical skin preparation: 4 % chlorhexidine – impregnated scrub followed by 2 applications of	Skin swabs Dermal swabs	**None** Total number of patients with positive *C. acnes* cultures: n=22 (73%) S1=47% vs S2 = 40% (p=0.13) vs S3=27% (p=0.76) vs D4=43% (p=0.19) vs D5=37% (p=0.53) vs S6= 43% (p=0.53)

	which was comprised by 4 % chlorhexidine – impregnated scrub followed by 2 applications of ChloraPrep in reducing *C. acnes* in patients undergoing shoulder arthroplasty.				ChloraPrep		

ChloraPrep = 2% chlorhexidine gluconate and 70% isopropyl alcohol; S=skin swab; D= dermal swab