

Management of acute traumatic wounds to prevent infection



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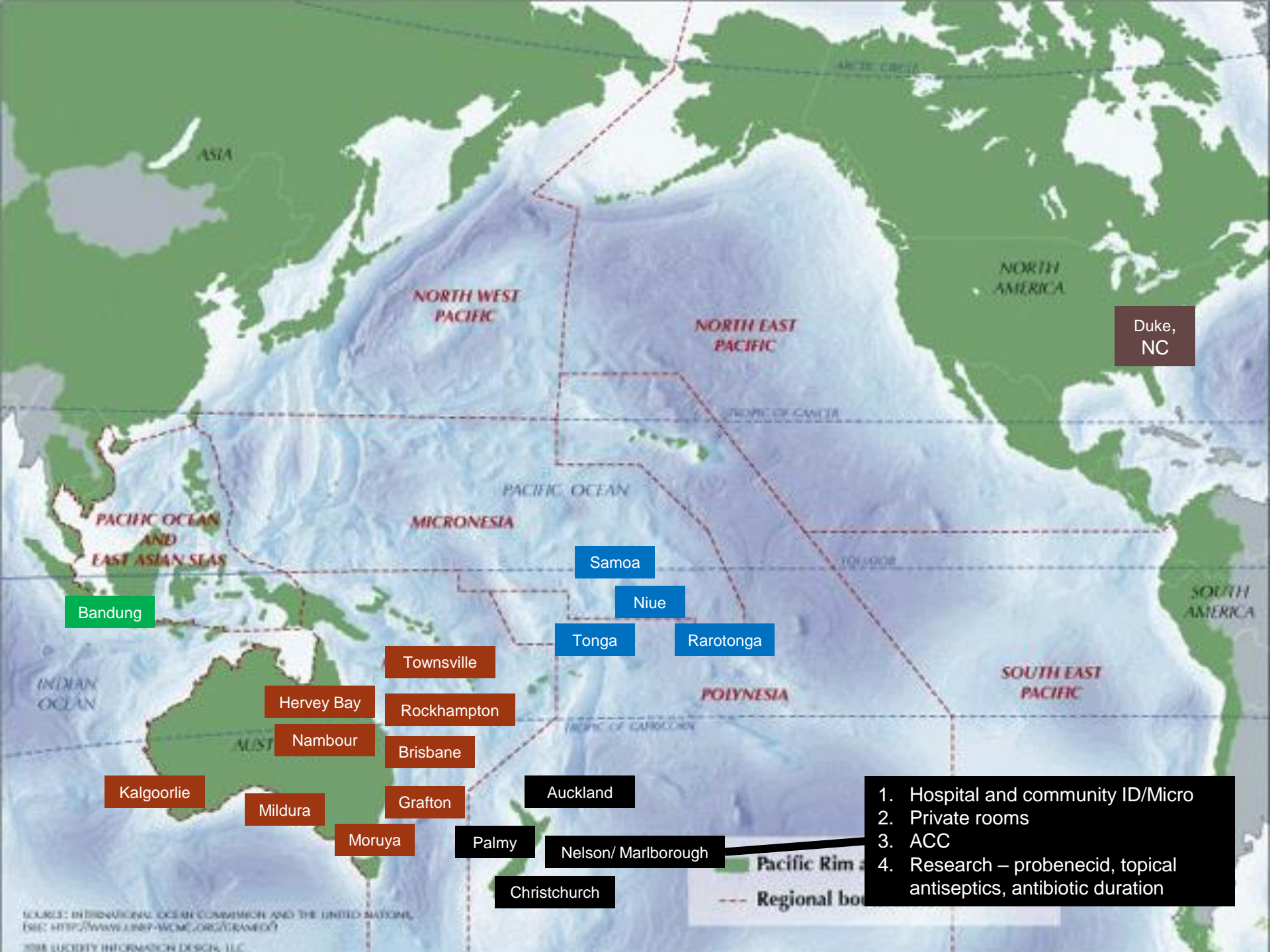
NZWCS Meeting – Rotorua – 20 May 2017

Conflicts of interest

- I got some free samples of Microdacyn, honey dressings and cadexomer iodine dressings

Acknowledgments





Duke,
NC

Bandung

Samoa

Niue

Tonga

Rarotonga

Townsville

Hervey Bay

Rockhampton

Nambour

Brisbane

Kalgoorlie

Mildura

Moruya

Grafton

Auckland

Nelson/ Marlborough

Palmy

Christchurch

1. Hospital and community ID/Micro
2. Private rooms
3. ACC
4. Research – probenecid, topical antiseptics, antibiotic duration

Plan

- Acute traumatic wounds
 - Who gets infections?
 - How to prevent infection
 - Topical antibiotics vs antiseptics
 - Leaves, nuts or bark?
- Topical antiseptics in other skin conditions.
- (Diagnosis and treatment of chronic wound and ulcer infection.)
- *Discussion.*



Acute traumatic wounds

Traumatic wounds are common

- 10 to 25% of Emergency Department workload

Am J Emerg Med 2000; 18(6): 683-6)

National hospital ambulatory medical care survey: 2006 Emergency department summary. National Health Care Statistics 6(7):1—40



2 to 17.5% get infected



Infection means:

- Pain, fever, discharge
- Unhappy patient
- Delayed wound healing
- Poor cosmetic result
- Increased cost
- Increased use of antibiotics.

Cellulitis

- 150 cases of acute leg cellulitis: 39 (26%) were preceded by an open wound injury.

Brit J Derm 2008; 158: 1288-92



Necrotising skin/soft tissue infection

- Preceded by trauma in 13 to 42%



CID 2001; 33(11):6-15

Int Med J 2011; 41(7): 543-8

Am J Med 1997; 103(1): 18-24

Arch Surg 2005; 140: 151-7

J Clin Pathol 1993; 46: 617-20

CID 1993; 16(6): 792-800

American Surgeon 2002; 68(2): 109-16

Ann Surg 1996; 224(5): 672-83

J Bone Joint Surg 2003; 85(8): 1454-60

Metastatic infection

- Discitis/epidural abscess
- Osteomyelitis
- Septic arthritis
- Endocarditis.



Case: 79 yr male

- Working in garden – injured right leg on trailer
- Red, swollen, cellulitic leg – Rx flucloxacillin 5 days
- Then feverish, back/shoulder pain
- Wound swab and blood culture +ve *Achromobacter xylosoxidans*
- CT scan = aortitis



ACC

- Infective complications of acute trauma:
 - A frequent reason for claims
 - Cost up to \$6.3 million/year.

Risk factors for acute traumatic wound infection

Host factors

- Advanced age
- Poor nutrition
- Obesity
- Diabetes
- Immune compromise (e.g. Steroids)

Devitalised tissue

- Crush injuries
- Large, deep, wide, non-linear lacerations.

• Contamination

- Bites

• Foreign material

- Soil/clay - contains highly-charged particles that impair leukocyte function and some antibiotics

• Time to closure

- Maybe not?

• Location...

Location of wound

- Probably relates to arterial supply, venous or lymphatic stasis, and degree of contamination.

Am J Emerg Med 21(1):1–7

Table 5 Wound location and infection rates [9]

Location	Infection rate (n)
Arm/forearm	15.3% (157)
Back	8.3% (12)
Chest/abdomen	11.8% (17)
Ear/nose	3.6% (28)
Face	3.9% (383)
Foot/toe	12.5% (21)
Hand/finger	5.7% (192)
Scalp	1.7% (233)
Thigh/leg	23.0% (87)

Adapted with permission from Elsevier Ltd

Bacterial causes

- 368 specimens from 340 trauma patients with wound infections:
- 711 isolates, 63% of which were anaerobes
- The most common single organisms found were *Bacteroides fragilis*, followed by peptostreptococci, *Clostridium* spp., *Staphylococcus aureus* and *Prevotella* spp.

Am J Emerg Med 1998; 16:585–591

The background of the slide is a close-up photograph of a green plant with numerous thin, needle-like leaves. The leaves are arranged in a dense, overlapping pattern, creating a textured green background. The lighting is bright, highlighting the vibrant green color of the foliage.

Prevention of infection after
traumatic wounds

Step 1 – clean and debride

- Clean to remove foreign material (soil).
- Debride non-viable tissue.
- How?
 - Remove big bits with tweezers
 - Moistened gauze
 - Irrigate with tap water (= saline)
 - Pressure – e.g. Syringe with needle.

Step 2 - antiseptic washout

- 50+ studies in animals, human acute traumatic wounds, human surgical wounds, human chronic ulcers and wounds, human burns
- Povidone-iodine, cadexamer iodine, silver, hydrogen peroxide, chlorhexidine, acetic acid, super-oxidising solutions (e.g. Microdacyn)
- Either x1 in ED or 3x/day after ED
- Results:
 - Reduce infection by $\approx 10-70\%$
 - No harm to healing rate (> 20 studies, despite *in-vitro* fibroblast, keratinocyte effects.)

Topical anti-microbial agents and acute traumatic wound infection trials in humans

First author	Reference	Type of wound	Number of patients	Outcome (infection rate unless otherwise stated)
<u>Lammers</u>	Ann Emerg Med 1990	Adult, trauma, visible contamination	33 total	<i>Change in bacterial count after vs before soak:</i> <u>Pov-iodine</u> : $\downarrow 9.9 \times 10^6$ <u>Saline</u> : $\uparrow 3.4 \times 10^7$
Roberts	J Hand Surg Brit 1985	Hand or finger laceration	152/170	<u>Pov-iodine</u> : 4.6% Control: 5.3%
Morgan	Brit J Clin Pract 1979 and Lancet 1978	Lacerations	166/154	<u>Pov-iodine</u> : 6% Control: 14.3%
Langford	Ann Pharmacoth 1997	Children, trauma	177 total	Cetrimide, bacitracin, polymyxin B: 1.6% Control: 12.5%
Naunton-Morgan	Injury 1980	Hands	91/105	<u>Pov-iodine</u> : 6.6% Control 19%
Naunton-Morgan	Injury 1980	Non-hand locations	150/179	<u>Pov-iodine</u> : 4.7% Control 12.8%
<u>Gravett</u>	Ann Emerg Med 1987	Acute lacerations in ED	201/194	<u>Pov-iodine</u> : 5.5% Control 15.5%

Bickerstaff	J Royal Coll Surg Edin 1984	Lacerations – hands	108/127	Pov-iodine: 6.5% Control 10.2%
Bickerstaff	J Royal Coll Surg Edin 1984	Lacerations – non-hand locations	245/300	Pov-iodine: 5.3% Control 7.7%
Gosnold	Practitioner 1979	Lacerations in ED	120/122	Pov-iodine: 2.5% Control 9.8%
Dire	Ann Emerg Med 1990	Acute sutured wounds in ED	531 total	Pov-iodine: 4.3% 'Pleuronic': 5.6% Saline 6.9%
Maddox	J Am Acad Derm 1985	Minor skin trauma		Bacitracin+Polysporin+neomycin: 15% Placebo: 47%
Dire, Coppola	Acad Emerg Med 1995	Lacerations in ED	465 total	Poly B+neom+bacitr: 4.5% Bacitracin: 5.5% Silver sulfadiazine: 12.1% Petrolatum: 17.6%
Caro, Reynolds	Brit J Clin Pract 1967	Superficial wounds	432 total	Neomycin+bacitracin+polymycin B: 9.1% Control: 11.4%
Lindsey	J Trauma 1982	Suture repair in ED	260 total	Penicillin soln: 10% Control: 31%

A photograph of a sunset over the ocean. The sun is a bright, glowing orb on the right side of the horizon, casting a long, shimmering reflection across the water. The sky is filled with large, billowing clouds that are illuminated from below, giving them a golden-orange hue. The water in the foreground is dark, with the sun's reflection creating a path of light. A solid blue rectangular box is positioned in the lower third of the image, containing the text "Antibiotics vs antiseptics" in a black, sans-serif font.

Antibiotics vs antiseptics

Topical antimicrobial agents

Antibiotics

- e.g. *mupirocin, fusidic acid, neomycin*
- One mechanism
- Kill only bacteria; narrow spectrum
- Resistance and cross-resistance
- Some used systemically
- Higher risk of allergy.

Antiseptics

- e.g. *iodine, alcohol, chlorhexidine*
- Multiple mechanisms
- Broad spectrum
- Rare resistance
- Too toxic to human cells for systemic use
- Occasional allergy.

Topical antibiotics in NZ 2016

Drug name	Trade names	Parenteral form	Spectrum	
Mupirocin	Bactroban	-	GPC	
Fusidic acid	Foban	Fusidic acid	GPC	
Gramicidin	Viaderm KC, Sofradex, Kenacomb	-	GPC	
Clindamycin	ClindaTech, Duac (with benz perox)	Clindamycin	GPC	
Neomycin	Viaderm KC, Pumifucort, Kenacomb, Maxitrol	Gentamicin		GNB
Framycetin	Soframycin, Sofradex	Gentamicin		GNB
Ciprofloxacin	Ciproxen HC	Ciprofloxacin	+/- GPC	GNB
Clioquinol	Locorten-Vioform	-	GPC	GNB
Sulfadiazine	Flamazine (with silver)	Cotrimoxazole	GPC	GNB
Chloramphenicol	Minims Chloramphenicol, Chlorafast, Chlorsig	Chloramphenicol	GPC	GNB
Metronidazole	Rosex, Metronidazole	Metronidazole	Anaerobes	

Mupirocin 2% (Bactroban®)



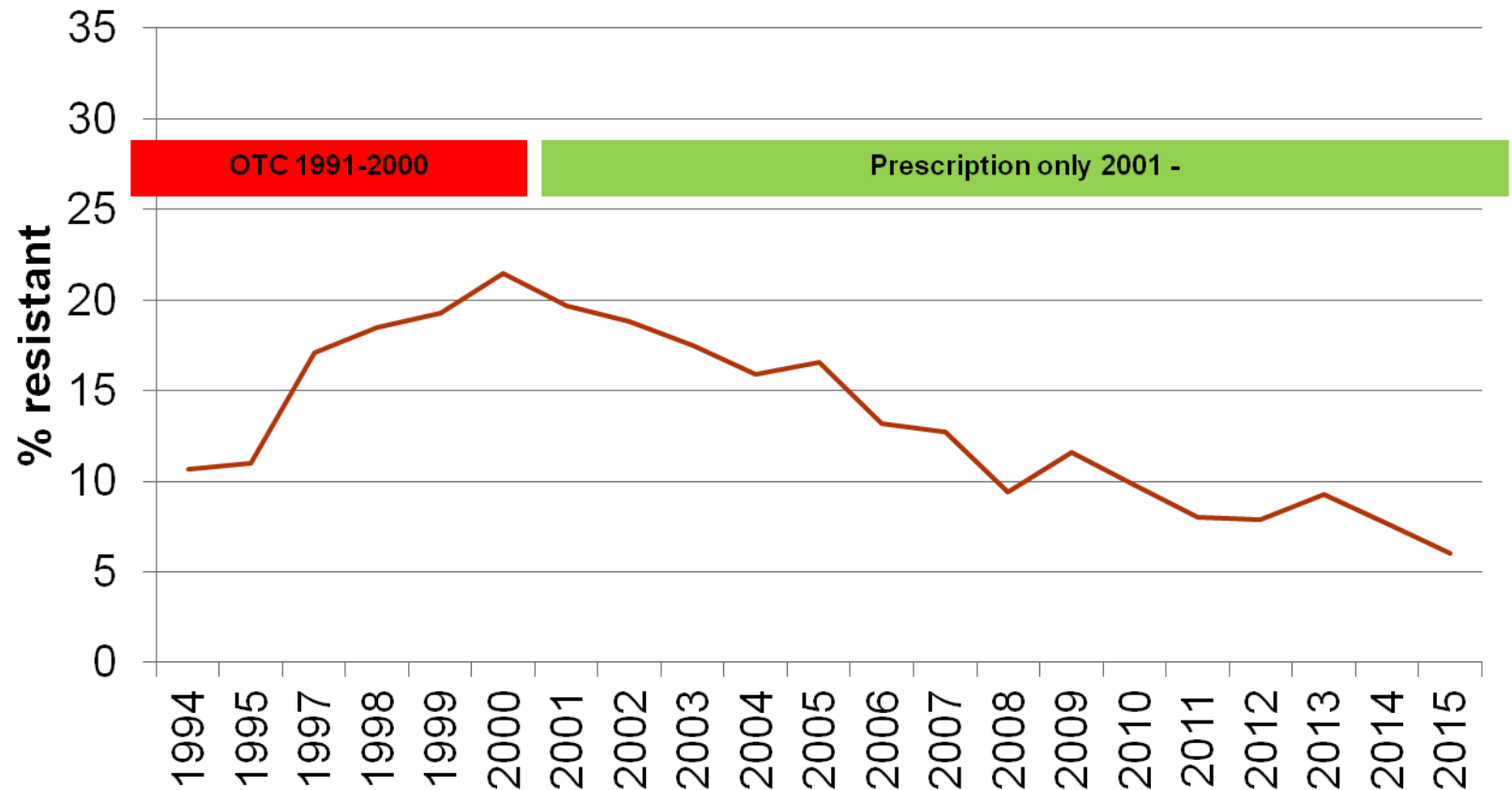
- From *Pseudomonas fluorescens*
- Active for *Staphylococcus aureus*, β -haem strep
- Effective:
 - Impetigo and other minor skin infections
 - Nasal *Staph. aureus* decolonisation
- Resistance – develops easily
 - MRSA outbreak Canadian hospital \rightarrow mupirocin ++ \rightarrow MRSA resistance 2.7% in 1990, 65% in 1993.

ICHE 1996; 17(12): 811-3
 - 2 hospitals in Brazil. One used mupirocin ++ vs one not \rightarrow *S. aureus* mupirocin resistance 61% vs 6%.

ICHE 1996; 17(12): 813-6

Mupirocin resistance in NZ

Community + Hospital *Staphylococcus aureus*



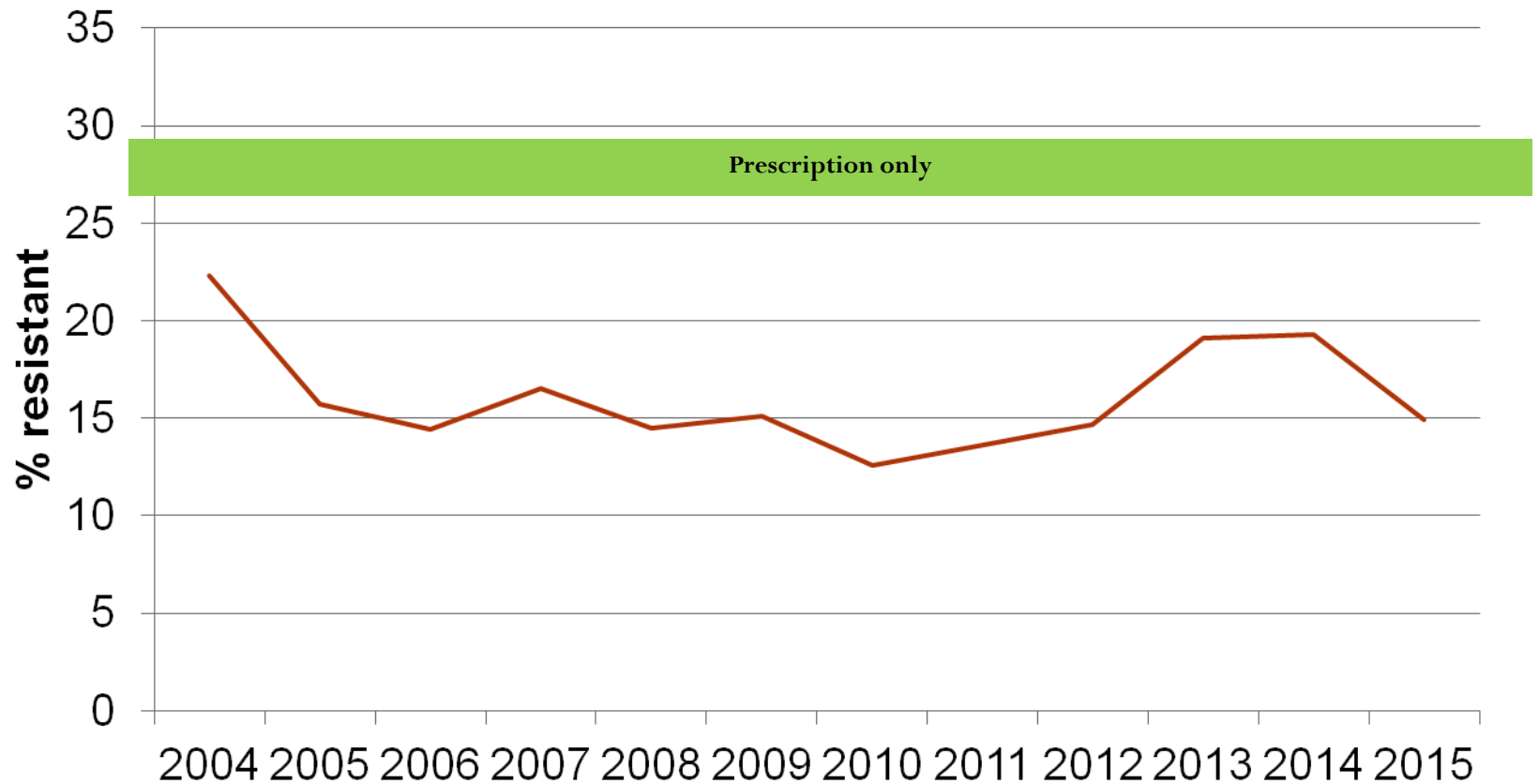
Fusidic acid (Foban[®])



- From *Fusidium coccineum*
- Active for *Staphylococcus aureus*, streptococci
- Effective:
 - Impetigo and other minor skin infections
 - Orally (+ rifampicin) for MRSA infections
- Resistance
 - Commonly develops during course of treatment.

Fusidic acid resistance in NZ

Community + Hospital *Staphylococcus aureus*



Fusidic acid resistance in NZ

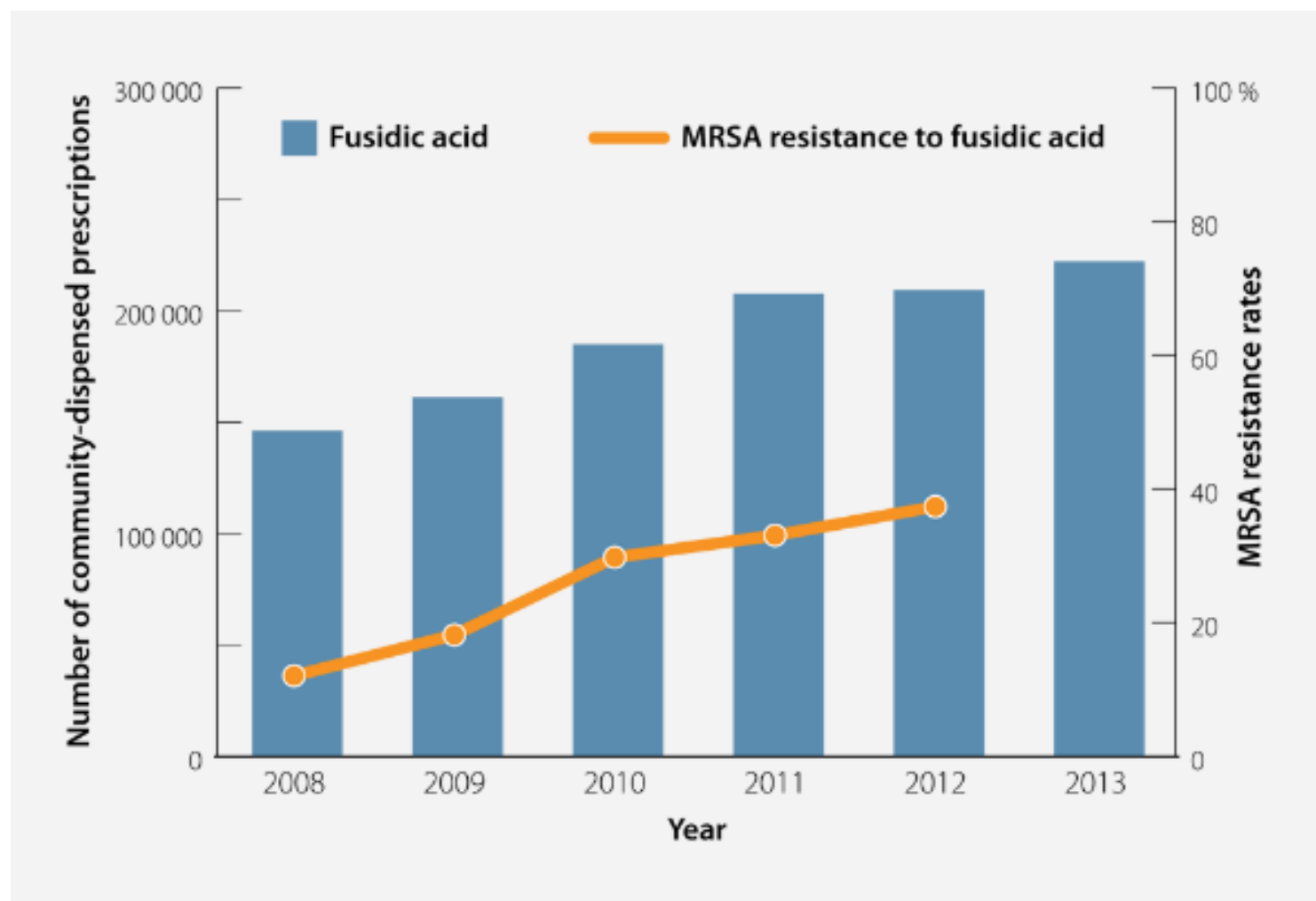
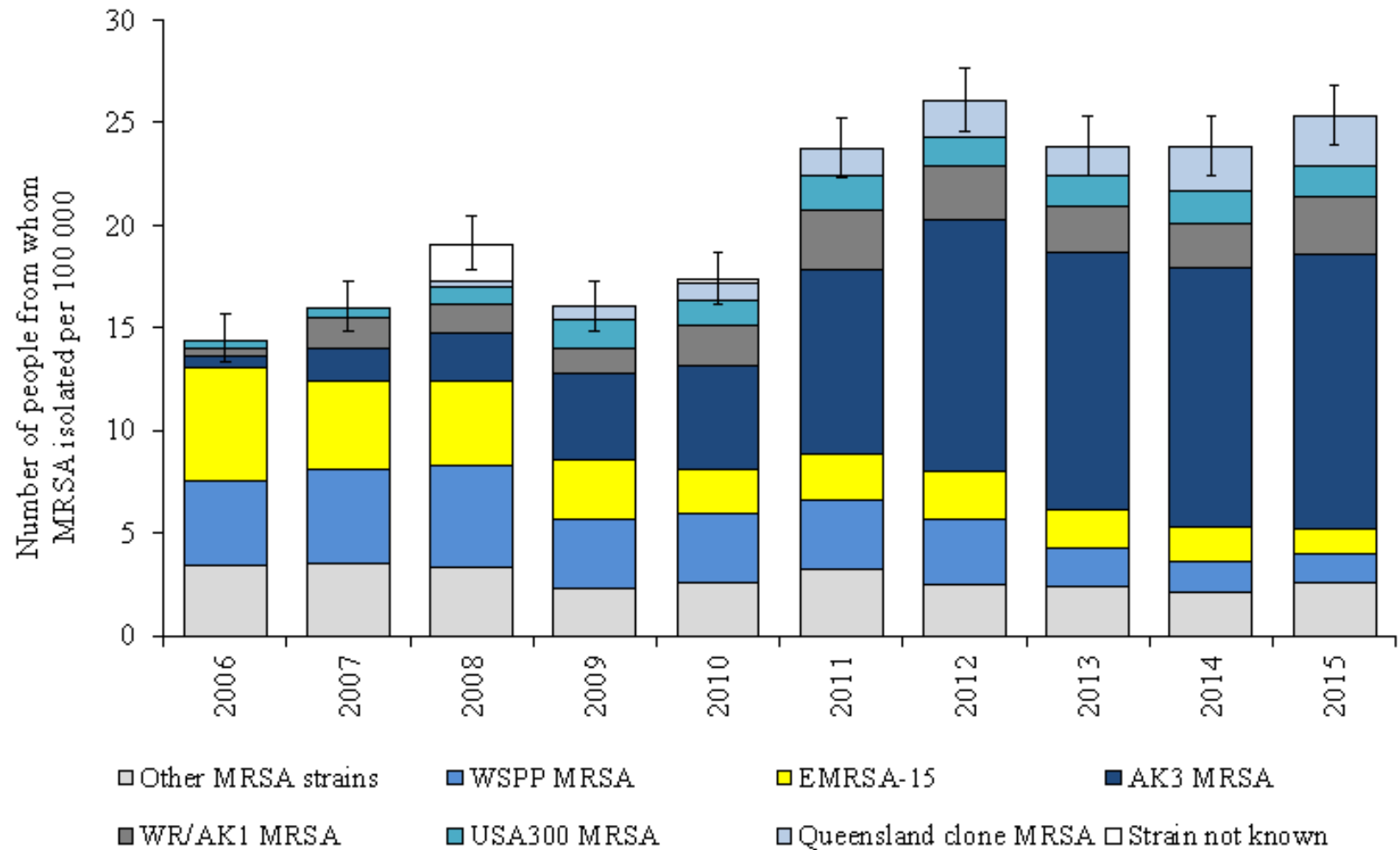


Figure 1. MRSA period-prevalence rates, 2006-2015



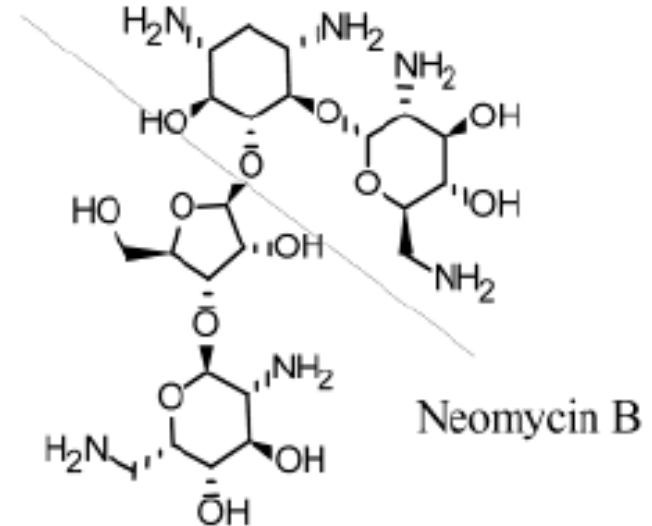
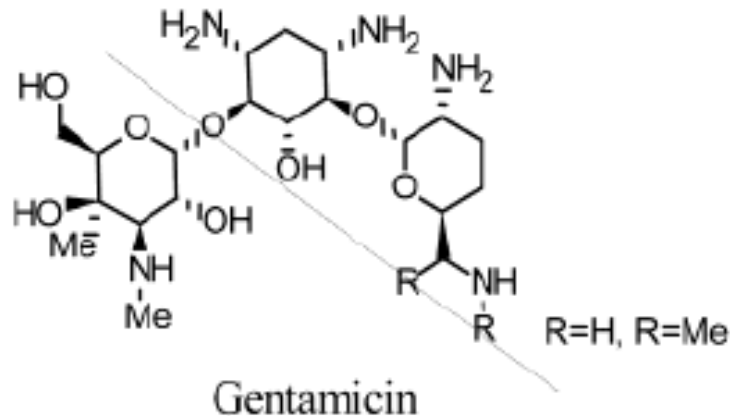
Neomycin



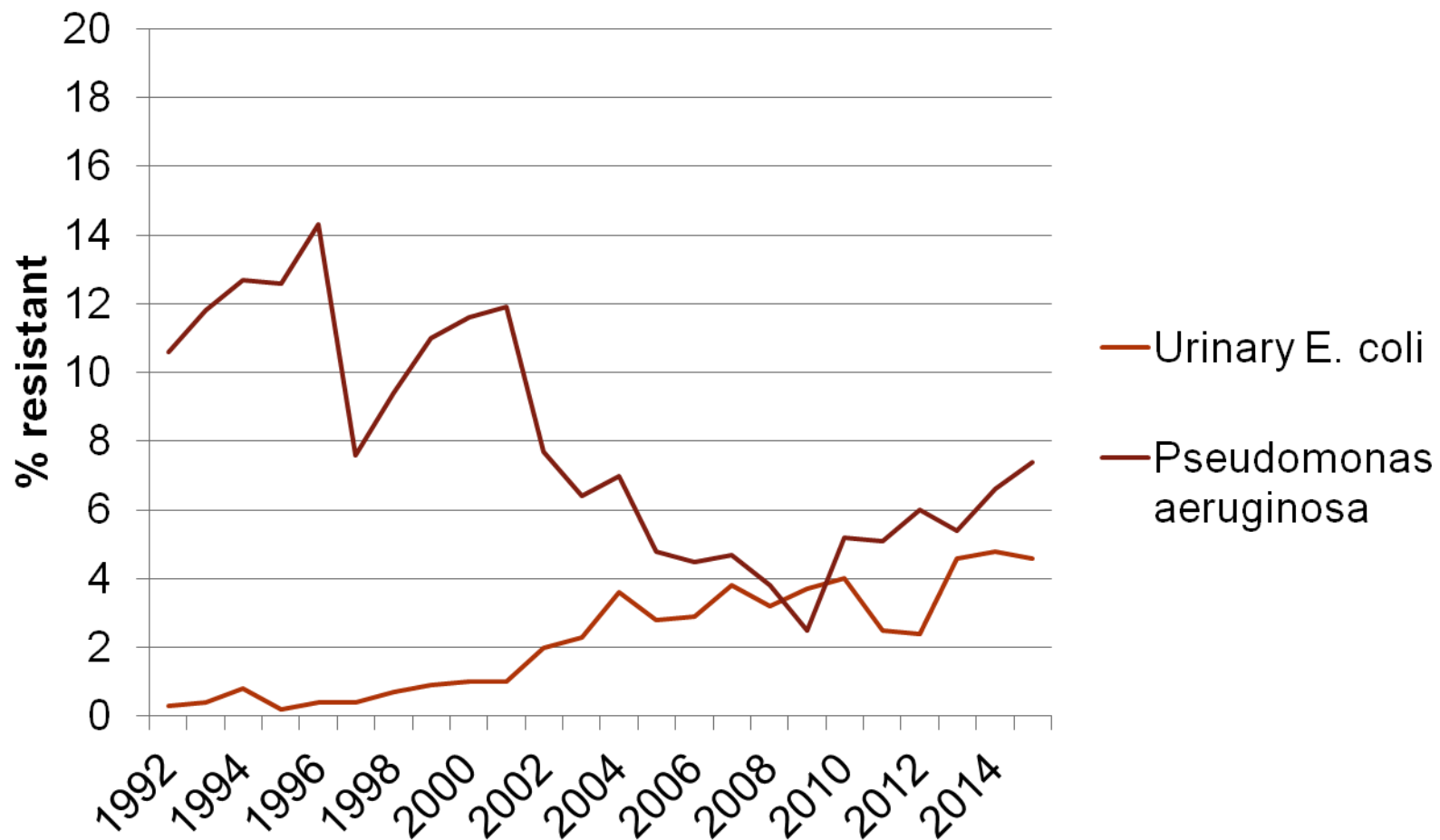
- From *Streptomyces fradiae*
- Active for gram-negative bacilli >> GPC
- Effective:
 - Non-absorbed oral drug – used for liver failure
 - In combination topical preparations:
 - (Neosporin[®]/Triple AB[®]/Mycitracin[®] = neomycin + bacitracin + polymyxin B – no longer available in NZ)
 - Viaderm KC = neomycin + gramicidin + nystatin + triamcinolone
 - Pumifucort = neomycin + natamycin + hydrocortisone
 - Kenacomb ear drops = neomycin + gramicidin + nystatin + triamcinolone
 - Maxitrol eye drops = neomycin + polymyxin B + dexameth.

Neomycin

- Allergic contact dermatitis - 7.2 to 13.1%
- Cross-resistance with gentamicin, tobramycin



Gentamicin resistance in NZ



Topical antiseptics

Chemical	Trade names	Spectrum		
Ethanol		GPC	GNB	V ⁺ / - norovirus , F
Hydrogen peroxide (and BP)	Crystaderm	GPC	GNB	V, F, spores
Povidone iodine	Betadine	GPC	GNB	V, F, + / - spores
Chlorhexidine	Savlon (Ch + cetrimide)	GPC*	Most GNB	+ / - V, + / - F *C-R SA, include NZ
Sodium hypochlorite	(Bleach)	GPC	GNB	V, F, spores
Super-oxidising solutions	Microdacyn	GPC	GNB	V, F, spores
Polyhexanide (PHMB)	Prontosan	GPC	GNB	V, F
Triclosan	Triclosan	GPC	< GNB	+ / - F
Acetic acid	(Vinegar)	<GPC	GNB	
Benzalkonium	Bepanthen	GPC	Most GNB	+ / - V, + / - F * recent B-R SA
Chloroxylenol	PCMX, Dettol	GPC	Most GNR	Not Pseudo, + / - V
Honey	(raw, in dressings)	GPC	GNB	F
Manuka oil		GPC	-	+ / - F
Silver	(in dressings)	GPC	GNB	+ / - F

Iodine



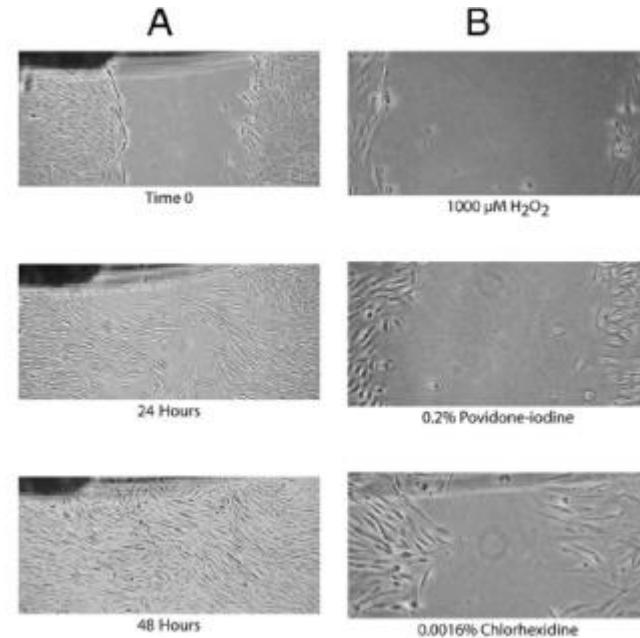
- The most studied antiseptic
- Kills all bacteria, no resistance after > 100 years
- Long effect (12-14 hours)
- Effective:
 - Pre-op skin scrub, acute injuries, *Staph. aureus* decolonisation, chronic ulcers and wounds
- Toxicity
 - Allergy – low (0.73%)
 - Staining skin, clothes, sheets
 - Hypothyroidism in very low birth-weight infants
 - ?? Adverse effect on wound healing.

1960s-90s

Topical antiseptics shown to reduce
wound infection

2000-2010

Topical antiseptics damage fibroblasts,
keratinocytes, lymphocytes *in-vitro*



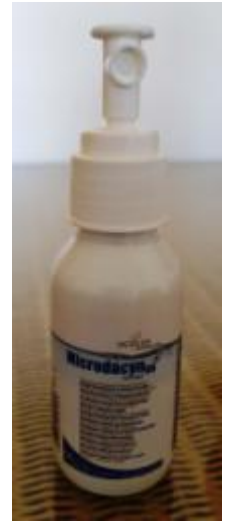
‘Don’t put in your wound
what you wouldn’t put in your eye!’

In-vitro toxicity of antiseptics

- Higher conc → worse *in-vitro* cytotoxicity
 - PI and NaClO low conc kill bacteria without fibroblast toxicity ^{Lineaweaver 1985, Hidalgo 2002}.
- Not all antiseptics are equally toxic *in-vitro*
 - Silver, SOS best, chlorhexidine OK, PI worst ^{Le Duc 2007}
 - Silver and chlorhex better than H₂O₂ and PI ^{Thomas 2009}
 - Best antibacterial to toxicity ratio is PHMB, chlorhex, then PI, then benzalkonium, then triclosan, and silver worst ^{Muller 2008}.
 - Best antimicrobial to toxicity ratio is acetic acid, then dilute bleach, dilute PI, H₂O₂, then 10% PI worst ^{Wilson 2005}.
- Does it matter *in-vivo*?
 - Metabolic support for human cells. Albumin, mucin etc.
 - 27 RCTs of PI versus a comparator in chronic ulcers and wounds showed no delay in wound healing ^{Vermeulen 2010}.

Microdacyn®

- Topical antiseptic, in NZ since 2015.
- Rapid and potent microbicide (bacteria - $> 5 \log_{10}$ in 30 sec, viruses, fungi, spores).
- Mechanism:
 - Hypo-osmolar
 - Reactive oxygen species (super-oxidised solution)
 - Hypochlorous acid (HOCl), sodium hypochlorite (NaClO)
- No resistance.
- Breaks down biofilms and kills bacteria within biofilms.



Microdacyn[®] comparative trials

Condition	Design	Comparator	N=	Outcome for Microdacyn group	Stats	Ref
DFS	Non-R	Pov-iodine	218	Faster healing ↓ infection	< 0.001	Dalla Paola 2006
Post-op DFS	Non-R	Pov-iodine	33	Faster healing, ↓ antibiotics	< 0.01	Goretti 2007
Chronic wounds	RCT	Pov-iodine	40	↓ symptoms/signs of infection, ↓ days hospital	?	Ricci 2007
DFS	RCT	Pov-iodine	45	Faster healing, ↓ odour	?	Martinez-De Jesus 2007
Diab ulcers	RCT	Saline	100	Faster healing, ↓ bacteria	0.05	Suri 2008
Chronic wounds	Non-R	Pov-iodine	30	Faster healing	0.0045	Abhyanker 2009
Post-op DFS	RCT	Pov-iodine	40	Faster healing, ↓ antibiotic, ↓ re-operation	< 0.01	Piaggese 2010
Sternotomy wounds	RCT	Pov-iodine	190	↓ infection	0.033	Mohd 2010
Various wounds	Non-R	Pov-iodine	200	Faster healing, ↓ inflammation	?	Kapur 2011
Post-op wounds	RCT	Pov-iodine	100	Faster healing, ↓ infection	< 0.0005	Pandey 2011
Mild DFS	RCT	Levofloxacin	67	Faster healing	NS	Landsman 2011
Infected traumatic wounds	RCT	Pov-iodine	60	Fewer symptoms and signs of infection	< 0.004	Mekkawy 2014
DFS	RCT	Pov-iodine	60	Faster healing	0.024	Prabhaker 2016

Microdacyn®

- Free active chlorine sub-toxic
- Little to no measurable cytotoxicity in *in-vitro* fibroblast cytotoxicity study or in a skin graft model.

Int JWound J 2007; 4(3):241

Brit J Derm 2007

- No toxicity in any trial performed so far.
- Non-staining and non-volatile.
- Relatively cheap.
- Not poisonous if ingested.



No effect on fibroblast migration

- HOCl solution = 218 ppm (M = 20 ppm)

Wounds 2014; 26(12): 342-50

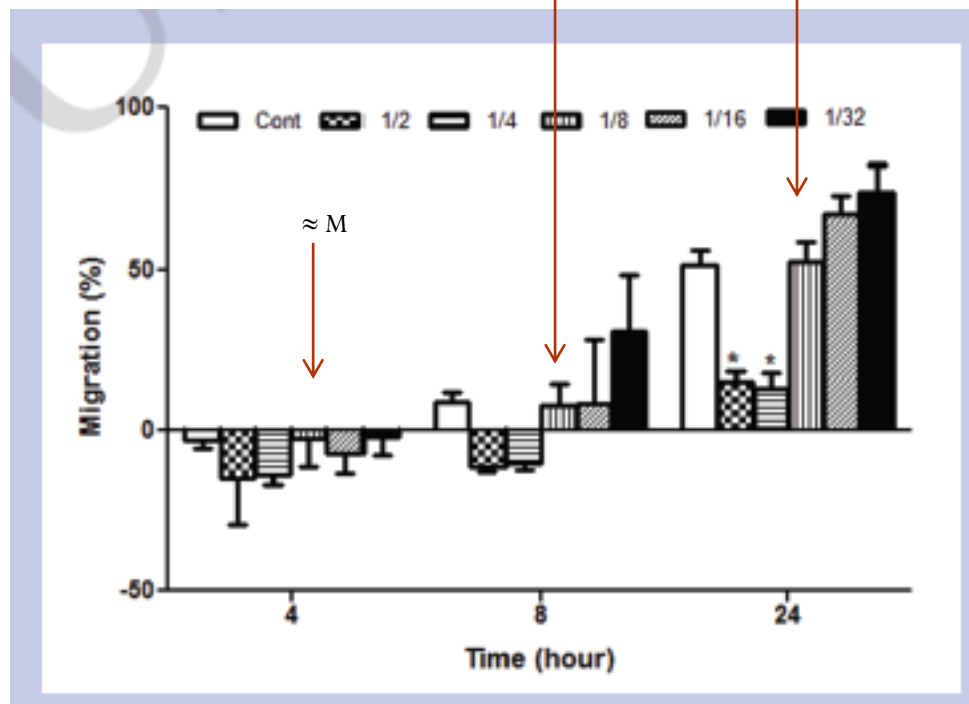
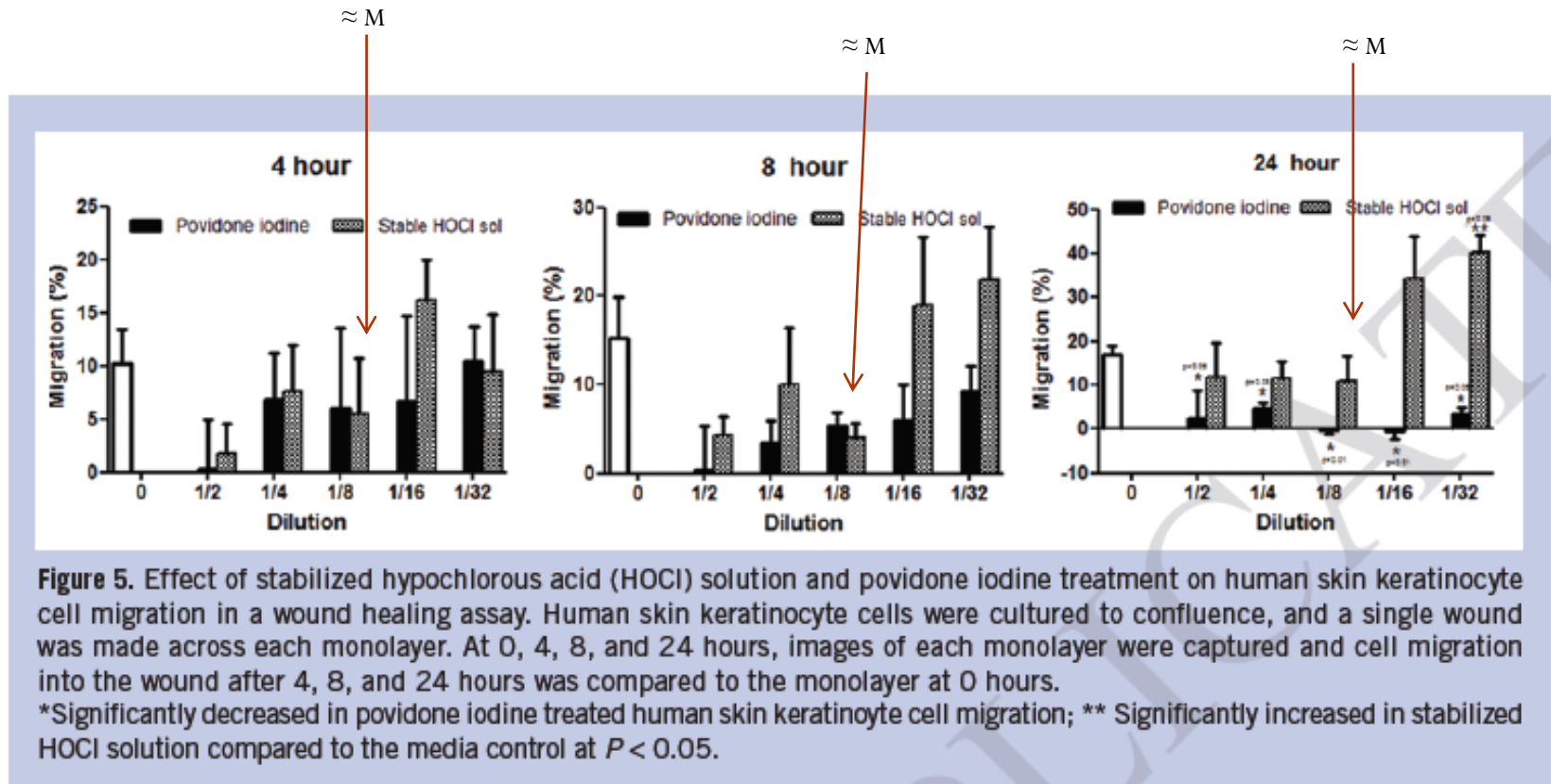


Figure 3. Effect of stabilized hypochlorous acid (HOCl) solution treatment on skin fibroblast cell migration in a wounding healing assay. Skin fibroblast cells were cultured to confluence, and a single wound was made across each monolayer. At 0, 4, 8, and 24 hours, images of each monolayer were captured and cell migration into the wound after 4, 8, and 24 hours was compared to the monolayer at 0 hours.

Minor effect on keratinocyte migration

- HOCl solution = 218 ppm (M = 20 ppm)

Wounds 2014; 26(12): 342-50



Choice of topical antiseptic

- Resistance:
 - Some GNR (e.g. *Pseudomonas aeruginosa*) resistant to chlorhexidine, benzalkonium ^{Bepanthen}, chloroxylenol ^{Dettol}
 - Chlorhexidine cross-resistance with colistin ^{Wand et al AAC 2016}
 - Some *Staphylococcus aureus* in NZ resistant to chlorhexidine, cetrimide ^{Savlon}, benzalkonium
 - No resistance – SOS ^{Microdacyn}, polyhexanide ^{Prontosan}, sodium hypochlorite ^{dilute bleach}, silver, iodine, H₂O₂, honey
- Long-lasting:
 - SR silver, cadexomer iodine, polyhexanide
- Biofilm disruption – SOS, polyhexanide/betaine ^{Prontosan}
- Staining – iodine; dilute bleach
- Painful – honey, alcohol, vinegar?, H₂O₂?

Dilute bleach – cheap, clothing...

Table 1 Sodium hypochlorite* dilution recommendations for use as a wound or skin antiseptic

Undiluted original bleach product ¹	Volume of bleach to add ^{2,3}			
	To 500ml water	To 1L water	To 15L bucket	To 30L water (a full-sized bath with 10cm water)
Budget brand – Regular (21.5g/L, 2.15%)	1ml (¼ teaspoon)	2ml (½ teaspoon)	35ml (2 tablespoons)	70ml (5 tablespoons)
Clor-o-gene (31.5g/L, 3.15%)	0.75ml	1.5ml (¼ teaspoon)	24ml (5 teaspoons)	48ml (3 tablespoons)
Homebrand – Regular (42g/L, 4.2%)	0.6ml (⅙ teaspoon)	1.2ml (¼ teaspoon)	18ml (3½ teaspoons)	35ml (2½ tablespoons)
Janola – Premium (42g/L, 4.2%)	0.6ml (⅙ teaspoon)	1.2ml (¼ teaspoon)	18ml (3½ teaspoons)	35ml (2½ tablespoons)

** Bleach. 1. Use regular, not perfumed, bleach. 2. Based on a target concentration of 0.05g/L (0.005%), but up to five times more concentrated (0.25g/L, 0.025%) may be more effective and is still likely to be safe. 3. Add double the volume of bleach to the water if the bleach product is near its expiry date, as sodium hypochlorite weakens with time to approximately half of its original strength by the expiry date*

Traditional healers in Pacific Is.

- 12 of 50 (24%) inpatients with infection in TTM Hospital (Jan 2017) admitted to visiting or using traditional Samoan medicine – mostly for leaves and massage



Guava leaves for skin infection

- Guava leaf extract killed 9 of 9 strains of *Staphylococcus aureus*

Journal of Ethnopharmacology. 68(1-3):103-8, 1999 Dec 15.



Research Paper

Quantification of polyphenols and evaluation of antimicrobial, analgesic and anti-inflammatory activities of aqueous and acetone–water extracts of *Libidibia ferrea*, *Parapiptadenia rigida* and *Psidium guajava*

Aurigena Antunes de Araújo^{a,*}, Luiz Alberto Lira Soares^b,
Magda Rhayanny Assunção Ferreira^b, Manoel André de Souza Neto^c,
Giselle Ribeiro da Silva^c, Raimundo Fernandes de Araújo Jr.^d,
Gerlane Coelho Bernardo Guerra^e, Maria Celeste Nunes de Melo^f



Traditional Tongan treatments for infections: Bioassays and ethnobotanical leads for activity

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An ethnobotanical survey of Tongan pharmacopoeia, conducted through semi-structured interviews with healers, informed the selection of twenty-six plants for antimicrobial bioassays. The parts of the plants recommended by the healers were collected and extractions were made with methanol and hexane in various concentrations, and screened against *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans* using microbial inhibition assay. Further, minimum inhibitory concentrations (MICs) of *Syzygium corynocarpum* (A.Gray) Müll. Stuttg. were determined against *S. aureus* and methicillin-resistant *S. aureus* (MRSA) using extractions from both the healer-recommended plant part—young leaves—and two other plant parts—mature leaves and bark—to test the hypothesis of greater antimicrobial activity in the traditionally used part. Cytotoxicity of the extractions was determined by trypan blue assay on human lymphocytes. The microbial inhibition assays yielded six species that inhibited the growth of *S. aureus*, *E. coli* and/or *C. albicans* at rates of 40% or above compared to the controls. The only species that inhibited all three microbes at above 40% was *S. corynocarpum*. Subsequent testing on *S. corynocarpum* revealed that both the methanol and hexane extractions of young leaves inhibited *S. aureus* (MIC 125 and 500 µg/ml respectively) and MRSA (MIC 250 and 500 µg/ml respectively), while only the methanol extract of the bark showed inhibition against both microbes (MIC = 250 µg/ml), and the extractions from the mature leaves showed no activity at the concentrations tested. An additional assay with extractions of *S. corynocarpum* on human lymphocytes suggests no cytotoxicity compared to control cells. These results support the traditional use of several of the tested plants. In particular *S. corynocarpum*, which has not previously been studied for antimicrobial activity, showed greater activity by the traditionally used part, emphasizing the importance of documenting specific plant parts used during ethnobotanical interviews.



Seasea



Seasea

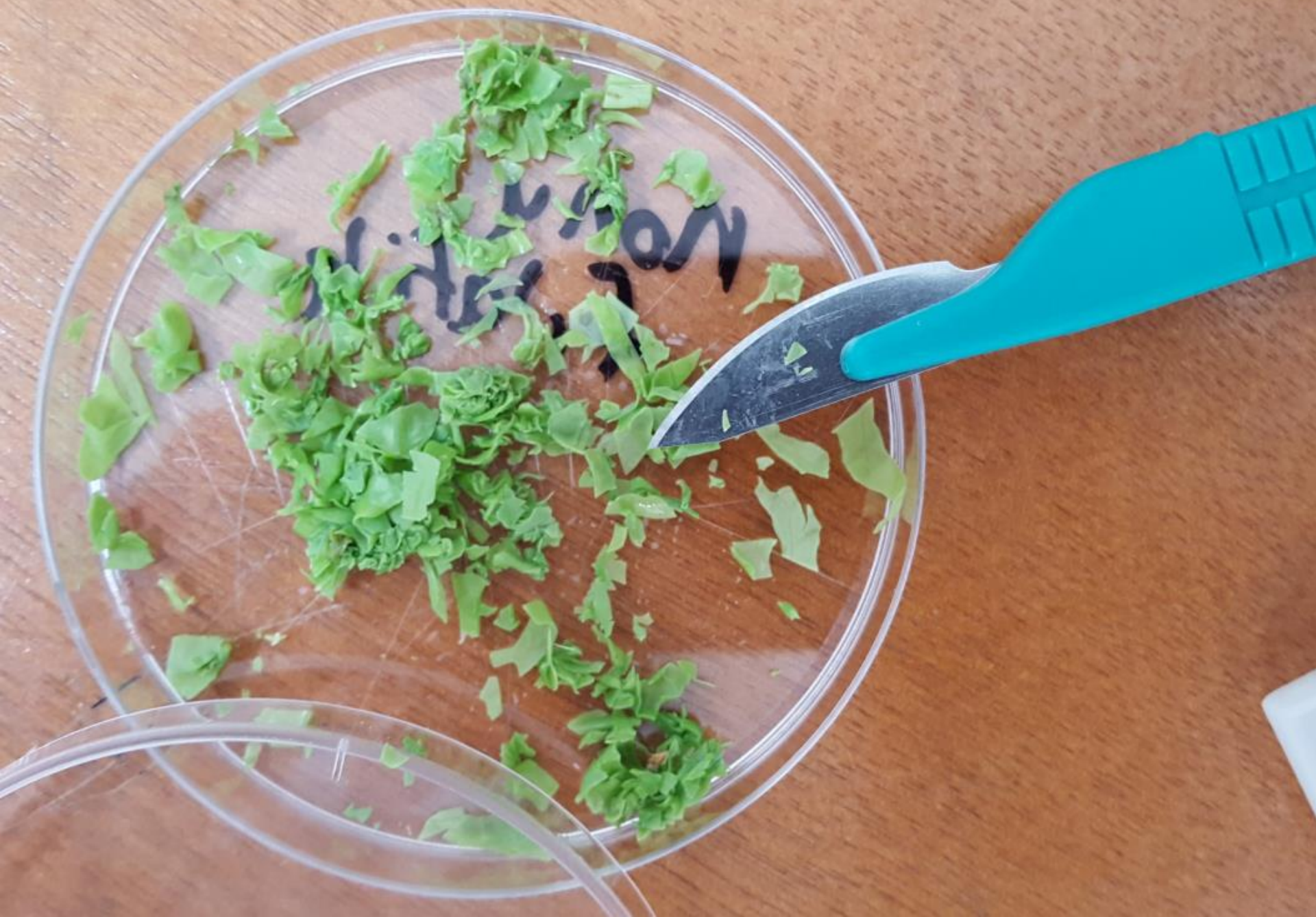


Nonu fi'afi'a





Fue sina



The image shows several petri dishes containing agar plates. The agar is a light cream color. On each plate, there are two distinct circular areas of bacterial growth. The growth in the upper-left area is dark, almost black, and has a fuzzy, irregular texture. The growth in the lower-right area is a lighter, brownish-orange color and also has a fuzzy texture. A small, bright green, leafy garnish is placed on the agar between the two growth areas. The petri dishes are arranged in a row, with the one in the foreground being the most in focus. The background is slightly blurred, showing more dishes and a wooden surface.

Fue sina

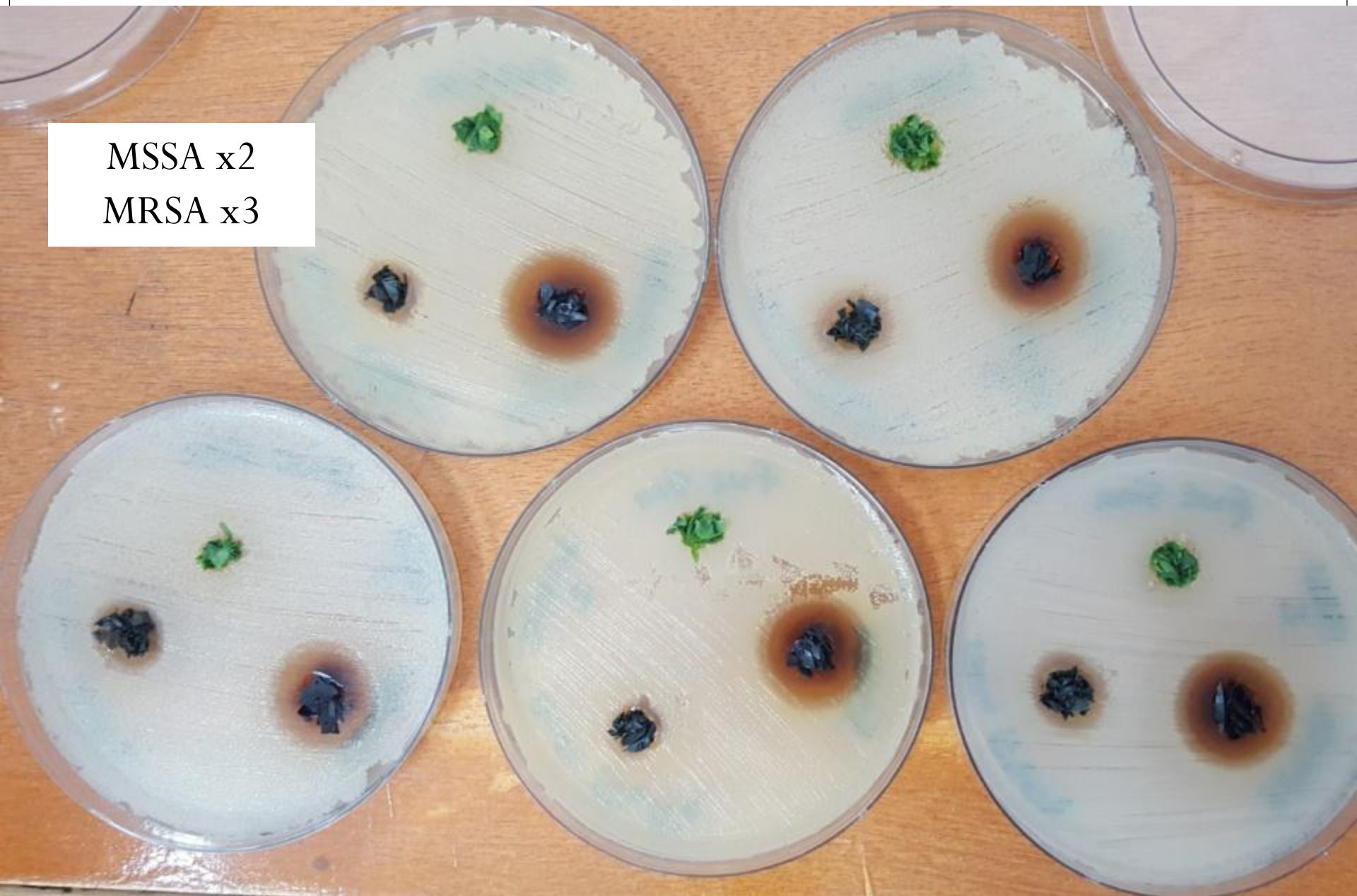
Nonu fi'afi'a

Seasea

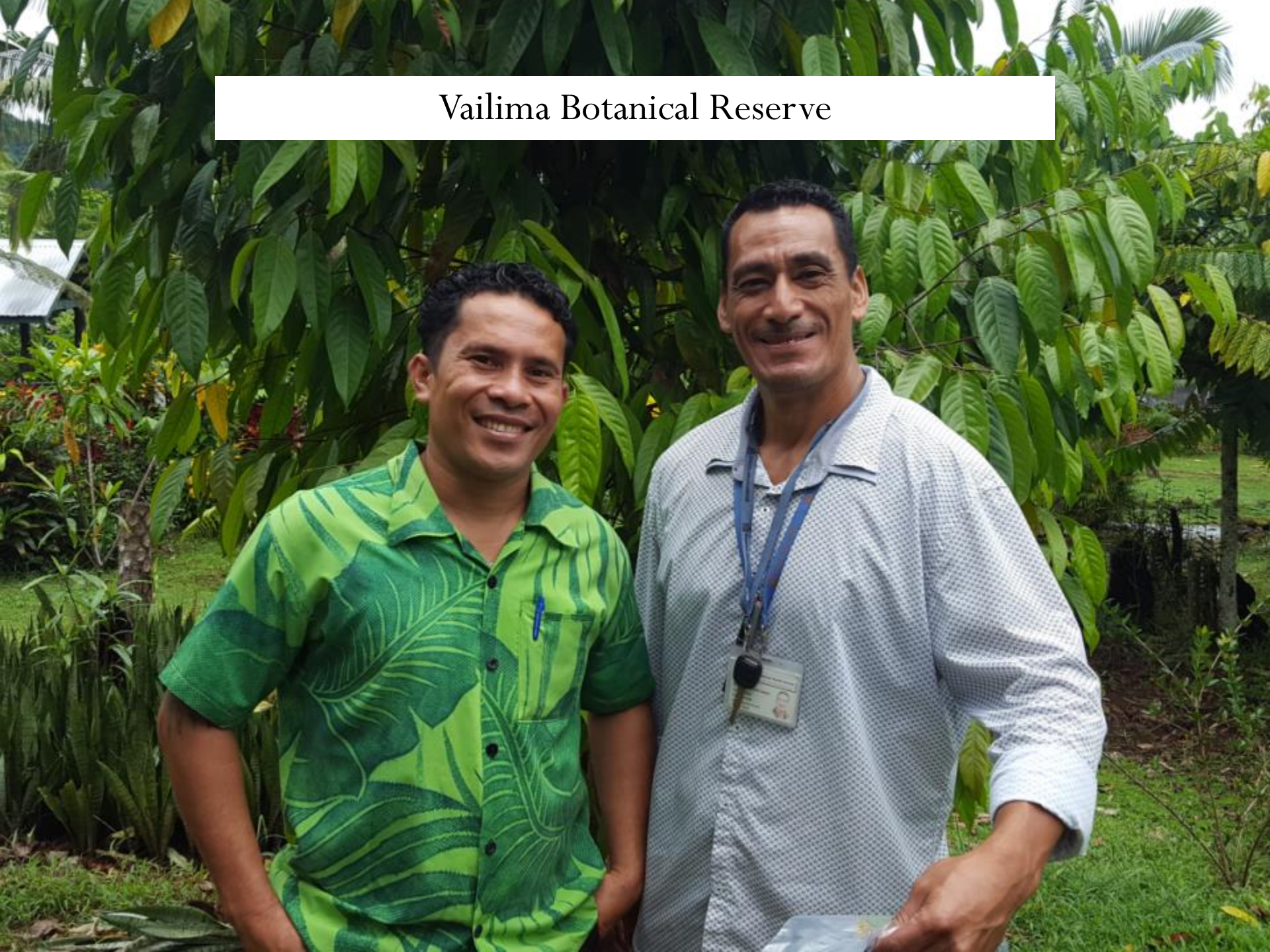
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MSSA x2

MRSA x3



Vailima Botanical Reserve







Kuava

Ali'i o le po



Kuava - young

Ali'i o le po

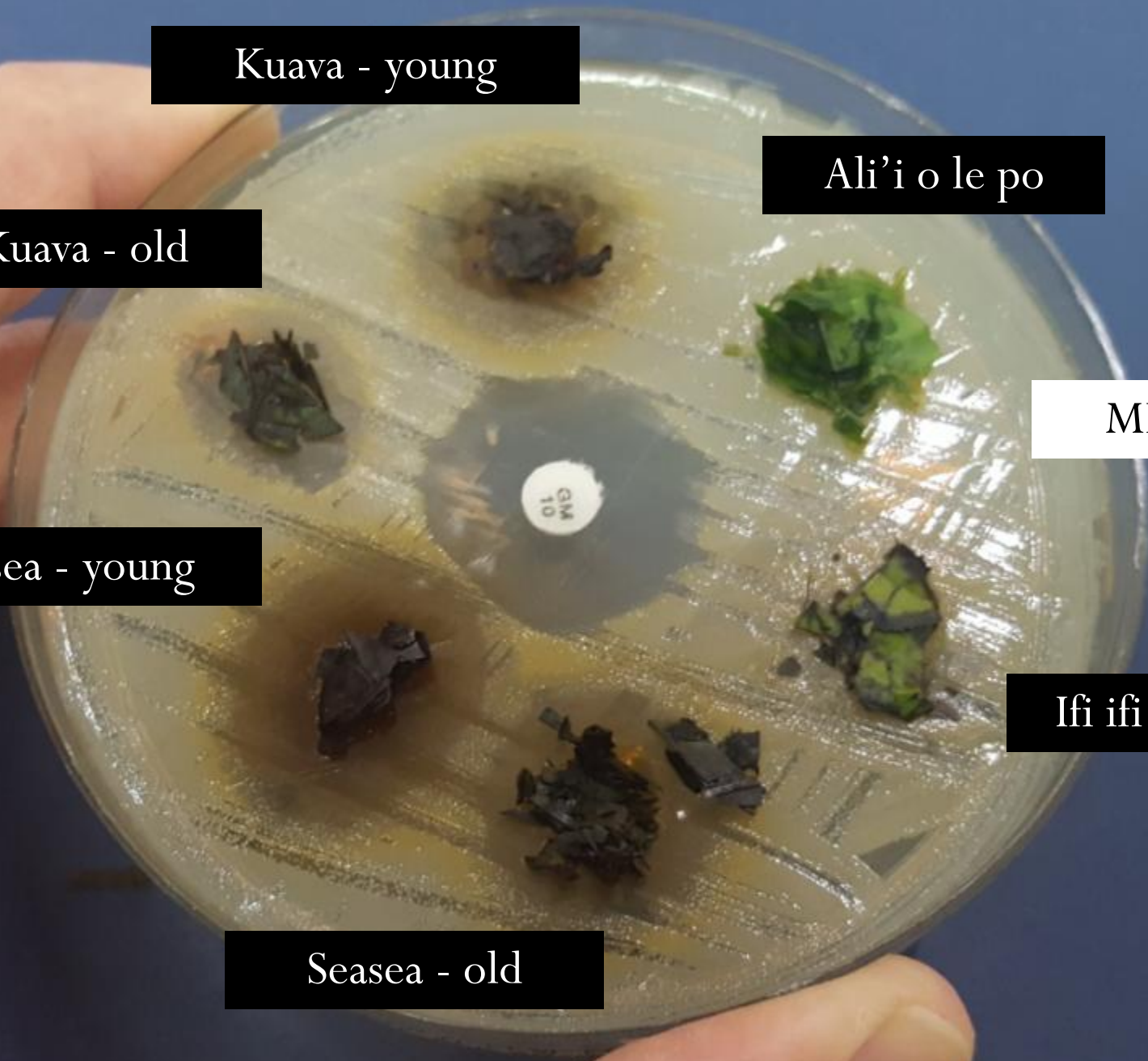
Kuava - old

MRSA

Seasea - young

Ifi ifi

Seasea - old

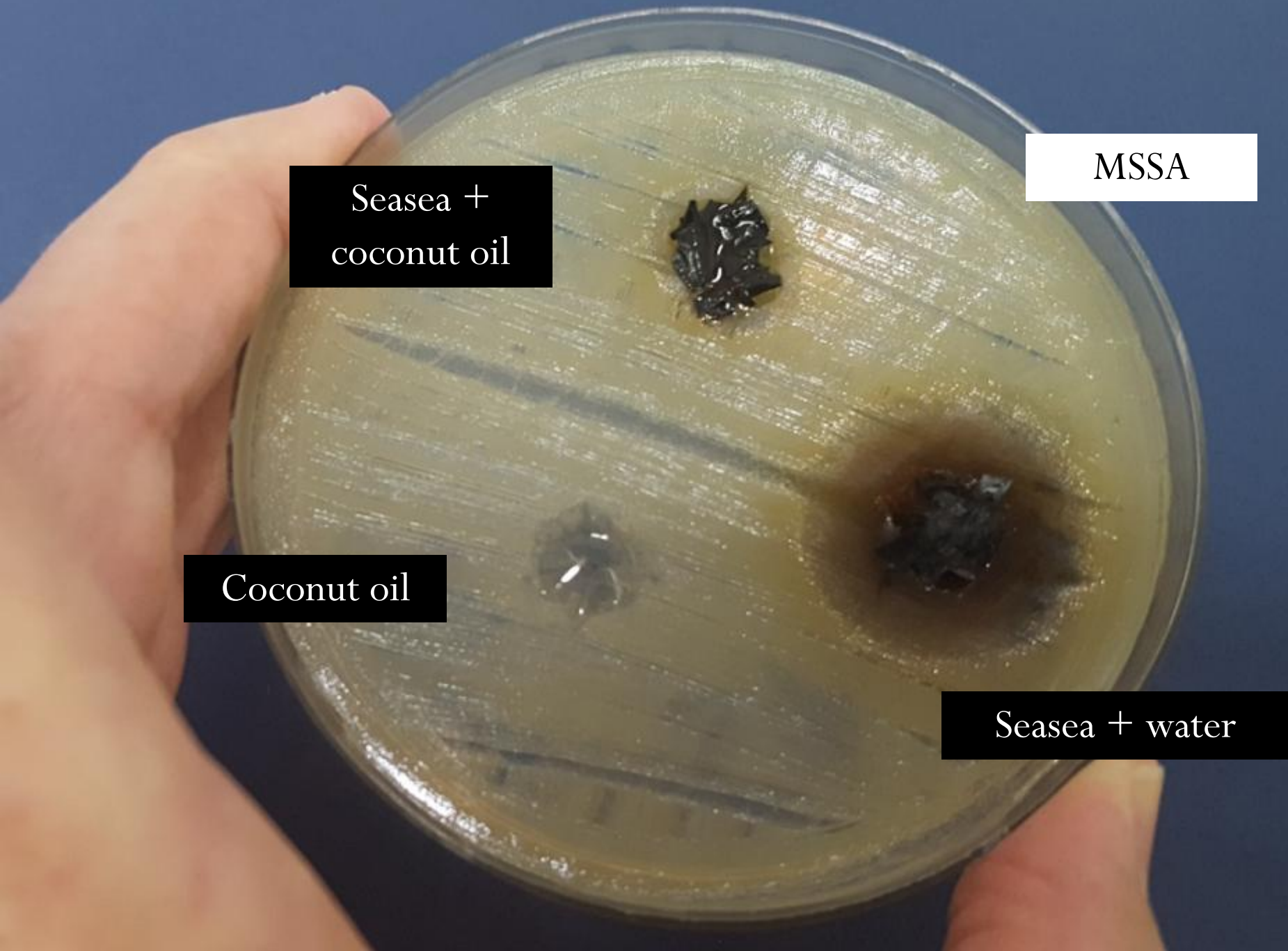


MSSA

Seasea +
coconut oil

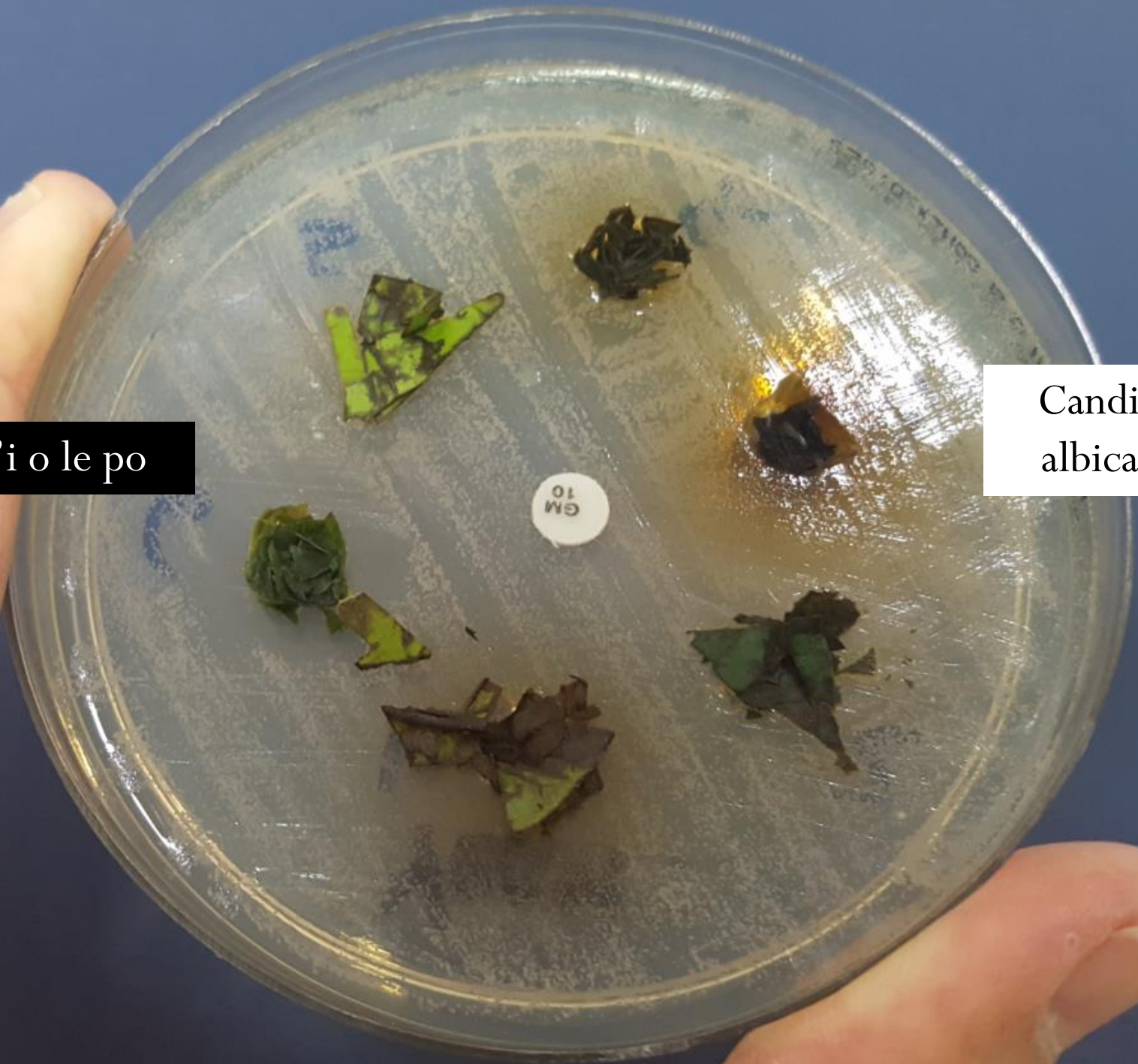
Coconut oil

Seasea + water



Ali'i o le po

Candida albicans

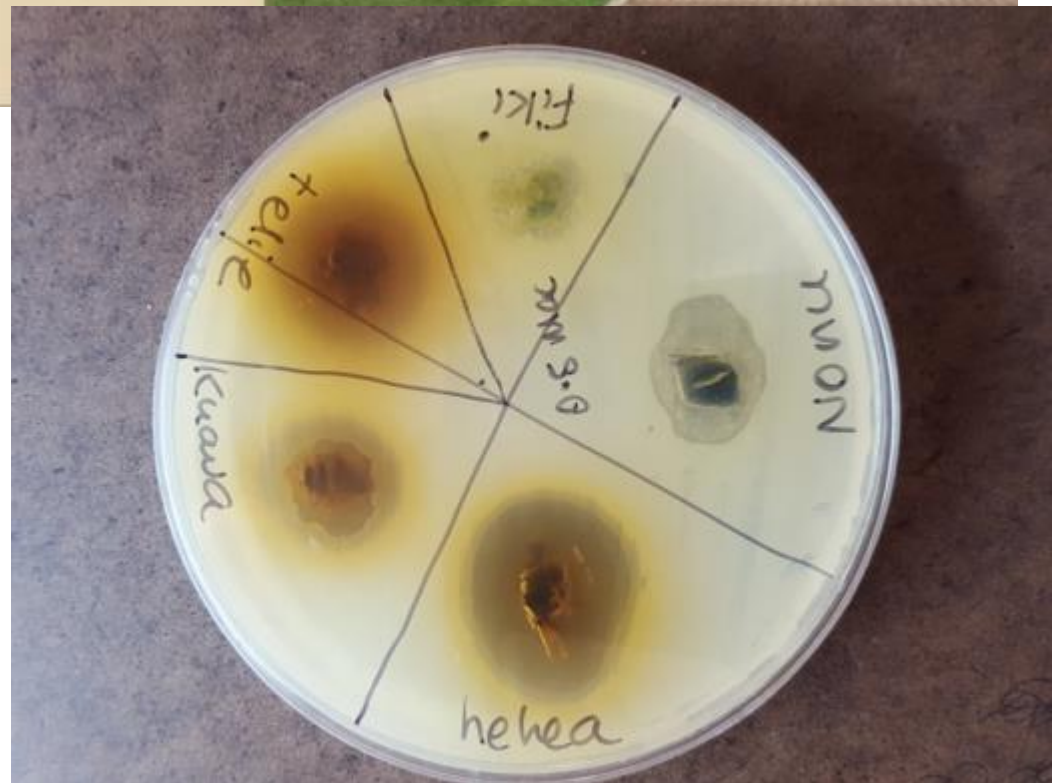


Contamination Control Laboratories (DCL) Pty Ltd
BIOLOGICAL SAFETY CABINET CLASS II
PERSONNEL & ENVIRONMENT PROTECTION AGAINST INHERENT AND SPECIAL HAZARDOUS AGENTS
DO NOT USE FLAMMABLE, EXPLOSIVE AND VOLATILE LIQUIDS OR CYTOTOXIC DRUGS IN THIS CABINET

Testing Samoan natural products against Samoan clinical pathogens

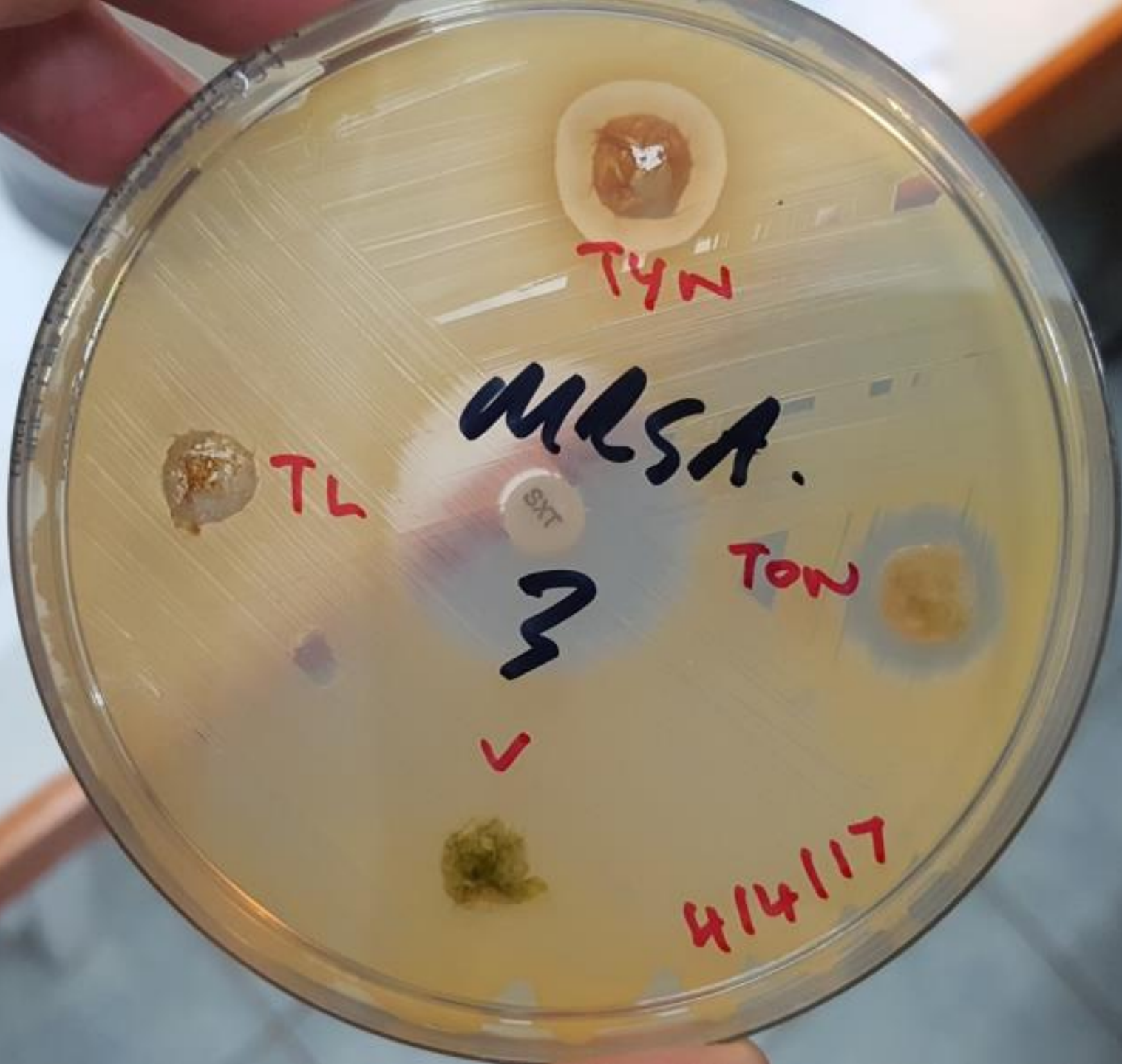


Tonga



Cook Islands





TYW

MRSA.

TL

SXT

3

TON

✓

4/14/17

Other ways to reduce acute traumatic wound infection

- Dressings – yes, probably!
 - Moisture – promotes healing
 - Remove exudate when remove (non-stick best)
 - Thermal insulation (cold slows healing)
 - Reduced bacterial contamination
 - Less additional trauma (damage, pain)
- Delayed closure – in certain circumstances.
- VAC (negative-pressure wound care) for high-risk, complex cases.
- Hyperbaric oxygen.
- Prophylactic antibiotics.....

Antibiotic prophylaxis

Indications:

- Crush injuries
- Gross contamination with soil/wood
- Deep – tendon, cartilage, open fracture, joint
- Immune compromise – steroids, poorly controlled diabetes
- Bites or oral wounds
- Feet or legs with lymphoedema, diabetes etc.

Choice

- Augmentin
- Cefalexin
- Clindamycin
- Add doxycycline if high MRSA risk.

Duration

- 3 to 5 days.

Other skin conditions



Minor burns

- Clean and debride; dressings (but which?)
- Topical antiseptics/antibiotics
 - Sustained-release silver products
 - Silver nitrate – kills bacteria but only 1 of 14 RCTs shows benefit on healing, some show harm.
 - Silver sulfadiazine - #1 used but no trials, ?↓healing
 - Honey - 2 good RCTs show healing faster than standard; 6 poor RCTs show = to SSD (Cochrane 2015)
 - Dilute bleach –↓ bacteria, low toxicity, no RCT.
 - Chlorhexidine, Microdacyn (1 non-randomised trial).

UpToDate 2016

My recommendation

1. SR-silver, honey, Microdacyn
2. Dilute bleach - cheap

Minor dermatologic procedures

- Overall 1.3 to 1.5% infection risk
- Skin prep and dressing probably important
- Topical antibiotics or antiseptics
 - Meta-analysis of > 4000 patients, 4 RCTs (Bacitracin, chloramphenicol, mupirocin, or gentamicin ointment)
 - Pooled odds of infection 0.71
 - Authors' conclusion: not indicated due to low risk

J Derm Treatment 2015; 26(2): 151-8

My recommendation

1. No topical antiseptic or antibiotic (?)
2. If high-risk consider Microdacyn, H2O2, Savlon (chlorhex+ cetrimide)
3. (Avoid mupirocin and chloramphenicol)

Major surgical procedures



- Stop smoking, control diabetes, ↓ weight.
- Treat distant infection first.
- Nasal *Staph. aureus* decolonisation (50% ↓ infection) – pov-iodine better than mupirocin.
- Chlorhexidine bodywash (7 RCT - no ↓ infection).
- Pre-op skin prep - 70%⁺ ethanol + either chlorhex (0.5% = 2%) or pov-iodine (Cochrane 2013).
- Antibiotic prophylaxis (>50% ↓ infection).
- Intra-op antiseptic – ↓ infection, but out-of-vogue
- Triclosan-coated sutures (13 RCT – 26% ↓ infn)
- Pre- and post-op antiseptic???

Impetigo (minor)

- Meta-analysis of 68 RCTs, 5578 patients
 - mupirocin, fusidic acid effective
 - Placebo – 0 to 42% cure in 7 days

Cochrane 2012

- H₂O₂ 72% cure (vs FA 82%, NS)

Acta Dermato-Venerologica 1994; 74(4): 460-2

- Povidone-iodine 67.5% cure

J Pediatr ID 2006; 1: 219-23

- No studies of Microdacyn, NaClO, chlorhexidine.

My recommendation

1. H₂O₂
2. Mupirocin or fusidic acid (but anticipate resistance)
3. Try Microdacyn or dilute bleach?

Infected eczema

Canad. Med. Ass. J.
Mar. 14, 1964, vol. 90

CURRENT DRUG THERAPY: DRUGS FOR "ECZEMA" OF CHILDREN 693

CURRENT DRUG THERAPY

*This series of articles has been arranged by an editorial subcommittee of the
C.M.A. Committee on Pharmacy.*

Drugs for Eczema of Children

ARTHUR R. BIRT, M.D.,* Winnipeg, Man.

Condy's crystals



Potassium permanganate is the simplest agent for use in the control of secondary infection in eczema. Through oxidation it controls bacteria and it also dries denuded areas. Potassium permanganate solution should be made freshly for each bath, using one drachm of crystals to every six gallons of water (1: 6,000). It should not be used in a good bathtub. If it is used in a tub that does not have any abrasions on its surface, the brown stains can be removed with an ordinary household bleach.

Infected eczema

- Benzalkonium + triclosan baths – no effect, irritation in cases
- Dilute bleach (NaClO) baths – effective for submerged skin

Pediatrics 2009; 123: e808-14

Ped Dermatol 2003; 30(3): 308-15

- Microdacyn-like products – effective

Cutis 2012; 90: 97-102

Allergy 1997; 52: 1012-6

My recommendation

1. Dilute bleach baths
2. Microdacyn

Hydradenitis suppurativa

- Stop smoking, lose weight, avoid trauma/friction, dairy-free diet, low glycaemic diet, anti-androgens, TNF-alpha inhib (inflixamab, adalimumab, etanercept), metformin, zinc.....
- Topical antiseptics and antibiotics?
 - Topical clindamycin 1% works (one RCT, n=27)
 - Triclosan, chlorhexidine, others sometimes recommended but not studied.

My recommendation

1. Try topical antiseptics – Microdacyn, H₂O₂, Savlon, dilute bleach (cheap), triclosan bodywash

DANGER
Data-free zone

Recurrent boils

- Often due to eczema, occasionally psoriasis
 - Treat underlying eczema, psoriasis
 - Bleach baths or Microdacyn
 - PRN oral antibiotics, I&D, ?? topical AS (e.g. H₂O₂)
 - Low success with decolonisation.
- Invasive, virulent *Staph. aureus* strain
 - Rarely immune-compromise, IVDU, Munchausens
 - Usually clears spontaneously (months, years) – may be sped up by good hygiene (cover active lesions), wash and no share clothing and towels, surface cleaning, antiseptic bodywash
 - PRN oral AB, I&D, ?topical AS
 - Formal decolonisation – nasal mupirocin or pov-iodine, body wash with chlorhexidine or triclosan or dilute bleach), rifampicin, surface cleaning, fabric items.

Chronic 'goopy' ulcers

- Nurses are often the experts
- Fix underlying cause (pressure, arterial disease, venous stasis)
- Debride necrotic/devitalised material/eschar
- Remove slough/goop (toxins, WC, bacteria)?
- Dressings (no one better than any other?)
- Topical antibacterial/antiseptic agents:
 - ↓ bacteria on surface
 - ↓ bacteria deep in tissue
 - ↓ signs of infection
 - Probably improve healing.

Topical anti-bacterial agents for venous ulcer healing

- Cochrane Database Syst Rev 2014
 - 45 RCTs, 53 comparisons, 4486 patients
 - Poor design - small, high risk of bias, different baseline status, different duration of treatment....
 - Overall – difficult to know if effective or not!
- Results:
 - Cadexomer iodine (12 RCT) – 4 RCT show likelihood of complete healing at 4 to 12 weeks improved by RR 2.17 compared with standard care
 - H₂O₂ (4 RCT) – ↓ ulcer size compared with usual care
 - No evidence of benefit for povidone iodine (7 RCT), silver (12 RCT), chlorhexidine, mupirocin or honey (2 RCT) Note: Cochrane review of honey 2015 – may help burns and post-op wounds

Topical anti-bacterial agents for venous ulcer healing

- Prontosan (polyhexanide + betaine)
 - Effective in at least 3 comparative trials
- Slow-release silver
 - Effective – limited evidence so far.

Microdacyn[®] comparative trials

Condition	Design	Comparator	N=	Outcome for Microdacyn group	Stats	Ref
DFS	Non-R	Pov-iodine	218	Faster healing ↓ infection	< 0.001	Dalla Paola 2006
Post-op DFS	Non-R	Pov-iodine	33	Faster healing, ↓ antibiotics	< 0.01	Goretti 2007
Chronic wounds	RCT	Pov-iodine	40	↓ symptoms/signs of infection, ↓ days hospital	?	Ricci 2007
DFS	RCT	Pov-iodine	45	Faster healing, ↓ odour	?	Martinez-De Jesus 2007
Diab ulcers	RCT	Saline	100	Faster healing, ↓ bacteria	0.05	Suri 2008
Chronic wounds	Non-R	Pov-iodine	30	Faster healing	0.0045	Abhyanker 2009
Post-op DFS	RCT	Pov-iodine	40	Faster healing, ↓ antibiotic, ↓ re-operation	< 0.01	Piaggese 2010
Sternotomy wounds	RCT	Pov-iodine	190	↓ infection	0.033	Mohd 2010
Various wounds	Non-R	Pov-iodine	200	Faster healing, ↓ inflammation	?	Kapur 2011
Post-op wounds	RCT	Pov-iodine	100	Faster healing, ↓ infection	< 0.0005	Pandey 2011
Mild DFS	RCT	Levofloxacin	67	Faster healing	NS	Landsman 2011
Infected traumatic wounds	RCT	Pov-iodine	60	Fewer symptoms and signs of infection	< 0.004	Mekkawy 2014
DFS	RCT	Pov-iodine	60	Faster healing	0.024	Prabhaker 2016

Chronic 'goopy' ulcers



My recommendation

1. Cadexamer iodine
2. Microdacyn
3. Prontosan
4. SR silver?

Thanks
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