A Retrospective Review of Two Years of Admissions to a Tertiary Intensive Care Unit for patients with a primary diagnosis of Burns.

By

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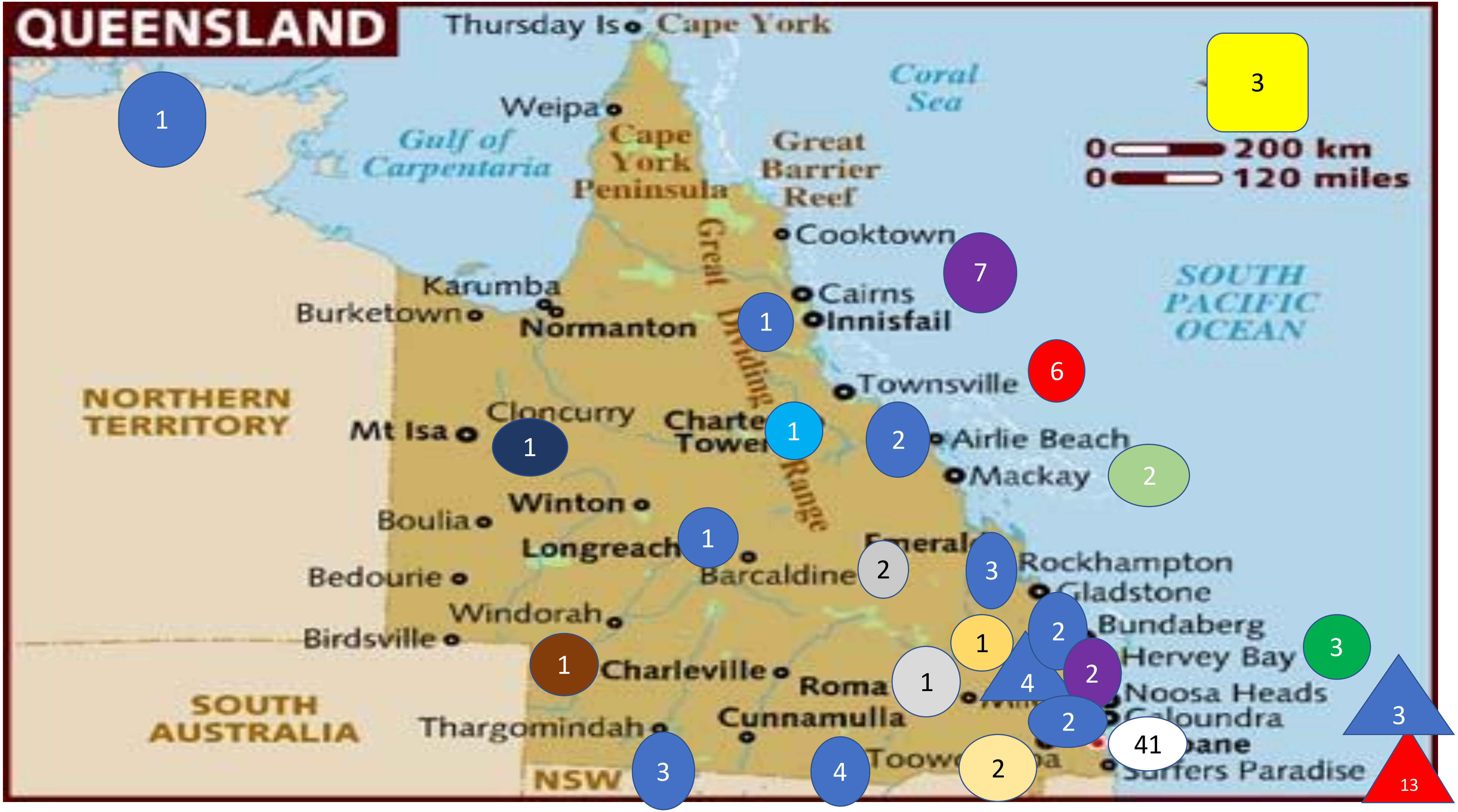
Who do we Treat?

- Epidemiology of our burns
- Admission demographics which might
- Help predict outcome
- Analgesia
- Microbiology and screening

Admission Demographics

- Ninety-four admissions 2015/2016 (1 excluded on review of notes)
- Sex
  - Male 64 (70%)
    - 16 Deliberate self harm
    - 21 recreational substance use
  - Female 27 (30%)
    - 10 Deliberate self harm,
    - 1 forensic
    - 7 recreational drug use as a confounder
- Age Range 17-85 yrs (Median 43.65 Yrs)

- IHT or Direct – 41 Direct and 52 IHT (1 or 2 centres) – no statistical difference in mortality
- Recreational Drug use reported on admission – Yes 35.8% No 53 (64.2%)
- Primary Cause - Accidental 64 (70%) Deliberate Self Harm 26 (28.5%) Forensic 1 (1.5%)
- LOS 1-78 days (median 11 days)


QUEENSLAND
Thursday Is
Cape York
Coral Sea
Weipa
Gulf of Carpentaria
Cape York Peninsula
Great Barrier Reef
0 200 km
0 120 miles
Cooktown
Great Dividing Range
Karumba
Burketown
Normanton
Cairns
Innisfail
SOUTH PACIFIC OCEAN
Townsville
NORTHERN TERRITORY
Mt Isa
Cloncurry
Airlie Beach
Mackay
Winton
Boulia
Longreach
Barcaldine
Rockhampton
Gladstone
Bedourie
Windorah
Bundaberg
Hervey Bay
Birdsville
Charleville
Roma
Noosa Heads
SOUTH AUSTRALIA
Thargomindah
Cunnamulla
Surfers Paradise
NSW
1
3
7
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6
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1
2
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41
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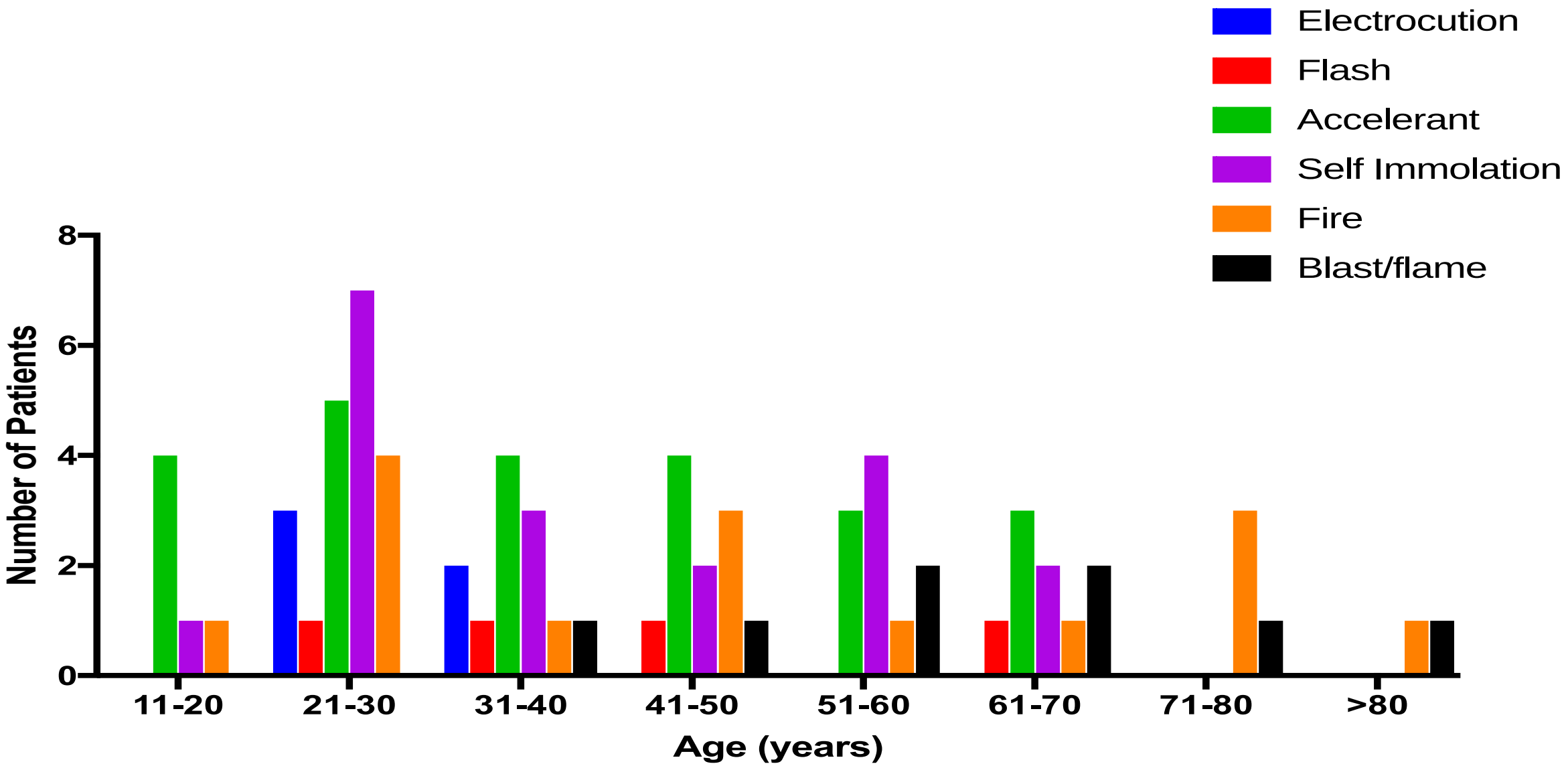
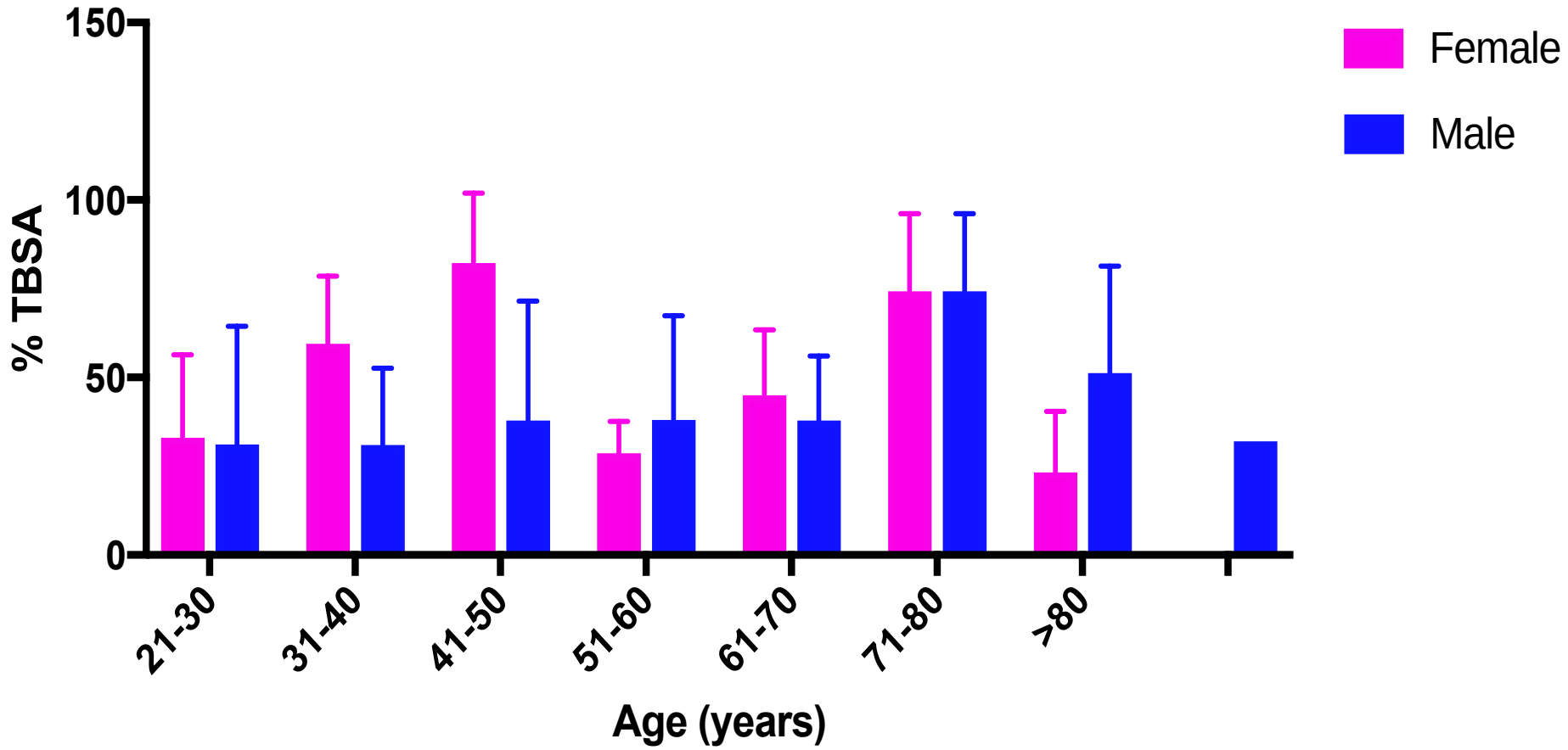
13

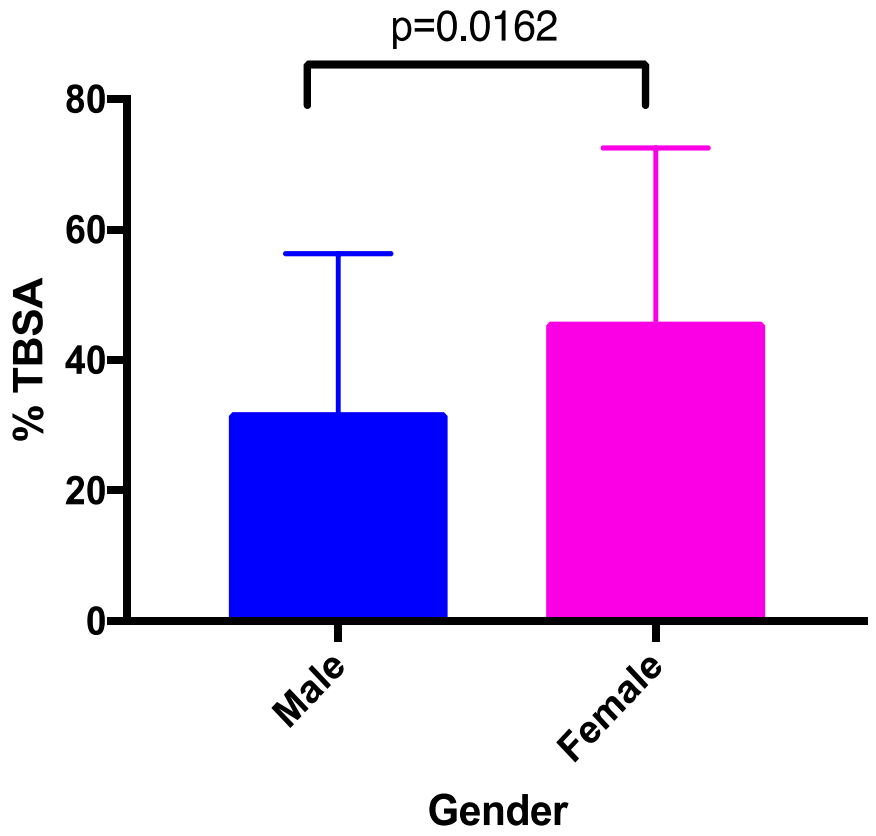
Mechanism of Burn by Age



Gender and Age at time of Admission



TBSA with Gender for all Mechanisms of Burn

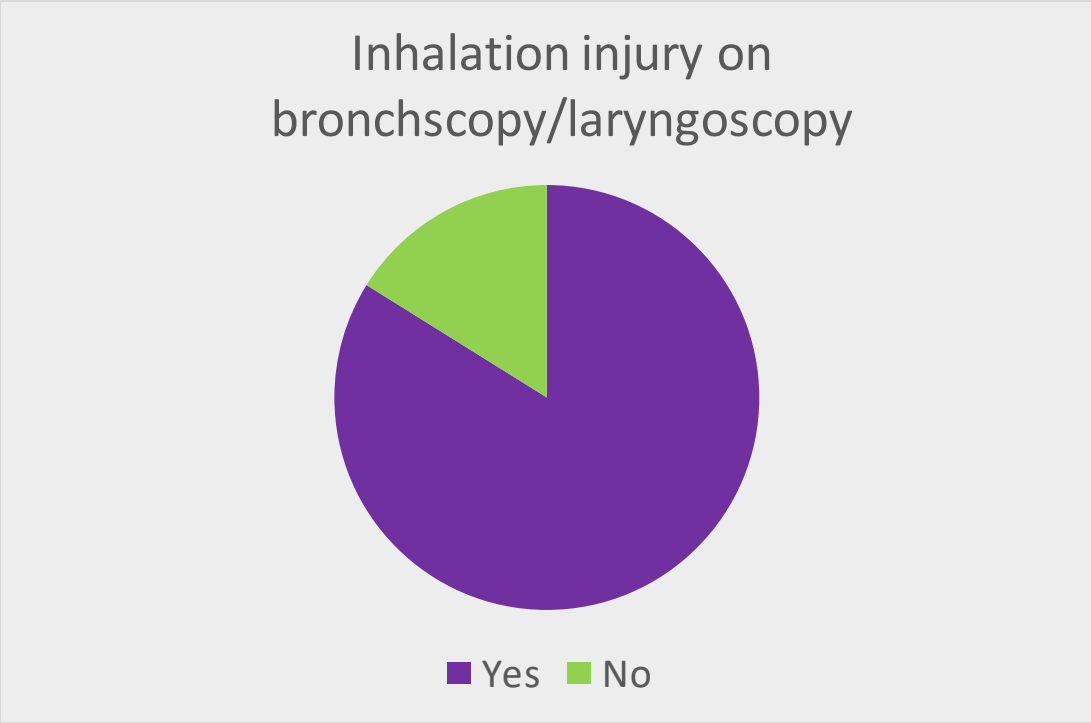


Difference between total body surface area (TBSA) between genders for all mechanisms of burn (p=0.0162)

Associated Inhalation injuries or Facial Burns

- Inhalation Injury - Yes 78 (86%)

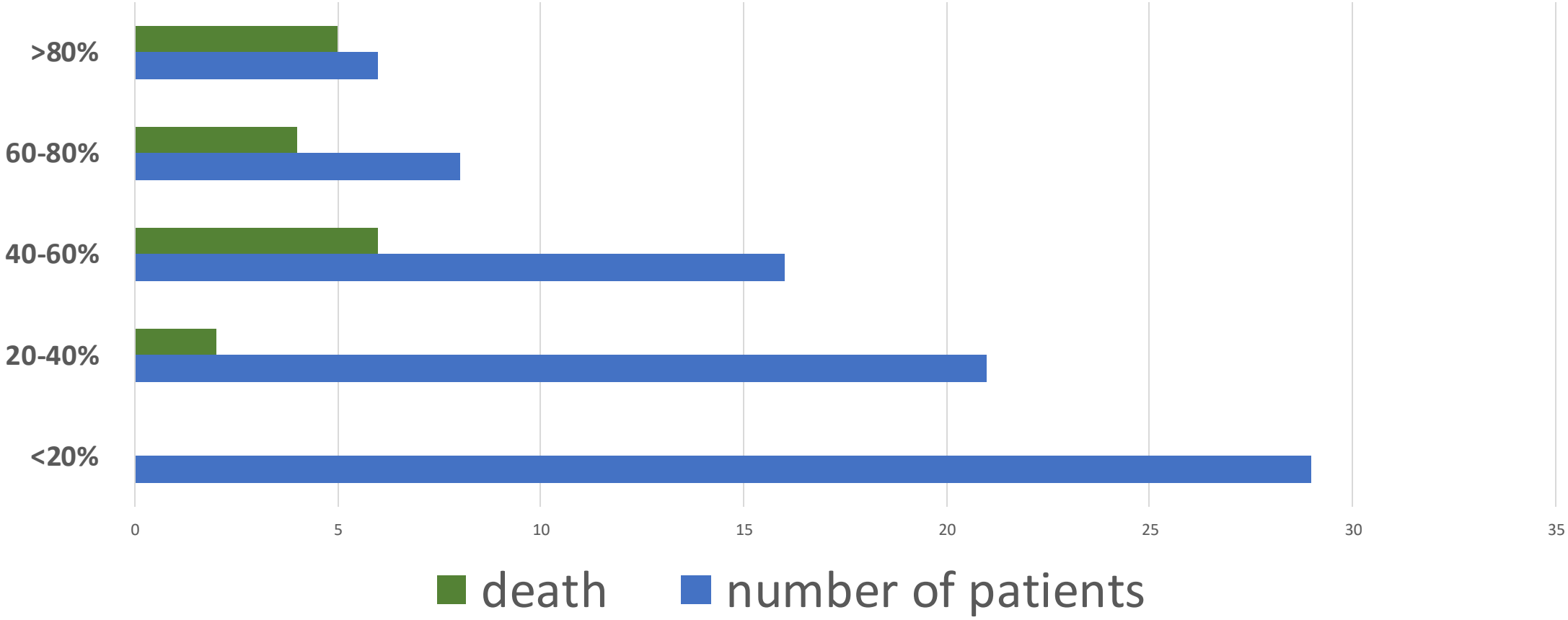
- Facial Burns - Yes 77 (85%)



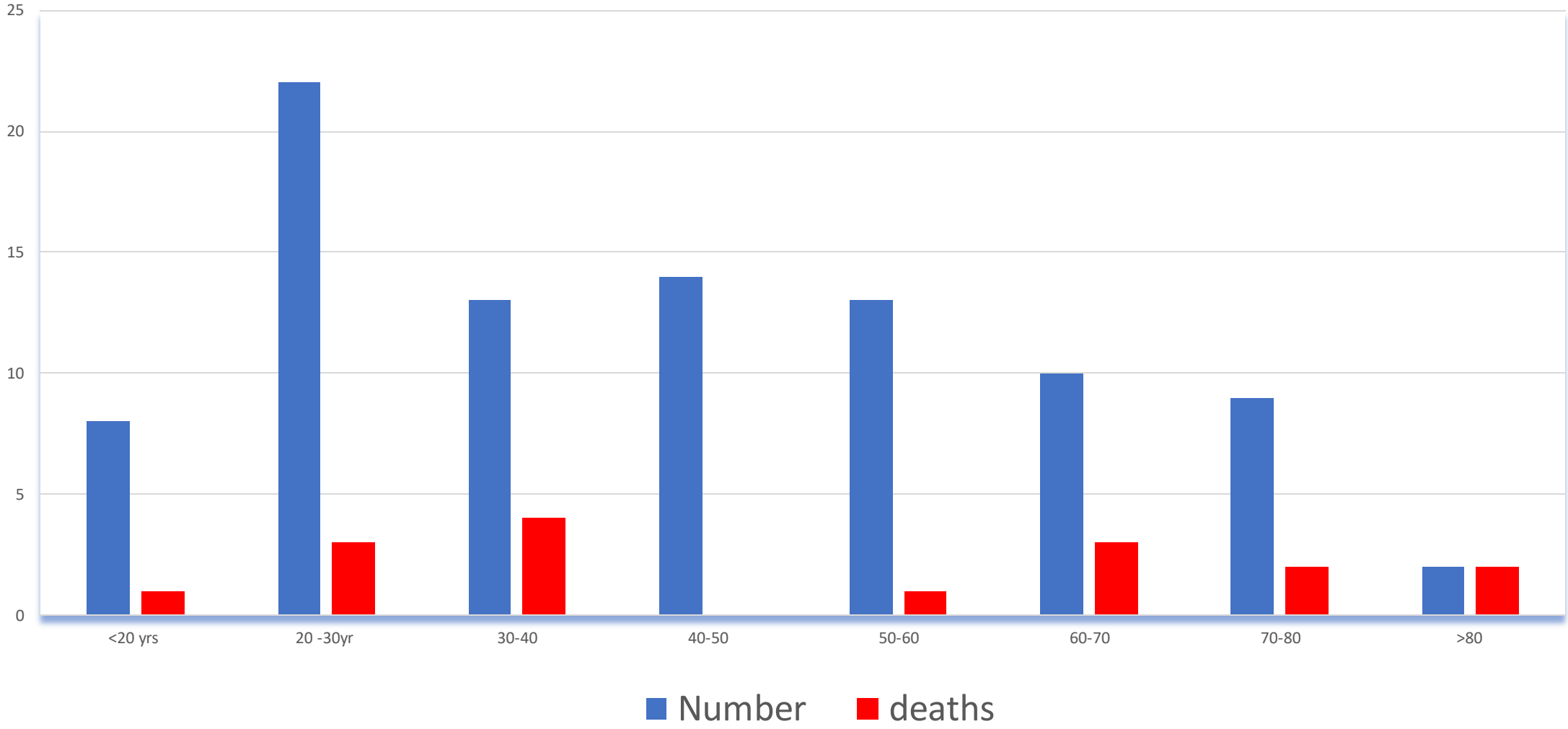
Mortality

- 17 deaths in total
  - Gender (not statistically significant)
    - 7 females 10 males
  - Intention – 7 DSH, 9 accidental, 1 forensic
  - Illicit Drugs 6 (35%)
  - Age – 100% mortality if age > 80yrs
  - TBSA - 84% Mortality if TBSA >80%
  - Resuscitation
    - If Parklands Resus 10-20L 25% mortality
    - If >20L 50% mortality
    - No correlation between vasopressors and mortality
  - Modified Beaux Score
    - 9 score <140 , 8 score >140
    - Not predictive of mortality in this cohort
  - Biochemistry
    - pH and Temp strongly associated with mortality but not
    - Lactate

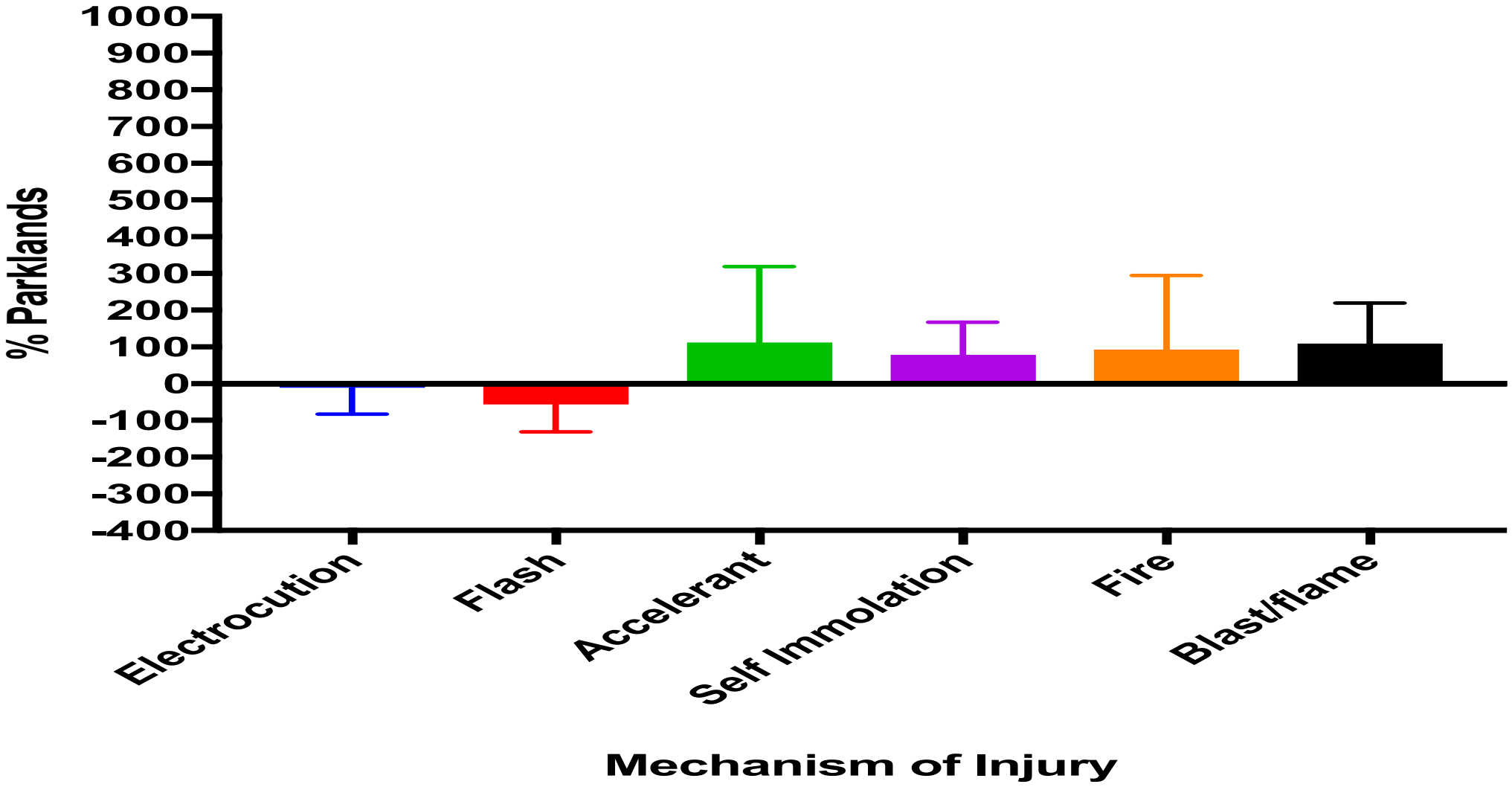
Deaths by % TBSA



Age on Admission and Mortality



% Parklands resuscitation per Mechanism



Fluids

- 41 (48%) patients did not have accurately recorded fluid balances prior to ICU admission
- 68 pts (73%) with fluids recorded had more than their calculated parklands in the first 24 hours of resuscitation.
- Lack of good data on actual BW and height. Likely underestimated
- If your Parkland Calculation was
  - >15L -20L – 25% mortality
  - >20L- >50% mortality rate
  - >30L 50% mortality. 1 patient had 46,200mls and survived!
- Multiple fluids used in Resus
  - Crystalloids – Hartmanns/N saline
  - Colloids – 4% albumin, 20% albumin, PRC and other Blood products
  - Significant variation between clinicians in their fluid of preference
- Mortality
  - 10 Pts more than their estimated Parklands
  - 6 Pts less

Vasopressors

- No statistical significance between use or number of vasopressors and mortality
  - 43 patients fluid resuscitation only
  - 40 patients single agent 38 NA – metaraminol 2
  - 2 patients dual agent NA/A or NA/V
  - 1 patient triple NA/A/V
  - No association between number of sedatives in regimen and requirement for pressors/tropes

Haematology and Biochemistry on Admission to ICU

- HB range 70-215 (no statistical relationship to mortality)
- pH 6.81- 7.56
  - 15/17 deaths had acidaemia pH <7.35 (statistical relationship to mortality)
  - No deaths in patients with alkalaemia or pH >7.4
- Temperature
  - <35 degrees Celsius on admission to ICU 7/12 patients died
  - <36 degrees 10/26 patients died
  - Normothermia 36-37.9 3/57 died
  - >38 2/9 died

Temperature and pH on Outcome

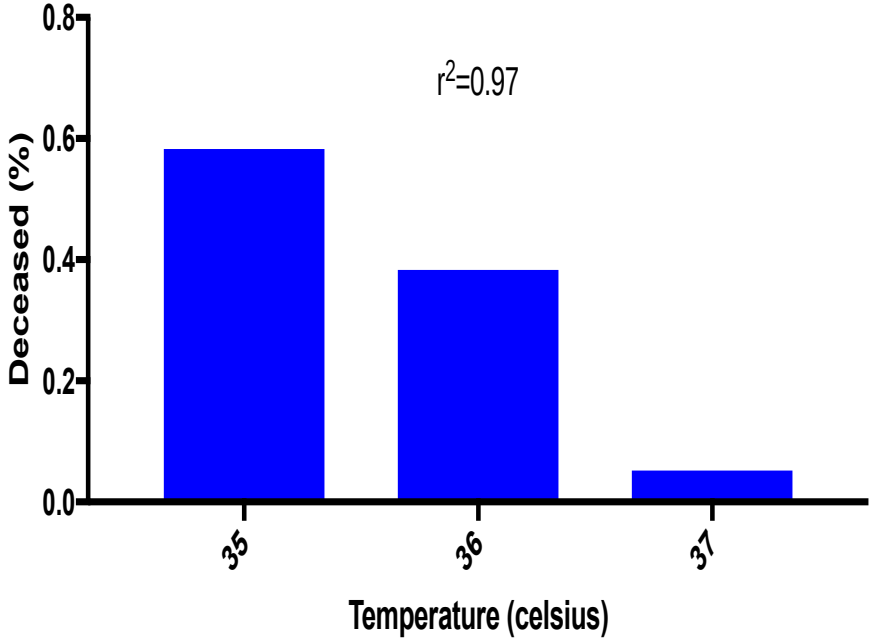
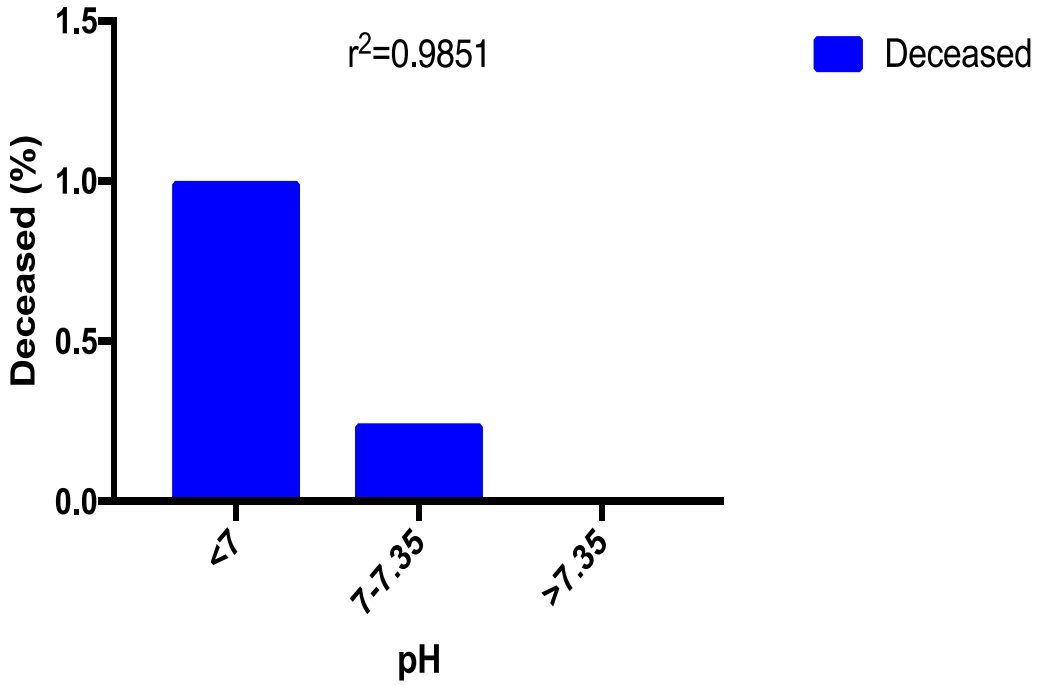


Figure shows an identified association between body temperature and outcome, indicating with decreasing temperature from normothermic, a proportion of deceased patients increases linearly (r^2=0.97)



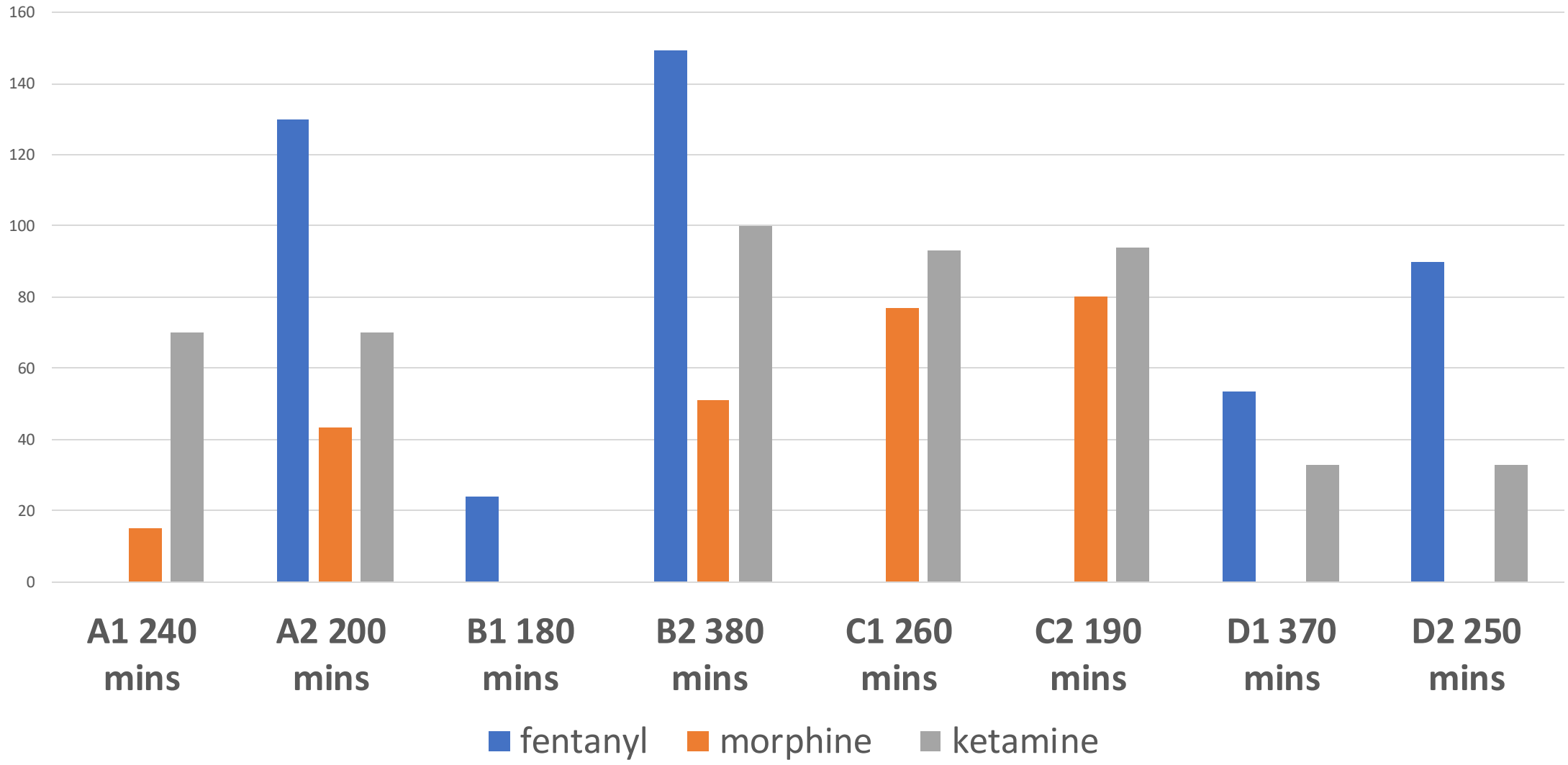
Analysis of pH on admission shows a linear trend (r^2=0.9851) with the proportion of patients with positive outcomes (discharge) decreasing with the rise in serum pH

Sedation

- 14 different regimens used for sedation in 89 patients

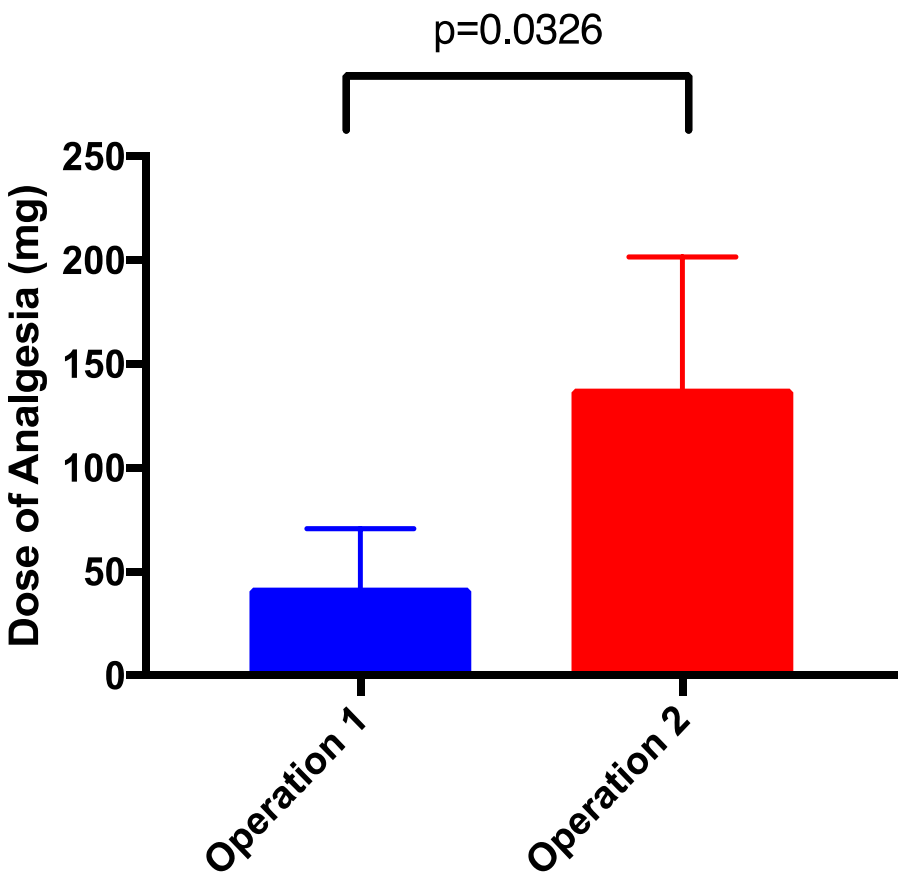
Sedation Agent	Number patients
Nil	4
clonidine	2
morphine	1
propofol	1
fentanyl/propofol	12
morphine/midazolam	29
fentanyl/midazolam	12
morphine/midazolam/propofol	6
fentanyl/midazolam/morphine	6
fentanyl/morphine/propofol	1
fentanyl/midazolam/propofol	5
midazolam/morphine/ketamine	1
fentanyl/midazolam/ketamine	1
fentanyl/morphine/midazolam/propofol	2
fentanyl/midazolam/morphine/ketamine/propofol	3

Analgesic Doses for First v Second Debridement/Grafting Operations per patient

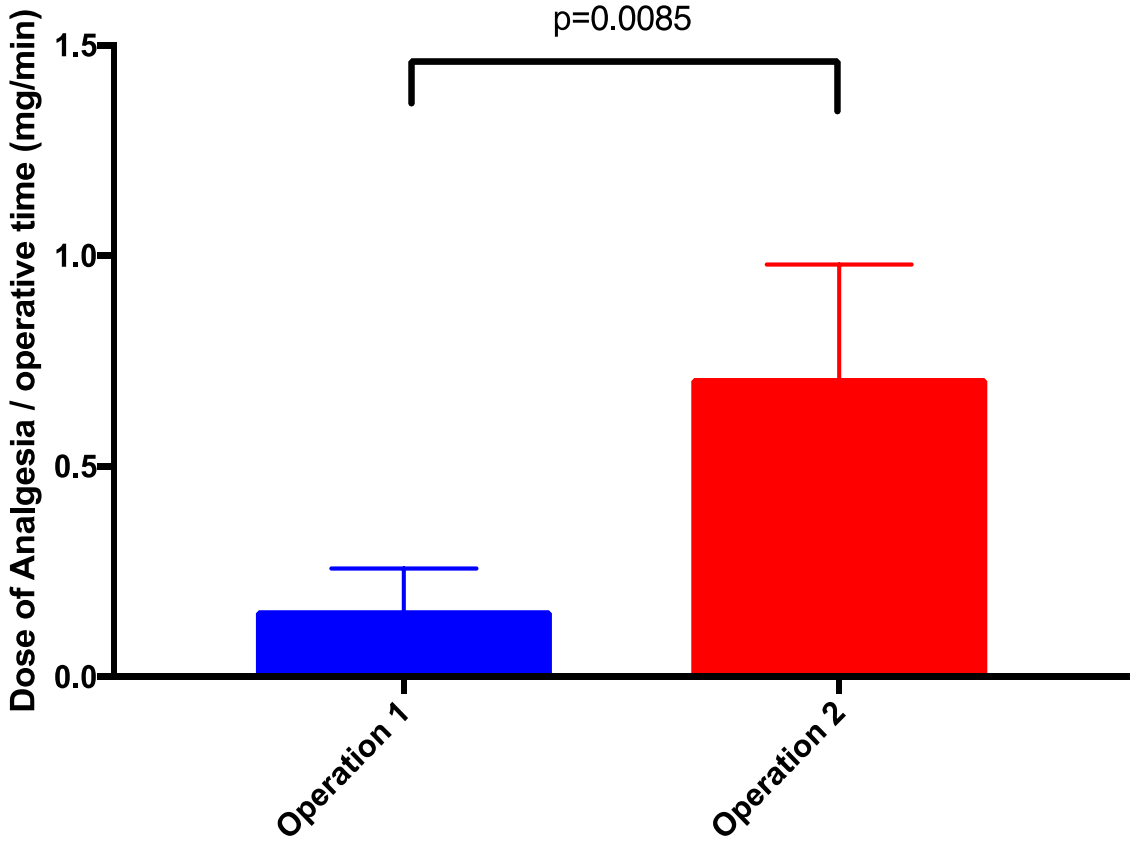


Comparison Intraoperative analgesia

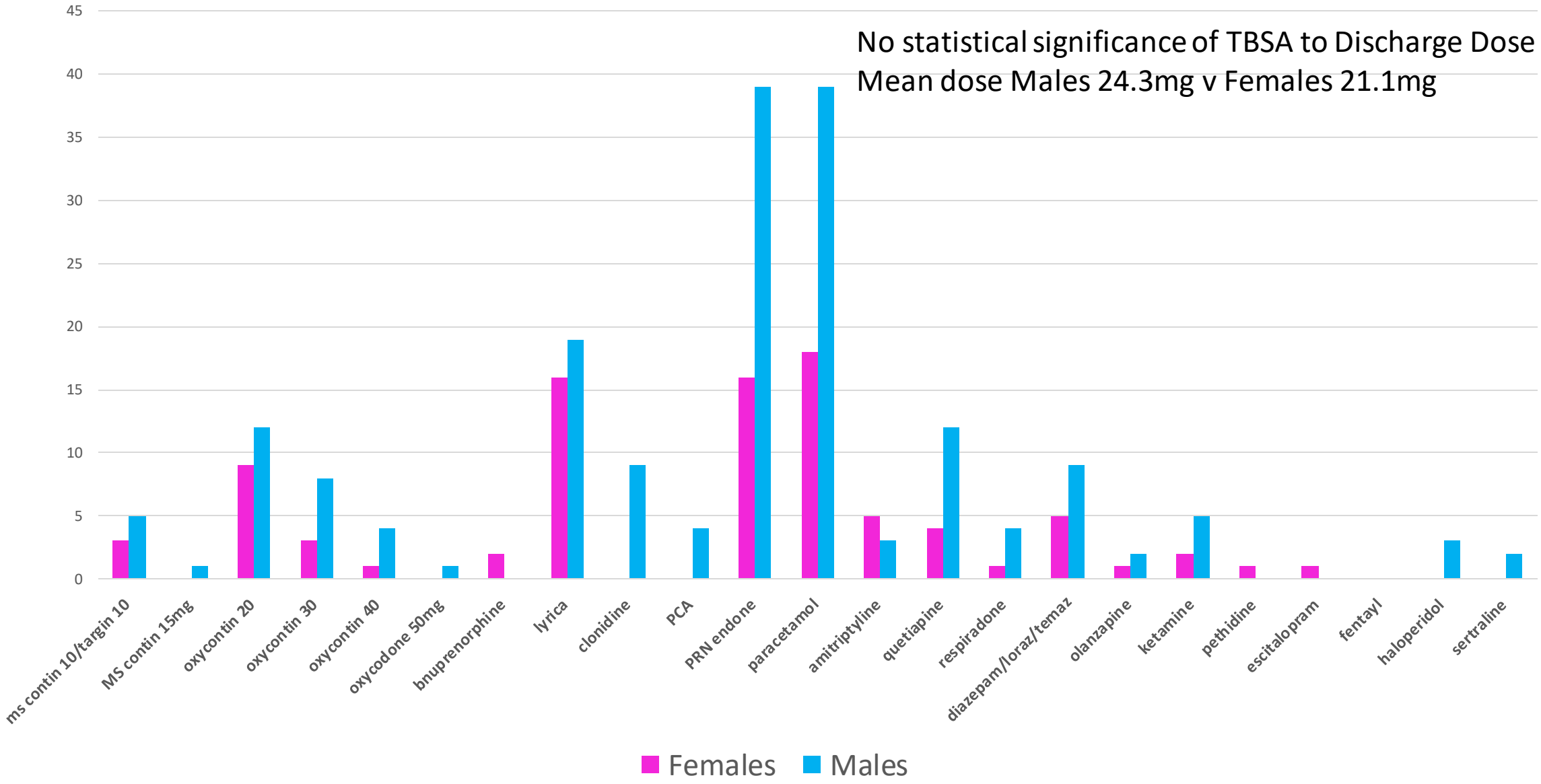
Total Dose per operation



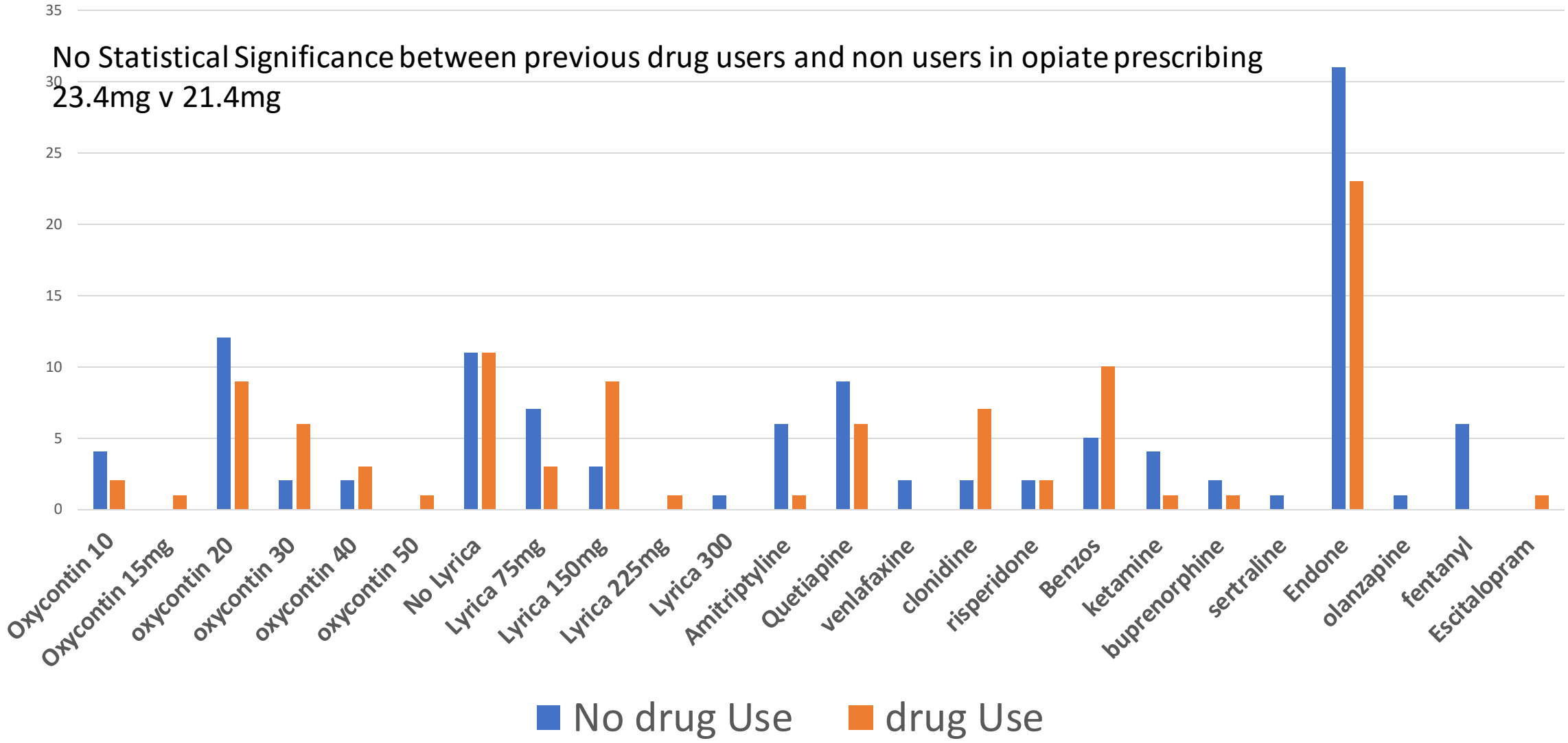
Dose mg/min per operation



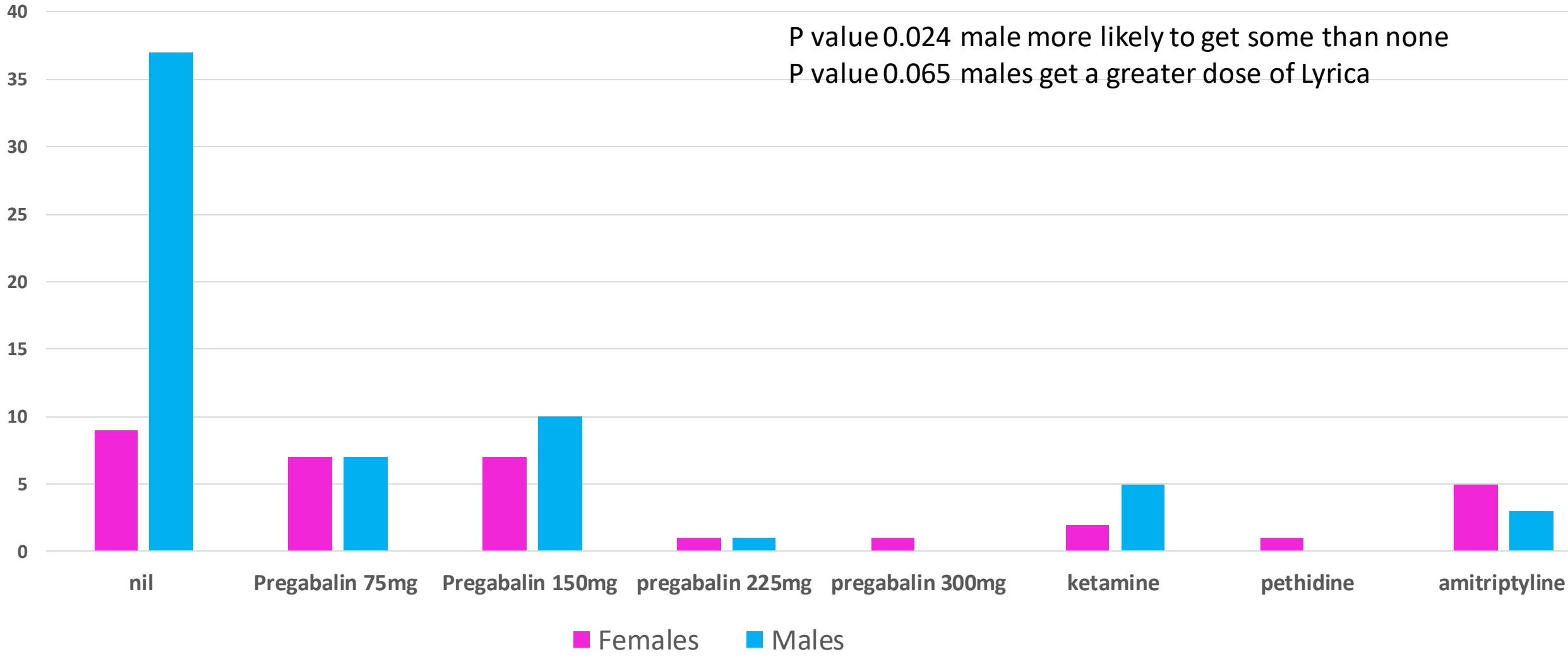
Discharge Analgesia by Gender



Discharge Analgesia – Previous Recreational drug use.



Neuropathic Agents on Discharge



MRO screening for Burns Patients

- Currently all patients are screened on admission
- They are then screened routinely every Monday and Thursday.
- Each set of screening test costs $60.75
  - on top of any septic screening
- All burns patients are barrier nursed in single rooms – delivery of care is not affected by screening results
- Our unit has a nurse initiated system.
- 2010 Prevention and control if infection in healthcare (currently under review)
- ACSQHC in collaboration with the Introduction of National Guidelines for Surveillance – on admission and twice weekly

Number of Screening Tests per patient in RBH

- 401 tests performed in 93 patients
  - Number of new positive tests 2.5% (13 tests – 3 already known to be colonized)
- Mean number of tests per patient 4.35
- Frequency of testing 2.7 days
- Cost per test $60.17
- Total cost for the burns patients
  - $24,128 2 years,
  - $12,064/year
- Review of data
  - Some patients had 2 sets of swabs in a day
  - One patient 4 rectal VRE swabs in 3 days
  - V poor compliance with unit protocol
  - Long stay patients fell off the pathway, short stay patients had multiple screens

Microbiology

- 36 organisms

Gram +ve Cocci

- Staph Aureus MSSA
- Staph Aureus MRSA
- Staph Cromogenes
- Staph Epidermidis
- Staph Lugdenesis

Gram –ve Cocci

- Moraxella Catarrhalis

Gram +ve Bacilli

- Strep Pneumoniae
- Strep Salivarius
- Strep sanguinus
- Strep mitis
- Corynebacterium
- Egglethera Lenta
- Proprionobacterium acnes
- Enterobacter aerogenes

Gram -ve Bacilli

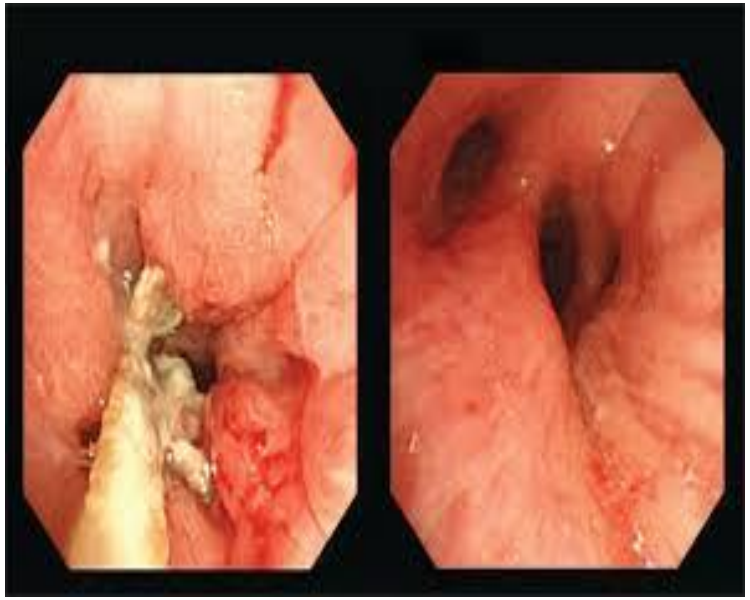
- Klebsiella Oxytoca
- Klebsiella Pneumoniae
- Pseudomonas Aeruginosa
- Pseudomonas chloraraphis
- Pseudomonas putida
- Bacteroides stercolis
- Bacteroides thetaiotaomicron
- Bacteroides fragilis
- Enterobacter Cloacae
- Aeromonas hydrophilia
- Serrait mascarens
- Hafnia Alvei
- Acinetobacter Baumannii
- E coli
- Citrobacter Freundii
- Coliforms
- Enterobacter Aerogenes
- Curvularia species
- Fusobacterium Necrophorium

Incidence and location

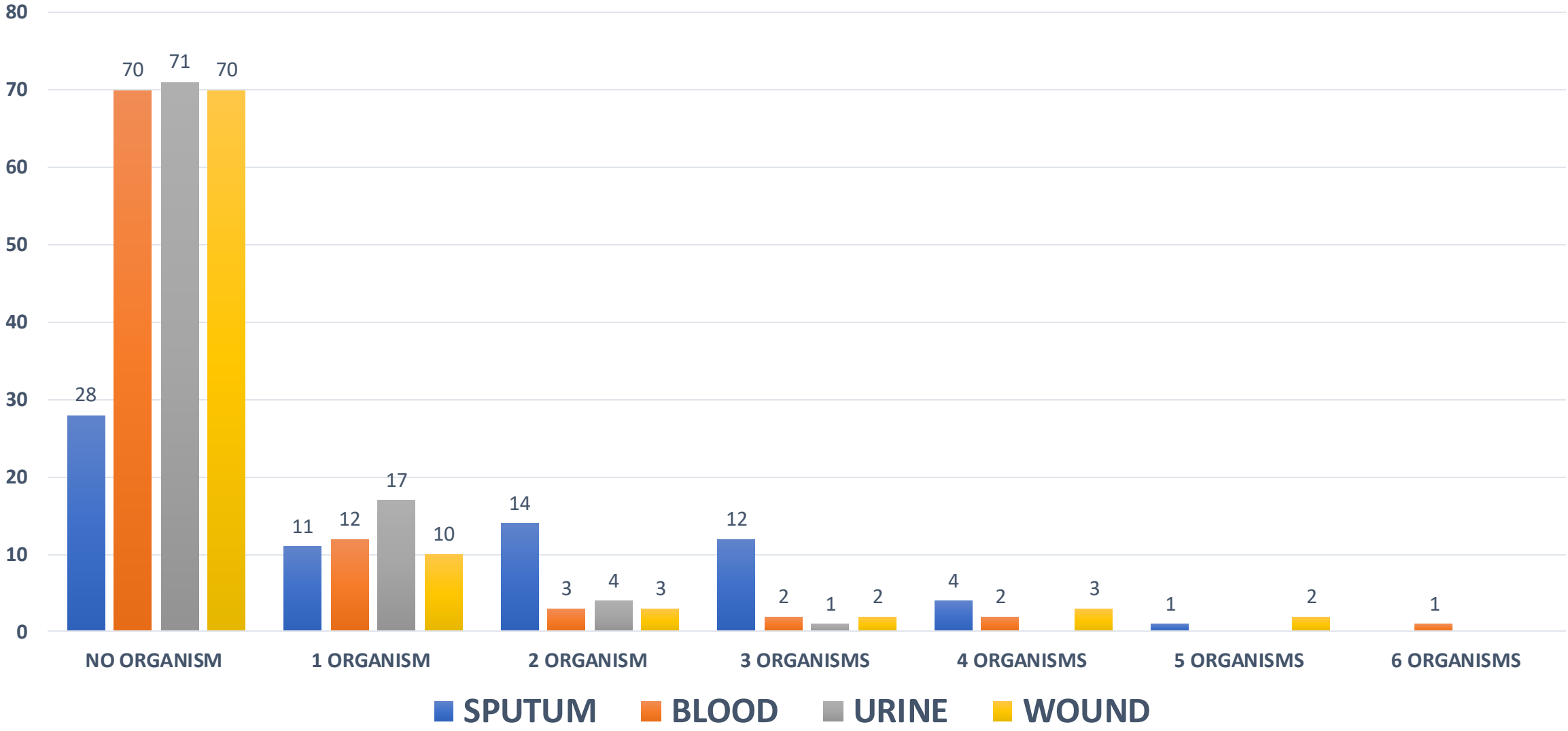
Organism	Sputum	Blood	Urine	Wound	Total
Staph aureus MSSA	31	1	2	3	37
Klebsiella Pneumoniae	12	2	2	1	17
Acinetobacter Baumannii	8	2	2	5	17
Pseudomonas Aerogenes	12	4	1		17
H influenza	15				15
Enterobacter Cloacae	7	5		2	14
Strep pneumoniae	7		1		8
Serratia Mascarens	2	2		4	8
E coli	1	2	1		4
Proteus Mirabilis	1	2			3
Moraxella catarrhalis	3				3
All the rest had 1 positive test					

Microbiology

- Respiratory tract infections
  - R/F for Resp infections include
    - Early endotracheal intubation *only controllable variable*
      - Unnecessary intubation may increase morbidity and mortality
      - Predictor of early onset Pneumonia – portal for contamination
      - Most patients had a gram negative on their admission ET aspirate
    - Inhalation injury
      - Associated with higher rates of pneumonia
      - The more severe the inhalation injury the higher the risk
  - ICan prolong intubation/ventilation and ICU LOS

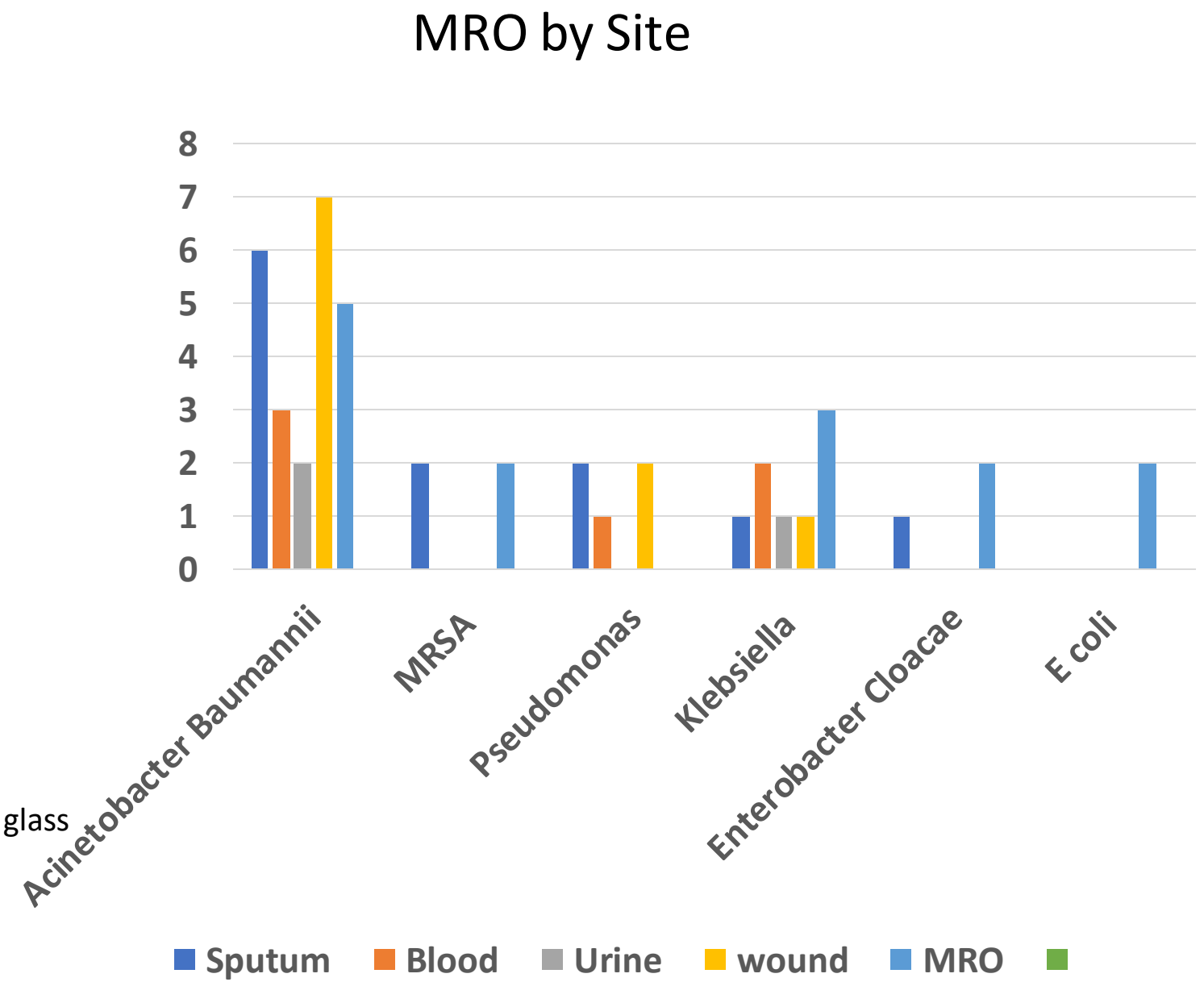


Number of Organisms by Site per patient



ESKAPE organisms

- **Acinetobacter Baumannii (new species)**
  - "Irakibacter" , homeless
  - "red alert" pathogen
  - 1 identified in PRC
  - Targets moist tissues
    - MM
    - Skin
    - Initially "peau d'orange"
    - Later sandpaper
    - Vesicular
    - Heamorrhagic bullae
  - Co pathogens
    - Klebsiella
    - Candida
    - Enterococcus faecalis
  - Highest colonization
    - Axilla, groin and toe webs
  - ICU increased risk
    - Intubation, dialysis, lines, antimicrobials
    - Biofilms on ET tubes and abiotic surfaces- glass
- **Klebsiella pneumoniae**
- **MRSA**
- **Pseudomonas aeruginosa**
- **E coli**



Antibiotics On Discharge

Discharge Antibiotics	Number
None	53
Cipro/gent/tobramycin/vanc/piptaz/fluconazole	1
ceftriaxone	1
cefepime/vancomycin/gentamycin	1
Meropenem	1
cephazolin	1
ciprofloxacin/tobramycin/meropenem/piptaz	1
piptaz/vancomycin	2
ceftriaxone/vancomycin	1
flucloxacillin/ceftriaxone/piptaz	1
piperacillin/tazobactrim	1
fluconazole/piptaz	1
piptaz/lincomycin/vancomycin	1
fluconazole/piptaz/ceftriaxone	1
flucloaxacillin/piptaz	1
Ciprofloxacin	1
Amikacin	1
Tigecycline/meropenem	1
lincomycin	1
lincomycin/piptaz	1
piptaz, cipro, moxifloxacin, vanc	1
colistin, tigecycline, flucloxacillin	1

In summary

- What are we doing well?
  - Survival rates – Only 7 patients died having active treatment.
  - LOS – Relatively short LOS
  - Retrieval. IHT have the same mortality as the direct admissions.
- What can we do better?
  - Standardization of analgesia, fluids, blood products, nutrition
  - Documentation of fluid resuscitation on admission
- Plan from here
  - Extend the audit to 5 years – low death rate meant it was hard to demonstrate statistical significance despite trends.
  - Present in our QI group and review our practice as a unit
  - Identify areas of further potential research

References

1 Costa Santos D, et al. Face and neck burns: a risk factor for respiratory infection? Annals of Burns and Fire Disasters. 2016 Jun30;29(2):97-102.

2 Fear VS, et al. Burn Injury Leads to increased Long-Term Susceptibility to Respiratory Infection in both mouse models and population studies. PLoS One.2017 Jan 9;12(1):e0169302