King's College Hospital
NHS Foundation Trust

I've Got You Under My Skin:
A Comparison of IV and s/c PCA

Nick Williamson Clinical Nurse Specialist

How did PCA get under my skin?

Started in 2009 when I started working at KCH

Subcut PCA ! ! !

PCA refers to an electronically controlled infusion pump that delivers an amount of ***intravenous*** analgesic when the patient presses a button.

WIKIPEDIA
The Free Encyclopedia

How did PCA get under my skin?

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Subcut PCA ! ! !

Observations:

Seemed to work well

Not so much PONV

How did PCA get under my skin?

Oct/Nov 2014

MSc Dissertation

Submission: Spring 2015

The planned (acupuncture) study snagged at R&D stage.

KCH acquired the PRUH in 2013.

There was 6 month's worth of (IV) PCA data from the PRUH available.

At KCH there are at least 25 (s/c) PCA patients each week.

Prospective data collection and compare.

What do we know about PCA?

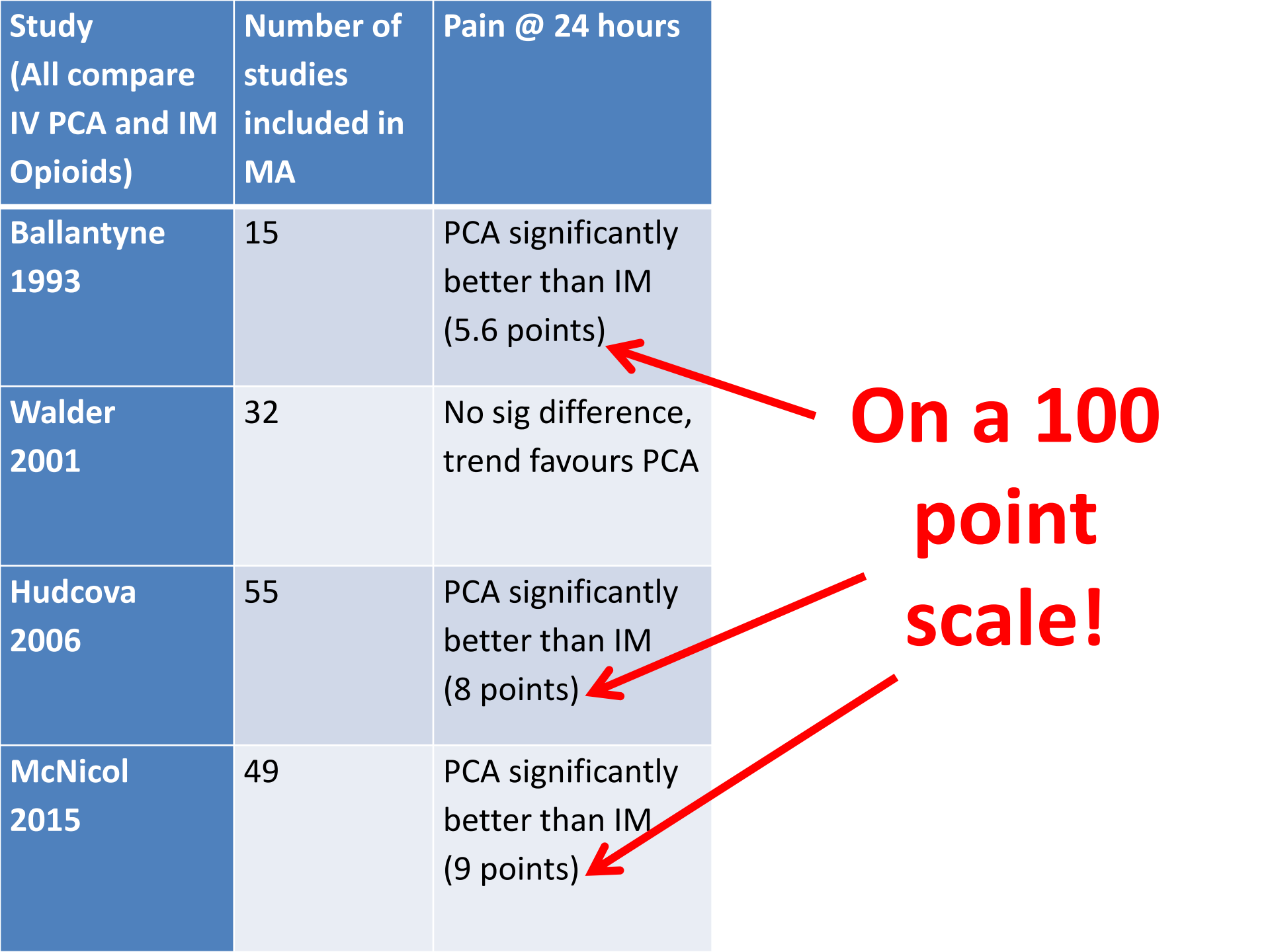
Early studies compared IV PCA with IM analgesia.

- PCA provided better analgesia
- similar incidences of side effects sometimes with a reduced consumption of opioid
- sometimes a shorter hospital stay

Bennett et al 1982; Finley et al 1984; Bollish et al 1985

Study (All compare IV PCA and IM Opioids)	Number of studies included in MA
Ballantyne 1993	15
Walder 2001	32
Hudcova 2006	55
McNicol 2015	49

Study (All compare IV PCA and IM Opioids)	Number of studies included in MA	Pain @ 24 hours
Ballantyne 1993	15	PCA significantly better than IM (5.6 points)
Walder 2001	32	No sig difference, trend favours PCA
Hudcova 2006	55	PCA significantly better than IM (8 points)
McNicol 2015	49	PCA significantly better than IM (9 points)



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Study (All compare IV PCA and IM Opioids)	Number of studies included in MA	Pain @ 24 hours	Opioid consumption @ 24 hours	Side effects IM vs IV PCA
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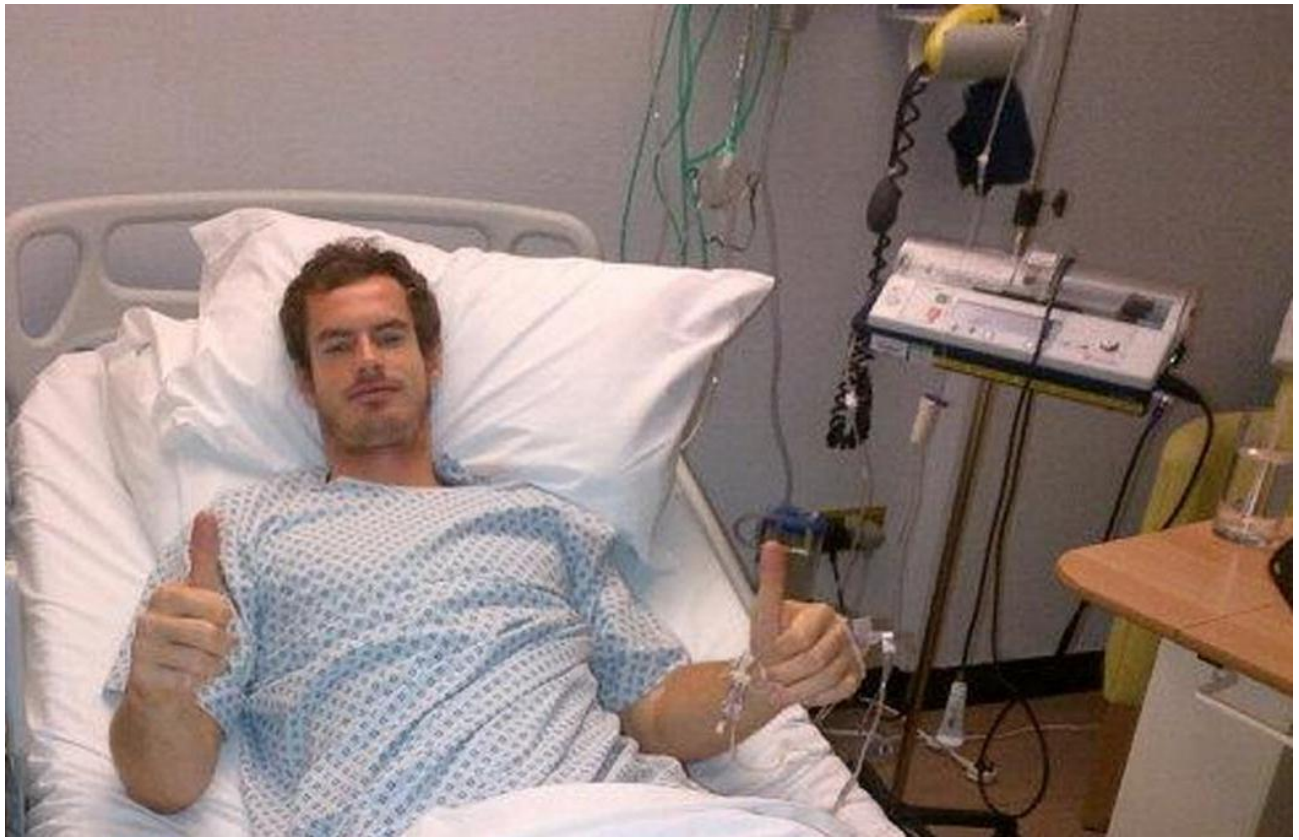
Patient satisfaction

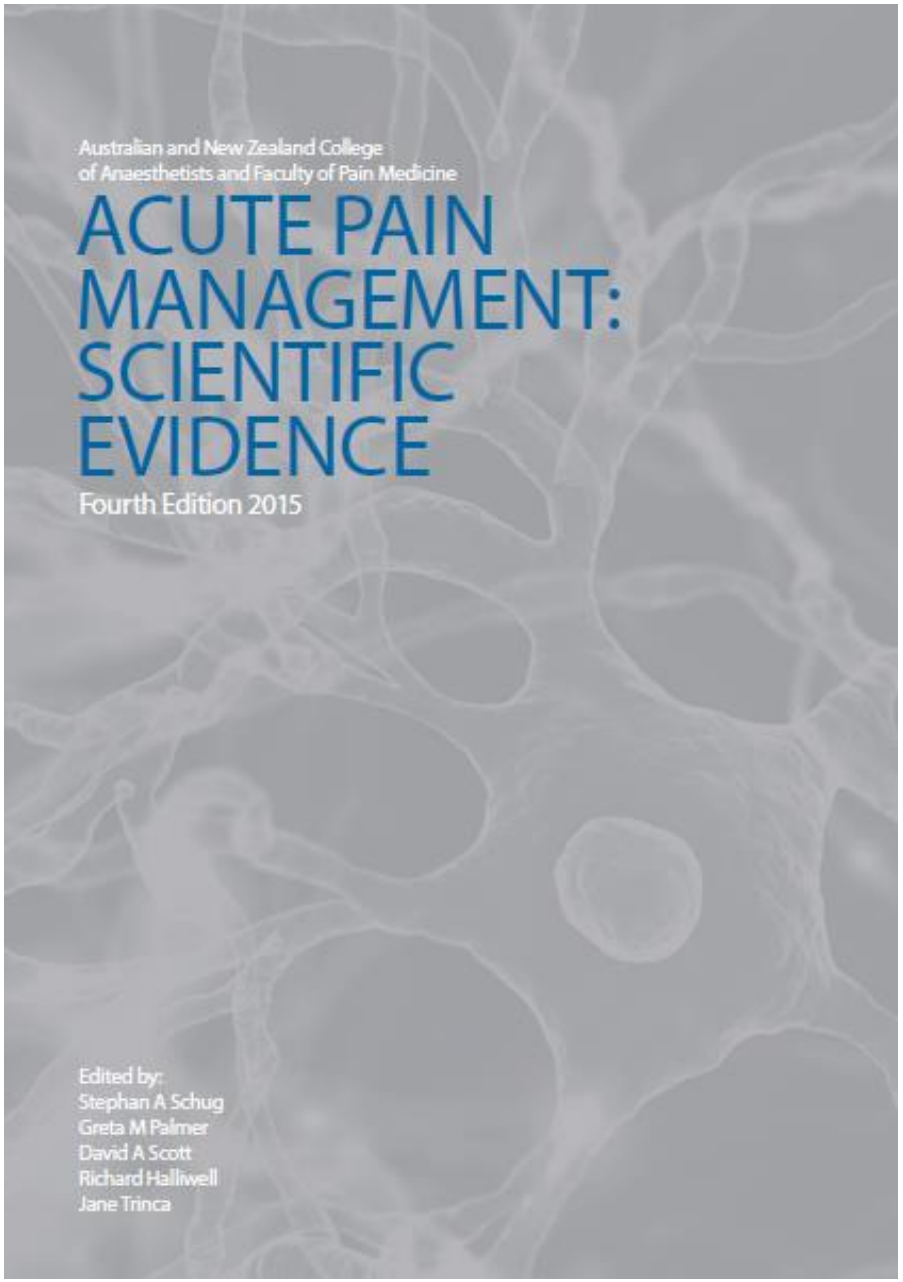


Meta-analysis of both the degree of satisfaction and the number of patients satisfied with therapy significantly favoured patients in the PCA group

Hudcova 2006

McNicol 2015

s/c PCA – What do we know?



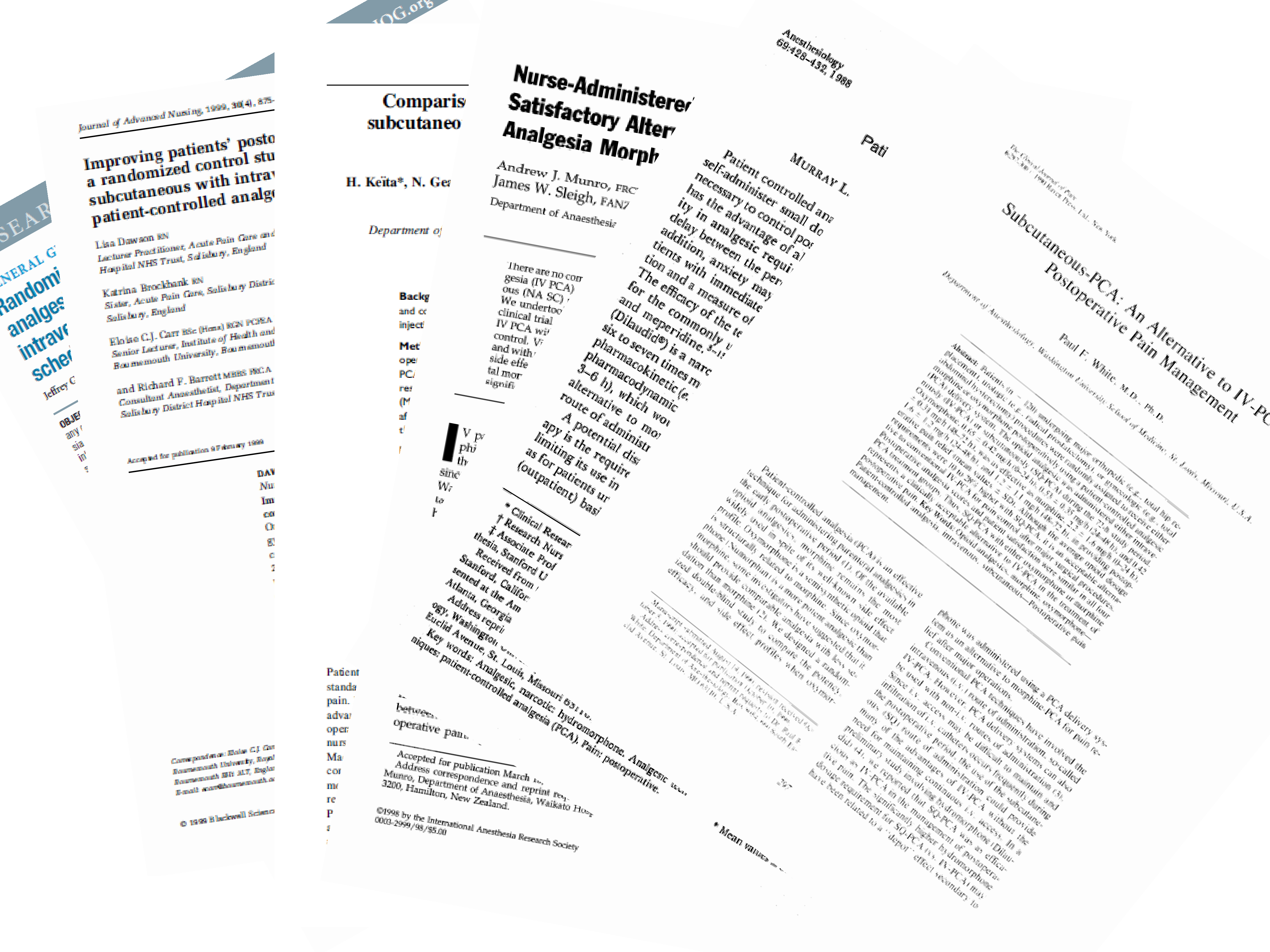
- 6 papers reported to compare IV and s/c PCA:

"Data on the effectiveness of SC PCA compared with IV PCA are variable and inconsistent. "

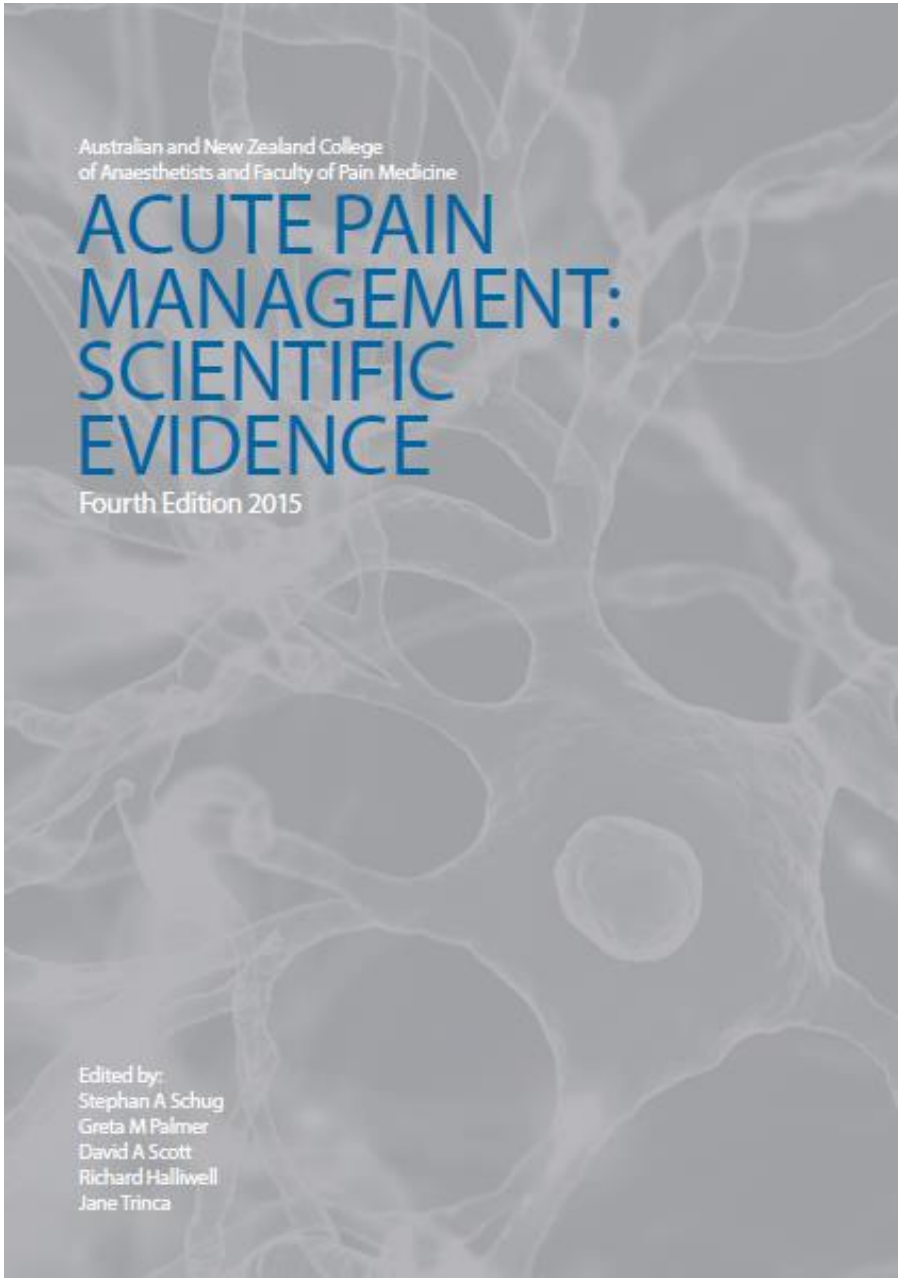
"Both similar and significantly better pain relief has been reported. "

"The same or a higher incidence of nausea and vomiting or pruritus."

"Compared with IV PCA, SC PCA may result in higher opioid use, or may not."


Journal of Advanced Nursing
Lisa Dawson RN
Katrina Brockbank RN
Nurse-Administered
Andrew J. Munro
James W. Sleigh
Anesthesiology
69:428–432, 1988
Subcutaneous-PCA: An Alternative to IV-PCA for
Postoperative Pain Management
Paul F. White, M.D., Ph.D.
©1998 by the International Anesthesia Research Society
0003-2999/98/$5.00

s/c PCA – What do we know?



Urquhart M, Klapp K & White P.
Patient-controlled analgesia: a comparison of intravenous versus subcutaneous hydromorphone.
Anesthesiology 1988; 69(3): 428–32.

White P. Subcutaneous-PCA: an alternative to IV-PCA for postoperative pain management.
Clinical Journal of Pain 1990; 6(4): 297–300.

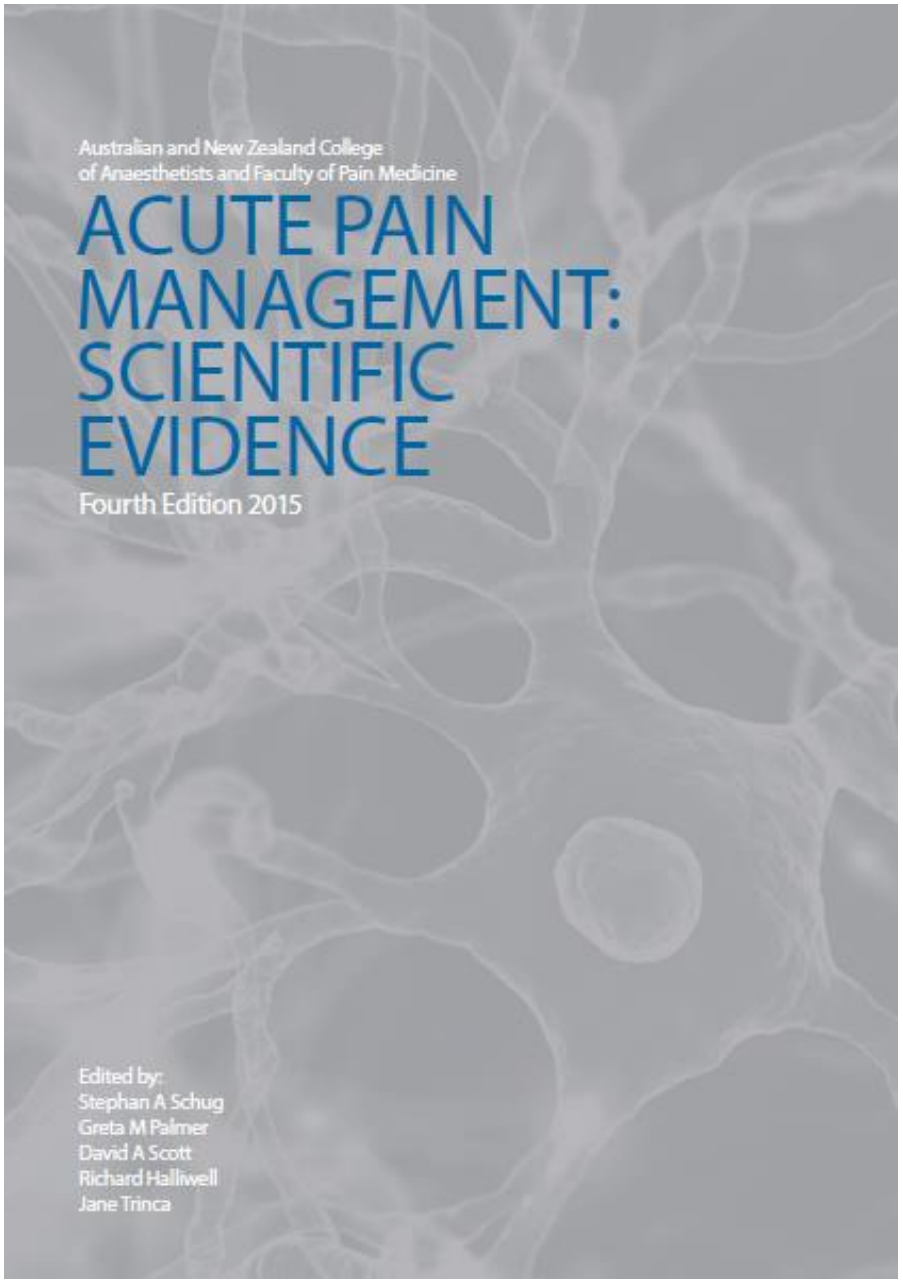
Dawson L, Brockbank K, Carr E.
Improving patients' postoperative sleep: a randomized control study comparing subcutaneous with intravenous patient-controlled analgesia.
J Adv Nurs. 1999; 30(4): 875–81.

Munro A, Long G, Sleigh J.
Nurse-Administered Subcutaneous Morphine Is a Satisfactory Alternative to Intravenous Patient-Controlled Analgesia Morphine After Cardiac Surgery
Anesth Analg 1998; 87:11-15

Bell J, Shaffer L & Schrickel-Feller T.
Randomized trial comparing 3 methods of postoperative analgesia in gynecology patients: patient-controlled intravenous, scheduled intravenous, and scheduled subcutaneous.
Am J Obstet Gynecol 2007; 197(5): 472 e1–7

Keita H, Geachan N, Dahmani S et al.
Comparison between patient-controlled analgesia and subcutaneous morphine in elderly patients after total hip replacement.
Br J Anaesth. 2003; 90(1): 53–7

s/c PCA – What do we know?



- 6 papers claimed to compare IV and s/c PCA
- 3 actually do so (Urquhart 1988, White 1990, Dawson 1999)
- Pain relief using s/c PCA is either the same or better than pain relief using IV PCA
- Nausea may be less of a problem using the s/c route
- Patients tend to use more opioid when using s/c PCA than when using IV PCA.

Pharmacokinetics of morphine after S/C & IV boluses.

Stuart-Harris et al 1999

The mean values for C_{max}, AUC, CL and V_d after s.c.b. were very similar to the respective parameters for i.v. administration.

The median t_{max} after s.c.b. morphine was significantly longer than after i.v. morphine (0.25 vs 0.08 h, P<0.001).

Nevertheless, this difference was relatively small and may not be significant clinically.

Post-administration samples taken at:
0.08, 0.17, 0.25, 0.50, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, 6.0, 8.0, 10.0 and 12.0 h

The Study:

I’ve Got You Under My Skin:
A Comparison of IV and s/c PCA

s/c and IV PCA – a comparison of two service evaluations

Method

PRUH

Retrospective analysis of data collected by pain nurses on the day after commencement of PCA
Dec 13 – May 14

KCH

Prospective collection of data on the day after commencement of PCA
Dec 14 – Feb 15

Primary outcome measure: Pain Score (conversion required)

Alignment of NRS & VRS

NRS pain score	VRS pain score
0	0 - no pain
1 - 4	1 - mild pain
5 - 6	2 - moderate pain
7 - 10	3 - severe pain

(Jensen et al 2003)

s/c and IV PCA – a comparison of two service evaluations

Method

PRUH
Retrospective analysis of data collected by pain nurses on the day after commencement of PCA
Dec 13 – May 14

KCH
Prospective collection of data on the day after commencement of PCA
Dec 14 – Feb 15

Primary outcome measure: Pain Score (conversion required)

Secondary outcome measures: PONV (Y/N)
Itch (Y/N)
Adverse Incidents

Additional data: PCA demands, good/bad
Peri-operative factors (time in theatre, volatile agents, loading doses, etc)
Anti-emetics, alternative analgesia

Statistics

Continuous data sets (age and opioid doses delivered), were assessed for normality of distribution of the samples. There were none.

Standard statistical analyses were used:

X^2 for categorical data (or Fisher's exact test if one of the cross tabulated cells had an expected frequency of 5 or less)

Mann-Whitney U and Kruskal-Wallace tests were used for continuous data.

Spearman's correlation coefficient was employed for correlations.

Significance value (α) was set as $P = 0.05$ for all analyses.

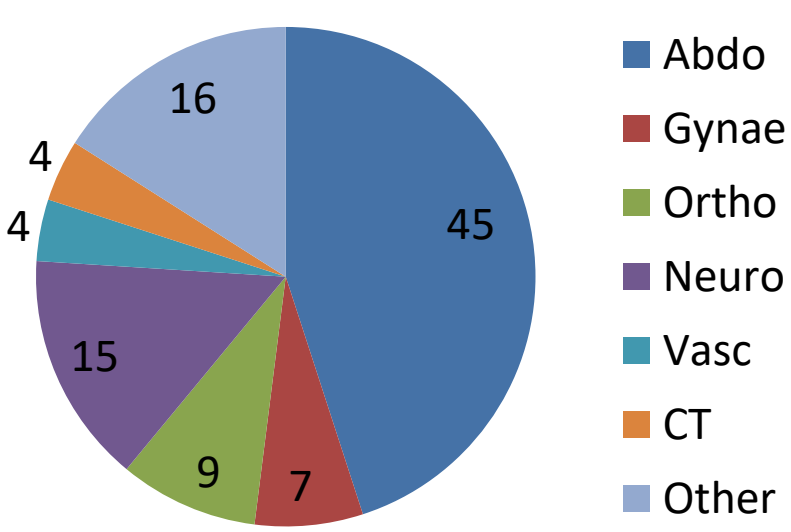
All statistical analyses used IBM SPSS version 22

Results

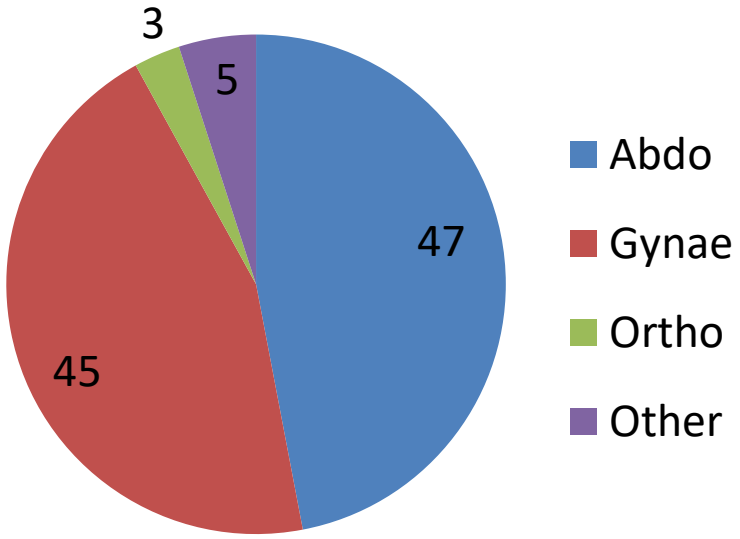
s/c PCA n = 86

IV PCA n = 74

KCH n=86



PRUH n=74



Results

s/c PCA n = 86

IV PCA n = 74

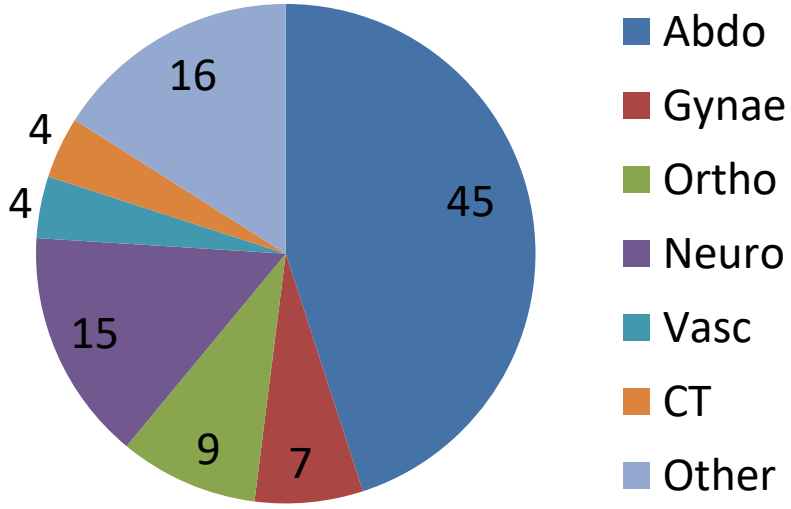
There were no significant differences between the two groups with regard to age and admission pathway (elective or via A&E).

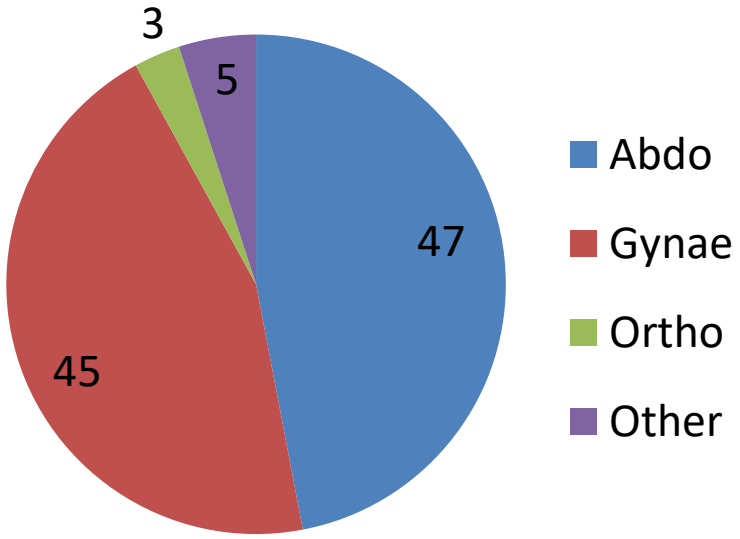
There were significant differences with regard to sex, even after excluding gynae patients.

KCH n=86

PRUH n=74

The largest group of patients in both hospitals were those having abdominal surgery





Open adbo surgery: n = 11

Laps abdo surgery: n = 28

Open adbo surgery: n = 26

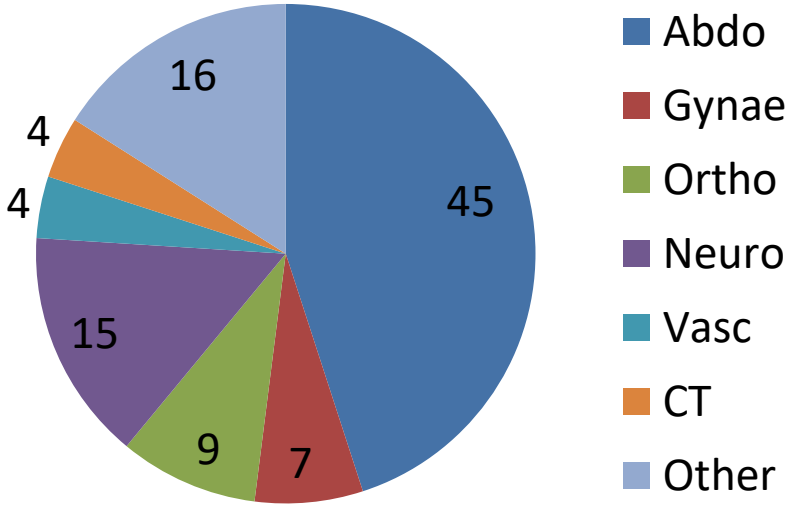
Laps abdo surgery: n = 3

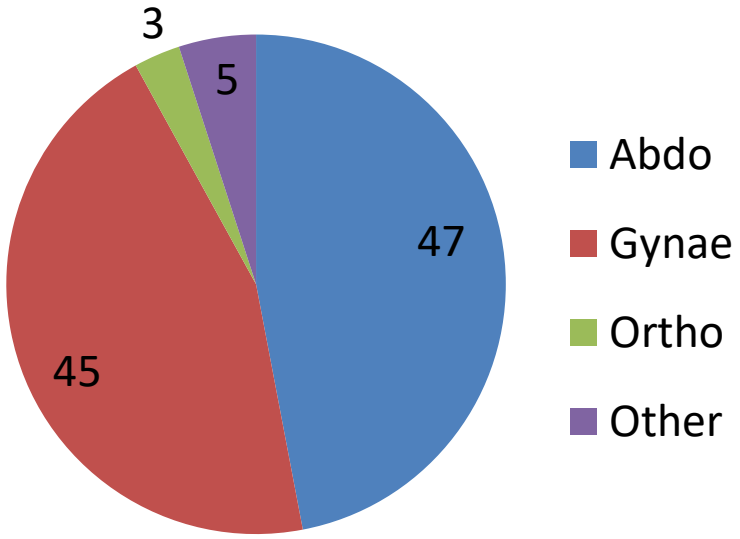
(some PRUH data missing)

KCH n=86

PRUH n=74

The largest group of patients in both hospitals were those having abdominal surgery





Open adbo surgery: n = 11

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Open adbo surgery: n = 26

Laps abdo surgery: n = 3

(some PRUH data missing)

Open Abdo Results

s/c PCA n = 11

IV PCA n = 26

There were no significant differences between the two groups with regard to age, sex or admission pathway .

Pain

s/c PCA n=86
IV PCA n=74
48%
23%
22%
7%
No Pain
Mild Pain
Moderate Pain
Severe Pain

$P = 0.001$

Pain – Open Abdo Surg

$P < 0.001$

PONV n = 160

s/c PCA

IV PCA

Itch

$P = 0.057$

How well do the s/c PCA results stand up against published data?

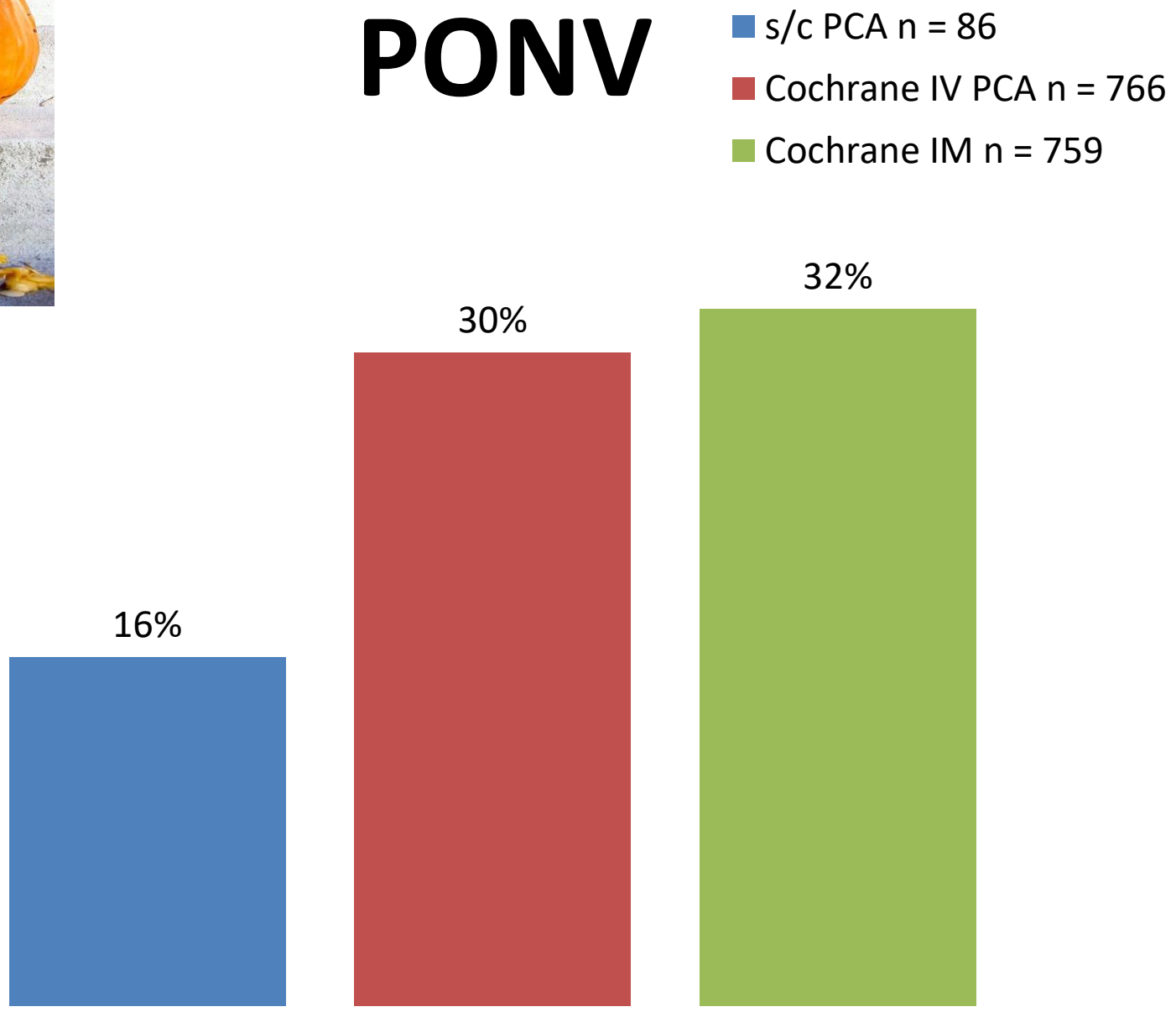
McNichol (2015) Cochrane Review

IV PCA after open abdo surgery
13 studies

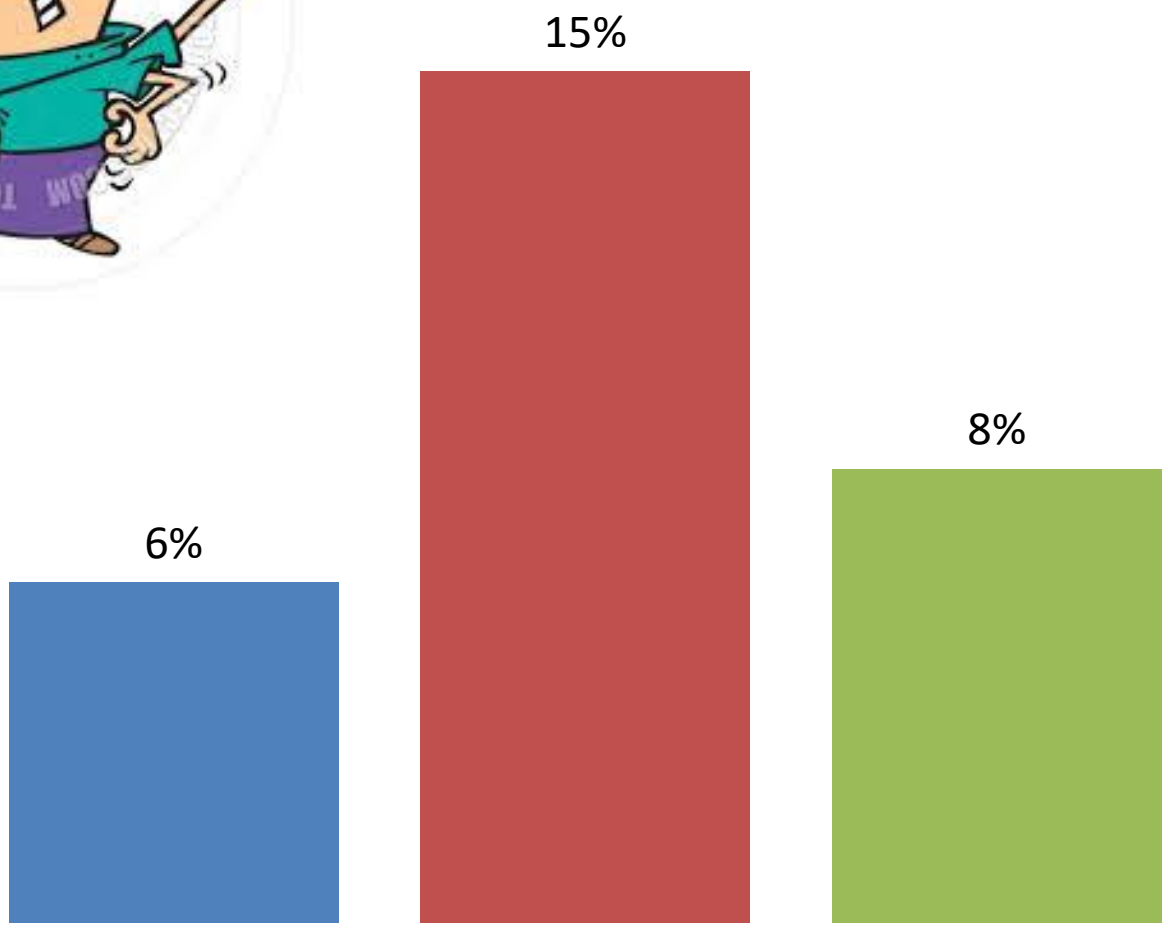
s/c PCA after open abdo surgery
n = 11 Median NRS: 2 (≈ 20 VAS)

Study	n	Mean VAS @ 24 hours	
Chang 2004	62	16	Abdominal gynaecologic surgery
Wheatley 1992	19	19	Upper abdominal surgery
Crisp 2012	30	25	Vaginal reconstructive surgery
Chan 1995	12	26	Cholecystectomy
Ellis 1982a	20	27	Hysterectomy
Snell 1997	44	32	Major abdominal surgery
Hu 2006	40	33	Lower abdominal surgery
Thomas 1995	61	36	Total abdominal hysterectomy
Wasylak 1990	20	38	Gynaecologic surgery
Rayburn 1988	67	41	Caesarean section
Ellis 1982b	15	43	Cholecystectomy
McGrath 1989	44	45	Cholecystectomy
Passchier 1993	17	46	Cholecystectomy, intestinal resection

PONV



Itch



Adverse incidents reported at KCH
(no adverse incidents reported at PRUH)

1 A patient who had undergone femoral nailing following a road traffic accident (RTA), required Naloxone 400mcg during the first post-operative night to reverse over-sedation accompanied by a respiratory rate of 7 breaths/minute and oxygen saturations of 89%.

2 A patient following foramen magnum decompression developed a rash using morphine PCA. The morphine PCA was switched to s/c oxycodone PCA (2mg/10minutes) with no further problem.

3 An elderly patient with fractured lumbar vertebrae following RTA developed confusion soon after commencement of morphine PCA and was found have an acute renal injury. Morphine PCA was switched to s/c Fentanyl PCA (20mcg/10minutes) with good effect. By the time of data collection the confusion was no longer apparent.

PCA usage and total morphine

Good PCA Demands & Total PCA Morphine Dose by PCA route		Hospital Total	Mean average per patient (median)	*P* value
Good demands	s/c PCA	2113 (n=86)	25 (25)	
	IV PCA*	2180 (n=69)	32 (24)	*P* = 0.25

* 5 missing data sets

IV PCA prescription: 1mg/5minutes

s/c PCA prescription: 2mg/10minutes

PCA usage and total morphine

Good PCA Demands & Total PCA Morphine Dose by PCA route		Hospital Total	Mean average per patient (median)	*P* value
Good demands	s/c PCA	2113 (n=86)	25 (25)	
	IV PCA*	2180 (n=69)	32 (24)	*P* = 0.25
Total PCA morphine (mg)	s/c PCA	4119 (n=86)	**49mg (49mg)**	
	IV PCA**	2240 (n=72)	**31mg (24mg)**	*P* = 0.001

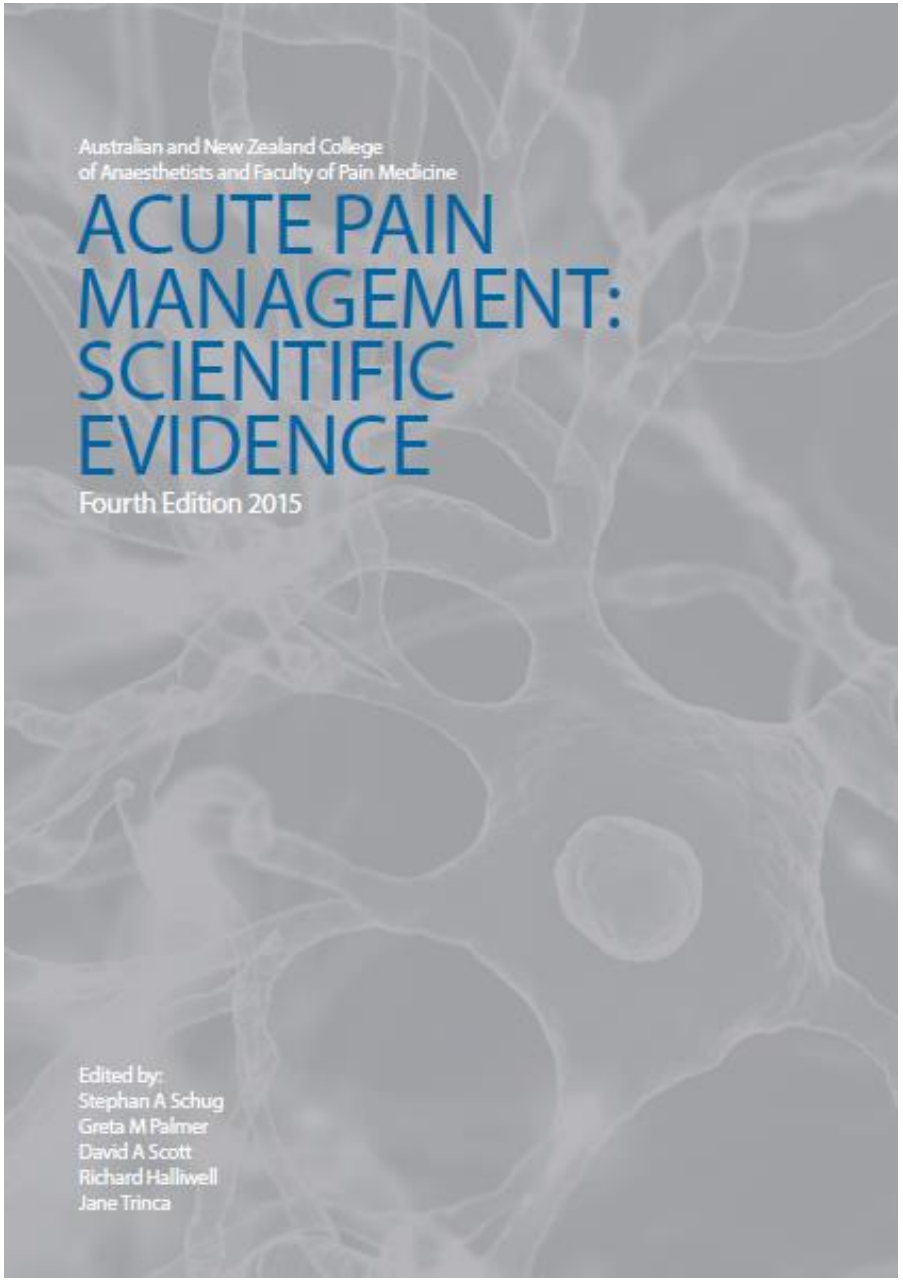
* 5 missing data sets
** 2 missing data sets

Patients using s/c PCA received twice as much morphine as those using IV PCA.

This may explain the finding of superior analgesia...

Despite receiving twice as much morphine, the side-effect burden was reduced.

s/c PCA – What do we know?



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- 3 actually do so (Urquhart 1988, White 1990, Dawson 1999)

- Pain relief using s/c PCA is either the same or better than pain relief using IV PCA
- Nausea may be less problematic using the s/c route
- Patients tend to use more opioid when using s/c PCA than when using IV PCA.

Limitations

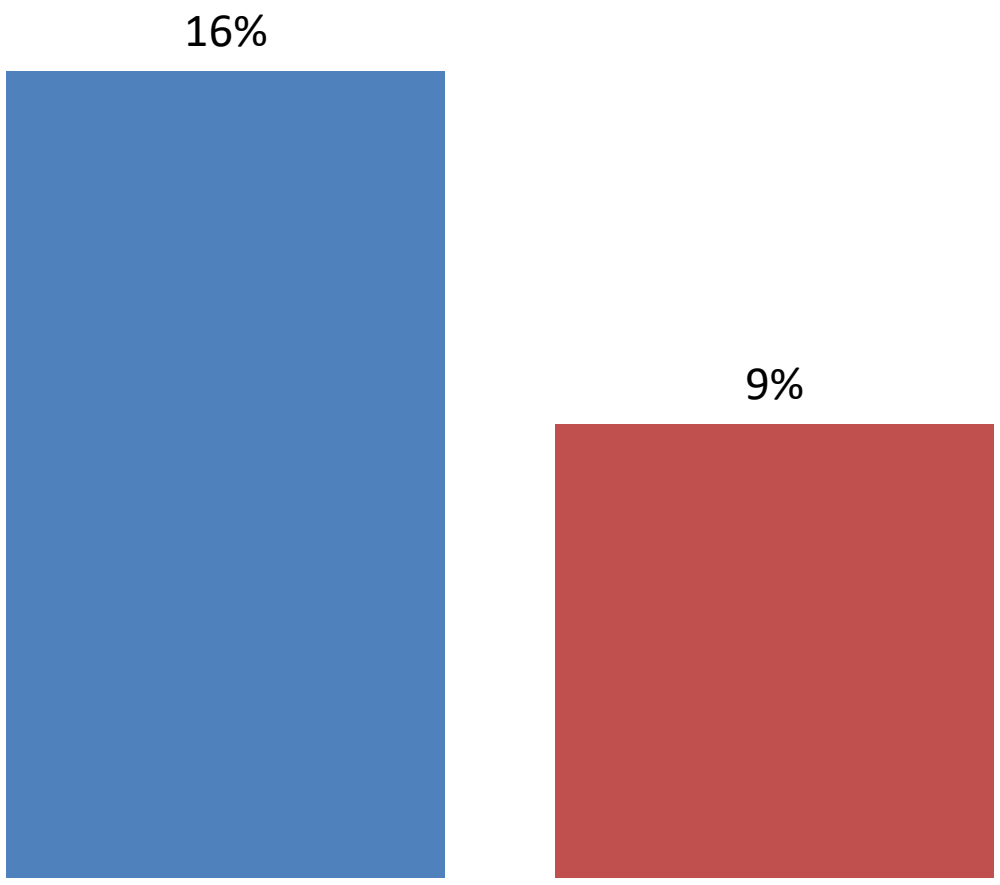
Sources of bias

Data collector

Pain

2014/15 n=86
2011/12 n=136
48%
46%
33%
23%
22%
13%
7%
8%
No Pain
Mild Pain
Moderate Pain
Severe Pain

PONV



Limitations

Sources of bias

- Data collector bias
- Seasonal bias

Single data collection point

Alignment of two pain score tools

Binary N&V score

Lack of homogeneity of samples

Conclusions

Seems to be effective

It's not worse than IV!

Seems to have a reduced side effect burden

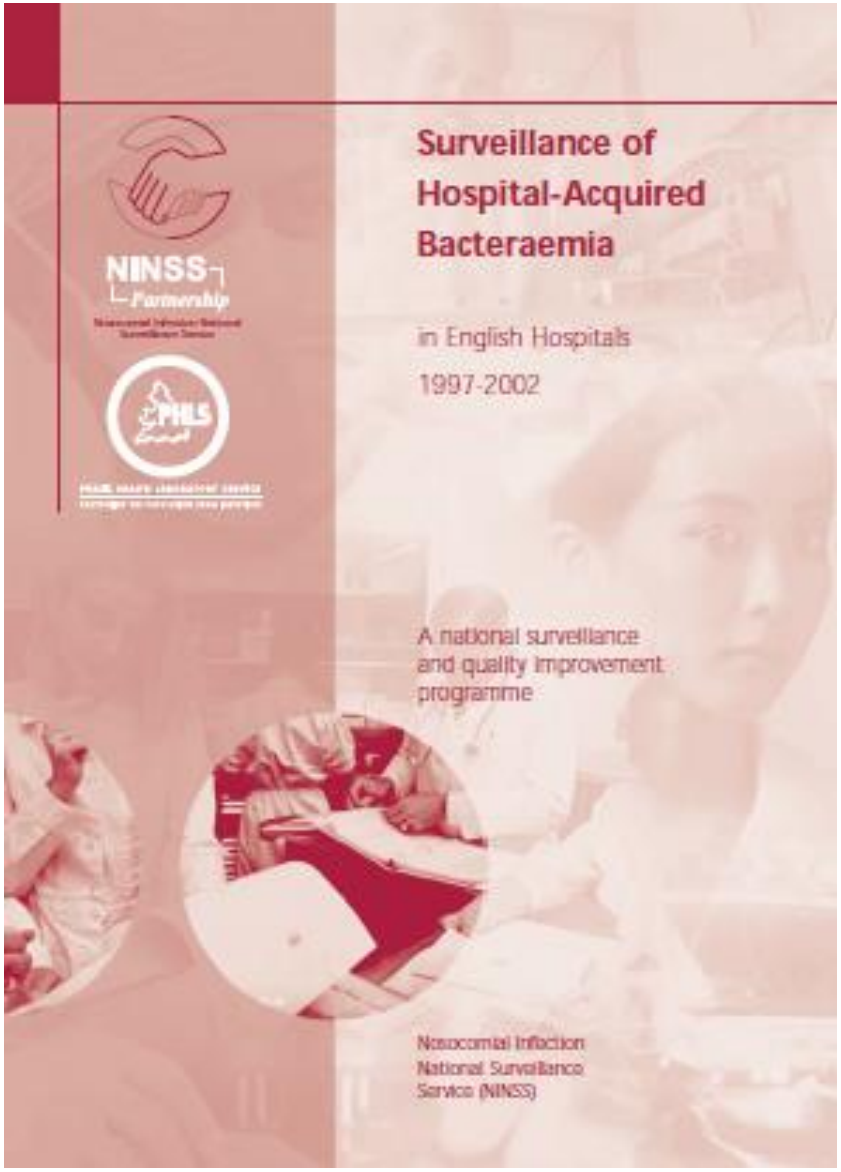
Less painful cannulation

No risk of phlebitis

Reduced risk of infection

6.2% HA bacteraemia from peripheral IV lines (NINSS 2002)

More consistent analgesia – anyone can re-site a s/c cannula



The next steps:

A cross-over study is currently in the planning stages…