# 3

# Provision of safe and effective acute pain management

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**3.1** | Education

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## 3.1 | Education

### 3.1.1 | Patients

Patients and carers who learn about assessment of pain, the risks and adverse effects of treatment, and who are informed that they should communicate both the effectiveness of treatment and any adverse effects, will have greater control over the quality of their pain relief. Information on treatment options, goals, likely benefits and probability of success should be available; this advice is found in most published recommendations and guidelines. Despite this, many patients still feel uninformed about pain, particularly in the perioperative period (Macintyre 2015 **NR**; Counsell 2008 **NR**). A national survey of patients who were undergoing total hip arthroplasty (THA) revealed that 70% did not believe they had been given adequate information about their procedure (including pain relief) and those who had higher levels of education perceived a larger deficit (Johansson Stark 2014 **Level IV**, n=320). A survey of health professionals acknowledged that perioperative pain management knowledge and other aspects of colonic surgery were deficient in patients undergoing the procedure (Sjostedt 2011 **Level IV**, n=49 [health care professionals]).

#### 3.1.1.1 | General principles

A systematic review of systematic reviews (using the AMSTAR 1 tool) pertaining to methods of patient education, in general, concludes that teaching strategies that increase patient knowledge decrease anxiety and improved patient satisfaction (Friedman 2011 **Level IV SR**, 23 systematic reviews & meta-analyses, n unspecified). This comprised those using computer technology, audio and videotapes, written materials and demonstrations. While only one systematic review addressed pain management, the more general results are relevant to this topic. Educational strategies were better when combined, structured, culturally appropriate and patient-specific, rather than generic or *ad hoc*. Verbal teaching and discussions were found to be the least effective strategies. Web-based teaching improved patient knowledge, anxiety, and satisfaction, as did audiotapes, videotapes, written materials and lectures, all of which were more effective than verbal teaching and discussions. Demonstrations had the highest effect of any of the teaching strategies evaluated. Multiple teaching strategies are better than single ones, with one systematic review finding that 67% of patients who received patient education using several different strategies had better outcomes than those who received routine care.

Patient education regarding the procedure or recovery provided a small improvement in postoperative pain (SMD -0.21; 95%CI -0.02 to -0.39) (12 RCTs, n=1,242), pre-operative anxiety (SMD -0.27; 95%CI -0.10 to -0.44) (12 RCTs, n=1,260) and postoperative anxiety (SMD -0.26; 95%CI -0.08 to -0.43) (11 RCTs, n=921), but had no impact on analgesic use (SMD -0.06; 95%CI 0.13 to -0.24) (10 RCTs, n=860) (Szeverenyi 2018 **Level I** [PRISMA], 62 RCTs, n=4,908). Pain psychoeducation undertaken before surgery (pre-emptive) or throughout the perioperative period (preventive) is an underutilised component of multimodal analgesia with data showing reduced pain intensity, analgesic use, LOS, return to ED, patient anxiety and possibly chronic postsurgical pain (Horn 2020 **Level IV SR**, 33 studies, n unspecified).

There is evidence that written information is better than verbal education. Written information resulted in more satisfaction, lower pain scores and lower analgesic use after gynaecological cancer surgery (Angioli 2014 **Level II**, n=190, JS 2). Knowledge was lower in those given non-standardised verbal information vs those given written information, including information regarding pain management, at the time of preoperative anaesthetic review

(Binhas 2008 **Level III-3**, n=180). Patients receiving education favoured the combination of verbal plus written information over verbal information alone, as it allowed them to refresh their memory (Andersson 2015 **Level III-1**, n=18). A study of emergency department patients found that the provision of patient information leaflets improved doctor-patient communication and patient satisfaction levels and reduced rates of reattendance for the same condition, as well as the number of drug prescriptions by doctors (Sustersic 2019 **Level III-2**, n=324). This aligns with the findings of a previous systematic review of systematic reviews which determined that patient information leaflets improve patient knowledge, satisfaction and adherence to treatment recommendations (Sustersic 2017 **Level IV SR**, 24 SRs, n unspecified).

A systematic review of studies of postoperative education (conducted between 1986 and 2007) which aimed at improvement in self-knowledge and symptom experience (including pain) evaluated the best type and amount of postoperative education (Fredericks 2010 **Level III-3 SR**, 58 studies, n=5,271). All types of surgery were included with 46% assessing cardiac surgery, 26% general surgery, 4% abdominal/ colorectal surgery and 5% hip and knee surgery. Individualised education with the patient having input into their educational requirements, use of combined media for delivery, provision of one-on-one education and multiple sessions were associated with improvement in educational and/or health outcomes. Individuals <50 y and those with higher educational level showed the highest benefit.

### **3.1.1.2** | Effects in specific postoperative settings

*PCA use*

Structured vs brief patient education prior to PCA use resulted in improved patient knowledge of PCA (Yankova 2008 **Level III-1 SR**, 5 RCTs & 1 study, n=592). No studies demonstrated that structured education about PCA improved postoperative pain scores.

*Total joint arthroplasty*

Three overlapping reviews draw similar conclusions as to the limited effect of preoperative patient education in addition to standard care on pre and postoperative outcomes after total hip and knee arthroplasty (THA/TKA) (McDonald 2014 **Level I** [Cochrane], 18 RCTs, n=1,463; Aydin 2015 **Level I** [PRISMA], 12 RCTS, n=1,567; Louw 2013 **Level III-1 SR**, 12 RCTs & 1 study, n=1,021) (10 & 8 RCTs overlap). The included RCTs are heterogeneous in terms of the patient population and teaching methods applied. There is some reduction in preoperative anxiety for THR (MD -5.10/60; 95%CI -7.17 to -3.03) (4 RCTs, n=333) and LOS for TKR (MD -1.86 d; 95% CI -3.40 to -0.32) (2 RCTs, n=183); but little or no evidence for any other outcomes including postoperative anxiety, mobility, pain, function or postoperative complications.

Preoperative education does not improve postoperative pain scores after either THA (up to 3 mth after surgery) or TKA (up to 12 mth after surgery) (McDonald 2014 **Level I** [Cochrane], 18 RCTs, n=1,463). However, education has a low risk of adverse effects, and may be beneficial for certain patients with depression, anxiety or unrealistic expectations about their surgery.

Interviews with focus groups of patients following THA and TKA identified patient requests for increased education on pain management in the postoperative period (Kennedy 2017 **Level IV**, n=32). Patients reported that they would have preferred more information regarding expected levels of postoperative pain, the purpose, administration and expected side effects of analgesic medication, and specific weaning instructions. Among the patients interviewed, there was a wide range of preference for content, mode of delivery (web-based or traditional methods), and timing of education. It is acknowledged in the literature that a more personalised education program that allows patients to ask questions may translate to improved outcomes following preoperative education (Aydin 2015 **Level I** [PRISMA], 12 RCTs, n=1,567). However, a randomised controlled trial that involved personalised preoperative information sessions prior

to TKA did not demonstrate any difference in pain at any time point vs a group receiving standard care (Wilson 2016 **Level II**, n=143, JS 4). The authors suggest that this may reflect a requirement for increased education for healthcare providers as well as patients in order to achieve significant benefits in postoperative analgesia. Online resources available for patients to read about pain control after TKA are generally of limited utility, with more than 90% of websites containing information directed at patients written in language that exceeds average reading levels (Schairer 2017 **NR**). This has the potential to limit patient understanding of postoperative pain management and highlights an opportunity for orthopaedic, anaesthetist and pain medicine specialists to develop and encourage access to appropriate patient-focused online resources.

### *Cardiac surgery*

Preoperative education reduces anxiety (6 RCTs, n=829) in patients undergoing mixed types of cardiac surgery, but there was limited evidence for any effect on pain (4 RCTs, n=704) (Ramesh 2017 **Level I** [PRISMA], 14 RCTs, n=2,071). This is consistent with a preceding systematic review which found no effect of preoperative education on pain levels or other outcome measures in patients after coronary artery bypass graft (CABG) surgery (Guo 2015 **Level I**, 6 RCTs, n=1,406 [2 RCTs pain, n=762]) (2 RCTs overlap).

### *Spinal surgery*

Patients receiving neuroscience education (including a conversation with a physical therapist for 30 min plus a neuroscience booklet) prior to lumbar spinal surgery for radicular pain had the same pain levels and function 12 mth following surgery vs controls who received routine care (Louw 2014 **Level II**, n=67, JS 3). However, those in the experimental group exhibited 45% less healthcare expenditure in the 12 mth following surgery and viewed their surgical experience more positively. At 3 y follow-up, this reduction in health care costs was maintained; the group that received preoperative neuroscience education spent 37% less on medical expenses (Louw 2016 **Level III-2**, n=50). The authors postulated this could be a result of the educational emphasis on neurobiology and neurophysiology (central and peripheral sensitisation, facilitation and inhibition) as opposed to the pathoanatomical explanation previously utilised for education in patients undergoing lumbar spinal surgery.

A preoperative educational intervention (provision of a detailed information booklet and 30 to 40 min guided explanation by a nurse) vs control in spinal surgery lowered preoperative anxiety and postoperative pain scores (6.1/10 to 5.3/10) (Lee 2018 **Level II**, n=86, JS 3) (see also Section 7.1.1).

### *Other types of surgery*

The provision of a detailed information sheet to parents after tonsillectomy in children provided postoperative benefit (Bailey 2015 **Level II**, n=60, JS 5). The information sheet contained specific instructions regarding the dose and timing of oxycodone and resulted in higher parental satisfaction and knowledge and some improvements in pain scores up to POD 7 vs standard verbal instructions.

After cosmetic day-surgery procedures, preoperative education reduced postoperative opioid requirements and pain intensity and duration (Sugai 2013 **Level II**, n=135, JS 2). Preoperative written and verbal education (two sessions by the same surgeon) on the adverse and negative effects of opioids resulted in 90% of the treatment group declining an opioid prescription vs 100% filling their opioid prescription in the control group.

Patients undergoing modified radical mastectomy, who had received a specific 20 min education about their analgesia management and medications, reported less pain and mobilised earlier than those who had not received the education (Sayin 2012 **Level III-1**, n=84).

### **3.1.1.3** | Effects in other acute pain settings

The effect of patient education has also been studied in patients with acute non-surgical pain.

Education programs, depending on their approach, may not be effective in the prevention and treatment of neck pain or low back pain in a widely heterogeneous patient and community groups (including children and at-risk workers) (Ainpradub 2016 **Level I**, 15 RCTS, n=10,488); these findings were cautioned against in a letter (Hurley 2016), because they were based excessively on a "biomedical education" approach which emphasises "*protecting the injured back*". This type of education has now been supplanted by the effective "biopsychosocial education" approach, which in contrast, emphasises the robustness of the back, and is in agreement with pain physiology. Another systematic review shows a beneficial outcome from patient education in the management of acute lumbar back pain when a "biopsychosocial/neuroscience" education-based approach is used (Traeger 2015 **Level I** [PRISMA], 14 RCTs, n=4,872). In this review, the outcomes were "*reassurance*" (which was a composite of anxiety, fear, worry, distress) and healthcare utilisation (number of primary care visits for LBP over 12 mth). The effect size for a benefit on reassurance at 4 mth was SMD -0.21 (95%CI -0.36 to -0.07), and the effect on reduction in healthcare utilisation was SMD -0.14 (95%CI -0.28 to 0.00).

Regarding acute back pain, there is moderate to high quality evidence that patient education provided by primary care practitioners can reassure patients for up to 12 mth, and lead to reductions in low back pain related healthcare utilisation, with a NNT of 17 to prevent one subsequent primary care visit (Traeger 2015 **Level I** [PRISMA], 14 RCTs, n=4,872). Patient reassurance is heightened with education provided by a physician rather than by other health professionals. Conversely, a subsequent RCT found that the addition of two sessions (1 h each) of patient education (focusing on biopsychosocial contributors to pain as well as self-management techniques) to standard practice did not improve pain intensity or disability vs a placebo educational intervention (Traeger 2019 **Level II**, n=202, JS 4).

An earlier systematic review of pain education strategies for neck pain was unable to find good evidence for the benefit of patient education, apart from one RCT (n=348) showing that an educational video of advice about being active was more beneficial in the medium term (Gross 2012 **Level I** [Cochrane], 15 RCTs, n=5,305) (3 RCTs overlap with Ainpradub 2016). After acute whiplash injury specifically, short educational interventions reduce pain and disability and enhance recovery and mobility (Meeus 2012 **Level I** [PRISMA], 10 RCTs, n=1,594) (2 RCTs overlap). Educational interventions for patients with whiplash (neurophysiology content) have demonstrated improvements in both pain behaviours and pain threshold (Rebbeck 2017 **NR**). It is also recommended that patients receive advice regarding the course of recovery and education about coping strategies and unhelpful beliefs.

Antenatal education regarding epidural analgesia led to more primigravid women indicating that they would request epidural analgesia for pain relief in labour (Alakeely 2018 **Level III-3**, n=81). Antenatal teaching about postnatal nipple pain and trauma resulted in reduced nipple pain and improved breastfeeding (Duffy 1997 **Level II**, n=70, JS 3).

An emergency department nurse-delivered opioid education intervention (verbal and written communication strategies) increased patient understanding of appropriate use of discharge opioids (Waszak 2018 **Level III-3**). However, this relied on nurses' ability to take extra steps in their usual discharge routine, including printing information sheets and conducting verbal 'teach-back' sessions.

### 3.1.1.4 | Web-based education for acute pain management

The internet and mobile devices are being increasingly used for pain education. There are few published studies that have evaluated these types of interventions for patients with acute pain. A systematic review of web-based pain education included only two RCTs that evaluated educational websites with information on acute postoperative pain (Bender 2011 **Level I**, 17 RCTs, n=2,503): one aimed to prepare adolescents for tonsillectomy and demonstrated improvements in satisfaction and knowledge, but no difference in pain scores or anxiety (O'Conner-Von 2008 **Level II**, n=69, JS 3); the other prepared adults for postoperative self-care after outpatient surgical procedures and found reductions in postoperative pain intensity the night and day afterwards (Goldsmith 1999 **Level II**, n=195 [only 80 at follow-up], JS 2). An innovative web technology used an assessment process to individualise the content of education and use persuasive educational techniques to effect changes in response to pain after cardiac surgery (Martorella 2012 **Level II**, n=60, JS 3). The 30 min web-based intervention used a virtual nurse to guide the patient, followed by two face-to-face 5-min booster sessions. In the experimental group, patients did not experience less intense pain, but they reported significantly less pain interference when breathing/coughing and used more analgesia. A web-based intervention program providing daily postural advice and exercise instructions with daily email reminders and personalised log over 9 mth to office workers with sub-acute low-back pain (of 6 wk duration) was effective in improving quality of life, behaviour change, function and pain vs standard care (del Pozo-Cruz 2013 **Level II**, n=100, JS 2).

A systematic review found no additional benefit for tailored vs standardised web-based patient education for patients with chronic pain (Martorella 2017 **Level I** [PRISMA], 16 RCTs [15 chronic], n=4,304).

The readability of web-based educational materials regarding epidural analgesia was well above the recommended reading level for patient education, which may limit the ability of patients to make informed choices (Patel 2015 **Level IV**, n=101 [educational materials on 128 websites in English and Spanish]). An assessment of online patient education material about regional anaesthesia produced by USA teaching hospitals found the mean (SD) Flesch-Kincaid Grade Level for patient education material was high at hospitals offering and not offering regional fellowship teaching programs: 13.8 (2.9) vs 10.8 (2.0) ie well above the recommended sixth-grade level (Kumar 2017 **Level III-3**, n=32 [websites]). Similarly, a review of patient education material about safe opioid use after surgery found the online information from the websites of selected North American academic medical centres to have the reading grade level 7.84 (SD 1.98) (Kumar 2019 **Level III-3**, n=38 [websites]).

## 3.1.2 | Staff

Appropriate education of medical and nursing staff is essential if more sophisticated forms of analgesia (eg PCA or epidural analgesia) are to be managed safely and effectively and if better results are to be gained from conventional methods of pain relief (Macintyre 2015 **NR**). Medical and health professional staff education may take several forms; the evidence for any benefit for the best educational technique is varied and inconsistent. Education may also include organisational approaches, the provision of guidelines and accompanying changes to practice to enable good outcomes.

### 3.1.2.1 | Nursing staff

Improvements in nursing knowledge and ability to manage epidural analgesia followed the reintroduction of an epidural-education program using an audit/guideline/problem-based teaching approach, accompanied by practical assessments (Richardson 2001 **Level III-3**). A more

recent simulation-based educational workshop (4 h) relating to epidural assessment improved knowledge and confidence of participating nursing staff and increased the number of correct procedures performed in a post-workshop assessment (Sawhney 2018 **Level III-3**). However, translation to practice changes in the clinical environment was not assessed, and educational workshops of this type require significant time and monetary investments. Pain documentation in surgical wards (Ravaud 2004 **Level III-1**, n=2,278; Karlsten 2005 **Level III-2**) and intensive care units (ICUs) (Erdek 2004 **Level III-3**; Arbour 2003 **Level IV**) was also improved by education programs. A quality-improvement system, which included education and guidelines as well as systems to improve practice, resulted in significant improvements in postoperative pain, nausea, vomiting and fatigue (Usichenko 2013 **Level III-3**, n=520). Implementation of a quality-improvement program led to improvements in nurses' knowledge and assessment of pain using pain-rating scales; however, while the number of patients assessed increased, there was no improvement in pain relief (Hansson 2006 **Level III-2**).

There are possible reasons why education programs may not always be successful in improving nursing staff knowledge or attitudes (Dahlman 1999 **Level III-3**) or pain relief (Knoblauch 1999 **Level IV**). In rural and remote settings, distance and professional isolation could affect the ability of healthcare staff to receive up-to-date education about pain relief. However, similarities between urban and rural nurses' knowledge and knowledge deficits relating to acute pain management have been reported (Kubecka 1996 **Level IV**, n=123 [nurses]) and a tailored education program in a rural hospital improved the management of acute pain (Jones 1999 **Level III-3**, n=126). An education program delivered to nurses in rural and remote locations and focusing on acute, chronic and cancer pain improved understanding of pain management (Linkewich 2007 **Level III-2**). Early attempts at using online education for nurses to improve pain management were not widely accessed. A proposed model involving e-learning and problem-based approaches have had some initial success (Keyte 2011 **NR**).

A range of didactic and interactive teaching methods have been applied in nursing pain management education (Drake 2017 **Level IV SR** [PRISMA], 12 studies, n≈726 [staff] & n≈8,124 [patients]). Overall, nurses showed an improvement in pain documentation after participating in a pain management education program. However, there was no assessment of the nurses' associated behavioural change, and failure to account for the challenges of daily nursing practice, such as the requirement to frequently shift attention, which may interfere with assessment and ability to empathise with patients in pain). The provision of information and skills has limited ability to improve patient outcomes if these practical barriers to pain management are not addressed.

#### **3.1.2.2** | Physiotherapists

Physiotherapists have recognised the need for more education about acute and subacute pain incorporating a biopsychosocial approach to prevent long-term disability and pain. However, an 8 d university course about how to identify and address psychosocial risk factors attended by practicing musculoskeletal physiotherapists led to no improvement in their patients being treated for musculoskeletal problems (Overmeer 2011 **Level II**, n=42, JS 2). The authors suggest that this type of teaching may be more effective if incorporated at an earlier stage of learning or by other methods if an impact on practice is to be made.

#### **3.1.2.3** | Medical staff

Education of junior emergency department medical staff improved patient pain relief (Jones 1999 **Level III-3**, n=126). Additionally, the implementation of an education program with guidelines for pain management improved analgesia and patient satisfaction (Decosterd 2007 **Level III-2**, n=441).

A number of studies have shown the benefits of education and/or guidelines on improved prescribing patterns both in general terms (Ury 2002 **Level III-3**, n=1,006; Humphries 1997 **Level III-3**) and specifically for NSAIDs (Ray 2001 **Level II**, n=209, JS 2; Figueiras 2001 **Level III-2**, 495 [doctors in north-western Spain]; May 1999 **Level III-3**, n=210 [doctors in South Australia]), paracetamol (acetaminophen) (Ripouteau 2000 **Level III-3**, n=35 [French anaesthetists and nurses]) and pethidine (meperidine) (Gordon 2000 **Level III-3**).

A pilot program facilitated within Stanford University's Clinical Pain Medicine Fellowship program has implemented simulation as a method of medical education in opioid prescription (Heirich 2019 **Level III-3**, n=27).

#### **3.1.2.4** | Interprofessional

Interprofessional education programs involving medical and nursing staff may improve collaboration and communication between health care team members and patients, and therefore encourage active self-management techniques and limit the implementation of passive pain management strategies (Hogans 2018 **NR**). An educational program (2 h) consisting of an interactive e-learning module and simulation session to both nursing and medical staff improved knowledge, but did not change analgesic administration or pain reduction for patients during an emergency department admission (Friesgaard 2017 **Level III-3**, n=2,140). The authors suggest that achieving behavioural change in healthcare professionals is complex, requiring repeated education, changes in workplace attitudes towards pain management, modification of daily practice environments and continuous support and follow-up.

Junior medical staff education over 3 y in an Australian tertiary hospital reduced inappropriate oxycodone IR prescriptions from 28% to 10% (Stevens 2019 **Level III-2**). The education package included junior medical and anaesthetic staff group and individual education (with feedback from audit data on individual prescribing), implementation of pharmacist-monitored prescription guidelines, an educational patient pamphlet and education sessions for surgical nursing staff regarding how to discuss opioid weaning and disposal.

#### **3.1.2.5** | Web-based

There is growth in web-based delivery of education programs for health professionals. Online educational resources improve knowledge and skills, but not confidence and competence, (Liossi 2018 **Level IV SR** [PRISMA], 13 RCTs & 19 studies, n unspecified). Notably, there was significant heterogeneity among studies and relevant health outcomes for patients were not assessed. A survey of clinicians who completed an interactive online learning module regarding opioid prescription determined that clinician knowledge, the likelihood of adherence to prescription guidelines, and perceived competence in opioid prescription improved following participation (Langford 2020 **Level III-3**, n=167).

#### **3.1.2.6** | Guidelines

When combined with education, the introduction of medical and nursing guidelines may contribute to improvements in pain management and prescribing practices (Gould 1992 **Level III-2**, n=2,035; Harmer 1998 **Level III-3**, n=2,738). Several initiatives have been described which employ guidelines with the aim of safe opioid prescription:

- A targeted medical, nursing and patient education initiative significantly reduced the median quantity of opioid analgesics provided at discharge for trauma patients (Oyler 2018 **Level III-3**, n=913);

- An emergency department opioid prescribing guideline reduced the number of discharge opioid prescriptions for dental, neck, back or chronic pain presentations from 53% (6 to 12 mth prior to introduction) to 34% (12 to 18 mth following introduction) (del Portal 2016 **Level III-3**, n=13,187);
- An Australian tertiary hospital introduced discharge analgesia prescribing guidelines which initially improved discharge prescribing practices, but diminished over time (Stewart 2019 **Level III-3**, n=170 [discharge prescriptions]). Maintaining education of junior medical staff can be a resource and time intensive proposition and is often maintained in an informal manner by pharmacists and other healthcare team members.

Advances in pain education require the engagement of healthcare professionals, patients, stakeholders, and ultimately a better understanding of pain education research (Hogans 2018 **NR**). Pain education research continues to present multiple challenges in terms of definition of content, ethical and practical study design, and consideration of appropriate outcome measures.

The importance of pain medicine education at an undergraduate medical level has also been recognised. A cross-sectional study of medical school curricula across Europe (Advancing the Provision of Pain Education and Learning [APPEAL] study) demonstrated that current undergraduate medical pain education is not consistent with that which would be expected given the current prevalence of pain conditions and their associated public health burden (Briggs 2015 **Level IV**, n=242 [curricula of medical schools]). Of 242 medical schools, only 31% offered a dedicated pain module and only 18% of these were compulsory, while 7% lacked any pain education. In response to the prescription opioid epidemic, American medical schools have implemented curriculum changes to include pain management and opioid prescribing (Barth 2017 **NR**). Furthermore, a systematic review of all articles that examined the content of pain education in medical school curricula found that the number of teaching hours was limited, and most had no mandatory formal pain medicine program (Shipton 2018 **Level IV SR**, 14 studies, n=383 [medical schools]); this did not reflect the healthcare needs for pain management in the population. Anaesthetists and acute pain services are central to the education of junior medical staff and development of hospital and state-wide prescription guidelines, and thus it is important that anaesthetists themselves receive appropriate exposure to acute pain medicine during their training (Macintyre 2014 **NR**).

## KEY MESSAGES

1. There is no good evidence in favour of general education for acute neck pain having significant effects on any relevant outcomes (**U**) (**Level I** [Cochrane Review]).
2. Short educational interventions in acute whiplash injury reduce pain and disability and enhance recovery and mobility (**U**) (**Level I** [PRISMA])
3. There is limited evidence that preoperative education may lead to small improvements in postoperative outcomes such as pain, preoperative and postoperative anxiety, but not in analgesic requirements (**Q**) (**Level I** [PRISMA]).
4. General “biomedical” education in patients with acute back pain does not reduce pain or improve other outcomes (**S**) (**Level I**); however, education using a “biopsychosocial/ neuroscience” approach reduces a composite of anxiety, fear, worry, distress and healthcare utilisation (**N**) (**Level I** [PRISMA]).

5. Targeted reassurance in acute back pain by physicians in primary care can result in improved changes in psychological factors such as fear, worry, anxiety, catastrophisation and healthcare utilisation (**U**) (**Level I** [PRISMA].
6. Preoperative education improves patient or carer knowledge of pain and encourages a more positive attitude towards pain relief (**U**) (**Level II**).
7. Specific pain neuroscience education in specific surgical settings may result in less healthcare utilisation (**U**) (**Level II**).
8. Written information given to patients is better than verbal information given at the time of the interview (**S**) (**Level II**).
9. Educational interventions in cancer pain patients improve knowledge, attitudes and pain control (**U**) (**Level III-1 SR**).
10. While evidence for the benefit of patient education in terms of better pain relief is inconsistent, structured preoperative education may be better than routine information (**U**) (**Level III-2**).
11. Staff education and the use of guidelines improve pain assessment, pain relief and prescribing practices (**S**) (**Level III-3**).
12. Pain psychoeducation undertaken before surgery (pre-emptive) or throughout the perioperative period (preventive) is an underutilised component of multimodal analgesia which may reduce pain intensity, analgesic use, length of stay, return to the emergency department, patient anxiety and possibly chronic postsurgical pain (**N**) (**Level IV SR**).
13. Pain score documentation improves with various forms of nursing education, but the impact of this behaviour change has not been adequately assessed (**N**) (**Level IV SR**).
14. Pain medicine education in medical school curricula is restricted in scope and content (**N**) (**Level IV SR**).

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The following tick boxes represent conclusions based on clinical experience and expert opinion:

☑ Successful management of acute pain requires close liaison between all personnel involved in the care of the patient (**U**).

☑ More effective acute pain management will result from appropriate education and organisational structures for the delivery of pain relief rather than the analgesic techniques themselves (**U**).

## 3.2 | Organisational requirements

It is recognised that patients should be able to access best-practice care, including appropriate assessment of their pain and effective pain management strategies (ASA 2012 **GL**; ANZCA 2010 **GL**). However, effective acute pain management will, to a large extent, depend not only on the medicines and techniques available, but also on the systems involved in their delivery (Macintyre 2015 **NR**). Even simple methods of pain relief can be more effective if proper attention is given to education (see Section 3.1 before), prescribing, administration, documentation, monitoring of patients and the provision of appropriate policies, protocols and guidelines (Gould 1992 **Level III-3**, n=2,035). The incorporation of pain measurement into clinical assessment for all patients, not only those under the care of an Acute Pain Service (APS), will aid pain management for all the patients throughout an institution (Gordon 2008 **NR**). Standardised clinical observation charts which include pain, sedation and function scores with other vital signs are an important step in ensuring safe provision of effective analgesia (Macintyre 2015 **NR**). In many institutions, an APS will assume responsibility for managing complex patients and more advanced methods of pain relief such as PCA, epidural analgesia and perineural infusions.

### 3.2.1 | General requirements

Guidelines to enhance patient outcomes and standardise analgesic techniques (eg selection of medicines and their concentrations, dose and dose intervals), monitoring requirements, choice of equipment, and responses to inadequate or excessive analgesic doses or other complications lead to consistency of practice. This can potentially improve patient safety and analgesic efficacy, regardless of the technique used (Macintyre 2015 **NR**; Counsell 2008 **NR**). These guidelines should be evidence-based wherever possible.

Marked improvements in conventional methods of pain relief have followed the introduction of guidelines for parenteral opioid administration (Humphries 1997 **Level III-3**, n=242; Gould 1992 **Level III-3**, n=2,035). However, it is the implementation of guidelines, not their development that remains the greatest obstacle to their use. Compliance with available guidelines is highly variable and may be better in larger and university-affiliated hospitals (Nasir 2011 **Level IV**, n=301 [USA hospitals]; Carr 1998 **Level IV**, n=400 [USA hospitals]). Resource availability, particularly staff with pain management expertise, and the existence of formal quality-assurance programs to monitor pain management are positive predictors of compliance with guidelines (Jiang 2001 **Level IV**, n=220 [USA hospitals]).

Different types of surgery require different types of analgesic regimens. Common and minor surgical procedures often result in high pain scores, which are frequently undertreated (eg laparoscopic appendicectomy, cholecystectomy, and haemorrhoidectomy) (Gerbershagen 2013 **Level IV**, n=70,764). The adoption of procedure-specific methods and the use of analgesic combinations may help to optimise analgesia and reduce adverse effects (Joshi 2013 **NR**) (see Section 8.1.3). A hospital-wide approach can be incorporated into postoperative enhanced-recovery programs (White 2010 **NR**) (see Section 3.2.3 below).

Professional bodies in a number of countries have issued guidelines for the management of acute pain (RCoA 2020 **GL**; Agency for Clinical Innovation NSW 2016 **GL**; Faculty of Pain Medicine RCoA 2015 **GL**; ANZCA 2013 **GL**; ASA 2012 **GL**).

While there is widespread agreement about the value of clinical guidelines, they do have limitations. Some of these include reliance on the population-wide aggregation of patient outcomes, which may not be optimal on an individual patient level. Individual patient

variability arises from complex interactions between genetic and environmental exposures over the life of the patient (Fillingim 2017 **NR**). A method that can incorporate standardised care but allow for individual patient variation is the SCAMP approach – Standardised Clinical Assessment and Management Plans (Beverly 2017 **NR**). This process is a clinician-engaged approach that promotes standardisation but accommodates patient preferences, includes clinician experience and incorporates recent medical knowledge. Benefits include reduced variability in medical care (Farias 2013 **NR**).

The success of an APS and patient treatment depends not only on good clinical care but also on a positive organisational culture(Powell 2009 **NR**; Bate 2008 **NR**). This should follow the key principles of effective change management. A series of semi-structured interviews of healthcare professionals identified key areas that need to be addressed for well-organised care. These include structural issues, political issues, cultural change, educational challenges, leadership and motivation, and technological challenges.

### **3.2.2** | Acute pain services

There is a very wide diversity of APS structures, with no consensus as to the best model and no agreed definition of what might constitute such a service (Counsell 2008 **NR**). Some are "low-cost" nurse-based (Shapiro 2004 **Level IV**, n=4,617; Rawal 2005 **NR**), others are anaesthetist-led but rely primarily on APS nurses as there may not be daily clinical participation by an anaesthetist (Nagi 2004 **NR**; Harmer 2001 **NR**). In contrast, others are comprehensive and multidisciplinary services with APS nursing staff, sometimes pharmacists or other staff (eg clinical psychologists) (Katz 2015 **NR**) and daily clinical input from and 24 h cover by anaesthetists (Macintyre 1990 **Level IV**, n=1,053; Ready 1988 **Level IV**, n=820; Schug 1993a **NR**). The development of specific paediatric pain services has also been described (Kost-Byerly 2012 **NR**) and is an emerging field (Finley 2014 **NR**).

Larger hospitals and those with university affiliations are more likely to have a formal APS and use protocols (Nasir 2011 **Level IV**, n=301 [USA hospitals]). When advanced modalities such as epidural analgesia and continuous peripheral nerve block (CPNB) are used, the APS is most commonly anaesthetist-led. An economic evaluation of a physician-led APS has shown it to be cost-effective even for patients having IV PCA after intermediate grade surgical procedures (Lee 2010 **Level II**, n=423, JS 2).

The degree of medical input varies enormously. A UK survey reported that while 90% of hospitals reported having an APS, dedicated medical staff sessions did not exist in 37%, were limited to one or two per wk in 40% and in only 4% were there five or more sessions (Nagi 2004 **NR**). In training hospitals in Australia, 91% of hospitals accredited for anaesthetic training had an APS run from the department of anaesthesia with daily input from medical staff. Consultant anaesthetist sessions (one session is 0.5 d) varied from zero in 27%, just one or two a wk in a further 22%, four to six per wk in 22% and ten per wk in 15% (Roberts 2008 **Level IV**, n=67 [AUS and NZ hospitals]). A UK survey of 141 acute pain services found variation in the structure, function and staffing of the APSs between the responding hospitals (Rockett 2017 **Level IV**, n=209 [UK hospitals]). The mean number of consultant hours per wk was only 5.5 h. 35% of the APSs also had other roles in addition to acute pain management. Only half of the teams (49%) had members that also worked in an integrated multidisciplinary pain service. A Dutch survey showed again that 90% of hospitals have an APS of variable organisational structure; important tasks of the APS were regular patient rounds and checking complex pain techniques (100%), supporting quality improvement of pain management (87%), pain education (100%) and pain research (21%) (van Boekel 2015 **Level IV**, n=96 [Dutch hospitals]). However, a survey repeated in Denmark from 2000–2009 showed a surprising decline of APSs in parallel to the

increased usage of enhanced-recovery programs (Nielsen 2012 **Level IV**). In the USA, APSs were more common in university/academic hospitals (96%) than in Veterans' Affairs hospitals (69%), with the lowest rate in private hospitals (47%) (Nasir 2011 **Level IV**, n=301 [USA hospitals]). Formal written postoperative pain protocols were more common in hospitals with an APS but overall only 55% of hospitals had such protocols. In Germany, 81% of the hospitals surveyed stated that they had an APS; however, only 45% met quality criteria defined by the authors (Erlenwein 2014 **Level IV**, n=403 [German hospitals]). In contrast to the USA data above, 97% of the hospitals had written acute pain protocols for surgical patients, but only 51% on nonsurgical wards.

Some APSs supervise primarily "high-tech" forms of pain relief and/or complex patients, while others have input into all forms of acute pain management in an institution and will work towards optimising traditional methods of pain relief so that all patients in that institution benefit (Macintyre 2015 **NR**; Counsell 2008 **NR**; Breivik 2002 **NR**). Increasingly, APSs are also called on to deal with much more complex pain management issues (eg acute-on-chronic pain, acute pain after SCI or other major trauma, and resulting from a multitude of medical illnesses) and more complex patients (eg opioid-tolerant patients, older patients) (Counsell 2008 **NR**).

Individual publications assessing the benefits of an APS have reported that the presence of an APS reduced pain scores (Stadler 2004 **Level III-3**, n=1,975; Bardiau 2003 **Level III-3**, n=2,283; Salomaki 2000 **Level III-3**, n=400; Sartain 1999 **Level III-3**, n=605; Harmer 1998 **Level III-3**, n=2,783; Gould 1992 **Level III-3**, n=2,035; Miaskowski 1999 **Level IV**, n=5,837) and adverse effects (Sartain 1999 **Level III-3**, n=605; Stacey 1997 **Level III-3**, n=40; Miaskowski 1999 **Level IV**, n=5,837; Schug 1993a **Level IV**, n=3,016). A review of publications (primarily audits) looking at the effectiveness of APSs (77% were physician-based, 23% nurse-based) concluded that the implementation of an APS is associated with a significant improvement in postoperative pain and a possible reduction in postoperative neurological symptoms (PONS), but that it was not possible to determine which model was superior (Werner 2002 **Level IV SR**, 48 studies, n=84,097). The authors comment, however, that it is not possible to assess the contribution of factors such as an increased awareness of the importance of postoperative analgesia, the use of more effective analgesic regimens (eg epidural analgesia), the effects of APS visits and better strategies for antiemetic therapy. The benefits of an APS can be enhanced when its role is expanded beyond its traditional postoperative realm and into the entire patient journey – preoperative, intraoperative, postoperative and posthospital discharge (Zaccagnino 2017 **NR**).

Possible benefits of an APS are summarised in Table 3.1.

Given the heterogeneity of APS models and types of patients and pain treated, as well as variation in the quality of published studies, it is difficult to meaningfully analyse the benefits or otherwise of an APS. Although systematic reviews have been attempted (McDonnell 2003 **Level III-3 SR**, 15 studies, n unspecified; NICS 2003 **Level III-3 SR**, 32 studies, n unspecified) (4 Studies overlap), the poor quality of the studies looking at the effectiveness or otherwise of APSs and the many different types of APSs, means that a meta-analysis cannot be performed.

In addition, the above studies looked at outcome in terms of immediate pain and adverse effects in postoperative patients only. It is possible that an APS may benefit patients in other ways.

Combination of an APS with a physician-based critical-care outreach team, which systematically reviewed high-risk postoperative patients for 3 d after their return to a general ward, showed a significant improvement in postoperative outcome with a decrease in serious adverse effects from 23 to 16 events per 100 patients and 30 d mortality from 9 to 3% (Story 2006 **Level III-2**, n=590). Finally, members of an APS may also be more likely to recognise the early onset of neuropathic pain associated with surgery, trauma or medical disease and institute the appropriate treatment (Counsell 2008 **NR**).

**Table 3.1** | Possible benefits of an acute pain service

| Benefit | References |
|---|---|
| Better pain relief | Stadler 2004; Bardiau 2003; Werner 2002; Salomaki 2000; Sartain 1999; Gear 1999; Harmer 1998; Gould 1992 |
| Lower incidence of adverse effects | Werner 2002; Sartain 1999; Miaskowski 1999; Stacey 1997; Schug 1993b |
| Lower postoperative morbidity/mortality | Story 2006 |
| Management of analgesic techniques that may reduce the incidence of persistent pain after surgery | Gehling 2003; Senturk 2002; Obata 1999 |
| Cost-effective patient care | Lee 2010 |
| Reduced persistent pain and discharge opioid use after surgery | Tiippana 2016; Katz 2015 |

The role of an APS can be extended into the pre-admission (elective cases) and post-acute phase of recovery. This approach can bridge the gap between ward-based acute pain care and outpatient chronic pain management. Descriptions of this type of extended and proactive care suggests a reduction in the occurrence of persistent pain and excessive opioid use after hospital discharge, which may also be cost-effective (Tiippana 2016 **Level IV**, n=200; Katz 2015 **NR**) (see also 3.3 Economic Considerations).

#### **3.2.2.1** | Safety

Unidimensional management of acute pain can lead to adverse outcomes including opioid-induced ventilatory impairment (OIVI) (Vila 2005 **Level III-3**; Macintyre 2011 **NR**). Structural changes in an APS can minimise such effects (Story 2006 **Level III-2**, n=590). Implementation of root-cause analysis for critical incidents improved the safety of patients looked after by an APS; this approach reduced the overall event rate (1.47% vs 2.35) with specific effects on the rate of respiratory depression (0.41% vs 0.71), severe hypotension (0.78% vs 1.34) and PCA pump programming errors (0.0% vs 0.08) (Paul 2014 **Level III-3**, n=35,384) (see also Sections 6.6 and 6.8).

Standardised written documentation of APS treatment can potentially improve the safety of patient care. An agreed and consistent format for prescribing, observation and documentation of care can reduce unnecessary clinical variation, which is beneficial (Agency for Clinical Innovation NSW 2016 **GL**). The use of an electronic medical record (EMR) can facilitate the function and safety of an institution's APS. Specifically, these benefits can include clear documentation, organisation of ward rounds, billing, analysis of patient safety and outcomes, and integration with research (Goldstein 2014 **NR**). It is important that the design of an EMR has features that facilitate usability, efficiency, safety and mobility (Telenti 2018 **NR**; Mandl 2012 **NR**; Grams 2009 **NR**). The integration of electronic smart-pumps directly into the EMR greatly increased the accuracy and completeness of recording PCA episode of care vs paper-based records (38% to 91) (Suess 2019 **Level III-3**, n=113).

## KEY MESSAGES

1. Implementation of an acute pain service may improve pain relief and reduce the incidence of adverse effects (**U**) (**Level III-3**).
2. Even "simple" techniques of pain relief can be more effective if attention is given to education, documentation, patient assessment and provision of appropriate guidelines and policies (**U**) (**Level III-3**).
3. Implementation of root-cause analysis to follow up critical incidents improved the safety of patients under care of an acute pain service (**U**) (**Level III-3**).

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The following tick boxes represent conclusions based on clinical experience and expert opinion:

☑ Successful management of acute pain requires close liaison between all personnel involved in the care of the patient (**U**).

☑ More effective acute pain management will result from appropriate education and organisational structures for the delivery of pain relief rather than the analgesic techniques themselves (**U**).

☑ Appropriate institutional support and engagement is important for the effective implementation of an acute pain service (**U**).

☑ Procedure-specific analgesic protocols can help optimise analgesia for the individual patient while reducing adverse effects (**U**).

☑ The adoption of individualised care pathways (eg SCAMPS) can improve patient outcomes and reduce clinical variation (**N**).

☑ The benefit of an acute pain service can be enhanced when acute pain management is integrated into the pre, intra and postoperative periods (**N**).

☑ The recruitment of patients 'at-risk' for persistent pain and/or excessive opioid use into a post-discharge treatment service for early review can improve outcomes (**N**).

☑ Appropriately designed, implemented and integrated Electronic Medical Records (EMR) can improve the standards of clinical care (**N**).

## 3.3 | Economic considerations in acute pain management

An economic evaluation of healthcare can be described as the "*comparative analysis of alternative courses of action in terms of their costs and consequences*" (Drummond 2008 **NR**). Health economics aims to maximise health benefits relative to the resources available. This approach is particularly crucial in a growing and ageing population, with fewer people in the workforce paying taxes, and a more substantial proportion with chronic conditions and aged care, requiring health services. An economic assessment of acute pain can be of the overall service provision (eg an APS), or a specific technique (eg PCA). Areas where acute pain management may affect the economics of healthcare include: patients, hospitals, and payers/insurers. These impacts may be direct or indirect, where the costs of delivering pain management may result in savings in other areas of patient treatment. Limited data indicate potential areas of cost savings arising from improved acute pain care. These include shorter ICU admissions, decreased cardiac and respiratory adverse events, decreased risk of postoperative infections, and potentially reduced risk of the development of chronic pain (Gray 2017 **NR**; Schug 2017 **NR**).

While the costs of healthcare are relatively easy to measure, the value of healthcare is harder to quantify (Goldman 2014 **NR**). Often, the benefits of healthcare are limited to those occurring within the healthcare system; however, there may be other significant benefits in society that should also be included eg return to full employment, long-term disability due to pain, or mental health related to ongoing pain (Drummond 2008 **NR**). The impact on a patients' family and carers in their workforce participation and their psychological well-being are further considerations (Schofield 2019 **Level IV**).

There are several types of economic assessment that are commonly used in the literature. These have important differences; there is a consensus agreement on their definitions (Husereau 2013 **GL**; Drummond 2005 **NR**) (see Table 3.2). The most commonly used is cost-effectiveness analysis, which examines the cost in dollars per additional life-year gained.

In the literature, these terms may be used interchangeably, without correct adherence to their definitions. No one assessment measure is superior to another, and health economists debate the merits of each. In addition, issues of social equity, needs, and priorities should also be part of the decision making process (Schlander 2009 **NR**; Phillips 2009 **NR**; McGregor 2003 **NR**).

In contrast to most commodities, healthcare is a "*credence good*" (Emons 1997 **NR**) ie patients or consumers/stakeholders find it difficult or impossible to determine the utility of a treatment prior to its consumption. They have to rely on the knowledge of healthcare experts when choosing a treatment. This situation is also referred to as "*asymmetry of knowledge*".

Patients value pain relief highly; a survey of two million USA inpatients found that "*how well their pain was controlled*" was the second most important factor in recommending a hospital (PressGaney 2009 **Level IV**). When healthcare funding occurs without regard to patient's values, then funding for formal acute pain services becomes limited (Sun 2010 **NR**).

A consistent risk factor for the development of chronic postsurgical pain (CPSP) is poorly controlled postoperative pain (see Section 1.4). CPSP is an economic burden on society. An economic report in 2019 found that the total cost of chronic pain in Australia was $73.2 billion, and that much of chronic pain originates as acute pain (Deloitte Access Economics 2019 **NR**). Chronic pain interferes with the return to employment, requires ongoing medical treatment with its inherent costs, and may require carers at an additional cost, or require informal care from a family member or friend, influencing their workforce participation (Schofield 2019 **IV**) .

**Table 3.2** | Definitions of health economic assessment measures

| | |
|---|---|
| **Cost-effectiveness analysis** | Consequences are measured in natural units, such as life years gained, disability days avoided, or cases detected |
| **Cost-utility analysis** | Consequences are measured in terms of preference-based measures of health, such as quality adjusted life years (QALY) or disability adjusted life years (DALY). |
| **Cost-benefit analysis** | Consequences are valued in monetary units |
| **Cost-minimisation analysis** | Consequences of compared interventions are equivalent (in terms of clinical efficacy and tolerability), and only relative costs are compared |
| **Cost-outcome description** | Costs measured in monetary value and health effects measured in natural units (eg intensive care unit days saved, patient satisfaction etc.) |
| **Value of statistical life** | A method to assign a monetary value to a person's life (or a proportion if a disability) using a willingness to pay approach. This is similar to a QALY. (Office of Best Practice Regulation 2014 **GL**) |

Economic assessment of pain relief requires direct and indirect evaluation of both the costs and the benefits. Assessment of subjective experiences, such as a reduction in pain scores, can be assigned a monetary value using techniques such as 'willingness to pay', and 'human capital approaches' (Kumar 2006 **NR**). These monetary values can then be used in performing a cost-benefit analysis. Economic analysis needs to include the assessment of a treatment in comparison with the alternatives eg IV PCA vs prn opioid analgesia. Direct costs can include the cost of equipment, drugs and staff. Indirect costs can include the duration of hospital stay, use of ICU, development of persistent pain and treatment of adverse effects. Potential benefits include: reduction in pain intensity, minimisation of pain-related adverse effects, improved fast-track recovery and compliance with rehabilitation, as well as earlier return to work of both the patient and their informal carer (White 2007 **NR**).

### 3.3.1 | Economic evaluation of PCA

The direct and indirect costs of PCA for pain relief after three common types of surgery have been assessed (Palmer 2014 **Level III-3**, n=11,805,513). This evaluation used data from a large administrative healthcare database (Premier 2015 **Level IV**). Further cost estimates of adverse events were derived from the literature. The use of PCA after TKA, THA and open abdominal surgery was evaluated. The costs included PCA pump usage, setup costs, and costs of IV extension set, drug, fluid for IV co-infusion and the pump. The total of these costs (standardised to US$ in 2012) during the first 48 h after surgery, were US$204, US$196, and US$243 respectively. Additionally, cost estimates for particular adverse events in the first 48 h of PCA use were calculated. These costs were: phlebitis (US$2.18), healthcare worker needle stick injury (US$1.67), and IV PCA programming error (US$35.52). The assessment of costs for PCA programming errors did not include newer pumps that have software for the mitigation of programming errors (ie 'smart pumps'). The cost of other adverse events, such as respiratory depression or nausea and vomiting, were not included in this assessment.

The costs and rates of harmful and non-harmful errors due to the use of IV PCA were estimated from two large safety-reporting databases in the USA (Meissner 2009 **Level IV**): the datasets included medication errors (MEDMARX) and device errors (MAUDE). A cost-accounting methodology was used, which included direct, indirect and opportunity costs. These were estimated from published literature, expert consensus, physician billing-charges and staff labour-rates (standardised to US$ in 2006). The estimated average cost of a PCA adverse event in the medication error dataset was US$733, whereas the cost related to a pump error was US$552. If an error led to patient harm, then the cost was 120 to 250 times more costly than a non-harmful error. For medication incidents, the most expensive harm-causing error was due to poor communication (US$8,984 per incident). For pump-related errors, the two most expensive were operator error (US$5,756) and those of indeterminate cause (US$6,120). The estimated annual USA error rates per 10,000 patients treated with PCA were 407 for PCA medication errors, and 17 for PCA device errors (see also Section 6.6).

### 3.3.2 | Economic evaluation of Acute Pain Services

A narrative review (Gray 2017 **NR**) examined the economic aspects of an APS from within a USA healthcare perspective. Assessment included the areas of the patient, the hospital and the payer (insurer). Indirect benefits may include improved outcome over a range of postoperative measures. This may be relevant for a hospital within an 'activity-based funding' agreement. The use of continuous regional anaesthesia/analgesia techniques can be made more cost-effective by instigating a single regional block service that covers multiple operating rooms. This service model could reduce the cost of time delays associated with the initiation of regional anaesthesia. The treatment options used by a specialised acute pain service could ensure there is greater use of non-opioids, and mitigation of excess opioid prescribing with that resultant long-term health cost.

A systematic review of the economic evaluations of APSs has been performed (Lee 2007 **Level IV SR**, 9 studies, n=14,774). Five of the studies were of nurse-based, anaesthetist-supervised services. Out-of-pocket expenses and loss of productivity due to absence from work were not included. No study went beyond five d. Monetary values were standardised to $US in 2005. The cost of an anesthetist-led APS ranged from US$31.73 to US$100.37 per patient per d. The cost of a nurse-based/anaesthetist supervised APS ranged from US$3.70 to US$50.77 per patient per d. The cost-savings from a shorter ICU stay were US$9.90 per patient per d. The cost-savings from a shorter duration of hospital stay were US$11.40 per patient per d. Savings from reduced nursing time were also identified. Data were not available to compare the economics of a nurse-based/anaesthetist supervised APS with an anaesthetist-led APS. No studies were of high quality or included all costs and benefits associated with APS care.

An RCT for the cost-effectiveness of APS care (anaesthetist-led, nurse-based) compared APS patient care (IV PCA plus adjuvants) with conventional ward analgesia for patients having major surgery (Lee 2010 **Level II**, n=423, JS 2). Regional analgesic techniques were not included. Of patients in the APS group, 86% had one or more d of highly effective pain relief vs 75% in the conventional care group. Costs were higher in the APS group when compared with the conventional group by US$46/d. Cost-effectiveness was determined using a 'willingness-to-pay' methodology which assigns a monetary value to pain relief. This analysis showed that to be 95% certain of obtaining one d of highly-effective pain relief per patient, the benefit was valued at US$546.

The cost-utility analysis of a nurse-based APS has been performed (Stadler 2004 **Level III-3**, n=1,975). The interventions used in this APS were: implementation of guidelines, use of multimodal analgesia, optimum use of systemic opioids as well as NSAIDs and paracetamol,

along with information pamphlets to patients. In 1.5% of patients, PCA was used; patients receiving epidural analgesia were not included. The patient population was a large tertiary hospital that included all surgical subspecialties. Cost-utility was assessed using a measure of 'Postoperative Pain Days Averted (PPDA)', which is a health state scale conceptually similar to quality adjusted life years (QALY). The PPDA measure summarises treatment outcome in terms of time spent with lower pain scores. A value of "1" represents a state of "no pain", whereas a value of "0" represents "worst pain imaginable". For POD 1 to 3, PPDA values were 0.075 (1.8 h), 0.05 (1.2 h) and 0.0375 (0.9 h) respectively. The incremental cost of pain management by the APS vs no APS, was 19 Euro per patient per d. The effectiveness of the APS may have been different if more advanced methods of pain relief had been used. Measuring PPDA alone may have missed other benefits from improved pain relief (ie quality of life surveys such as SF-12).

### 3.3.3 | Economic benefit related to improved patient outcome and reduced chronic postsurgical pain.

While not intended as economic assessments, there are studies that have measured patient outcomes, other than pain, which are related to an economic outcome. These are similar to a cost-effectiveness analysis (see Table 3.2). For example, the mental health issues following chronic pain, inability to return to the workforce for a patient or informal carers, and the resultant isolation and psychological distress are all non-monetary considerations. Monetary considerations of pain outcomes can be considered either from the health system or patient perspective, depending on whether the issue in question is the impact of pain on the individual or the health systems. From an individual perspective, out-of-pocket costs, travel, parking and accommodation for rural patients are considerations, particularly for those with chronic pain. From the health system perspective, cost includes Medicare costs such as the Pharmaceutical Benefits Scheme (PBS) or Medicare Benefits Scheme (MBS), outpatient visits, as well as other hospital costs.

The pattern of opioid prescribing (dose, duration and type) while in hospital and after discharge are significant instigators of opioid misuse and its resultant economic burden (Neuman 2019 **NR**; Lowenstein 2018 **NR**; Shah 2017 **Level IV**). This important public health problem can be mitigated by appropriate acute pain strategies in the hospital setting. These may include analgesic techniques that minimise the dose and duration of opioid use; this includes using non-opioid analgesic strategies. At the time of patient discharge there needs to be appropriate limitations on the dose and duration of the prescribed opioids (Lowenstein 2018 **NR**) (see Sections 8.13 and 10.4.5). The estimated financial cost of prescription opioid misuse in Australia comprises the costs related to deaths, hospitalisation, and pharmacotherapy. The estimated annual (2018) costs of these three areas are $4.7 billion, $13.4 million and $60.2 million respectively (Deloitte Access Economics 2019). These costs may be further mitigated by a real-time prescription monitoring program which can reduce deaths and the issue of multiple prescribers ("*doctor shopping*") (Finklea 2014 **NR**; Winters 2013 **NR**).

A systematic review of patient outcomes after epidural analgesia showed a reduction in the incidence of costly adverse events. These included a reduced risk of atrial fibrillation, supraventricular tachycardia, deep vein thrombosis, respiratory depression, atelectasis, pneumonia, ileus, postoperative nausea and vomiting and improved recovery of bowel function (Popping 2014 **Level I** [PRISMA], 125 RCTs, n=9,044) (see section 5.6). These must be balanced against the increase in adverse events associated with epidural analgesia such as hypotension, pruritus, urinary retention and motor block.

One study examined the effect on patient outcome when an APS provided additional advice on patient care during their usual ward round (Story 2006 **Level III-3**, n=590). Examples of advice include oxygen therapy, IV fluid management, physiotherapy, analgesia, or calling the medical emergency team. This APS intervention resulted in a reduction of serious adverse events (from 23 to 16 per 100 patients) and reduced 30 d mortality (9% to 3%).

Chronic postsurgical pain (CPSP) has a significant prevalence, which is typically 1 to 10% at one year after surgery. This is dependent on the nature of surgery. A consistent predictor for the development of CPSP is the severity and duration of postoperative pain. The provision of effective acute pain management can reduce this costly public health problem. Examples include limb amputation, thoracotomy, craniotomy, joint arthroplasty, breast surgery and inguinal hernia repair. (Glare 2019 **NR**). Once CPSP is established, it may be challenging to treat, resulting in ongoing costs. Additionally, there are indirect costs, including impairment of return to employment. The annual cost per patient (2018) with chronic pain was estimated at A$42,979 (Deloitte Access Economics 2019 **NR**). A potential strategy to reduce the transition from acute to chronic postsurgical pain, along with its economic costs, is the use of a transitional pain clinic. Patients at this clinic are reviewed and managed in the early period after hospital discharge to prevent the progression from acute to chronic pain and reduce opioid usage (Huang 2016 **Level IV**; Katz 2015 **NR**) (see also Section 1.4).

Quantifying the health outcomes of patients immediately after surgery as well as over the longer term will allow improved assessments of cost-effectiveness of new strategies.

## KEY MESSAGES

1. Long term economic consequences from the progression of acute to chronic postsurgical and post-traumatic pain can be significant (**S**) (**Level IV**).
2. Strategies to optimise acute and subacute pain management (including involvement of transitional pain services) may reduce the economic burden of chronic pain and inappropriate prescription opioid use (**N**) (**Level IV**).
3. The early pattern of prescription opioid use after surgery may increase the risk of chronic use with significant direct and indirect economic costs (**N**) (**Level IV**).
4. Patients' willingness to pay for good pain relief is high (**S**) (**Level IV**).
5. Costs from PCA errors can be considerable; the most common high cost errors arise from staff communication error and operator error (**S**) (**Level IV**).

The following tick boxes represent conclusions based on clinical experience and expert opinion:

☑ There are different measures of economic assessment and analysis used in healthcare; no one method is the most appropriate (**U**).

☑ Prescription drug monitoring may reduce the economic burden through its impact on inappropriate opioid prescribing (**N**).

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