



REDUCED COSTS

COST SAVING POTENTIAL THROUGH AUDIOVISUAL DISTRACTION: A SUMMARY

Medication cost saving

- Sedation: reduced consumption in 45% of patients
- Analgesics: 61% reduced pain perception due to audiovisual distraction

Personnel cost saving

- Preoperative care: relief of medical personnel through patient distraction: less nursing intervention necessary, enhanced patient cooperation, eased induction and performance of procedures
- Postoperative care: less monitoring needed for non-sedated patients who opt for regional anesthesia, bypassing of PACU in 82% of cases (saving approx. 3 hours of personnel costs per patient)

Process cost saving

- Throughput time: process optimisation (preparing patients punctually and occupying them during their waiting time in the holding area), increased acceptance towards regional anaesthesia (90% preference rate), fewer procedural complications during surgery (58% risk reduction), reduced OR cost (4% reduction of average procedure time per patient), higher volume of procedures (10,9%)
- Recovery: PACU discharge is 24 min earlier per patient, delirium prevention (5 % risk minimisation), reduced length of hospital stay by 8%

[Long Version](#)

How does patient anxiety affect costs in the hospital?

Anxiety is a burden on patient health and a risk factor for several adverse outcomes of medical treatments. A longer recovery phase, extended hospital stays and complications hold a huge amount of hidden costs that can hardly be tracked by medical health care professionals. Uncovering the significant impact of anxiety related to medical treatments, audiovisual technologies providing distraction and relaxation have been proven to save on costs for the hospital site. Studies confirm that these low cost-methods are capable of reducing costs for



medication, optimising processes from preoperative preparation to postoperative care, facilitating patients' decisions to use regional anaesthesia and positively impacting patient recovery.

1. OPERATING ROOM

Patients who experience anxiety related to medical treatments in the hospital are routinely treated with sedatives. This may result in **increased costs, necessitate additional nursing staff, increase the need for appropriately equipped bed space in the preoperative holding area,** and delayed discharge from the post-anaesthesia care unit (PACU).¹

For patients undergoing elective surgery under general anaesthesia, **sedative premedication** with lorazepam **prolongs time to extubation and cognitive recovery.** Compared to non-sedated patients, those patients needed 5 extra minutes until readiness for extubation and reached a rate of early cognitive recovery which was 20% lower.² Calculating with a median cost of £20 per OR minute in the United Kingdom,³ preoperative anxiety causing additional administration of sedatives prior to surgery comes with **£100 of extra cost per patient.**

Operating theatres are one of the most expensive areas to run in a hospital, with an average cost of approximately £1200 per hour. They also represent one of the most profitable areas of healthcare delivery for NHS trusts, if delivered efficiently. Streamlining could lead to significant savings. For example, the NHS Institute for Innovation and Improvement calculate that the average trust has an opportunity to save £7 million a year in efficiency savings by running a 'productive theatre'.³

2. RECOVERY ROOM & HOSPITAL STAY

Preoperative anxiety is known to negatively impact patient health and wellbeing in the hospital. What is more, patient anxiety has been directly linked to complications and delayed recovery. As a consequence, **anxious patients are likely to cause operating room delays and prolonged stays in recovery rooms, thus increasing health care costs** for hospitals and statutory health insurance.⁴

Retrospective studies identifying patients with different levels of anxiety prior to elective lumbar spinal surgery found that **anxiety is significantly associated with a lengthier hospital stay.** Results show that **patients who were diagnosed with anxiety and took anxiolytics before surgery stayed in the hospital 1.8 days longer** than patients who were not anxious and did not take anxiolytic medication.⁵ Considering that a bed costs the NHS £400 per day, **high levels of preoperative anxiety can amount to up to £800 of extra costs per patient** in terms of length of hospital stay.

3. INTENSIVE CARE UNIT

Preoperative anxiety has been associated with the development of emergence delirium.

On average, the estimated risk of the overall development of emergence delirium is increased by 5% when receiving sedative premedication before induction.⁶



Delirious patients need longer intubation and ventilation, additional personnel expenditure and **stay on average 4.2 days longer** at the intensive care unit compared to non-delirious patients.⁷ When taking into account personnel and material costs, one single hyperactive **delirium patient accounts for approximately €1.200,- in extra costs for the hospital.**⁸

4. ANAESTHETIC PROCEDURE

*“General anaesthesia is fast and known by all anaesthesiologists. However, concerning postoperative pain, complications needing readmissions and costs, regional anaesthesia offers major advantages.”*⁹ For patients having elective surgeries such as limb surgery, doctors often recommend local or regional anaesthetic procedures for reasons of patient health and security. In 2008, a review of more than 18.000 patients undergoing surgery for hip fractures found that *“the use of regional anaesthesia was associated with a 25–29% reduction in major pulmonary complications and death”*.¹⁰

Nevertheless, patients scheduled for hip or knee surgeries tend to opt for general anaesthesia when given the choice. Of about 30,000 patients having anaesthesia-type information available, 89% of patients decide to have general anaesthesia or combined neuraxial and general anaesthesia. Here, the complication rate is significantly higher compared to surgery under neuraxial anaesthesia. Taking into account that general anaesthetic procedures come along with a higher rate of complications, prolonged period for recovery and thus lengthier hospital stays, preoperative anxiety leading patients choosing this anaesthetic procedure causes higher hospital costs.¹¹

To encourage more patients to opt for local or regional anaesthesia, researchers have recommended **improving the hospital environment**, especially operating theatre atmosphere, **and enhancing anxiety management** before and during surgical procedures.¹²

How can audiovisual distraction help to reduce hospital costs?

1. MEDICATION COSTS

Material costs make up 37% of the overall healthcare expenses for hospitals, which were calculated at €105.7 bn in 2017. Material costs include expenditures on medical equipment and medication, which in total accounted for €19.2 bn of the overall hospital costs.¹³

Pain medication, sedatives and sleep medication are not only costly, but also have side effects which might negatively impact the patients' recovery process, thus accounting for higher costs. Essentially, medical health care professionals tend to over-sedate patients to ensure a positive experience for their patients. However, high doses of medication might not always be necessary,



and some patients could even go completely without additional sleep or pain medication, if they experienced less anxiety and felt more relaxed prior to their procedures.

The modern era of new technologies in the hospital sector has generated new possibilities of non-pharmacological pain relief, such as audiovisual distraction therapy:

A survey conducted by Oxford NHS Trust found that by audio-visually distracting patients during hip replacements, **45% of patients did not consume any additional procedural sedative medication.**¹⁴ For children undergoing elective surgery, children who were audio-visually distracted before induction achieved better surgery outcomes than children who received preoperative sedation pills.¹⁵

Audiovisual distraction was also successfully used during shockwave lithotripsy for bladder and kidney stone removals. By shifting patients' attention from unpleasant sensations to a variety of movies, both pain and distress scores were reduced significantly. *"Reducing patient pain and distress during lithotripsy is not only desirable for compassionate reasons but also could reduce analgesia requirements, accelerate post-procedure recovery, allow maximal energy delivery, and lead to overall improvement in stone fragmentation."* The overall intensity of **pain perception decreased by 61%**, which consequently leads to **reduced need for analgesics and benefits in terms of patient health, resulting in overall cost savings.**¹⁶

In flexible laryngoscopy, topical anaesthetic sprays were effectively replaced by distraction via monitor. Patients who were visually distracted during their procedures perceived significantly less discomfort than controls, regardless of whether they received local anaesthetics to reduce their pain. Those anaesthetic sprays are commonly used in the practice of endoscopic procedures and account for an average **cost of £11.48 per application.** The study, which was performed by the University Hospital Southampton belonging to the NHS Foundation Trust, demonstrated that **distraction methods can be a cost saving alternative to anaesthetic topical medication**, which can be very costly and provoke side effects.¹⁷

Furthermore, audiovisual distraction via video glasses including headphones was found to potentially **decrease the use of sleep medication** in a geriatric hospital ward. Twelve patients diagnosed with sleep disorders were offered to watch nature and relaxation videos before bedtime during four days of a hospital stay. Sleep quality was measured through patient questionnaires and objective activity trackers during the night. Both, patients' subjective and objective sleep quality *could be improved significantly by means of audiovisual stimulation.* In general, patients fell asleep faster, and slept better through the night. **In 3 out of 12 cases, the dose of hypnotics administration could be reduced.**¹⁸

2. PERSONNEL COSTS

According to an evaluation of the German Federal Office of Statistics in 2017, personnel costs accounted for 60% of overall hospital expenditures and amounted to €63.8 bn.¹³ Relieving medical



personnel by increasing patients' cooperation and making vulnerable patient groups feel more at ease in the hospital environment would likely take the time pressure off doctors and nurses.

2.1. PEDIATRICS

Audiovisual distraction was demonstrated to be effective in reducing self-reported pain, and as a consequence, **improved patient cooperation** in school age children. A large-scale randomised trial with 300 pediatric patients aged 8 to 9 years found that distracting children with cartoon movies increased cooperation rate from 81% to 92%. As a result, **success rate of venipuncture procedures was higher, and procedure time was significantly decreased.** The authors recommend audiovisual distraction *as an effective, labour saving and easy to administer analgesia, which should be used to help prevent pain from venipuncture in school age children.*¹⁹

Another RCT with 88 children aged 1 to 7 years undergoing venipuncture claimed that passive movie distraction works better than active distraction with toys: Providing children with a sufficiently engaging and easy-to-use distraction device might be a **cost-effective and time-efficient pediatric distress management technique.**²⁰

Kaur and colleagues (2015) found that children experience significantly less pain and distress during intravenous injections when being distracted while watching cartoons. Since a higher level of pain and distress turned out to proportionally extend the duration of the procedure, reducing pain perception in children is assumed to lead to **significant time savings in terms of personnel cost.** The authors concluded that *"pain and distress assessment and its management through distraction techniques should be made mandatory in all pediatric units."*²¹

Audiovisual distraction was further declared useful for children having laceration repair in emergency departments. Eighty-four children aged 3 to 10 years were randomised into either control group receiving standard care or intervention group receiving standard care while watching DVDs on a screen. Results demonstrated that pediatric patients perceived significantly less pain during the treatment. Moreover, children cooperated more which made it easier for doctors and nurses to perform the procedure. Increased cooperation through audiovisual distraction therapy might not only reduce the time taken for laceration repair, but also the overall time spent in the emergency room.²²

2.2. GERIATRICS

Up to 80% of patients staying at the intensive care unit develop emergence delirium.²³ This development is partly caused by use of medication and stressful environments. Agitated patients not only consume resources in terms of extended length of stay and material costs, but also account for **additional personnel expenditure of approximately 4 hours per agitated patient.**⁸



According to an evaluation conducted by the Nottingham University Hospitals NHS Trust in 2015, **6% of patients were confused and verbally agitated every day**. Verbal agitation was perceived as distressing by the medical personnel but also by other patients. It included verbal aggression, permanently asking questions or repeating the same sentences, screaming, shouting, swearing and constantly requesting attention or help. Distraction and engagement were described as useful methods to calm those patients, although space or appropriate activities were often lacking. **Relaxing and distracting content displayed via video glasses might be helpful to calm those patients down and occupy their busy minds, while saving costs in terms of personnel time.**²⁴

2.3. PRE- AND POSTOPERATIVE CARE

Preparing children for surgery can be very demanding and time-intensive for both doctors and nurses. The sight of unfamiliar surroundings and people as well as separation from parents is especially anxiety-provoking for young children. As a natural reaction, children often exhibit aggressive and uncooperative behavior such as crying, hitting, and trying to escape from the situation. Today, some hospitals are even employing child specialists to emotionally support and accompany anxious children from preparation until induction.²⁵

Audiovisual distraction has been proposed as a non-pharmacological, easy to administer and cost-efficient alternative to other approaches. While the administration of calming oral premedication is often not easy due to refusal or reluctance, distraction through animated cartoons before and during induction have been accepted very well by children of various age groups,^{26, 27, 6} and **positively affected children's cooperation during induction.**²⁸ Savings in terms of personnel time are reasonable.

Being awake after surgery is one of the top criteria for patients' readiness for ambulation. Therefore, non-sedated patients having regional anaesthesia can often be transferred earlier than sedated patients, and might even skip postoperative monitoring if no complications occurred. Also, significantly more patients are able to bypass PACU (40-60%), if they chose regional nerve blocks over general anaesthesia.⁹ **Reducing surgery-related anxiety by applying non-pharmacological methods is, thus, likely to relieve the medical personnel and save on costs in terms of postoperative monitoring time.**

3. PROCESS COSTS

Hospital costs do not only arise from expenses for medication and personnel, but are highly depending on variable costs, including but not limited to **expenses for OR waiting times, complication and delays in recovery**. Those costs are hardly predictable and pose a certain risk to medical institutions. To keep variable costs low, hospitals started implementing so-called fast-track programs, which seek to minimise risks of complications and enhance patient recovery after surgery. These programs comprise of a variety of methods to enforce patient information and early patient mobilisation. **Relieving stress and anxiety related to surgery is an essential part of fast-track concepts and can be tackled by audiovisual distraction methods.**



3.1. THROUGHPUT

Complication or emergency cases mean a risk in a surgery ward, which can hardly be foreseen but crucially impact daily surgical schedules. As a consequence, patients who are already prepared for undergoing their surgery are exposed to waiting times. Having to wait in front of the operating room can be a stressful event and, in fact, is included in the most stressful experiences in a hospital ward.²⁹ **Audiovisual distraction can help to bridge waiting times and relieve preoperative anxiety.** Furthermore, patients can be prepared earlier and watch movies while waiting in the preoperative patient area. In this way, processes might be optimised, throughput increased and variable costs lowered.

Effectiveness of the operating room theatre is often measured by throughput of cases and met when the cancellation rate is low.³⁰ Higher volumes of procedures were also achieved by distracting children before undergoing Computed Tomography (CT). In 2005, researchers from the Children's Hospital of Pittsburgh started an initiative to reduce administration of sedatives in children undergoing CT scans. By projecting visual images onto the walls of the scanner, they aimed to prevent the need for procedural sedation in young children. Indeed, children remained still during the procedures which came with a significant saving of sedation but also an **increase of throughput time by a total 10.9%.**³¹

Audiovisual distraction was furthermore described as beneficial to occupying patients before undergoing Magnetic Resonance Imaging (MRI). Many patients feel strong tension and significant anxiety before having an MRI procedure. Salas and colleagues (2015) suggested to make use of those interventions to **prevent additional doses of medication and cancellations of procedures, which results in cost savings for the hospital.**³²

In 2010, researchers from "The Royal Australian and New Zealand College of Radiologists" successfully used audiovisual interventions in the course of radiation therapy. Since pediatric patients often exhibit high levels of anxiety, many clinicians are forced to perform general anaesthesia in order to keep patients still and treatable. The aim of the investigation was to distract patients from the stressful situation to reduce the need for general anaesthesia. **Twenty-two children were allowed to watch DVDs during their procedure,** and the results showed that **92% of them could undergo their procedure without narcosis.** Keeping pediatric patients awake during radiation therapy comes with significant savings in terms of medication, time spent for pre- and postoperative monitoring as well as a shortened recovery time.³³

Throughput can be drastically increased by avoiding general anaesthetic procedures for surgeries, which can also be performed under regional anaesthesia. Literature indicates that procedures done under regional anaesthetics came along with a 58% relative risk reduction of complications compared to narcosis and a shorter average duration of procedures.³⁴ Besides several positive impacts on patient's health, studies show that **local and regional anaesthesia are more cost-efficient than general anaesthesia:**



When comparing the cost of hysterectomy, Wodlin, Nilsson, Carlsson and Kjølhede (2011) found that **procedures performed under spinal anaesthesia cost on average £737 less** than when performed under general anaesthesia. Cost savings resulted from outcomes of reduced need for anaesthetic drugs, overall shorter duration of operating room time, shorter stay in the postoperative recovery room, earlier recovery, and reduced need for hospital care in the ward for women undergoing surgery under spinal compared to general anaesthesia.³⁵

This finding was underpinned by another study which compared cost of various methods of anaesthesia across 1,587 orthopedic surgeries. **Spinal anaesthesia was found to be the most cost-efficient procedure.** Compared to general anaesthetic procedures, **hospitals saved between 5 to 13 percent of operation theatre costs** for 50 and 200 minutes of operation duration respectively.³⁶

A retrospective study with more than 10,000 patients revealed that **patients having total hip or knee arthroplasty under spinal anaesthesia could leave the hospital one day earlier** (5.7 vs. 6.6 days) compared to those undergoing general anaesthesia, **thus saving £400 of costs for the hospital per case.**³⁴ Furthermore, the overall complication rate - including wound infection and blood transfusion - as well as duration of surgery was found to be significantly reduced for knee surgeries under spinal compared to general anaesthesia.³⁷

In outpatient orthopaedic surgery, patients can bypass the PACU if they fulfill criteria which is the case in 60-80% of patients having regional anaesthesia compared to 20% of patients undergoing narcosis. Opting for regional instead of general anaesthetic procedures thus results in *significant hospital cost, time, and personnel resource savings.*

In fact, PACU stays are anticipated to extend beyond 2.5 to 3.5 hours. According to an evaluation in France in 2012, PACU costs amounted to €10,80,- per minute (€623,- per hour).³⁸ **Having more and more patients bypassing PACU will thus result in significant cost savings. Through the use of nerve block analgesia instead of common general anaesthesia** during complex outpatient surgical procedures (N=948), 96% of patients could avoid hospital admission and 82% of those patients also bypassed the PACU. Associated **hospital cost reduction was significant and amounted to 33%.**³⁹ **Total cost savings amounted to \$805 per patient.**

Notwithstanding, 57% of patients scheduled for total knee arthroplasty choose narcosis over regional anaesthesia when having the choice.³⁷ Preoperative anxiety was found to be significantly higher in patients selecting general over regional anaesthesia. The fear of being awake and perceiving noise and sight of the operating room is a major issue and keeping patients from deciding for a regional anaesthetic technique.⁴⁰ Offering audiovisual distraction devices has been described as a useful approach to positively affect patients' attitudes towards regional anaesthesia.⁴¹ Indeed, 90% of patients who had previous experiences with narcosis and received film and music distraction during elective limb surgery under regional anaesthesia preferred this procedure to general anaesthesia. Increasing acceptance towards regional anaesthesia through audiovisual distraction might be a powerful tool to save costs for the hospital site.



3.2. RECOVERY

Medical treatments and surgeries are known to provoke stress in patients of all age groups, while preoperative stress and anxiety crucially impact period of recovery and health outcomes.

Relaxation and anxiety management were demonstrated to have positive impacts on recovery parameters such as length of stay. Receiving guided imagery intervention before undergoing surgery, resulted in a **8% reduction of the length of stay** in 126 hysterectomy patients. Considering related savings in medication, **total costs were decreased by 14%, which resulted in an average saving of €1.765,- per procedure.**⁴²

Applying audiovisual distraction devices instead of administering standard premedication with midazolam is a cost-effective approach in pediatric surgery. Children randomised into the intervention group receiving distraction before and during induction needed less time in the recovery room and could be discharged on average 24 minutes earlier than their controls. The authors concluded that distraction methods *reduce separation anxiety while still promoting a faster discharge of ambulatory pediatric patients.*⁶

Earlier discharge was primarily related to the incidence of emergence delirium, which decreased by 5% in pediatric patients who received preoperative distraction instead of sedation. Although sedation might be an easy and effective method to alleviate anxiety, it has been associated with maladaptive behavioural changes and delayed hospital discharge.²⁶

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