AHRQ Comparative Effectiveness Review Surveillance Program

CER #30: Comparative Effectiveness of Pain Management Interventions for Hip Fracture

Original Release Date: May, 2011

Surveillance Report: March, 2012

Surveillance Report: October, 2012

Surveillance Report: August, 2015

Summary of Key Findings from Surveillance Report:

- Conclusions related to all Key Questions are likely current

Signal Assessment: The signals examined in this surveillance assessment suggest that the original CER is likely current.

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Conflict of Interest:

None of the investigators has any affiliations or financial involvement that conflicts with the material presented in this report.

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Introduction

The purpose of the surveillance process for the EPC Program is to decide if the findings of a systematic review are current. Approximately 25 systematic reviews are selected for surveillance annually based on popularity, use in obtaining continuing medical education certificates, potential impact for changing the field, and use in clinical practice guidelines.

Comparative Effectiveness Review (CER) #30 titled "Pain Management Interventions for Hip Fracture" was originally released in May, 2011.[1]

The key questions for the original CER are as follows:

Key Question 1. In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions for controlling acute (up to 30 days postfracture) and chronic pain (up to 1 year postfracture) compared with usual care or other interventions in all settings?

Key Question 2. In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions on other outcomes up to 1 year postfracture compared with usual care or other interventions in all settings? Other outcomes include:

a. Mortality (30-day and up to 1 year postfracture)
b. Functional status
c. Pain medication use; change in type and quantity
d. Mental status
e. Health-related quality of life
f. Quality of sleep in the hospital
g. Ability to participate in rehabilitation
h. Return to prefracture living arrangements
i. Health services utilization

Key Question 3. In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the nature and frequency of adverse effects that are directly or indirectly associated with pharmacologic and nonpharmacologic pain management interventions up to 1 year postfracture compared with usual care or other interventions in all settings?

Key Question 4. In older adults (≥50 years) admitted to the hospital following acute hip fracture, how do the effectiveness and safety of pharmacologic and nonpharmacologic pain management interventions vary in differing subpopulations following acute hip fracture up to 1 year after fracture compared with usual care or other interventions in all settings?

Our surveillance assessment began in July 2015. We conducted an electronic search for literature published since the end date of the most recent surveillance report search date. After completing a scan of this literature to identify evidence potentially related to the key questions in this CER, we contacted experts involved in the original CER to request their opinions as to whether the conclusions had changed.

Methods

Prior Surveillance

A surveillance report for the original CER was released in March 2012 and October 2012. The second surveillance report included a search for relevant literature published between 2008 and September 2012, expert opinion, and a search of U.S. Food and Drug Administration (FDA), Health Canada, and Medicines and Healthcare Products Regulatory Agency (MHRA) surveillance alerts received from the Emergency Care Research Institute (ECRI). The findings from this report are included in our assessment.

Literature Searches

We conducted a literature search of PubMed covering 2011 to July 2015, using the identical search strategy used for the original report[1] and searching for studies published since the end date of the most recent surveillance search.

The search was conducted to assess the currency of conclusions using journals from among the top 10 journals from relevant specialty subject areas and among those most highly represented among the references for the original report. We included the journals searched in the previous surveillance assessment. The included journals were five high-profile general medical interest journals (Annals of Internal Medicine, British Medical Journal, Journal of the American Medical Association, Lancet, and the New England Journal of Medicine) and six specialty journals (Anesthesia and Analgesia, Anesthesiology, Emergency Medicine, Journal of the American Geriatrics Society, Osteoporosis International Journal, and Regional Anesthesia and Pain Medication). The search strategy is reported in Appendix A.

Study Selection

Using the same inclusion and exclusion criteria as the original CER (see Appendix B), one investigator reviewed the titles and abstracts of the 11 high-impact journal search results (Appendix C).

Expert Opinion

We shared the conclusions of the original report and most recent surveillance assessment, findings from the literature analysis, and the newly identified studies with 13 experts in the field (original peer reviewers, technical expert panel members [TEP], and a local expert) to request their assessment of the currency of report conclusions and their recommendations of any relevant new studies. Three subject matter experts responded to our request. Appendix D shows the form experts were asked to complete.

Horizon Scanning

The AHRQ Healthcare Horizon Scanning System identifies emerging health care technologies and innovations with the potential to impact health care for AHRQ's 14 priority conditions.[2] We reviewed the Functional Limits and Disability section to identify new potentially high-impact interventions related to the key questions in this CER. Potentially high impact interventions were considered in the final assessment of the currency of the report and its conclusions.

FDA Black Box Warnings

We searched the FDA MedWatch online database website for black box warnings, device recalls, and recently approved devices relevant to the key questions in this CER.

Check for Qualitative Signals

The authors of the original CER conducted qualitative and quantitative synthesis of data on the effectiveness of pharmacologic and nonpharmacologic pain management interventions on controlling acute pain and other outcomes in adults 50 and older, as well as the adverse events associated with these interventions and any differential effect in subpopulations. We compared the conclusions of the included abstracts to the conclusions of the original CER and surveillance reports, assessed expert input, horizon scan results, and FDA alert information to identify qualitative signals about the currency of conclusions.

Compilation of Findings and Conclusions

For this assessment we constructed a summary table (Appendix E) that includes the key questions, the conclusions from the original CER and most recent surveillance assessment, findings of the new literature search, and the expert assessments that pertained to each key question. Because we did not find any FDA black box warnings or Horizon Scan interventions relevant to the key questions in this CER, we did not include a column for this in the summary table. We categorized the currency of conclusions using a 3-category scheme:

- Original conclusion is still valid and this portion of the CER is likely current
- Original conclusion is possibly out of date and this portion of the CER may not be current
- Original conclusion is out of date.

We considered the following factors when making our assessments:

- If we found no new evidence or only confirmatory evidence and all responding experts assessed the CER conclusion as still valid, we classified the CER conclusion as likely current.
- If we found some new evidence that might change the CER conclusion, and /or a minority of responding experts assessed the CER conclusion as having new evidence that might change the conclusion, then we classified the CER conclusion as possibly not current.
- If we found new evidence that rendered the CER conclusion out of date or no longer applicable, we classified the CER conclusion as out of date. Recognizing that our literature searches were limited, we reserved this category only for situations where a limited search would produce prima facie evidence that a conclusion was out of date, such as the withdrawal of a drug or surgical device from the market, a black box warning from FDA, etc.

Signal Assessment for Currency of the CER

We used the following considerations in our assessment of currency of the CER:

- **Strong signal:** A report is considered to have a strong signal if new evidence is identified that clearly renders conclusions from the original report out of date, such as the addition or removal of a drug or device from the market or a new FDA boxed warning.
- **Medium signal:** A report is considered to have a medium signal when new evidence is identified which may change the conclusions from the original report. This may occur when abstract review and expert assessment indicates that some conclusions from the original report may not be current, or when it is unclear from abstract review how new evidence may impact the findings from the original report. In this case, full-text review and data abstraction may be needed to more clearly classify a signal.
- **Weak signal:** A report is considered to have a weak signal if little or no new evidence is identified that would change the conclusions from the original report. This may occur when little to no new evidence is identified, or when some new evidence is identified but it is clear from abstract review and expert assessment that the new evidence is unlikely to change the conclusions of the original report.

Results

Prior Surveillance

The most recent surveillance of the topic included three studies and consultation with three subject matter experts, and concluded that all original CER conclusions were up to date.

Literature Search

The literature search identified 62 unique titles from the 11 selected high profile general medical and specialty journals (Appendix E). Upon abstract review, 61 studies were excluded because they did not meet the original CER inclusion criteria (see Appendix B). The remaining 1 study[3] was examined for potential to change the results of the original review.

Horizon Scanning

Our review of the most recent Horizon Scan did not identify interventions relevant to the key questions in this report. Thus, we did not identify new interventions with high-impact potential for this topic.

FDA Black Box Warnings

We did not find any FDA black box warnings relevant to the key questions in this CER. We identified no Class I device recalls and eight new devices (all transcutaneous electrical nerve stimulation [TENS] units) approved since the most recent surveillance report:

- Electronic Pulse Simulator
- Smart TENS
- Dolphin Neurostimulator OTC
- SIMPAD
- 5000z Firefly System
- Maxpower Relief

- Health Expert Electronic Stimulator
- CP Relief Wand

Expert Opinion

We shared the conclusions of the original report with 13 individuals in the field (original peer reviewers, TEP members and a local expert) to request their assessment of the currency of report conclusions and their recommendations of any relevant new studies. Three subject matter experts responded.

One expert identified potentially relevant studies related to Key Question 3[13] and 4[14]. All three experts felt that the conclusions related to all Key Questions in the report were likely current (Appendix F).

Identifying Qualitative Signals

Appendix E shows the original key questions, the conclusions of the original report and the most recent surveillance report, the results of the literature search, the experts' assessments, and the conclusions regarding the currency of the CER.

For Key Question 3, one prospective cohort study[3] of patients >65 who underwent hip fracture without preoperative delirium found no association between the use of any postoperative opioid and incident delirium in participants with and without dementia. In addition, a study[13] identified by a peer reviewer reported results related to component loosening or failure and clinical outcomes in 100 total hip joint arthoplasties with a mean follow up of 7.3 years. No evidence of prosthetic loosening was identified. These studies do not have the potential to change the conclusions of the original CER or prior surveillance assessments.

We identified no new studies for Key Questions 1, 2, and 4. There were no new high-impact potential interventions for this report based on horizon scanning data, and no FDA boxed warnings were identified since the original report was published, and there have been no new relevant drugs approved by the FDA.

Signal Assessment

The conclusions based on the results of the prior surveillance assessment, literature published since the original report, FDA boxed warnings, horizon scanning, and expert assessment is that:

- Conclusions related to all Key Questions are likely still current.

The signal for this report is weak, suggesting that the conclusions in the original CER are likely still current.

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Institute of Rheumatology, Rheumatoid Arthritis cohort study. Arthritis Research & Therapy. 2014; 16(2): R75.

Appendices

Appendix A: Search Strategy

Appendix B: Inclusion and Exclusion Criteria from Original Systematic Review

Appendix C: Literature Search Results

Appendix D: Questionnaire Sent to Expert Reviewers

Appendix E: Summary Table

Appendix A. Search Strategy

Database: Ovid MEDLINE(R) and Ovid OLDMEDLINE(R) <1946 to July Week 1 2015>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <July 08, 2015> Search Strategy:	
1 exp "anesthesia and analgesia"/ or exp analgesia/ or ((an?esthet$ or an?esthesia) adj4 (regional$ or local$ or general or spinal or epidural)).mp. or (block or analges*).mp. (529515) 2 exp Hip Fractures/ or ((i ntertrochanter* or petrochanter* or subtrochanter* or extracapsular or petrochant* or trochant* or hip or femoral neck) adj4 (hemiarthroplasty or fracture*)).mp. (26408) 3 ("neck of femur" adj4 fractur*).mp. (639) 4 2 or 3 (26534) 5 1 and 4 (905) 6 ((pain* or discomfort* or ache* or aching or so re* or suffer*) adj3 (assess* or relief or reliev* or reduc* or treat* or manage* or control* or experience* or medicat* or duration or evaluat* or alleviat* or level or score* or subjective or felt or prevent* or duration or outcome* or heal or healing or therap* or recover* or "quality of life")).mp. (181196) 7 exp Pain/rt, th, us, rh, dh, su, pc, dt (137447) 8 pain postoperative/pc, th (10986) 9 Pain Measurement/ (65127) 10 6 or 7 or 8 or 9 (289520) 11 exp Hip Fractures/ (18555) 12 ((intertrochanter* or petrochanter* or subtrochanter* or extracapsular or petrochant* or trochant* or hip or femoral neck) adj4 (hemiarthroplasty or fracture*)).mp. (26586) 13 ("neck of femur" adj4 fractur*).mp. (639) 14 11 or 12 or 13 (26712) 15 10 and 14 (871) 16 exp Pain/ (324525) 17 exp Hip Fractures/ (18555) 18 ((intertrochanter* or petrochanter* or subtrochanter* or extracapsular or petrochant* or trochant* or hip or femoral neck) adj4 (hemiarthroplasty or fracture*)).mp. (26586) 19 ("neck of femur" adj4 fractur*).mp. (639)	Original Search Strategy

20 17 or 18 or 19 (26712) 21 16 and 20 (581) 22 exp Therapeutics/ or exp "Outcome Assessment (Health Care)"/ or exp "Length of Stay"/ or "Quality of Life"/ or "functional outcome".ti,ab. (3973183) 23 exp Hip Fractures/rh, nu, th, dt, dh (2568) 24 22 and 23 (1560) 25 5 or 15 or 21 or 24 (3233) 26 limit 25 to (english language and humans) (2562)	
27 "annals of internal medicine".jn. (30549) 28 bmj.jn. (62930) 29 jama.jn. (66955) 30 "new england journal of medicine".jn. (72542)	Journal Limits : General Medicine
31 anesthesia & analgesia.jn. (22473) 32 anesthesiology.jn. (22031) 33 emergency medicine.jn. (19) 34 "journal of the american geriatrics society".jn. (15437) 35 osteoporosis international.jn. (4813) 36 regional anesthesia & pain medicine.jn. (2406) 37 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 (300155) 38 26 and 37 (247)	Journal Limits : Specialty Journals
39 limit 38 to yr="2011 -Current" (70)	Date Limits

Appendix B. Inclusion and Exclusion Criteria from Original Systematic Review

Inclusion Criteria:

Study Design: Randomized controlled trials, nonrandomized controlled trials (e.g., quasi-randomized trials), cohort studies (prospective or retrospective), case-control studies

Participants: Older adults (≥ 50 years old) of either sex admitted to hospital with acute hip fracture due to low energy trauma.

Interventions: Pharmacological and/or nonpharmacological pain management monotherapy or combination therapy, regardless of mode of administration or time point during the usual care pathway.

Comparator: Usual care (as defined by study authors) or another intervention(s) for pain management, administered as monotherapy or combination therapy.

Outcomes: Primary outcomes – acute pain, chronic pain; secondary outcomes – mortality, functional status, pain medication use (including change in type and quantity); Adverse effects – adverse effects related to the pain management intervention, mental status, health related quality of life, quality of sleep in the hospital, ability to participate in rehabilitation, return to prefracture place of residence, length of stay for acute hospitalization, skilled nursing facility, subacute care facility, health service utilization.

Exclusion Criteria:

Study Design: Observational study designs with no comparison group (case reports, case series, cross-sectional studies).

Participants: Majority (>80%) of participants <50 years, as stated by the study investigators or evident from the study characteristics (e.g., mean/SD of patient population); participants with underlying pathological conditions that may directly lead to fracture; acute hip fractures due to high energy trauma.

Interventions: Interventions directly related to surgical/nonsurgical treatment of the hip fracture and not a pain management intervention.

Comparator: Initial care for patients is substantially different than the current practices in North America (e.g., based on time to discharge from acute care to subacute care).

Outcomes: None of the aforementioned outcomes were available from the trial report or through communication with the study's corresponding author.

Appendix C. Literature Search Results

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Appendix D. Questionnaire Sent to Expert Reviewers

AHRQ Comparative Effectiveness Review Surveillance Program

Reviewer Form

Title of Original Review: Comparative Effectiveness of Pain Management Interventions for Hip Fracture

Link to Report Link to Surveillance

Name of Reviewer: _____

Instructions:

The AHRQ Scientific Resource Center (SRC) periodically conducts surveillance of published AHRQ reviews to assist with prioritization of reports for updating. One part of this process includes soliciting expert review of our synthesis of recently published literature and any identified FDA black box warnings.

The attached document includes a table highlighting the conclusions from the original report, conclusions from a surveillance review conducted in 2012, and our synthesis of the recently published literature. Abstracts from relevant literature are included at the end of the attached document. If you would like a list of our full search results, please let us know.

Please review the table in the attached document and provide responses to the questions for each key question below. The primary goal of this review is to identify any missing studies, drugs, interventions, or devices; and ensure the accuracy of our synthesis of the recently published literature.

Key Question 1:

In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions for controlling acute (up to 30 days postfracture) and chronic pain (up to 1 year postfracture) compared with usual care or other interventions in all settings?

Prior Surveillance Assessment (September 2012):

- All conclusions were up to date

SRC Literature Analysis:

- No new research was found

Reviewer Questions:

1. Are the original report conclusions still supported by the current evidence?

Click here to enter text.

2. Are there any published or unpublished studies that you know of that we may have overlooked?

Click here to enter text.

Key Question 2:

In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions on other outcomes up to 1 year postfracture compared with usual care or other interventions in all settings? Other outcomes include:

- Mortality (30-day and up to 1 year postfracture)
- Functional status
- Pain medication use; change in type and quantity
- Mental status
- Health-related quality of life
- Quality of sleep in the hospital
- Ability to participate in rehabilitation
- Return to prefracture living arrangements
- Health services utilization

Prior Surveillance Assessment (September 2012):

- All conclusions were up to date

SRC Literature Analysis:

- No new research was found

Reviewer Questions:

1. Are the original report conclusions still supported by the current evidence?

Click here to enter text.

2. Are there any published or unpublished studies that you know of that we may have overlooked?

Click here to enter text.

Key Question 3:

In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the nature and frequency of adverse effects that are directly or indirectly associated with pharmacologic and nonpharmacologic pain management interventions up to 1 year postfracture compared with usual care or other interventions in all settings?

Prior Surveillance Assessment (September 2012):

- All conclusions were up to date

SRC Literature Analysis:

- One prospective study cohort study of patients >65 who underwent hip fracture without preoperative delirium found no association between the use of any postoperative opioid and incident delirium in participants with and without dementia.

Reviewer Questions:

1. Are the original report conclusions still supported by the current evidence?

Click here to enter text.

2. Are there any published or unpublished studies that you know of that we may have overlooked?

Click here to enter text.

Key Question 4:

In older adults (≥50 years) admitted to the hospital following acute hip fracture, how do the effectiveness and safety of pharmacologic and nonpharmacologic pain management interventions vary in differing subpopulations following acute hip fracture up to 1 year after fracture compared with usual care or other interventions in all settings?

Prior Surveillance Assessment (September 2012):

- All conclusions were up to date

SRC Literature Analysis:

- No new research was found

Reviewer Questions:

1. Are the original report conclusions still supported by the current evidence?

Click here to enter text.

2. Are there any published or unpublished studies that you know of that we may have overlooked?

Click here to enter text.

Original Review Conclusions and Literature Analysis

Title of Original Review: Comparative Effectiveness of Pain Management Interventions for Hip Fracture

Link to Report Link to Surveillance

The conclusions from the original report, conclusions from a prior surveillance assessment and an analysis of recent literature identified by the Scientific Resource Center (SRC) are summarized below. Abstracts are provided for included literature at the end of the document.

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Key Question 1: In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions for controlling acute (up to 30 days postfracture) and chronic pain (up to 1 year postfracture) compared with usual care or other interventions in all settings?		
Systemic Analgesia		
3 RCTs (n=214) evaluated different types of systematic analgesia. The mean age ranged from 77.2 to 78.5 years; most patients were female. All three trials reported acute pain. Acute pain was measured using the 10cm Visual Analogue Scale (VAS); the mean baseline measure was 6.5cm. One trial (n=90) comparing parecoxib intravenous (IV) vs. diclofenac intramuscular (IM) ± merperidine IM found a significant difference in favor of parecoxib IV (MD -0.70; 95% CI -1.04, -0.36; p<0.0001). Another trial (n=30) compared intrathecal isotonic clonidine vs. intrathecal hypertonic clonidine reported a significant difference in favor of isotonic clonidine	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
(MD -1.69; 95% CI -2.01, -1.37; p<0.00001). The third trial (n=94) comparing lysine clonixinate vs. metamizole found no significant difference (MD -0.43; 95% CI -1.30, 0.44; p=0.33).		
Anesthesia		
Twenty-one RCTs and one nRCT (n=1,062) evaluated anesthesia including neuraxial (i.e., continuous vs. single administration) or neuraxial versus general anesthesia, or another form of anesthesia (i.e., spinal or regional); sample sizes ranged from 20 to 90. Additionally, eight cohort studies (n=3,086) provided additional data. The mean age of participants ranged from 70 to 86 years; most were female. Acute pain was measured using different scales (numbering rating score [1-5] and 10cm VAS). The studies were grouped as follows: spinal versus epidural or general anesthesia (n=10); neuraxial anesthesia: addition of clonidine, fentanyl, merperidine, morphine, or sufentanil (n=14);	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
neuraxial anesthesia: different doses or modes of administration (continuous vs. single administration) (n=13). The average baseline VAS pain score was 4.7. Spinal versus general anesthesia: One RCT (n = 30) reported a statistically significant difference of additional pain relief in favor of spinal anesthesia (MD = -0.86; 95% CI -1.30, -0.42; p = 0.0001). The strength of the evidence was rated as insufficient. Neuraxial anesthesia: addition of clonidine, fentanyl, meperidine, morphine, or sufentanil: Three RCTs compared additional fentanyl (n = 40), morphine (n = 40), and sufentanil (n = 50) versus standard spinal anesthesia. In the studies comparing the addition of fentanyl or sufentanil, no patients reported feeling pain following the procedure. In the study comparing the addition of morphine, there was no significant difference between groups (MD = -0.36; 95% CI -1.11, 0.39; p = 0.35). One RCT and one nRCT (n = 80) comparing additional fentanyl reported acute pain on day 1 and found no significant difference between groups (OR 1.24; 95% CI 0.34, 4.48; p = 0.75).		
Complementary and Alternative Medicine:		
Two RCTs (n = 98) evaluated the administration of CAM interventions versus no or sham intervention. The mean age ranged from 76.8 to 86.3 years; most were female. One trial (n = 38) compared acupressure versus	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
sham control delivered preoperatively. Acute pain was measured using the 10cm VAS; the baseline measure was 6.5cm. The second trial (n = 60) compared the Jacobson relaxation technique (a two-step process of contracting and relaxing specific muscles) versus no intervention. Pain was measured using a 10-point verbal scale; the baseline measure was not reported.		
Acupressure reduced pain versus a sham intervention (MD -3.01; 95% CI -4.53, -1.49; p <0.0001). Relaxation also showed a reduction in pain versus no relaxation (MD -1.10; 95% CI -1.43, -0.77; p <0.00001). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found
Multimodal Pain Management:		
Two cohort studies (n = 226) evaluated multimodal pain management versus standard care. These studies described the use of multiple pain management strategies (sequential or in parallel) as part of the clinical pathway for patients with hip fractures. The mean age was not reported; most participants were female. One study compared a formal postoperative protocol of IV and oral tramadol plus acetaminophen versus standard care. The second compared a formal preoperative protocol of skin traction, morphine and acetaminophen versus standard care.	Up-to-date	No new research was found
No data were reported.	Up-to-date	No new research was found
Nerve Blocks:		
Twenty-nine RCTs (n = 1,757) evaluated nerve blocks, including 3-in-1 (neurostimulation [NS]/ultrasoundguided [US]), combined lumbar/sacral plexus, fascia iliaca compartment, femoral, lumbar	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
plexus plus sciatic nerve, posterior lumbar plexus, psoas compartment, obutarator, and epidural nerve blocks. These were compared with placebo/standard care, or a different method of nerve blocks. Additionally, three cohort studies (n = 696) evaluated 3-in-1, femoral, and lumbar plexus plus sciatic nerve blocks versus analgesia, or comparing different analgesic medications in femoral lumbar plexus plus sciatic blocks. The mean age of participants ranged from 59.2 to 85.9 years; most were female. Acute pain was measured using different scales (i.e., numeric rating scales and 10cm VAS). Eight studies using the VAS reported mean baseline scores from 1.4cm to 7.3cm. The studies were grouped as follows: nerve blocks versus standard care/placebo; nerve blocks versus neuraxial anesthesia; nerve blocks–ropivacaine versus bupivacaine; nerve blocks–addition of clonidine; and nerve blocks		
Nerve blocks versus no block: Acute pain was reported in 13 RCTs (n = 942). There was significant heterogeneity between the study results (I2 = 92 percent) and so pooled results are not reported. Even so, subgroup analyses showed significant results in favor of individual nerve blocks, except 3-in-1 block. Also preoperative nerve blocks seemed to be more effective than postoperative administration. One trial (n = 50) reported a significant difference in postoperative pain on day 1 favoring nerve blocks (OR 0.10; 95% CI 0.03, 0.36; p = 0.0005). The strength of the evidence was rated as moderate.	Up-to-date	No new research was found
Nerve blocks versus neuraxial anesthesia: Acute pain was reported in three RCTs (n = 109). There was no significant difference between groups (MD -0.35; 95% CI -1.10, 0.39; p = 0.35). The strength of the evidence	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
was rated as low.		
Neurostimulation:		
Two RCTs (n = 123) evaluated transcutaneous electrical neurostimulation (TENS) versus sham control. One trial administered the TENS preoperatively, and the other postoperatively. The mean age of participants ranged from 71.2 to 80.5 years; most were female. Pain was measured using the VAS; the mean baseline measure was 8.4 to 8.8.	Up-to-date	No new research was found
Two RCTs (n = 123) found a significant difference in additional pain relief in favor of TENS (MD -2.79; 95% CI -4.95, -0.64; p = 0.01). Pain on movement was reported in one trial (n = 60) and found a significant difference in favor or TENS (MD -3.90; 95% CI -6.22, -1.58; p = 0.001). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found
Rehabilitation:		
One RCT (n = 37) evaluated physical therapy (stretching and strengthening of spinal and psoas muscles) versus standard care. The mean age was 67.1; all participants were female. Pain was measured using the 10cm VAS; the mean baseline measure was 7.9cm.	Up-to-date	No new research was found
There was a significant difference in additional pain relief following physical therapy (MD -1.39; 95% CI -2.27, -0.51; p = 0.002). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found
Traction:		

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Nine RCTs, four nRCTs, and one cohort study evaluated skin or skeletal traction versus no intervention or other interventions. Sample sizes ranged from 60 to 311. The mean age ranged from 74.0 to 81.0; most participants were female.	Up-to-date	No new research was found
Acute pain was measured using the 10cm VAS; the mean baseline measure ranged from 0.3 to 6.9cm. Eight trials compared skin traction (n = 498) versus no traction (n = 594) and found no significant difference between groups. The strength of the evidence was rated as low. One trial (n = 78) compared skin traction versus skeletal traction and found no difference between groups. The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found
Key Question (KQ) 2: In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions on other outcomes up to 1 year postfracture compared with usual care or other interventions in all settings? Other outcomes include: **a. Mortality (30-day and up to 1 year postfracture)** **b. Functional status** **c. Pain medication use; change in type and quantity** **d. Mental status** **e. Health-related quality of life** **f. Quality of sleep in the hospital** **g. Ability to participate in rehabilitation** **h. Return to prefracture living arrangements** **i. Health services utilization**		
Systemic Analgesia		
Additional pain medication use was reported in one trial comparing lysine clonixinate vs. metamizole and reported no significant difference between groups (OR 3.00; 95% CI 0.30, 29.94; p=0.35).	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Delerium was reported in one trial comparing lysine clonixinate vs. metamizole and found no significant difference (OR 0.96, 95% CI 0.06, 15.77; p=0.98).		
Anesthesia		
Spinal versus general anesthesia or spinal versus epidural anesthesia: Two RCTs reported 30-day mortality (n = 99) and found no statistically significant difference in mortality rates (OR 1.73; 95% CI 0.53, 5.68; p = 0.36). In two cohort studies (n = 650), pooling was not performed due to marked statistical heterogeneity and conflicting results between the studies. The strength of the evidence was rated as insufficient. Delerium: In one RCT (n = 30) that reported delirium there was no significant difference between groups (OR 0.76; 95% CI 0.18, 3.24; p = 0.71). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found
Length of stay (LOS) for acute hospitalization: Reported in two RCTs (n = 99). LOS was significantly less in the general anesthesia group (MD 1.69; 95% CI 0.38, 3.01; p = 0.01).	Up-to-date	No new research was found
Neuraxial anesthesia: addition of clonidine, fentanyl, meperidine, morphine, or sufentanil. Additional pain medication use: Reported in six RCTs. In one RCT (n = 40) comparing	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
the addition of lonidine versus standard spinal anesthesia, all participants required additional pain medication. The pooled estimate from three trials examining the addition of fentanyl (n = 102) showed no significant difference between groups (OR 5.51; 95% CI 0.25, 122.08; p = 0.28). There was no significant difference in additional pain medication use in one RCT (n = 40) that compared the addition of morphine (OR 0.27; 95% CI 0.07, 1.04; p = 0.06). Similarly, three RCTs (n = 132) that compared the addition of sufentanil found no difference between groups (Peto's OR 7.39; 95% CI 0.15, 372.38; p = 0.32)		
Delirium: Reported in one RCT (n = 40) comparing the addition of morphine and found no significant difference between groups (OR 3.15; 95% CI 0.12, 82.16; p = 0.49). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found
Neuraxial anesthesia: different doses and modes of administration (continuous vs. single administration): Three RCTs (n = 163) reported 30-day mortality. In two, there were no deaths. In the third, there was no significant difference between groups (OR 0.46; 95% CI 0.07, 3.02; p = 0.42). Additionally, 30-day mortality was reported in one cohort study (n = 291) that found no significant difference between groups (OR 0.96; 95% CI 0.30, 3.00; p = 0.94). The strength of the	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
evidence was rated as low.		
Additional pain medication use: Reported in two RCTs (n = 134); there were no events in either group.	Up-to-date	No new research was found
LOS for acute hospitalization: Reported in two RCTs (n = 89). There was no significant difference between groups (MD = -0.98; 95% CI -2.06, 0.10; p = 0.07). In two RCTs (n = 134) that reported delirium, there was no significant difference between groups (OR 1.27; 95% CI 0.32, 4.99; p = 0.73). The strength of the evidence was rated as low	Up-to-date	No new research was found
Spinal anesthesia (different doses): One cohort study (n = 182) reported that there was no significant difference in 30-day mortality rates between groups (OR 0.49; 95% CI 0.12, 2.02; p = 0.32). The strength of the evidence was rated as insufficient. Another cohort study (n = 60) reported no significant difference in the incidence of delirium (OR 0.46; 95% CI 0.08, 2.75).		No new research was found
Additional pain medication use: One RCT (n = 60) that reported there was no significant difference between groups at different doses (4 vs. 5mg, 4 vs. 6mg, or 5 vs. 6mg).	Up-to-date	No new research was found
Complementary and Alternative Medicine:		
In the RCT that examined relaxation, fewer patients in the relaxation group required additional pain medication (e.g., meperidine or morphine) versus the control group (MD -8.43; 95% CI -15.11, -1.75; p = 0.01).	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Multimodal Pain Management:		
Mortality: Reported in one study (n = 106). There was no significant difference between groups after 30 days (OR 0.54; 95% CI 0.16, 1.77; p = 0.31), or at 1 year (OR 0.60; 95% CI 0.25, 1.47; p = 0.26). Delerium: Both studies reported delirium and found no significant difference between groups. The strength of the evidence for both outcomes was rated as insufficient.	Up-to-date	No new research was found
Nerve Blocks:		
Nerve blocks versus no block: Four RCTs (n = 228) evaluated 30-day mortality; there was no significant difference between groups (OR 0.28; 95% CI 0.07, 1.12; p = 0.07). The strength of the evidence was rated as low. There was no significant difference in 1-year mortality in two RCTs (n = 112) (OR 0.82; 95% CI 0.25, 2.72; p = 0.74), or in one cohort study (n = 535) (OR 0.73; 95% CI 0.48, 1.10; p = 0.14). Additional pain medication use: Seven RCTs (n = 378) found a significant difference favoring nerve blocks (OR 0.32; 95% CI 0.14, 0.72; p = 0.006). Similarly, one cohort study (n = 99) reported a significant difference favoring nerve blocks (OR 0.03; 95% CI 0.00, 0.44; p = 0.01). Delerium:		No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Pooled results for four RCTs (n = 461) and two cohort studies (n = 634) that provided data on delirium showed a significant difference favoring nerve blocks (OR 0.33; 95% CI 0.16, 0.66; p = 0.002 [RCTs]; OR 0.24; 95% CI 0.08, 0.72; p = 0.01[cohort studies]). <u>LOS for acute hospitalization:</u> The strength of the evidence was rated as moderate. LOS for acute hospitalization (days) was reported in two cohort studies (n = 634), but the pooled results are not reported due to marked heterogeneity between the original study results. <u>Quality of sleep:</u> Reported in one RCT (n = 77) that found no significant difference (MD 0.30; 95% CI -0.46, 1.06; p = 0.44).		
<u>Nerve blocks versus neuraxial anesthesia:</u> Additional pain medication use was reported in one RCT (n=30); there was no significant difference between groups (OR 2.00; 95% CI 0.38, 10.51; p = 0.41). Delirium was reported in one RCT (n = 29); there was no significant difference between groups (OR 1.20; 95% CI 0.27, 5.40; p = 0.81). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found
<u>Ropivacaine versus bupivacaine:</u> Additional pain medication use and delirium were reported in one cohort study (n=62). There was no significant difference between groups for either outcome (OR 1.25; 95% CI 0.42, 3.76; p=0.69; OR 1.93; 95% CI 0.17, 22.50; p=0.60, respectively). The strength of the evidence for delirium was rated as insufficient.	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Nerve blocks versus no block • Respiratory infection: Reported in five RCTs (n=268) and found no significant difference (OR 0.43; 95% CI 0.18, 1.04; p=0.06). There were no significant differences between groups for the following adverse effects: • Cardiac complications (2 RCTs, n=128; 1 cohort study, n=99) • Damage to surrounding structures (3 RCTs, n=224) • Deep venous thrombosis (2 RCTs, n=100) • Myocardial infarction (2 RCTs, n=145; 1 cohort study, n=535); • Nausea/vomiting (6 RCTs, n = 421) • Pulmonary embolism (2 RCTs, n = 128) • Surgical wound infection (2 RCTs, n = 110) • Urinary retention (2 RCTs, n = 62; 1 cohort study, n = 535). There were no reports of infection in two RCTs (n = 184). The remaining reported adverse effects were from single studies and did not demonstrate any significant statistical differences between the pain management interventions.		No new research was found
Nerve blocks versus neuraxial anesthesia, ropivacaine versus bupivacaine and addition of clonidine: The reported adverse effects were from single studies and did not demonstrate any significant statistical differences between the pain management interventions.	Up-to-date	No new research was found
US versus NS:	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Two RCTs (n = 100) reported no significant difference in damage to surrounding structures (OR 0.16; 95% CI 0.02, 1.30; p = 0.09). The remaining reported adverse effects were from single studies and did not demonstrate any significant statistical differences between the pain management interventions.		
Neurostimulation:		
One RCT (n = 60) provided data on health-related quality of life (HRQOL) and quality of sleep. TENS provided significant improvement in HRQOL (MD -4.30; 95% CI -6.86, -1.74; p = 0.001) and quality of sleep (MD -3.60; 95% CI -575, -1.45; p = 0.001).	Up-to-date	No new research was found
Rehabilitation:		
No other outcomes were reported.	Up-to-date	No new research was found
Traction:		
LOS for acute hospitalization: Reported in two trials (n = 326) comparing skin traction versus no traction and no significant difference was found. Thirty-day mortality: Reported in one RCT (n = 80) that found no difference between skin and skeletal traction versus no traction. Additional pain medication use: Reported in one RCT and one nRCT (n = 352). There was no significant difference between groups.	Up-to-date	No new research was found
Key Question (KQ 3): In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the nature and frequency of adverse effects that are directly or indirectly associated with pharmacologic and nonpharmacologic pain management interventions up to 1 year postfracture compared with usual care or other interventions in all settings?		

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Systemic Analgesia		
One trial comparing lysine clonixinate vs. metamizole reported the number of partiicpants with any adverse event and found a significant difference in favor of metamizole (OR 3.50; 95% CI 1.04, 11.84; p=0.04). Similarly, fewer patients in the metamizole group reported any gastrointestinal disturbance (OR 11.84; 95% CI 1.45, 96.75; p=0.02). The remaining reported adverse effects were from single studies and did not demonstrate any significant differences between the pain management interventions.	Up-to-date	One prospective study cohort study of patients >65 who underwent hip fracture without preoperative delirium found no association between the use of any postoperative opioid and incident delirium (P = .61) in participants with (P = .33) and without (P = .40) dementia. Dementia, but not postoperative delirium, was associated with less opioid use (P < .001 for dementia; P = .12 for delirium; P = .04, for their interaction; Wald chi-square = 142.8, df = 7). Opioid dose (P > .59) on Postoperative Days 1 and 2 was not predictive of incident delirium. Dementia (P < .001) and intensive care unit admission (P = .006), not opioid consumption, were the most important predictors of incident postoperative delirium.
Anesthesia		
<u>Spinal versus general anesthesia or spinal versus epidural anesthesia:</u> Two RCTs (n = 73) and one cohort study (n = 335) reported adverse effects. Overall, the RCTs reported no significant differences in the occurrence of hypotension, myocardial infarction, or ST segment depression. The cohort study found no difference in the incidence of headaches and hypotension.	Up-to-date	No new research was found
<u>Neuraxial anesthesia: addition of clonidine, fentanyl, meperidine, morphine, or sufentanil:</u> Eleven RCTs and one nRCT (n = 490) provided data on adverse effects.	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
a) Addition of clonidine. One trial (n = 40) reported no damage to surrounding structures, headaches, or infections. b) Addition of fentanyl. There was no significant difference in the number of participants reporting an allergic reaction in four RCTs (n = 164). There was no significant difference in the number of participants reporting bradycardia in one RCT 6 (n = 42). Seven trials (n = 284) reported the frequency of hypotension. Results were inconsistent across studies and the pooled results are not reported due to high heterogeneity. Five trials (n = 204) reported nausea or vomiting and found no significant difference between groups (OR 1.10; 95% CI 0.06, 20.73; p = 0.95). There were no reports of neurological complications in one RCT (n = 40); no reports of respiratory distress in three RCTs (n = 124); no reports of gastrointestinal symptoms in three RCTs (n = 140); and no reports of headaches in one trial (n = 40). c) Addition of meperidine. There were no reports of headaches in one RCT (n = 34). d) Addition of morphine. One RCT (n = 40) reported no significant difference in the number of participants reporting allergic reactions, gastrointestinal symptoms, or nausea or vomiting. e) Addition of sufentanil. There was no significant difference in the incidence of bradycardia in one trial. Three trials (n = 132) reported a significantly lower incidence of hypotension in participants receiving		

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
sufentanil (OR = 0.05; 95% CI 0.01, 0.34). In one RCT (n = 42) there were no reports of allergic reaction, nausea or vomiting, or respiratory distress.		
Neuraxial anesthesia: different modes of administration: In one cohort study (n = 291), there were no reports of adverse effects. In one RCT (n = 60) there was no significant difference in the occurrence of gastrointestinal symptoms. In two trials (n = 103) that reported on hypotension there was a significant difference between groups in favor of continuous spinal anesthesia (OR 0.12; 95% CI 0.03, 0.51; p = 0.004). Similarly, in one cohort study (n = 291) there was a statistically significant difference in favor of continuous spinal anesthesia (OR 0.08; 95% CI 0.04, 0.14; p < 0.00001). There was no significant difference in myocardial infarction in one trial (n = 29). There was no significant difference in the occurrence ST depression in one trial (n = 29). In one RCT (n = 74) there were no reports of bradycardia, myocardial ischemia, or stroke, and no reports of headache in one trial (n = 60) or one cohort study (n = 291).	Up-to-date	No new research was found
Neuraxial anesthesia: different doses: In one cohort study (n = 182), there were no reports of adverse effects. In one RCT (n = 60) there was no significant difference in the occurrence of allergic reaction for the different doses of bupivacaine. Bradycardia was reported in two trials (n = 120); there was no significant difference among the different doses of bupivacaine or levobupivacaine. Hypotension was reported in four RCTs (n = 190). There was a There was a significant difference following 4mg versus 6mg	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
of bupivacaine (OR 0.03; 95% CI 0.00, 0.58; p = 0.02), but not 5 versus 6mg of bupivacaine (OR 0.31; 95% CI 0.08, 1.13; p = 0.08). Three cohort studies reported hypotension (n = 267) and found a significant difference following 2.5mg versus 5mg of bupivacaine (OR 0.08; 95% CI 0.03, 0.23; p <0.00001), 4 versus 12mg of bupivacaine (OR 0.03; 95% CI 0.01, 0.15; p <0.00001), and 0.125 versus 0.5 percent of bupivacaine (OR 0.15; 95% CI 0.03, 0.87; p = 0.03). One cohort study reported a significant difference in the incidence of hypotension following 4mg versus 12mg (OR 0.03; 95% CI 0.01, 0.15; p <0.00001), but no difference in the incidence of delirium. There were no reports of nausea or vomiting in two trials (n = 100); no reports of residual sensory deficits or motor weakness, respiratory distress, sedation, or urinary retention in one RCT (n = 60); no reports of gastrointestinal symptoms in two trials (n = 100); and no reports of headache in one cohort study (n = 182).		
Complementary and Alternative Medicine:		
No data were reported.	Up-to-date	No new research was found
Multimodal Pain Management:		
Data were reported in one study (n = 106). There were no significant differences between groups.	Up-to-date	No new research was found
Neurostimulation:		
No data were reported.	Up-to-date	No new research was found
Rehabilitation:		
No data were reported.	Up-to-date	No new research was found
Traction:		

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
Seven RCTs (n = 1,043) and one cohort study (n = 134) provided data on adverse effects. The reported adverse effects were from one to two studies, and did not demonstrate any significant statistical differences between the pain management interventions.	Up-to-date	No new research was found
Key Question (KQ 4): In older adults (≥50 years) admitted to the hospital following acute hip fracture, how do the effectiveness and safety of pharmacologic and nonpharmacologic pain management interventions vary in differing subpopulations following acute hip fracture up to 1 year after fracture compared with usual care or other interventions in all settings?		
Systemic Analgesia		
No data were reported	Up-to-date	No new research was found
Anesthesia		
No data were reported	Up-to-date	No new research was found
Complementary and Alternative Medicine:		
No data were reported	Up-to-date	No new research was found
Multimodal Pain Management:		
No data were reported	Up-to-date	No new research was found
Nerve Blocks:		
One RCT recruited patients with pre-existing heart disease. There was a significant reduction in pain favoring nerve blocks (MD -0.55; -0.81, -0.29; p <0.0001). There was no significant difference in 30-day mortality (OR 0.10; 95% CI 0.01, 1.90; p = 0.12) or adverse effects. One RCT recruited participants that were independent prior to their hip fracture. There was no significant difference between nerve blocks versus	Up-to-date	No new research was found

Conclusions From Original Review	Conclusions from Prior Surveillance Assessment (Sept 2012)	SRC Literature Analysis (July 2015)
standard care for 30-day mortality (OR 1.00; 95% CI 0.06, 16.76; p = 1.00).		
Neurostimulation:		
No data were reported	Up-to-date	No new research was found
Rehabilitation:		
All participants were female.	Up-to-date	No new research was found
Traction:		
No data were reported	Up-to-date	No new research was found

Legend: RCT = randomized control trial; nRCT = non-randomized control trial; LOS = length of stay; VAS = visual analog scale; MD = mean difference; CI = confidence intervals; OR = odds ratio

Abstracts from Relevant Literature

Sieber, F. E., Mears, S., Lee, H. and Gottschalk, A. 2011
Postoperative opioid consumption and its relationship to cognitive function in older adults with hip fracture. Journal of the American Geriatrics Society.

OBJECTIVES: To determine the relationship between opioid consumption and cognitive impairment after hip fracture repair.;DESIGN: Prospective study of consecutive patients.;SETTING: Johns Hopkins Bayview Medical Center, Baltimore, Maryland.;PARTICIPANTS: Two hundred thirty-six participants aged 65 and older undergoing hip fracture repair.;MEASUREMENTS: Older adults without preoperative delirium who underwent hip fracture repair between April 2005 and July 2009 were followed for pain, opioid consumption, and postoperative delirium. Participants were tested for delirium using the Confusion Assessment Method preoperatively and midmorning on Postoperative Day 2. The nursing staff assessed pain on a numeric oral scale (range 0-10). Opioid analgesia was provided in response to pain at rest to achieve scores of 3 or less. Opioid consumption was analyzed with respect to the occurrence of incident postoperative delirium, presence of dementia, and other demographic variables.;RESULTS: Of the 236 participants, 66 (28%) had dementia, and 213 (90%) received opioids postoperatively, including 55 (83%) with dementia and 158 (93%) without. There was no association between the use of any postoperative opioid and incident delirium (P = .61) in participants with (P = .33) and without (P = .40) dementia. Dementia, but not postoperative delirium, was associated with less opioid use (P < .001 for dementia; P = .12 for delirium; P = .04, for their interaction; Wald chi-square = 142.8, df = 7). Opioid dose (P > .59) on Postoperative Days 1 and 2 was not predictive of incident delirium. Dementia (P < .001) and intensive care unit admission (P = .006), not opioid consumption, were the most important predictors of incident postoperative delirium.;CONCLUSION: Concern for postoperative delirium should not prevent the use of opioid analgesic therapy

sufficient to achieve a generally accepted level of comfort in individuals with or without preexisting cognitive impairment.

Appendix E. Summary Table*

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
Key Question 1: In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions for controlling acute (up to 30 days postfracture) and chronic pain (up to 1 year postfracture) compared with usual care or other interventions in all settings?				
Systemic Analgesia:				
3 RCTs (n=214) evaluated different types of systematic analgesia. The mean age ranged from 77.2 to 78.5 years; most patients were female. All three trials reported acute pain. Acute pain was measured using the 10cm Visual Analogue Scale (VAS); the mean baseline measure was 6.5cm. One trial (n=90) comparing parecoxib intravenous (IV) vs. diclofenac intramuscular (IM) ± merperidine IM found a significant difference in favor of parecoxib IV (MD -0.70; 95% CI -1.04, -0.36; p<0.0001). Another trial (n=30) compared intrathecal isotonic clonidine vs. intrathecal hypertonic clonidine reported a significant difference in favor of isotonic clonidine (MD -1.69; 95% CI -2.01, -1.37;	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
p<0.00001). The third trial (n=94) comparing lysine clonixinate vs. metamizole found no significant difference (MD -0.43; 95% CI -1.30, 0.44; p=0.33).				
Anesthesia:				
Twenty-one RCTs and one nRCT (n=1,062) evaluated anesthesia including neuraxial (i.e., continuous vs. single administration) or neuraxial versus general anesthesia, or another form of anesthesia (i.e., spinal or regional); sample sizes ranged from 20 to 90. Additionally, eight cohort studies (n=3,086) provided additional data. The mean age of participants ranged from 70 to 86 years; most were female. Acute pain was measured using different scales (numbering rating score [1-5] and 10cm VAS). The studies were grouped as follows: spinal versus epidural or general anesthesia (n=10); neuraxial anesthesia: addition of clonidine, fentanyl, merperidine, morphine, or sufentanil (n=14); neuraxial anesthesia: different	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
doses or modes of administration (continuous vs. single administration) (n=13). The average baseline VAS pain score was 4.7.				
Spinal versus general anesthesia: One RCT (n = 30) reported a statistically significant difference of additional pain relief in favor of spinal anesthesia (MD = -0.86; 95% CI -1.30, -0.42; p = 0.0001). The strength of the evidence was rated as insufficient. Neuraxial anesthesia: addition of clonidine, fentanyl, meperidine, morphine, or sufentanil: Three RCTs compared additional fentanyl (n = 40), morphine (n = 40), and sufentanil (n = 50) versus standard spinal anesthesia. In the studies comparing the addition of fentanyl or sufentanil, no patients reported feeling pain following the procedure. In the study comparing the addition of morphine, there was no significant difference between	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
groups (MD = -0.36; 95% CI -1.11, 0.39; p = 0.35). One RCT and one nRCT (n = 80) comparing additional fentanyl reported acute pain on day 1 and found no significant difference between groups (OR 1.24; 95% CI 0.34, 4.48; p = 0.75).				
Complementary and Alternative Medicine:				
Two RCTs (n = 98) evaluated the administration of CAM interventions versus no or sham intervention. The mean age ranged from 76.8 to 86.3 years; most were female. One trial (n = 38) compared acupressure versus sham control delivered preoperatively. Acute pain was measured using the 10cm VAS; the baseline measure was 6.5cm. The second trial (n = 60) compared the Jacobson relaxation technique (a two-step process of contracting and relaxing specific muscles) versus no intervention. Pain was measured using a 10-point verbal scale; the baseline measure was not reported.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Acupressure reduced pain versus a sham intervention (MD -3.01; 95% CI -4.53, -1.49; p <0.0001). Relaxation also showed a reduction in pain versus no relaxation (MD -1.10; 95% CI -1.43, -0.77; p <0.00001). The	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
strength of the evidence was rated as insufficient.				
Multimodal Pain Management:				
Two cohort studies (n = 226) evaluated multimodal pain management versus standard care. These studies described the use of multiple pain management strategies (sequential or in parallel) as part of the clinical pathway for patients with hip fractures. The mean age was not reported; most participants were female. One study compared a formal postoperative protocol of IV and oral tramadol plus acetaminophen versus standard care. The second compared a formal preoperative protocol of skin traction, morphine and acetaminophen versus standard care.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
No data were reported.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Nerve Blocks:				
Twenty-nine RCTs (n = 1,757) evaluated nerve blocks, including 3-in-1 (neurostimulation [NS]/ultrasoundguided [US]), combined lumbar/sacral plexus, fascia iliaca compartment, femoral, lumbar plexus plus	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
sciatic nerve, posterior lumbar plexus, psoas compartment, obutarator, and epidural nerve blocks. These were compared with placebo/standard care, or a different method of nerve blocks. Additionally, three cohort studies (n = 696) evaluated 3-in-1, femoral, and lumbar plexus plus sciatic nerve blocks versus analgesia, or comparing different analgesic medications in femoral lumbar plexus plus sciatic blocks. The mean age of participants ranged from 59.2 to 85.9 years; most were female. Acute pain was measured using different scales (i.e., numeric rating scales and 10cm VAS). Eight studies using the VAS reported mean baseline scores from 1.4cm to 7.3cm. The studies were grouped as follows: nerve blocks versus standard care/placebo; nerve blocks versus neuraxial anesthesia; nerve blocks–ropivacaine versus bupivacaine; nerve blocks–addition of clonidine; and nerve blocks				
Nerve blocks versus no block: Acute pain was reported in 13 RCTs (n = 942). There was significant heterogeneity between the study results (I2 = 92 percent) and so pooled results are not reported. Even so,	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
subgroup analyses showed significant results in favor of individual nerve blocks, except 3-in-1 block. Also preoperative nerve blocks seemed to be more effective than postoperative administration. One trial (n = 50) reported a significant difference in postoperative pain on day 1 favoring nerve blocks (OR 0.10; 95% CI 0.03, 0.36; p = 0.0005). The strength of the evidence was rated as moderate.				
Nerve blocks versus neuraxial anesthesia: Acute pain was reported in three RCTs (n = 109). There was no significant difference between groups (MD -0.35; 95% CI -1.10, 0.39; p = 0.35). The strength of the evidence was rated as low.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Neurostimulation:				
Two RCTs (n = 123) evaluated transcutaneous electrical neurostimulation (TENS) versus sham control. One trial administered the TENS preoperatively, and the other postoperatively. The mean age of participants ranged from 71.2 to 80.5 years; most were female. Pain was measured using the VAS; the mean baseline measure was 8.4 to 8.8.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Two RCTs (n = 123) found a	Up-to-date	No new research was found	The three experts did not	Original conclusion is

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
significant difference in additional pain relief in favor of TENS (MD -2.79; 95% CI -4.95, -0.64; p = 0.01). Pain on movement was reported in one trial (n = 60) and found a significant difference in favor or TENS (MD -3.90; 95% CI -6.22, -1.58; p = 0.001). The strength of the evidence was rated as insufficient.			know of any additional studies, and either believed the original report to be up to date or did not know.	still valid and this portion of the CER is likely current
Rehabilitation:				
One RCT (n = 37) evaluated physical therapy (stretching and strengthening of spinal and psoas muscles) versus standard care. The mean age was 67.1; all participants were female. Pain was measured using the 10cm VAS; the mean baseline measure was 7.9cm.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
There was a significant difference in additional pain relief following physical therapy (MD -1.39; 95% CI -2.27, -0.51; p = 0.002). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Traction:				
Nine RCTs, four nRCTs, and one cohort study evaluated skin or skeletal traction versus no intervention or other interventions. Sample sizes ranged from 60 to 311. The	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
mean age ranged from 74.0 to 81.0; most participants were female.				
Acute pain was measured using the 10cm VAS; the mean baseline measure ranged from 0.3 to 6.9cm. Eight trials compared skin traction (n = 498) versus no traction (n = 594) and found no significant difference between groups. The strength of the evidence was rated as low. One trial (n = 78) compared skin traction versus skeletal traction and found no difference between groups. The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Key Question (KQ) 2: In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the effectiveness of pharmacologic and/or nonpharmacologic pain management interventions on other outcomes up to 1 year postfracture compared with usual care or other interventions in all settings? Other outcomes include: **a. Mortality (30-day and up to 1 year postfracture)** **b. Functional status** **c. Pain medication use; change in type and quantity** **d. Mental status** **e. Health-related quality of life** **f. Quality of sleep in the hospital** **g. Ability to participate in rehabilitation** **h. Return to prefracture living arrangements** **i. Health services utilization**				
Systemic Analgesia				
Additional pain medication use was reported in one trial comparing lysine clonixinate vs. metamizole and reported no significant difference between	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
groups (OR 3.00; 95% CI 0.30, 29.94; p=0.35). Delerium was reported in one trial comparing lysine clonixinate vs. metamizole and found no significant difference (OR 0.96, 95% CI 0.06, 15.77; p=0.98).				
Anesthesia				
Spinal versus general anesthesia or spinal versus epidural anesthesia: Two RCTs reported 30-day mortality (n = 99) and found no statistically significant difference in mortality rates (OR 1.73; 95% CI 0.53, 5.68; p = 0.36). In two cohort studies (n = 650), pooling was not performed due to marked statistical heterogeneity and conflicting results between the studies. The strength of the evidence was rated as insufficient. Delerium: In one RCT (n = 30) that reported delirium there was no significant difference between groups (OR 0.76; 95% CI 0.18, 3.24; p = 0.71). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Length of stay (LOS) for acute	Up-to-date	No new research was found	The three experts did not	Original conclusion is

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
hospitalization: Reported in two RCTs (n = 99). LOS was significantly less in the general anesthesia group (MD 1.69; 95% CI 0.38, 3.01; p = 0.01).			know of any additional studies, and either believed the original report to be up to date or did not know.	still valid and this portion of the CER is likely current
Neuraxial anesthesia: addition of clonidine, fentanyl, meperidine, morphine, or sufentanil. Additional pain medication use: Reported in six RCTs. In one RCT (n = 40) comparing the addition of lonidine versus standard spinal anesthesia, all participants required additional pain medication. The pooled estimate from three trials examining the addition of fentanyl (n = 102) showed no significant difference between groups (OR 5.51; 95% CI 0.25, 122.08; p = 0.28). There was no significant difference in additional pain medication use in one RCT (n = 40) that compared the addition of morphine (OR 0.27; 95% CI 0.07, 1.04; p = 0.06). Similarly, three RCTs (n = 132) that compared the addition of sufentanil found no difference between groups	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
(Peto's OR 7.39; 95% CI 0.15, 372.38; p = 0.32)				
Delirium: Reported in one RCT (n = 40) comparing the addition of morphine and found no significant difference between groups (OR 3.15; 95% CI 0.12, 82.16; p = 0.49). The strength of the evidence was rated as insufficient.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Neuraxial anesthesia: different doses and modes of administration (continuous vs. single administration): Three RCTs (n = 163) reported 30-day mortality. In two, there were no deaths. In the third, there was no significant difference between groups (OR 0.46; 95% CI 0.07, 3.02; p = 0.42). Additionally, 30-day mortality was reported in one cohort study (n = 291) that found no significant difference between groups (OR 0.96; 95% CI 0.30, 3.00; p = 0.94). The strength of the evidence was rated as low.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Additional pain medication use: Reported in two RCTs (n = 134); there were no events in either group.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
LOS for acute hospitalization: Reported in two RCTs (n = 89). There was no significant	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed	Original conclusion is still valid and this portion of the CER is

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
difference between groups (MD = -0.98; 95% CI -2.06, 0.10; p = 0.07). In two RCTs (n = 134) that reported delirium, there was no significant difference between groups (OR 1.27; 95% CI 0.32, 4.99; p = 0.73). The strength of the evidence was rated as low			the original report to be up to date or did not know.	likely current
Spinal anesthesia (different doses): One cohort study (n = 182) reported that there was no significant difference in 30-day mortality rates between groups (OR 0.49; 95% CI 0.12, 2.02; p = 0.32). The strength of the evidence was rated as insufficient. Another cohort study (n = 60) reported no significant difference in the incidence of delirium (OR 0.46; 95% CI 0.08, 2.75).	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Additional pain medication use: One RCT (n = 60) that reported there was no significant difference between groups at different doses (4 vs. 5mg, 4 vs. 6mg, or 5 vs. 6mg).	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Complementary and Alternative Medicine:				
In the RCT that examined relaxation, fewer patients in the relaxation group required additional pain medication (e.g., meperidine or morphine) versus the control group (MD -8.43;	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
95% CI -15.11, -1.75; p = 0.01).				
Multimodal Pain Management:				
Mortality: Reported in one study (n = 106). There was no significant difference between groups after 30 days (OR 0.54; 95% CI 0.16, 1.77; p = 0.31), or at 1 year (OR 0.60; 95% CI 0.25, 1.47; p = 0.26). Delerium: Both studies reported delirium and found no significant difference between groups. The strength of the evidence for both outcomes was rated as insufficient.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Nerve Blocks:				
Nerve blocks versus no block: Four RCTs (n = 228) evaluated 30-day mortality; there was no significant difference between groups (OR 0.28; 95% CI 0.07, 1.12; p = 0.07). The strength of the evidence was rated as low. There was no significant difference in 1-year mortality in two RCTs (n = 112) (OR 0.82; 95% CI 0.25, 2.72; p = 0.74), or in one cohort study (n = 535) (OR 0.73; 95% CI 0.48, 1.10; p = 0.14). Additional pain medication use:	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
Seven RCTs (n = 378) found a significant difference favoring nerve blocks (OR 0.32; 95% CI 0.14, 0.72; p = 0.006). Similarly, one cohort study (n = 99) reported a significant difference favoring nerve blocks (OR 0.03; 95% CI 0.00, 0.44; p = 0.01). Delerium: Pooled results for four RCTs (n = 461) and two cohort studies (n = 634) that provided data on delirium showed a significant difference favoring nerve blocks (OR 0.33; 95% CI 0.16, 0.66; p = 0.002 [RCTs]; OR 0.24; 95% CI 0.08, 0.72; p = 0.01[cohort studies]). LOS for acute hospitalization: The strength of the evidence was rated as moderate. LOS for acute hospitalization (days) was reported in two cohort studies (n = 634), but the pooled results are not reported due to marked heterogeneity between the original study results. Quality of sleep: Reported in one RCT (n = 77) that found no significant difference (MD 0.30; 95% CI -0.46, 1.06; p = 0.44).				
Nerve blocks versus neuraxial anesthesia:	Up-to-date	No new research was found	The three experts did not know of any additional	Original conclusion is still valid and this

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
Additional pain medication use was reported in one RCT (n=30); there was no significant difference between groups (OR 2.00; 95% CI 0.38, 10.51; p = 0.41). Delirium was reported in one RCT (n = 29); there was no significant difference between groups (OR 1.20; 95% CI 0.27, 5.40; p = 0.81). The strength of the evidence was rated as insufficient.			studies, and either believed the original report to be up to date or did not know.	portion of the CER is likely current
Ropivacaine versus bupivacaine: Additional pain medication use and delirium were reported in one cohort study (n=62). There was no significant difference between groups for either outcome (OR 1.25; 95% CI 0.42, 3.76; p=0.69; OR 1.93; 95% CI 0.17, 22.50; p=0.60, respectively). The strength of the evidence for delirium was rated as insufficient.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Nerve blocks versus no block • Respiratory infection: Reported in five RCTs (n=268) and found no significant difference (OR 0.43; 95% CI 0.18, 1.04; p=0.06). There were no significant differences between groups for the following adverse effects: • Cardiac complications		No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
(2 RCTs, n=128; 1 cohort study, n=99) • Damage to surrounding structures (3 RCTs, n=224) • Deep venous thrombosis (2 RCTs, n=100) • Myocardial infarction (2 RCTs, n=145; 1 cohort study, n=535); • Nausea/vomiting (6 RCTs, n = 421) • Pulmonary embolism (2 RCTs, n = 128) • Surgical wound infection (2 RCTs, n = 110) • Urinary retention (2 RCTs, n = 62; 1 cohort study, n = 535). There were no reports of infection in two RCTs (n = 184). The remaining reported adverse effects were from single studies and did not demonstrate any significant statistical differences between the pain management interventions.				
Nerve blocks versus neuraxial anesthesia, ropivacaine versus bupivacaine and addition of clonidine: The reported adverse effects were from single studies and did not demonstrate any significant	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
statistical differences between the pain management interventions.				
US versus NS: Two RCTs (n = 100) reported no significant difference in damage to surrounding structures (OR 0.16; 95% CI 0.02, 1.30; p = 0.09). The remaining reported adverse effects were from single studies and did not demonstrate any significant statistical differences between the pain management interventions.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Neurostimulation:				
One RCT (n = 60) provided data on health-related quality of life (HRQOL) and quality of sleep. TENS provided significant improvement in HRQOL (MD -4.30; 95% CI -6.86, -1.74; p = 0.001) and quality of sleep (MD -3.60; 95% CI -575, -1.45; p = 0.001).	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Rehabilitation:				
No other outcomes were reported.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Traction:				
LOS for acute hospitalization: Reported in two trials (n = 326)	Up-to-date	No new research was found	The three experts did not know of any additional	Original conclusion is still valid and this

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
comparing skin traction versus no traction and no significant difference was found. Thirty-day mortality: Reported in one RCT (n = 80) that found no difference between skin and skeletal traction versus no traction. Additional pain medication use: Reported in one RCT and one nRCT (n = 352). There was no significant difference between groups.			studies, and either believed the original report to be up to date or did not know.	portion of the CER is likely current
Key Question (KQ 3): In older adults (≥50 years) admitted to the hospital following acute hip fracture, what is the nature and frequency of adverse effects that are directly or indirectly associated with pharmacologic and nonpharmacologic pain management interventions up to 1 year postfracture compared with usual care or other interventions in all settings?				
Systemic Analgesia				
One trial comparing lysine clonixinate vs. metamizole reported the number of partiicpants with any adverse event and found a significant difference in favor of metamizole (OR 3.50; 95% CI 1.04, 11.84; p=0.04). Similarly, fewer patients in the metamizole group reported any gastrointestinal disturbance (OR 11.84; 95% CI 1.45, 96.75; p=0.02). The remaining reported adverse effects were from single studies	Up-to-date	One prospective study[3] cohort study of patients >65 who underwent hip fracture without preoperative delirium found no association between the use of any postoperative opioid and incident delirium (P = .61) in participants with (P = .33) and without (P = .40) dementia. Dementia, but not postoperative delirium, was associated with less opioid use (P < .001 for dementia; P = .12 for delirium; P =	One reviewer suggested a study examining the relationship of NSAIDs to endoprosthetic loosening.[13] The study reported results related to component loosening or failure and clinical outcomes in 100 total hip joint arthoplasties with a mean follow up of 7.3 years. No evidence of prosthetic loosening was identified.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
and did not demonstrate any significant differences between the pain management interventions.		.04, for their interaction; Wald chi-square = 142.8, df = 7). Opioid dose (P > .59) on Postoperative Days 1 and 2 was not predictive of incident delirium. Dementia (P < .001) and intensive care unit admission (P = .006), not opioid consumption, were the most important predictors of incident postoperative delirium.		
Anesthesia				
Spinal versus general anesthesia or spinal versus epidural anesthesia: Two RCTs (n = 73) and one cohort study (n = 335) reported adverse effects. Overall, the RCTs reported no significant differences in the occurrence of hypotension, myocardial infarction, or ST segment depression. The cohort study found no difference in the incidence of	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
headaches and hypotension.				
Neuraxial anesthesia: addition of clonidine, fentanyl, meperidine, morphine, or sufentanil: Eleven RCTs and one nRCT (n = 490) provided data on adverse effects. f) Addition of clonidine. One trial (n = 40) reported no damage to surrounding structures, headaches, or infections. g) Addition of fentanyl. There was no significant difference in the number of participants reporting an allergic reaction in four RCTs (n = 164). There was no significant difference in the number of participants reporting bradycardia in one RCT 6 (n = 42). Seven trials (n = 284) reported the frequency of hypotension. Results were inconsistent across studies and the pooled results are not reported due to high heterogeneity. Five trials (n = 204) reported nausea or vomiting and	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
found no significant difference between groups (OR 1.10; 95% CI 0.06, 20.73; p = 0.95). There were no reports of neurological complications in one RCT (n = 40); no reports of respiratory distress in three RCTs (n = 124); no reports of gastrointestinal symptoms in three RCTs (n = 140); and no reports of headaches in one trial (n = 40). h) Addition of meperidine. There were no reports of headaches in one RCT (n = 34). i) Addition of morphine. One RCT (n = 40) reported no significant difference in the number of participants reporting allergic reactions, gastrointestinal symptoms, or nausea or vomiting. j) Addition of sufentanil. There was no significant difference in the incidence of bradycardia in one trial. Three trials (n = 132) reported a significantly				

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
lower incidence of hypotension in participants receiving sufentanil (OR = 0.05; 95% CI 0.01, 0.34). In one RCT (n = 42) there were no reports of allergic reaction, nausea or vomiting, or respiratory distress.				
Neuraxial anesthesia: different modes of administration: In one cohort study (n = 291), there were no reports of adverse effects. In one RCT (n = 60) there was no significant difference in the occurrence of gastrointestinal symptoms. In two trials (n = 103) that reported on hypotension there was a significant difference between groups in favor of continuous spinal anesthesia (OR 0.12; 95% CI 0.03, 0.51; p = 0.004). Similarly, in one cohort study (n = 291) there was a statistically significant difference in favor of continuous spinal anesthesia (OR 0.08; 95% CI 0.04, 0.14; p < 0.00001). There was no significant difference in myocardial infarction in one trial (n = 29). There was no significant difference in the occurrence ST depression in one trial (n = 29). In one RCT (n = 74) there were	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
no reports of bradycardia, myocardial ischemia, or stroke, and no reports of headache in one trial (n = 60) or one cohort study (n = 291).				
Neuraxial anesthesia: different doses: In one cohort study (n = 182), there were no reports of adverse effects. In one RCT (n = 60) there was no significant difference in the occurrence of allergic reaction for the different doses of bupivacaine. Bradycardia was reported in two trials (n = 120); there was no significant difference among the different doses of bupivacaine or levobupivacaine. Hypotension was reported in four RCTs (n = 190). There was a There was a significant difference following 4mg versus 6mg of bupivacaine (OR 0.03; 95% CI 0.00, 0.58; p = 0.02), but not 5 versus 6mg of bupivacaine (OR 0.31; 95% CI 0.08, 1.13; p = 0.08). Three cohort studies reported hypotension (n = 267) and found a significant difference following 2.5mg versus 5mg of bupivacaine (OR 0.08; 95% CI 0.03, 0.23; p <0.00001), 4 versus 12mg of bupivacaine (OR 0.03; 95% CI 0.01, 0.15; p <0.00001), and 0.125 versus 0.5 percent of bupivacaine (OR 0.15; 95% CI	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
0.03, 0.87; p = 0.03). One cohort study reported a significant difference in the incidence of hypotension following 4mg versus 12mg (OR 0.03; 95% CI 0.01, 0.15; p <0.00001), but no difference in the incidence of delirium. There were no reports of nausea or vomiting in two trials (n = 100); no reports of residual sensory deficits or motor weakness, respiratory distress, sedation, or urinary retention in one RCT (n = 60); no reports of gastrointestinal symptoms in two trials (n = 100); and no reports of headache in one cohort study (n = 182).				
Complementary and Alternative Medicine:				
No data were reported.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Multimodal Pain Management:				
Data were reported in one study (n = 106). There were no significant differences between groups.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Neurostimulation:				
No data were reported.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up	Original conclusion is still valid and this portion of the CER is likely current

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
			to date or did not know.	
Rehabilitation:				
No data were reported.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Traction:				
Seven RCTs (n = 1,043) and one cohort study (n = 134) provided data on adverse effects. The reported adverse effects were from one to two studies, and did not demonstrate any significant statistical differences between the pain management interventions.	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Key Question (KQ 4): In older adults (≥50 years) admitted to the hospital following acute hip fracture, how do the effectiveness and safety of pharmacologic and nonpharmacologic pain management interventions vary in differing subpopulations following acute hip fracture up to 1 year after fracture compared with usual care or other interventions in all settings?				
Systemic Analgesia				
No data were reported	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Anesthesia				
No data were reported	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Complementary and Alternative Medicine:				
No data were reported	Up-to-date	No new research was found	The three experts did not know of any additional	Original conclusion is still valid and this

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
			studies, and either believed the original report to be up to date or did not know.	portion of the CER is likely current
Multimodal Pain Management:				
No data were reported	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Nerve Blocks:				
One RCT recruited patients with pre-existing heart disease. There was a significant reduction in pain favoring nerve blocks (MD -0.55; -0.81, -0.29; p <0.0001). There was no significant difference in 30-day mortality (OR 0.10; 95% CI 0.01, 1.90; p = 0.12) or adverse effects. One RCT recruited participants that were independent prior to their hip fracture. There was no significant difference between nerve blocks versus standard care for 30-day mortality (OR 1.00; 95% CI 0.06, 16.76; p = 1.00).	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Neurostimulation:				
No data were reported	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current
Rehabilitation:				
All participants were female.	Up-to-date	No new research was found	The three experts did not know of any additional	Original conclusion is still valid and this

Conclusions From CER Executive Summary	Assessment from Most Recent Surveillance Assessment (Sept 2012 – Link to Paper)	Literature Analysis (July 2015)	Expert Opinion	Surveillance Assessment
			studies, and either believed the original report to be up to date or did not know.	portion of the CER is likely current
Traction:				
No data were reported	Up-to-date	No new research was found	The three experts did not know of any additional studies, and either believed the original report to be up to date or did not know.	Original conclusion is still valid and this portion of the CER is likely current

*No relevant FDA warnings or Horizon Scanning interventions were identified.