Effectiveness of Multi-factorial Interventions in Reducing Post-operative Delirium among Elderly Patients with Hip Fracture

by

Hon Suet

BNurs, HKU

A thesis submitted in partial fulfilment of the requirements for the degree of Master of Nursing at the University of Hong Kong

July 2013
DECLARATION

I declare that the thesis and the research work thereof represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualification.

Signed …………………………………………

HON SUET

Signed …………………………………………

HON SUET
ACKNOWLEDGEMENTS

I should like to express my sincerest gratitude to my supervisor, Dr. Marie Tarrant, for her unfailing support and guidance. She walked with me along the path of this dissertation, opened the door for me towards the sea of knowledge, and even devoted her personal time to making every aspect close to perfection. She deserves my heartfelt thanks because without her assistance and advice this work would still be far from complete.

I would also like to thank my beloved Bambi, the ever-energetic corgi who could (surprisingly) behave itself when I buried my head in the depths of journal articles; and Doodles, the ever-gluttonous dachshund, for not chewing up my work.

Last but by no means the least, my family (both in Hong Kong and China) deserve my deep appreciation for their support and understanding. At the time of writing, my father, who recently underwent a major surgical operation, will certainly continue to do his utmost and survive his battle against cancer, and hopefully attend my graduation ceremony in good health. Thanks to Mum for taking care of him when I was too physically and mentally occupied by work and study. And thanks to my sister Phoebe and brother Andrew for their support; and to my partner Patrick, for shouldering my fears and hesitations in life, and empowering me to become both a more competent professional, and a better person.
Abstract of thesis entitled

Effectiveness of Multi-factorial Interventions in Reducing Post-operative Delirium among Elderly Patients with Hip Fracture

Submitted by

HON Suet

for the degree of Master of Nursing at
the University of Hong Kong
in July 2013

According to the World Health Organisation, hip fracture among elderly people is a global public health problem, with 1.7 million cases worldwide in 1991, a figure due to the aging population and believed likely to increase. Post-operative delirium is a common complication following hip-fracture surgery, and occurs in 25% to 65% of cases (Gustafson 1988). It not only affects the rehabilitation progress of the elderly, but also prolongs hospitalisation, which in turn increases the financial burden on the government.

There are different ways of managing post-operative delirium among the elderly, including pharmacological and multifactorial interventions and education programmes. However, there is no standard nursing management of post-operative delirium in Hong Kong, and this affects both patient care and nursing standards. According to the National Institute for Health and Clinical Excellence (2011), multifactorial intervention is cost-effective and an effective method of reducing post-operative delirium, where nurses play an important role as gatekeepers, and thus allow such intervention to be introduced into the clinical setting. With this in mind, translational nursing research was performed by a review of four studies, to introduce the concept of multifactorial intervention to nurses, to formulate the implementation for the intervention, and finally to obtain feedback from colleagues.
# CONTENTS

<table>
<thead>
<tr>
<th>Declaration</th>
<th>p.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>p.4</td>
</tr>
<tr>
<td>Abstract</td>
<td>p.5</td>
</tr>
<tr>
<td>Contents</td>
<td>p.6</td>
</tr>
<tr>
<td><strong>Chapter 1: STATEMENT OF THE PROBLEM</strong></td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>p.10</td>
</tr>
<tr>
<td>Background to hip fractures</td>
<td>p.10-11</td>
</tr>
<tr>
<td>Background to post-operative delirium</td>
<td>p.11-12</td>
</tr>
<tr>
<td>Affirming needs</td>
<td>p.12</td>
</tr>
<tr>
<td>Significance of hip fractures and post-operative delirium</td>
<td>p.12-13</td>
</tr>
<tr>
<td>Current proposed interventions for delirium</td>
<td>p.13</td>
</tr>
<tr>
<td>Nurses’ knowledge of post-operative delirium</td>
<td>p.13-14</td>
</tr>
<tr>
<td>Multifactorial intervention for post-operative delirium</td>
<td>p.14</td>
</tr>
<tr>
<td>Need for multifactorial intervention</td>
<td>p.14</td>
</tr>
<tr>
<td>Objective and significance</td>
<td>p.14-15</td>
</tr>
<tr>
<td>Research question</td>
<td>p.15</td>
</tr>
<tr>
<td><strong>CHAPTER 2: REVIEW OF EVIDENCE</strong></td>
<td></td>
</tr>
<tr>
<td>Selecting studies for review</td>
<td>p.16</td>
</tr>
<tr>
<td>Type of studies</td>
<td>p.16</td>
</tr>
<tr>
<td>Type of participants</td>
<td>p.16</td>
</tr>
<tr>
<td>Type of interventions</td>
<td>p.16</td>
</tr>
<tr>
<td>Type of outcomes</td>
<td>p.17</td>
</tr>
<tr>
<td>Flow diagram of studies included and excluded</td>
<td>p.17</td>
</tr>
<tr>
<td>Search strategies</td>
<td>p.18-19</td>
</tr>
</tbody>
</table>
Results of review p.19-19
Description of studies p.19-26
Quality assessment p.26-33
Summary and synthesis p.34
Analysis of the intervention characteristics review p.34-35
Analysis of intervention effectiveness p.35-36
Implications for practice p.36
Summary of chapters 1 and 2 p.36-37

Chapter 3: Assessing implementation potential p.38-44

Brief overview of intervention p.38
Target audience and setting p.38
Transferability of the findings p.38
Fit of intervention in proposed setting p.38
Similarity of research and target populations p.38-39
Philosophy of care p.39
Sufficient clients to benefit p.39
Implementation and evaluation time p.39-40
Feasibility p.40
Freedom to implement p.40
Interference with current functions p.41
Administrative/organisational support p.41
Consensus among staff p.41
Friction/conflict among staff p.41-42
Skills available to implement intervention p.42
Facilities available p.42-43
Evaluation tools available p.43
Cost-benefit ratio of the innovation p.43
Potential risks p.43
Potential benefits for clients, and other benefits p.43
Costs p.43-44
Costs of not implementing intervention p.44

**Chapter 4: EBP Guideline/protocol** p.45-48
Guideline title p.45
Aims and objectives of guidelines p.45
Target group p.45
Interventions and practices considered p.45
Major outcomes considered p.45
Recommendations p.45-47
Summary of chapters 3 and 4 p.47-48

**CHAPTER 5: IMPLEMENTATION PLAN** p. 49-52
Introduction/review and summary of D1 and D2 (in brief) p. 49
Plan for communication with potential users p. 49
Stakeholders p. 49-50
Communication process p. 50
Communication methods p. 51
Sustaining the change process p. 51
Pilot testing p. 51-52

**CHAPTER 6: EVALUATION PLAN** p. 53-59
Intervention outcomes p. 53
Client outcomes p. 53
Other outcomes p. 53
Outcome measurements p. 53-54
Nature and number of clients involved p. 54
Eligibility criteria p. 54
Sample size calculation p. 54-55
Data analysis p. 55
Data collection p. 55
Data evaluation p. 55-56
Criteria for effectiveness p. 56
Client outcomes p. 56
Other outcomes (process indicators) p. 56-59
REFERENCES p. 60-62
CHAPTER 1: STATEMENT OF THE PROBLEM

Hip fractures among the elderly constitute one of the commonest orthopaedic problems in Hong Kong, and post-operative delirium is a common complication following surgery, not only prolonging the stay in hospital, but also delaying the rehabilitation process. However, there is no standard nursing or medical management of post-operative delirium in Hong Kong. Several studies in Western countries suggest that multifactorial intervention is one way of managing post-operative delirium, and it is cost-effective and easily implemented.

Background to hip fractures

Hip fractures are classified as femoral neck fractures or inter-trochanteric and sub-trochanteric fractures; they form the most common orthopaedic trauma, occurring especially in the elderly. Hip fracture is a public health problem: according to a press release from the WHO in 1999, there were 1.7 million cases worldwide in 1991, and it is expected that the number will rise to 6.5 million by 2050, because of aging populations worldwide. There are several causes of hip fracture among the elderly, including falls, osteoporosis, weak bones due to infection or tumor (i.e. pathological fracture) and high-energy injuries, for example, those caused by car accidents. Falls and osteoporosis are the most common causes of hip fracture among elderly people (University of Chicago Medicine Centre, 2012). Other risk factors include sex, race, excessive alcohol and caffeine consumption, smoking, lack of exercise, vision problems, dementia and medications that cause bone loss.

In Hong Kong, the 1995 incidence of hip fracture was 110 per 100,000 in women and 50 per 100,000 in men (Lau 1999), and nearly 4,500 hip fracture operations were performed under Hospital Authority auspices in 2009. Most of the patients involved were aged over 65, and it was one of the most frequent injuries in the elderly population. It is also believed that there will be an increasing trend in the incidence of hip fracture in the coming decades because of the aging population (Lau 2010).
**Background to post-operative delirium**

Delirium occurring in the post-operative phase is a common complication associated with elderly hip fracture patients, with a prevalence ranging between 25% and 65% (Gustafson 1988). It is a neuro-psychiatric syndrome characterised by disturbed attention, and changes in cognition and perception. Changes in cognition include memory impairment, disorientation, language disturbance; changes in perception include hallucination, illusions and misinterpretations; other symptoms include sleep and emotional disturbance, which can develop over a period of hours or days, and fluctuate over the course of the day.

According to Staus (2011), there are three sub-types of delirium, hyperactive, hypoactive and mixed type. The hyperactive type occurs in 20% of patients with delirium, where patients usually present with anger, combativeness, irritability and restlessness. However, this type of patient has a more favourable prognosis. The remaining 80% of patients suffer from hypoactive or mixed-type delirium, where the former type presents with apathy, lethargy and staring, and has a less favourable prognosis than the hyperactive group, while the mixed type has the worst prognosis, usually presenting with unawareness.

While patients with hyperactive delirium are usually more agitated - they may even climb out of bed or pull out intravenous tubing - those with hypoactive or mixed type delirium are not disruptive and as a result their diagnosis of delirium is usually missed.

The causes of delirium can be multifactorial, for example, central nervous system disorder, e.g. head trauma and seizure; metabolic disorder, e.g. hypoxia, fluid or electrolyte imbalance; cardiopulmonary disorder, e.g. myocardial infarction, and shock; and systemic illness, e.g. infection (Trzepacz 1999).

The predisposing factors of delirium include old age, dementia, depression, history of alcohol abuse, vision/hearing loss, past history of delirium, impaired mobility and dehydration. The precipitating factors delirium include inadequate pain management, application of physical restraint,
use of multiple medications, use of urinary catheters and malnutrition. It is suggested that delirium among elderly hospitalised patients usually has multiple aetiologies (44% of elderly patients showing an average of 2.8% aetiology per patient (Trzepacz 1999)) and that this explains why the elderly are prone to develop post-operative delirium.

**Affirming needs**

It may be wondered why introducing multifactorial intervention could be thought to reduce post-operative delirium in elderly hip-fracture patients, and why this intervention rather than another is recommended. This can be explained in three aspects: the significance of hip fractures and post-operative delirium; current interventions suggested; and nurses’ knowledge of post-operative delirium.

**Significance of hip fracture and post-operative delirium**

According to the International Osteoporosis Foundation, between 12% and 20% of people will die within one year following a hip fracture (2012). Most of these deaths are due to other associated conditions rather than the fracture itself. The complications from hip fractures include pulmonary embolism, pneumonia, improper union of bones, post-operative delirium following surgery in elderly patients, chronic pain, disability and decreased quality of life. The occurrence of a fall and hip fracture can aggravate any underlying condition.

As for the personal aspect, post-operative delirium can prolong the length of hospitalisation, increase the risk of dementia, produce a higher chance of hospital-acquired complication, such as developing pressure sores or a reoccurrence of the fall, reduce functional ability and increase mortality. Studies have shown that patients who experience delirium are less likely to return to their pre-fracture level of walking or daily living activity. Furthermore, they are also more likely to be placed in a nursing home for the first time and to die there (Robertson 2006).

As for the social aspect, post-operative delirium leads to prolonged hospitalisation, increasing the financial burden on the healthcare system. The actual cost, including non-self-financed
medication, manpower and meals, of a stay in a general ward of a public hospital is more than HKD $4,400 per bed/day, with the government subsidising most of the cost and the patients only having to pay HKD $100 per bed/day.

**Current proposed interventions for delirium**

Based on guidelines for managing delirium produced by the National Institute for Health and Clinical Excellence in 2010, methods include pharmacological treatment, eg the use of antipsychotic drugs; multi-component intervention, assessing and managing the risk factors contributing to delirium; and education programmes for healthcare professionals to increase awareness of post-operative delirium and its management. In Hong Kong, there is no standard/proposeded prevention and treatment for post-operative delirium provided by the Hospital Authority. It has been noted that some nurses consider patients with post-operative delirium to be confused and apply physical restraint to them, rather than looking for any causes leading to the condition. However, the application of physical restraint is one of the precipitating factors of delirium (Staus 2011).

**Nurses’ knowledge of post-operative delirium**

Although nurses receive formal education about delirium and its management in nursing school, a study conducted by Frick and Foreman (2000) demonstrated that 75% of nurses in the study had difficulty in differentiating between delirium and dementia; elderly patients might have pre-existing health conditions related to normal aging, which in turn complicated recognition of delirium. In Hong Kong, no studies have explored the perceptions of nurses towards delirium and post-operative delirium, or their ability to recognise either condition among elderly hip-fracture patients.

**Multifactorial intervention for post-operative delirium**

Several studies (Marcantonio 2001; Lundström 2007; Björkelumd 2010) have shown that post-operative delirium can be prevented and treated among elderly hip-fracture patients by multifactorial interventions that target the risk factors contributing to the occurrence of the condition.
Nurses play an important role in assessing patients’ cognitive function and physiological parameters for the early detection of post-operative delirium, so that treatment can be initiated to shorten the period of delirium or to prevent its occurrence completely.

**Need for multifactorial intervention**

To provide better patient care and reduce the financial burden, there is a necessity to introduce the management of post-operative delirium in Hong Kong healthcare settings; the use of multifactorial interventions can be considered as the guideline for nurses to manage post-operative delirium among elderly hip-fracture patients.

**Objective and significance**

1. To gather and review the evidence of multifactorial intervention in reducing post-operative delirium in elderly patients with hip fractures;
2. To synthesise and critique the quality of studies related to the research question;
3. To develop evidence-base guidelines for multifactorial intervention suitable for the Hong Kong setting.

Once post-operative delirium in elderly hip-fracture patients is resolved by multifactorial intervention, patient care can be improved. The intervention emphasises nursing knowledge and awareness of the condition, and can also decrease complications due to post-operative delirium, decreasing the cost of prolonged stays in hospital. Furthermore, certain studies (Inouye 1999; Milisen 2001; Lundström 2005; Naughton 2005) suggest that multifactorial intervention is applicable to elderly patients with medical problems, and elderly hip-fracture patients often suffer from other medical problems due to aging. In this way, multifactorial intervention can be beneficial to the frailest and oldest patients.

**Research question**

PICO component

P: Elderly patients with hip fractures
I: Multifactorial interventions

C: No intervention (usual care)

O: Post-operative delirium

PICO: In elderly hip-fracture patients, what is the effectiveness of a multifactorial intervention compared with no intervention in reducing post-operative delirium?
CHAPTER 2: REVIEW OF EVIDENCE

Reviewing existing studies is necessary to provide the knowledge base and supporting evidence for the suggested interventions. In order to ensure the quality of the evidence used, a well-planned, detailed search and critical appraisal of the studies should be performed.

In this chapter, I elaborate the review of evidence step by step: selection of studies for review, search strategies, methods of the study review, description of studies, results of the review, quality assessment and summary and synthesis of the studies.

Selecting studies for review

The process of reviewing studies, inclusion criteria have to be set based on the research question:

Type of study

- Randomised controlled trial
- Systematic reviews and meta-analysis
- Cohort studies
- All studies to have been published in the last 15 years (i.e. 1998-2012)
- All studies to be in English

Type of participants

- Hip-fracture patients
- Aged 60 or above
- Cognitively intact
- Studies with medical patients are also included for reference

Type of intervention

A multifactorial intervention which is non-pharmacological and mainly targets the risk factors of post-operative delirium.
Type of outcome

- Proportion of post-operative delirium sufferers during hospitalisation

**Figure 1: Flow diagram of studies included and excluded**

**Step 1**
- Search Engines:
  - Medline; Pubmed; CINAHL; Google Scholar; Reference list of each study

**Step 2**
- Keyword search:
  - Delirium + Multifactorial + Intervention + Hip fracture + Femoral neck fracture

**Step 3**
- 82 Relevant articles found:
  - 21 Medline
  - 52 Pubmed
  - 9 CINAHL
  - 416 relevant articles from Google Scholar
  - 2 relevant articles from reference list

**Step 4**
- 26 studies included by the titles and with full text

**Step 5**
- Articles included after the quality screening
  - 3 Randomized controlled trails
  - 1 Quasi-experiemntal intervention study
  - 2 Cohorts studies
  - 1 Case-matched controlled trails
  - 1 longitudinal before and after design study

**Search strategies**

The study search was carried out from October 2011 to May 2012. Three electronic databases, CINAHL, Medline and PubMed, were used as the search engines, and other search engines, such as Google Scholar, was also used. The reason for using these three databases was that they covered a
wide range of studies from medical and other healthcare disciplines, and were produced by the world’s leading publishers. The keywords used in the search strategies included delirium, multifactorial, intervention, hip fracture and femoral neck fracture.

The search strategy results are presented in the following tables 1 and 2:

<table>
<thead>
<tr>
<th>Table 1</th>
<th>First screening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>Delirium (D)</td>
</tr>
<tr>
<td>CINAHL</td>
<td>737</td>
</tr>
<tr>
<td>Medline</td>
<td>4963</td>
</tr>
<tr>
<td>PubMed</td>
<td>17794</td>
</tr>
<tr>
<td>Google Scholar</td>
<td>248000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Second screening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>D+M+I+H</td>
</tr>
<tr>
<td>CINAHL</td>
<td>0</td>
</tr>
<tr>
<td>Medline</td>
<td>0</td>
</tr>
<tr>
<td>PubMed</td>
<td>2</td>
</tr>
<tr>
<td>Google Scholar</td>
<td>1730</td>
</tr>
</tbody>
</table>

Once a suitable study was identified, a further search was performed on each reference list. In this way, a few more studies were identified, for example that conducted by Inouye et al., which was found in the references of Lundström et al. (2007). Other search engines like Google Scholar were also used for the search, using the same keywords as above.

Results of review
In line with the inclusion criteria, eight studies were included in this dissertation, four of which completely fulfilled the criteria. Three (Marcantonio 2001; Lundström 2007; Björkelund 2010) discussed the effectiveness of multifactorial intervention in reducing post-operative delirium in elderly hip-fracture patients, while the other (Chrispal 2010) demonstrated the association of risk factors with post-operative delirium, which indirectly suggested the effectiveness of multifactorial intervention in reducing delirium.

Another four studies (Inouye 1999; Milisen 2001; Lundström 2005; Naughton 2005) discussed the effectiveness of multifactorial intervention in reducing delirium in hospitalised medical patients, and these were used as references in this dissertation.

**Description of studies**

All eight studies were conducted in a hospital setting, three (Lundström 2005; Lundström 2007; Björkelund 2010) in Sweden, two (Inouye 1999; Naughton 2005) in the USA, one (Milisen 2001) in Belgium and one (Chrispal 2010) in India. However, one study (Marcantonio 2001) did not mention where it was conducted. The studies were published between 1999 and 2010, and all were of the quantitative type.

The duration of the follow-up varied from three months (Naughton) to 36 months (Inouye), and the study subjects varied from 81 (Chrispal 2010) to 852 (Inouye 1999). Whether a large sample size is more likely to produce a true result depends on how adequately the study is powered - if the power is adequate, then the sample size is adequate.

The primary outcome of seven studies was the incidence of delirium during hospitalisation, while Chrispal et al. demonstrated the association of risk factors with post-operative delirium among elderly hip-fracture patients. Some studies may have secondary outcomes, for example the length of stay (Chrispal; Lundström 2005 and 2007; Marcantonio).
<table>
<thead>
<tr>
<th>Journal</th>
<th>Type of study</th>
<th>Length of follow-up</th>
<th>Type of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Björkelund et al. (2010)</td>
<td>Prospective, quasi-experimental intervention</td>
<td>12 months</td>
<td>Hip-fracture patients (nIG: 102; nCG: 97)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Age: &gt;/= 65 years old</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Short Portable Mental Status Questionnaire &gt;8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Cognitively intact on admission</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. No severe neuro-psychiatric illness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. No difficulties in communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6. No multi-trauma</td>
</tr>
<tr>
<td>Lundström et al. (2007)</td>
<td>RCT</td>
<td>12 months</td>
<td>Hip-fracture patients (nIG:139; nCG:136)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. &gt;/= 70 years old</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. No severe rheumatoid arthritis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. No severe osteoarthritis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. No severe renal impairment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. No pathological fracture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6. Not bedridden before the fracture</td>
</tr>
<tr>
<td>Marcantonio et al. (2001)</td>
<td>Prospective, RCT</td>
<td>12 months</td>
<td>Hip-fracture patients (nIG:62; nCG:64)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Age: &gt;/= 65 years old</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Admitted as emergency for surgical repair of hip fracture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Life expectancy &gt; 6 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Able to obtain consent within 24 hours of surgery or 48 hours of admission</td>
</tr>
<tr>
<td>Chrispal et al. (2010)</td>
<td>Prospective, cohort</td>
<td>12 months</td>
<td>Hip-fracture patients (n: 81)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Age: &gt;/= 60 years old</td>
</tr>
<tr>
<td>Journal</td>
<td>Type of study</td>
<td>Length of follow-up</td>
<td>Type of Participants</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------------------</td>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Inouye et al. (2004)</td>
<td>Case-matched controlled trial</td>
<td>36 months</td>
<td>Medical patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n\text{IG}: 426; n\text{CG}: 426)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Age: \geq 70 years old</td>
</tr>
<tr>
<td>Lundström et al. (2005)</td>
<td>Prospective, intervention</td>
<td>8 months</td>
<td>Medical patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n\text{IG}: 200; n\text{CG}: 200)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Age: \geq 70 years old</td>
</tr>
<tr>
<td>Milisen et al. (2001)</td>
<td>Prospective, longitudinal before and after sequential design</td>
<td>14 months</td>
<td>Medical patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n\text{IG}: 60; n\text{CG}: 60)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Verbally testable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Hospitalised in one of two traumatological nursing units within 24 hours of surgery</td>
</tr>
<tr>
<td>Naughton et al. (2005)</td>
<td>Pre-test, post-test cohort study</td>
<td>3 months</td>
<td>Medical patients</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n_{\text{baseline}}: 110)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n\text{IG 4 months}: 84; n\text{CG 4 months}: 70)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n\text{IG 9 months}: 37; n\text{CG 9 months}: 73)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Age: \geq 75 years old</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. History of dementia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Current dementia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Cognitive impairment</td>
</tr>
<tr>
<td>Journal</td>
<td>Type of intervention in intervention group</td>
<td>Type of intervention in control group</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Björkelund et al. (2010)</strong></td>
<td>1. Multifactorial programme starting from pre-hospital and pre-operative in the orthopaedics ward</td>
<td>1. Usual care in orthopaedics ward</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Focus on the causes of delirium, including oxygen saturation, nutritional status, pain control, avoid polypharmacia, avoid delay in transfer and closely monitor patient’s condition throughout hospitalisation</td>
<td>2. Perform surgery within 24 hours when possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. With urinary catheter during operation and the first post-operative day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. With antibiotic and anticoagulant prophylaxis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Mobilise patient within the first post-operative day when possible</td>
<td></td>
</tr>
<tr>
<td><strong>Lundström et al. (2007)</strong></td>
<td>1. Multifactorial intervention in specialised geriatric ward</td>
<td>1. Usual care in conventional orthopaedic ward</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Interventions focus on active prevention, detection and treatment of delirium and its complications, encourage early rehabilitation, and provide staff education</td>
<td>2. No staff education before or during the study and not all different disciplines will consistently collaborate with each other</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Secondary prevention of falls and provide osteoporosis prophylaxis</td>
<td>3. Rehabilitation and secondary prevention of falls and fractures: not performed consistently for control group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Emphasis on individualised care plan and collaborate with different disciplines in caring</td>
<td>4. Manpower: 1.01 nurses/aids per bed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Manpower: 1.07 nurses/aids per bed</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marcantonio et al. (2001)</strong></td>
<td>1. Geriatrics consultation pre-operative or within 24 hours post-operative, and daily basis, with specific recommendation for patient care to focus on the causes of delirium</td>
<td>1. Usual care by the orthopaedics team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Internal medicine and geriatric consultation not on a proactive basis</td>
<td>2. Internal medicine and geriatric consultation not on a proactive basis</td>
<td></td>
</tr>
<tr>
<td><strong>Chrispal et al. (2010)</strong></td>
<td>1. Ten approaches to reduce and treat delirium based on risk factors; for example, monitor oxygen saturation, fluid and electrolyte imbalance, pain control, use of unnecessary medication, nutritional intake etc.</td>
<td>1. Not mentioned</td>
<td></td>
</tr>
<tr>
<td><strong>Inouye et al. (2004)</strong></td>
<td>1. Standard intervention protocols based on delirium risk factors</td>
<td>1. Standard hospital service provided by physicians, nurses and support staff</td>
<td></td>
</tr>
<tr>
<td>Journal</td>
<td>Type of intervention in intervention group</td>
<td>Type of intervention in control group</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Lundström et al. (2005)</td>
<td>2. Orientation and therapeutic activities protocol for cognitive impairment</td>
<td>1. Task-oriented nursing care</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Non-pharmacological sleep and sleep-enhancement protocol for sleep deprivation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Protocol developed based on the causes of delirium, for example, early mobilisation, vision, hearing and dehydration protocols</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milisen et al. (2001)</td>
<td>1. Staff education in multifactorial intervention focuses on the assessment, prevention and treatment of delirium</td>
<td>1. Usual care (Details not mentioned)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Emphasis on individual care plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naughton et al. (2005)</td>
<td>1. Nurse-led interdisciplinary intervention programme, including:</td>
<td>1. Usual care (Details not mentioned)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Education of nursing staff about early recognition of delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Use of systematic cognitive screening</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Consultation service by delirium resource nurses, geriatric nursing specialist or psycho-geriatrician</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Acute geriatric unit protocol, including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Implementing behaviour measurement scale for delirious/suspected delirious patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Treating underlying medical and precipitating factors for delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Providing family support</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Non-pharmacological intervention for aggressive behaviour</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Review evidence of psychosis with medical officials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journal</td>
<td>Type of outcome measures</td>
<td>Effect size (all answers correct to 1.d.c.)</td>
<td>p-value</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Björkelund et al. (2010)</td>
<td>Develop delirium during hospitalisation</td>
<td>22% (IG) VS 34% (CG)</td>
<td>0.031</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (34-22)/34= 35.29%</td>
<td></td>
</tr>
<tr>
<td>Lundström et al. (2007)</td>
<td>Primary outcome:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) No. of days of post-operative delirium</td>
<td>1) 5.0+/-7.1 days (IG) VS 10.2+/-13.3 days (CG)</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (10.2-5)/10.2= 51%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary outcome:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Length of stay</td>
<td>1) 28.0 +/- 17.9 days (IG) VS 38.0 +/- 40.6 days (CG)</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (38-28)/28= 26%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Proportion of post-operative delirium</td>
<td>2) 54.9% (IG) VS 75.3% (CG)</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (75.3-54.9)/75.3=27.1%</td>
<td></td>
</tr>
<tr>
<td>Marcantonio et al. (2001)</td>
<td>1) Incidence of delirium throughout the acute hospital stay</td>
<td>1) 32% (IG) VS 50% (CG)</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (50-32)/50= 36%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Length of stay</td>
<td>2) 5 +/- 2 days (IG &amp; CG)</td>
<td>0.95</td>
</tr>
<tr>
<td>Chrispal et al. (2010)</td>
<td>1) Incidence of post-operative delirium</td>
<td>1) 21% with delirium</td>
<td></td>
</tr>
<tr>
<td>Inouye et al. (2004)</td>
<td>1) Incidence of delirium</td>
<td>1) 9.9% (IG) VS 15% (CG)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (15-9.9)/15=34%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Total days of delirium</td>
<td>2) 105 days (IG) VS 161 days (CG)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (161-105)/161=34.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3) Total no. of episodes of delirium</td>
<td>3) 62 (IG) VS 90 (CG)</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effect size: (90-62)/90= 31.1%</td>
<td></td>
</tr>
<tr>
<td>Journal</td>
<td>Type of outcome measures</td>
<td>Effect size (all answers correct to 1.d.c.)</td>
<td>p-value</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Lundström et al.</td>
<td>1) Delirium remaining on day 7</td>
<td>1) 30.2% (IG) VS 59.7% (CG) Effect size: (59.7-30.2)/59.7 = 49.4%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>2) Mean length of hospital stay +/-SD</td>
<td>2) 9.4 +/- 8.2 VS 13.4 +/- 12.3 Effect size: (13.4-9.4)/13.4 = 29.9%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milisen et al.</td>
<td>1) Incidence of delirium</td>
<td>1) 20.0% (IG) VS 23.3% (CG) Effect size: (23.3-20)/23.3 = 14.2</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>2) Duration of delirium</td>
<td>2) p-value: 0.03 (only p-value provided in the journal)</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>3) Severity of delirium</td>
<td>3) p-value: 0.049 (only p-value provided in the journal)</td>
<td>0.049</td>
</tr>
<tr>
<td>Naughton et al.</td>
<td>1) Prevalence of delirium at baseline, 4 months, 9 months</td>
<td>1) 40.9% (baseline, i.e. CG) VS 22.7% (4 months IG), Effect size: (40.9-22.3)/40.9 = 45.51</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40.9% (baseline, i.e. CG) VS 19.1% (9 months IG), Effect size: (40.9-19.1)/40.9 = 53.3%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Quality Assessment

Scottish Intercollegiate Guidelines Network (SIGN) is used as the tool for quality assessment in this dissertation; all eight studies mentioned above are included (see Tables 4, 5 and 6).

Because of the design of the selected eight studies, different methodology checklists are applied: the randomised controlled trial methodology checklist is applied to five studies (Björkelum; Inoyue; Lundström 2005; Lundström 2007; Marcantonio), the cohort study methodology checklist to the remaining three (Chrispal; Milisen; Naughton).

All eight studies addressed appropriately and clearly the stated research questions, with the outcomes also clearly identified. All studies had a clear description of the inclusion and exclusion criteria, and clearly indicated the population of each group. However, not all of them indicated the characteristics of the treatment and control groups, only four (Björkelum; Inoyue; Lundström 2005; Marcantonio) showing that the characteristics of both groups were similar at the start of the trial, and that the only difference between groups was the treatment under investigation. The entire outcome was measured by a standard, valid and reliable instrument. The Confusion Assessment Method (CAM), for instance, was used in all eight cases to assess delirium among patients, while the Organic Brain Syndromes Scales (OBS) were used in three studies (Björkelum; Lundström 2005; Lundström 2007).

Three studies (Lundström 2005; Lundström 2007; Marcantonio) showed well covered randomisation, two (Lundström 2007; Marcantonio) with adequate concealment by means of sealed envelopes, which further decreases the bias of the studies. However, Lundström et al. did not mention the method of randomisation used, and randomisation is not relevant to the other two studies (Björkelum; Inoyue), the former being a prospective, quasi-experimental design, with a follow-up of 12 months, where the intervention was commenced in the last six months. The latter was a prospective matching study design, and randomisation was not therefore applicable either.

Blinding of subjects and nurses was difficult to achieve, since the nurses would be aware of
the implementation of the intervention. All eight studies recruited independent staff to collect data and assess patient’s cognitive condition for post-operative delirium. Lundström et al. and Marcantonio et al. both stated that trained research interviewers were recruited who were not aware of the status of subjects. Björkelund et al. mentioned that all personnel were informed of the implementation of the intervention, and it was assumed that this included nurses, patients and investigators. Three studies (Lundström 2005; Milisen; Naughton) mentioned that there were trained research assistants for data collection and patient assessment, but did not mention whether they were kept blinded or not. Chrispal et al. did not report who conducted the data collection. The remaining four studies (Chrispal; Marcantonio; Milisen; Naughton) did not mention any dropouts before the study was completed, but showed that the total number of subjects recruited at the start of the study and the number in each group at the end were the same, and so it can be assumed that all participants completed the study. Inouye et al. used prospective matching strategies, where the characteristics of each patient in each group were compared. In this way, patients who could not be matched were excluded, and so the problem of drop outs before the study was completed did not arise.

Overall, three studies (Björkelund; Lundström 2007; Marcantonio) were in complete accord with the PICO components mentioned in Chapter 1, and their grading of the level of evidence ranged from 1+ to 1++, with Lundström et al (2007) having the highest rating of the three (1++) after quality assessment.
Table 6
Scottish Intercollegiate Guidelines Network (SIGN) methodology checklist: randomised controlled trials

<table>
<thead>
<tr>
<th>Journal</th>
<th>1.1</th>
<th>1.2</th>
<th>1.3</th>
<th>1.4</th>
<th>1.5</th>
<th>1.6</th>
<th>1.7</th>
<th>1.8</th>
<th>1.9</th>
<th>1.10</th>
<th>2.1</th>
<th>2.2</th>
<th>2.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Björkelund et. al. (2010)</td>
<td>WC</td>
<td>NA</td>
<td>NAd</td>
<td>AA</td>
<td>AA</td>
<td>WC</td>
<td>WC</td>
<td>2.9% (IG)</td>
<td>5.8% (CG)</td>
<td>WC</td>
<td>NA</td>
<td>+</td>
<td>✓</td>
</tr>
<tr>
<td>Lundström et. al. (2007)</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
<td>WC</td>
<td>17.6% (IG)</td>
<td>21.6% (CG)</td>
<td>WC</td>
<td>NA</td>
<td>+</td>
<td>✓</td>
</tr>
<tr>
<td>Marcantonio et. al. (2001)</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
<td>WC</td>
<td>WC</td>
<td>0% (IG, CG)</td>
<td></td>
<td>WC</td>
<td>NA</td>
<td>+</td>
<td>✓</td>
</tr>
<tr>
<td>Lundström et. al. (2005)</td>
<td>WC</td>
<td>NAd</td>
<td>NAd</td>
<td>PA</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>0% (IG, CG)</td>
<td></td>
<td>WC</td>
<td>NA</td>
<td>+</td>
<td>✓</td>
</tr>
</tbody>
</table>

Key: WC: Well covered
     AA: Adequately addressed
     NAd: Not addressed
     PA: Poorly addressed
     NR: Not reported
     NA: Not applicable

Section 1: Internal validity
1.1 The study addresses an appropriate and clearly focused question.
1.2 The assignment of subjects to treatment groups is randomised
1.3 An adequate concealment method is used
1.4 Subjects and investigators are kept ‘blind’ about treatment allocation
1.5 The treatment and control groups are similar at the start of the trial
1.6 The only difference between groups is the treatment under investigation
1.7 All relevant outcomes are measured in a standard, valid and reliable way
1.8 What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed?
1.9 All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis)
1.10 Where the study is carried out at more than one site, results are comparable for all sites
Section 2: Overall assessment of the study
2.1 How well was the study done to minimise bias? Code ++, +, or -?
2.2 Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the study intervention?
2.3 Are the results of this study directly applicable to the patient group targeted by this guideline?
Table 7
*Scottish Intercollegiate Guidelines Network (SIGN) methodology checklist: cohort study*

<table>
<thead>
<tr>
<th>Journal</th>
<th>1.1</th>
<th>1.2</th>
<th>1.3</th>
<th>1.4</th>
<th>1.5</th>
<th>1.6</th>
<th>1.7</th>
<th>1.8</th>
<th>1.9</th>
<th>1.10</th>
<th>1.11</th>
<th>1.12</th>
<th>1.13</th>
<th>1.14</th>
<th>2.1</th>
<th>2.2</th>
<th>2.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrispal et al. (2010)</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WA</td>
<td>0%</td>
<td>WC</td>
<td>WC</td>
<td>NR</td>
<td>NA</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
<td>AA</td>
<td>✓</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Milisen et al. (2001)</td>
<td>WC</td>
<td>AA</td>
<td>WC</td>
<td>NA</td>
<td>0%</td>
<td>WC</td>
<td>WC</td>
<td>PA</td>
<td>NA</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
<td>AA</td>
<td>X</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Naughton et al. (2005)</td>
<td>WC</td>
<td>AA</td>
<td>WC</td>
<td>NA</td>
<td>0%</td>
<td>WC</td>
<td>WC</td>
<td>PA</td>
<td>NA</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
<td>AA</td>
<td>X</td>
<td>+</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Key: WC: Well covered  
AA: Adequately addressed  
PA: Poorly addressed  
NAd: Not addressed  
NR: Not reported  
NA: Not applicable

Section 1: Internal validity

1.1 The study addresses an appropriate and clearly focused question.

Selection of subjects

1.2 The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation.

1.3 The study indicates how many of the people asked to take part did so, in each of the groups being studied.

1.4 The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis.

1.5 What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed?

1.6 Comparison is made between full participants and those lost to follow up, by exposure status.

Assessment

1.7 The outcomes are clearly defined.

1.8 The assessment of outcome is made blind to exposure status.

1.9 Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome.

1.10 The measure of assessment of exposure is reliable.

1.11 Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable.

1.12 Exposure level or prognostic factor is assessed more than once.

Confounding
1.13 The main potential confounders are identified and taken into account in the design and analysis.

Statistical analysis

1.14 Have confidence intervals been provided?

Section 2: Overall assessment of the study

2.1 How well was the study done to minimise the risk of bias or confounding, and to establish a causal relationship between exposure and effect?

Code ++, +, or -

2.2 Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the study intervention?

2.3 Are the results of this study directly applicable to the patient group targeted by this guideline?

Table 8

Scottish Intercollegiate Guidelines Network (SIGN) methodology checklist: overall quality rating

<table>
<thead>
<tr>
<th>Journal</th>
<th>Overall quality rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Björkelund et al. (2010)</td>
<td>1</td>
</tr>
<tr>
<td>Lundström et al. (2007)</td>
<td>1++</td>
</tr>
<tr>
<td>Marcantonio et al. (2001)</td>
<td>1+</td>
</tr>
<tr>
<td>Chrispal et al. (2010)</td>
<td>1-</td>
</tr>
<tr>
<td>Inouye et al. (1999)</td>
<td>1</td>
</tr>
<tr>
<td>Lundström et al. (2005)</td>
<td>1</td>
</tr>
<tr>
<td>Milisen et al. (2001)</td>
<td>1-</td>
</tr>
<tr>
<td>Naughton et al. (2005)</td>
<td>1-</td>
</tr>
</tbody>
</table>
Summary and synthesis

These eight studies demonstrated that multifactorial intervention could prevent the occurrence of post-operative delirium. Although the focus of the interventions mentioned in each study was slightly different in each case, they all generally focus on optimising the nursing care of patients, identifying and addressing the underlying causes of post-operative delirium.

Analysis of the characteristics of interventions review

All eight studies emphasised that there was no single intervention to prevent post-operative delirium. Therefore, preventive efforts need to focus on minimising the risk factors leading to the condition. For example, Marcantonio et al. demonstrated that a proactive geriatric consultation performed pre-operatively or within 24 hours post-operatively, and then performed on a daily basis, with specific recommendations about the patient care focus on the causes of delirium, the total cumulative incidence of delirium throughout the acute hospital stay was significantly reduced. The effect of the intervention on reducing the incidence of delirium was 36% (p= 0.04).

Out of the three studies targeting hip-fracture patients (Björkelund; Lundström 2007; Marcantonio), the multifactorial intervention was perhaps slightly different in each study. However, they all emphasised the prevention of risk factors which lead to delirium: prevention and treatment of post-operative complications (Lundström 2007; Marcantonio), adequate pain management (Björkelund; Lundström 2007; Marcantonio), avoiding polypharmaica (Björkelund; Marcantonio), monitoring oxygen saturation and providing an adequate oxygen supply (Björkelund; Lundström 2007; Marcantonio), monitoring body temperature and blood pressure (Björkelund; Lundström 2007); maintaining adequate nutritional intake (Björkelund; Lundström 2007; Marcantonio); and early mobilisation and rehabilitation (Lundström 2007; Marcantonio).

Other than focusing on the risk factors, certain studies (Milisen; Lundström 2005; Naughton; Lundström 2007) suggested education for healthcare professionals is necessary to reduce the
incidence of post-operative delirium, because it can increase knowledge about the subject and the use of assessment tools, thus further facilitating implementation of the intervention.

**Analysis of intervention effectiveness**

Although eight studies were used, only four targeted elderly hip-fracture patients, the other four being concerned with elderly patients with medical problems, which were used as reference, since hip-fracture patients also suffered some kind of medical problems. In the four studies (Björkelund; Crispal; Lundström 2007; Marcantonio) targeting elderly hip-fracture patients, the effect of the multifactorial intervention was 27.1-36%, statistically significant in all cases.

Two of the three studies demonstrated that the multifactorial intervention could decrease the length of hospital stays (Lundström 2005; Lundström 2007), but Marcantonio et al’s results were not significant (p=0.95), meaning there was no difference between the two groups, in both cases the length of stay being 5 +/- 2 days.

It was also noted that education for nurses was important for the successful implementation of the multifactorial intervention. Milisen et al. emphasised the education of nursing staff in the early recognition of delirium, although they did not demonstrate a significant decrease in the prevalence of delirium, but only a significant decrease in the duration (the effect size was 75%, p=0.03) of post-operative delirium. Lundström et al. (2005) also demonstrated a significant decrease in the delirium still remaining on day 7 (the effect size was 49.4%, p= <0.001). Both studies emphasised that nursing education was important for the implementation of the intervention, since it could increase understanding of delirium and the use of an assessment tool to identify patients with delirium, the causes of delirium and so on. The multifactorial intervention is not only effective in reducing the incidence of post-operative delirium, but can also be applied to medical patients, Lundström et al. (2007) showing that the significance decreased with the number of days of delirium (the effect size was 50%, p=0.009) among medical patients. However, there was disagreement with Milisen et al’s
data, which showed that multifactorial intervention did not decrease delirium among medical patients, where the incidence was 20.0% (intervention group) vs. 23.3% (control group).

**Implications for practice**

Based on the findings of the studies, the suggestion is that post-operative delirium is not inevitable, the effect size of reducing the incidence of post-operative delirium during hospitalisation by using multifactorial intervention being 27.1-36%. Early detection and intervention are necessary for the implementation of the intervention and nurses play an important role in assessing and monitoring the patient’s condition.

The aims of multifactorial intervention focus on early assessment, detection and treatment of factors which lead to delirium, and it is therefore necessary to provide education for nurses to increase their understanding of the condition, its assessment, pathophysiology, diagnosis and treatment. And it is also necessary to educate nurses in how to differentiate between delirium, dementia and depression, which they commonly confuse. Increasing nurses’ knowledge will enable them to become more sensitive towards the risk factors which may lead to post-operative delirium, for example, inadequate oxygen supply, fluid and electrolyte imbalance, inadequate pain control, use of multiple drugs and inadequate nutritional balance. A protocol of the multifactorial intervention can be introduced into the clinical setting, which is not only straightforward and easily incorporated into a busy ward environment, but also bring benefit to the recovery of patients by improving nursing care.

**Summary of chapters 1 and 2**

With Hong Kong’s aging population, a high proportion of elderly patients occupy most surgical wards. Post-operative delirium is a common complication among elderly hip-fracture patients. It not only prolongs hospitalisation, but also increases the financial burden on the Hospital Authority. The intervention is useful in reducing the incidence of the condition by early detection of risk factors and early interventions, where successful implementation must include good cooperation
between medical and nursing staffs, since nurses play an important role as gatekeepers in assessment and implementation. The use of multifactorial intervention can be beneficial to the needs of the frailest, oldest patients.
CHAPTER 3: ASSESSING IMPLEMENTATION POTENTIAL

Post-operative delirium is caused by multiple factors, and multifactorial intervention therefore targets these causal factors. The interventions include monitoring haemoglobin levels and signs of infection; maintaining oxygen saturation, hydration and nutritional status; adequate pain control and the avoidance of polypharmacia and anticholinergic.

Target audience & setting

The target setting will be the orthopaedic departments of public hospitals in Hong Kong. The target population will be elderly hip-fracture patients who are cognitively intact.

Transferability of the findings

In order to assess the implementation potential of the multifactorial intervention in the target setting, it is necessary to assess its transferability and feasibility. In this section, we assess the transferability of the intervention from five aspects.

Fit of intervention in proposed setting

The multifactorial intervention fits into the proposed setting, i.e. the orthopaedic departments of public hospitals in Hong Kong, when compared with the setting of the five studies (Björkelund; Chrispal; Lundström 2007; Marcantonio; Milisen). Björkelund et. al., Chrispal et. al. and Marcantonio et. al. were all conducted in an orthopaedic ward, Lundström et al. in conventional orthopaedic wards (control group) or specialised geriatric wards (intervention group), and Milisen et al. in a traumatological ward.

Similarity of research population to target population

The studies’ target populations were similar in age and diagnosis to those in the proposed setting: aged over 60 and suffering from hip fractures; all had been through an operation (Marcantonio; Milisen; Lundström 2007; Björkelund; Chrispal). The primary target outcome was a decrease in the length of delirium, with nurses implementing the intervention (Inoyue; (Marcantonio; Milisen; Lundström 2005& 2007; Björkelund; Chrispal).
Philosophy of care

The philosophy of care underlying the intervention was the same as that prevailing in the practice setting, both aiming to improve the quality of patient care and reduce the length of post-operative delirium (Björkelund; Inoyue; Lundström 2005& 2007; Marcantonio), which in turn can reduce the length of hospitalisation (Lundström 2007) and consumption of resources, so that the financial burden on the healthcare authority can be reduced (Lundström 2007). Furthermore, the rehabilitation phase will not be delayed, since the period of post-operative delirium is reduced. The philosophy of care of the Hospital Authority in Hong Kong entails helping people to stay healthy and providing people-centred care, the philosophy of the findings and the Hospital Authority therefore being quite similar.

Sufficient clients to benefit

According to information provided by the Hospital Authority’s website, almost 4,500 hip-fracture operations were performed in public hospitals in 2009, or almost 370 cases per month (Hospital Authority, 2012). There are thus sufficiently large numbers of patients in the practice setting who can benefit from the multifactorial intervention.

Implementation and evaluation time

In order to implement the intervention in the orthopaedic departments of public hospitals in Hong Kong, a pilot study will be carried out to identify any potential difficulties during the actual implementation. The pilot study will be carried out in the orthopaedic department of Queen Mary Hospital, because it is the place where I am currently working and where, according to Lau et. al. (2010), from 2007 to 2009, 964 hip-fracture cases were managed, which means that there were around 450 hip-fracture cases per year and therefore sufficient clients to benefit from the study and sufficient data for evaluation. There are four orthopaedic wards in Queen Mary Hospital, and the pilot study will be conducted in one of them for three months. Patient data will be collected daily and input to the database. After three months, feedback will be collected from colleagues to evaluate any
difficulties during the implementation, and to assess their compliance and room for improvement in facilitating it. The intervention will then be introduced to the entire orthopaedic department of the hospital, and applied to elderly hip-fracture patients who fit the inclusion criteria. It will be implemented over one year and data will be collected to evaluate its effectiveness, strengths and limitations, in order to refine it further. Finally, the intervention will be introduced into the orthopaedic departments of all public hospitals in Hong Kong.

**Feasibility**

This section assesses the feasibility of the multifactorial intervention in the clinical setting.

**Freedom to implement**

An evidence-based protocol for the multifactorial intervention is suggested, so that nurses can have a certain freedom to initiate the intervention in specified circumstances. As mentioned earlier, the intervention targets the multiple causes of post-operative delirium, and some interventions have to be prescribed by medical officers, for example, blood transfusion. However, this does not mean that nurses have no freedom to implement the intervention - instead, their roles are as assessors and gatekeepers. Most factors can be assessed by nurses, for example, when nurses find patients looking pale, with increased blood staining in the drain within a short period of time after the operation, we can suggest that the doctor take blood for a complete picture, and to look for any decrease in haemoglobin levels.

**Interference with current functions**

The implementation of this intervention means that applying physical restrain or neglecting patients with post-operative delirium must be a last resort. Nurses should implement the intervention first, and look for any causes of and improvement in the post-operative delirium, but this brings an additional burden to current practice.

**Administrative/organisational support**
The pilot study will be implemented in Queen Mary Hospital, one of the leading hospitals in Hong Kong, even in the world, where high quality research and evidence-based practice in different health disciplines is necessary to maintain this reputation, and the quality of patient care. The success of an evidence-based intervention requires a consensus between the organisation and the staff, but the administration is likely to support this intervention, because it not only improves the quality of care, but also decreases the length of hospitalisation and thus the financial burden.

**Consensus among staff**

Even though the organisation supports the intervention, backing from clinical staff is also necessary for successful implementation. Some nurses may be reluctant to introduce the intervention, because of a certain resistance to change and fear of increasing their current workload. Understanding their concerns, maintaining communication with them throughout the implementation and providing any necessary help before and during the process is therefore of great importance.

**Friction/conflict among staff**

Conflicts among nurses about the implementation of new evidence-based practice can certainly happen, for example, when patients develop post-operative delirium, some nurses may choose to neglect it and let the problem resolve itself spontaneously, or apply physical restraint. The new intervention means that there is an extra workload for them, and changes in so-called current practice. On the other hand, some nurses may welcome the new intervention, since they may notice that (there being no standard/suggested nursing care for post-operative delirium) it will enhance the quality of patient care. Some nurses may worry that they need to learn how to implement the intervention in their own time; an extra workload may be entailed by the evaluation of the pilot study, and support from the management level is therefore necessary to relieve any conflicts among staff. For example, a training day could be provided for the briefing session, so that nurses do not need to spend their own leisure time in attending a briefing session right after their tiring spell of duty; extra manpower, such as research nurses, can be hired to be responsible for data collection and
evaluation - all these recommendations aiming to avoid an increase in the nurses’ current workload. Furthermore, it is necessary for nurses to understand that the aims of the intervention can improve the quality of patient care, decrease the length of post-operative delirium and related complications, and also decrease the length of hospitalisation, all of which implies that the workload of the nurses can also be decreased.

**Skills available to implement intervention**

Understanding the causes of post-operative delirium is necessary for the implementation of the intervention; if nurses understand the causes then they will be more aware of the factors leading to the condition. For example, inadequate oxygenation can be related to the occurrence of delirium (Björkelund; Lundström 2005 and 2007; Marcantionio; Robertson 2006). Also, encouraging nurses to use the assessment tool to identify patients with post-operative delirium is necessary, something already learnt during nursing training. For example, MMSE is seldom applied, because it is usually performed by occupational therapists, so we may have the idea that it must be performed by them. If we can be more proactive in conducting assessments, we can identify patients with delirium earlier and implement the intervention earlier.

**Facilities available to implement intervention**

Multifactorial intervention consists of a package of interventions which target the causes of post-operative delirium, and is performed in a systematic way. Understanding the causes is necessary in order to understand the rational of each intervention. In fact, nurses may perform each intervention daily but it is task-oriented and prescribed by doctors, for example, monitoring haemoglobin levels or infection markers, and assessing the patient’s cognitive function by MMSE. The facilities are already available, but nurses may not use them well.

**Evaluation tools available**

We can evaluate the effectiveness of the intervention by the length of post-operative delirium and the length of hospitalisation.
Cost-benefit ratio of the innovation

Potential risks

Taking blood to monitor a patient’s condition, for example, haemoglobin levels or infection markers, may cause pain; supplementary intravenous fluid may be needed to support hydration status; there is a potential risk of infection through the drip site; phlebitis.

Potential benefits for clients, and other benefits

Certain benefits may be brought to patients by the intervention: a decrease in the length of hospital stay, lower costs due to shorter hospitalisation, and promotion of the rehabilitation phase (Gustafson; Marcantionio; Robertson).

Implementation of an evidence-based protocol allows nurses more autonomy in certain clinical situations, and enhances their ability to distinguish between depression, dementia and delirium (Staus).

Costs

Extra spending is needed to implement a new evidence-based protocol, entailing material and non-material costs. The former include paper printouts for the teaching material in the briefing session, and the assessment tools; the latter hourly pay for nurses attend briefing sessions in their own time.

Costs of not implementing intervention

Studies show that the length of hospitalisation can be reduced; for example, Lundström et al. (2007) demonstrated that the total post-operative hospitalisation of the intervention group was shorter, i.e. 28.0+/−17.9 days in the intervention group against 38.0+/−40.6 days in the control group, with an effect size of 1/2. As mentioned earlier, the actual cost of one night’s stay in a general ward of a public hospital is more than HKD $4,400, and so the longer the hospitalisation, the more money is spent.
CHAPTER 4: EBP GUIDELINE/PROTOCOL

Guideline title

Implementation of a multifactorial intervention to decrease the incidence of post-operative delirium among elderly hip-fracture patients.

Aims and objectives of guidelines

1) To increase nurses’ awareness of the multiple causes of post-operative delirium
2) To implement multifactorial interventions to prevent these causes
3) To decrease the incidence of post-operative delirium

Target group

The target group includes all nurses working in the orthopaedic departments of public hospitals in Hong Kong.

Interventions and practices considered

The multifactorial intervention consists of several interventions which target prevention of the multiple causes leading to post-operative delirium.

Major outcomes considered

We are looking for a decrease in the incidence of post-operative delirium among elderly hip-fracture patients.

Recommendation 1:

Multifactorial interventions should be introduced on admission to hospital, and all clients should be assessed for factors that may contribute to the occurrence of post-operative delirium.

(Grade A)

Evidence:

A multifactorial intervention started at an early point with intensified care and supporting treatment can reduce the incidence of post-operative delirium by 35% of the relative risk (Björkelumd) (1).
Multifactorial intervention can reduce the incidence of delirium on post-operative day 1 because patients immediately receive systematic assessment to detect, treat or prevent factors that might cause delirium (Lundström 2007) (1++).

**Recommendation 2:**

Assessment of patient’s oxygenation saturation and provision of supplemental oxygen therapy to keep saturation \( \geq 95\% \), in order to increase oxygen delivery into tissue (Grade B).

**Evidence:**

Continuous supplementary oxygen has contributed to alleviating post-operative delirium (Björkelund) (1).

Hypoxia can lead to post-operative delirium since it alters the balance between acetylcholine and dopamine; imbalance in neurotransmitters plays an important role in the development of post-operative delirium (Chrispal (1-).

**Recommendation 3:**

Assessment of patients’ pain level by asking them about its severity, and providing oral analgesic at an early stage to relieve patients’ pain. (Grade A).

**Evidence:**

Treating elderly hip-fracture patients with significantly higher doses of analgesic in the post-operative phase contributes to a decrease in the incidence of delirium (Björkelund 2010) (1).

Elderly patients who have developed post-operative delirium are usually prescribed sedatives and opioid drugs on demand (Lundström 2007) (1++).

**Recommendation 4:**

Assessment of patient’s hydration status and provision of early intravenous fluid can reduce the incidence of delirium (Grade B).

**Evidence:**
Early intravenous fluid infusion to treat dehydration of elderly patients can contribute to decreasing the incidence of delirium (Björkelund) (1).

**Recommendation 5:**

Assess patient’s current medication history and avoid polypharmacia and anticholinergics; sedatives should be administered with restrictions (Grade A).

**Evidence:**

Patients with post-operative delirium are more often treated with anticholinergics (Björkelund; Marcantionio) (1; 1+).

Among elderly patients with post-operative delirium, the only significant difference between the control and intervention groups at baseline was that the control were prescribed anti-depressants (Lundström 2007) (1++).

**Summary of Chapters 3 and 4**

To conclude, after assessing the multifactorial intervention for transferability and feasibility, and the recommendation to develop an evidenced-based guideline, it is believed that it can be implemented in an actual clinical setting.
<table>
<thead>
<tr>
<th>Material costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Paper printout for assessment tool</td>
<td>$1000</td>
</tr>
<tr>
<td>2. Extra laboratory blood test for each patient, e.g. blood for ESR, CRP to assess signs of infection; CBC to check haemoglobin levels</td>
<td>$5000</td>
</tr>
<tr>
<td>Non-material costs</td>
<td></td>
</tr>
<tr>
<td>1. Hourly pay for nurses who attend briefing sessions in their own time</td>
<td>$200/hour/person</td>
</tr>
</tbody>
</table>
CHAPTER 5: IMPLEMENTATION PLAN

In this section, the implementation plan for the multifactorial intervention is introduced in detail. First of all, a brief summary of D1 and D2 is reviewed, and then the plan for communication with potential users is discussed; lastly, pilot testing of the intervention will be demonstrated.

Introduction/review and summary of D1 and D2 (in brief)

D1 is composed of Chapters 1 and 2. In Chapter 1, I have described the content of the multifactorial intervention, the current local and worldwide figures of post-operative delirium among elderly hip-fracture patients, the current local nursing practice towards patients with that condition, and the reasons for introducing the intervention to the Hong Kong clinical setting. Based on the above information, the PICO-format research question was formulated. Then, in Chapter 2, eight studies were selected according to certain inclusion and exclusion criteria and a quality assessment was performed, in order to check whether the intervention was evidence-based or not.

D2 consists of Chapters 3 and 4. In Chapter 3, the potential for introducing multifactorial intervention into the clinical setting was assessed for its transferability and feasibility. Guidelines and recommendations for introducing the intervention were introduced in Chapter 4.

Plan for communication with potential users

In order to introduce a new evidence-based intervention to the clinical setting, communication with potential users before and during implementation is necessary. Therefore, in this section, a communication plan with potential users is discussed.

Stakeholders

The implementation involves medical officers, nurses and para-medical assistants. Medical officers have to be aware of and understand the interventions, since they have to prescribe some of them, for example, blood transfusions. Nurses are the assessors and gatekeepers of the intervention, and so they too have to understand the reasons and concepts of the intervention and its benefits to patients; they may otherwise feel bothered by the innovation. Some para-medical assistants, such as
healthcare assistants, may be used to applying physical restraints right away before informing nurses when they notice patients with post-operative delirium. They must therefore understand that physical restraint will be the last resort for patients with delirium, and nurses need to instruct them about the rationale of the intervention.

**Communication process**

It is usual in the case of a new evidenced-based intervention for some of the stakeholders to support the proposed intervention and some to oppose it. In order to facilitate the implementation, support from management/administrative staff is important, and thus introducing the intervention to ward managers is essential, so that they understand the benefit of the intervention to the public and the department, and can help us to gain the support and approval of the Department Operation Manager (DOM) and Chief of Service (COS). After that, two briefing sessions will be introduced, four weeks and two weeks before the pilot study and implementation, for the entire orthopaedic department. The briefing session aims to introduce the reasons, content and implementation methods of the intervention, and also educates the nurses in how to identify patients with post-operative delirium, and differentiate it from dementia and depression.

It is expected that the pilot study will be implemented in an orthopaedic ward for three months, during which period a regular monthly meeting with nurses is suggested to further assess any difficulties or suggestions that come up during implementation. I will conduct the briefing sessions, meetings, data collection and evaluation process, so frontline staff will not need to spend their own time on extra projects, and may therefore be more supportive of the intervention.

**Communication methods**

Individual interviews and group discussion with stakeholders will be used as the main communication methods, each having different advantages and disadvantages: individual interviews are useful because they offer more direct contact with the stakeholders, and immediate responses can be gained; also, I can clarify the responses immediately if needed, and discuss with the stakeholder
any difficulties during implementation, for example, confusion with the wording of the CAM form. However, conducting individual meetings will be time-consuming. A few stakeholders will therefore be randomly selected for individual interviews. The advantages of using group meetings are that they will take up less time and involve more useful interaction between stakeholders during the discussion. During these group discussion, I will therefore focus more on the process of the implementation, whether it is difficult to carry out in a busy ward, and what improvements can be made to facilitate it further.

**Sustaining the change process**

In order to sustain the change process, I will regularly check whether the stakeholder is following the protocol, and ensure adequate supplies of any resources related to the process of the implementation - for example, adequate supplies of CAM assessment forms and protocol/guideline sheets - so that frontline staff can follow the protocol step by step and facilitate the implementation.

**Pilot testing**

In order to implement the intervention in an orthopaedic department of a public hospital, pilot testing will be carried out in the orthopaedic department of Queen Mary Hospital. The reason for introducing pilot testing is that it can give advice on or early warning of the intervention’s potential failure; whether it can be followed by nurses, or whether it is too complicated to apply in a real setting (van Teijlingen 2001). The reason for implementing the pilot in Queen Mary Hospital is that this is where I am currently working, and I am more familiar with the environment so that support for the stakeholders can be provided immediately. Also, according to Lau et al. 2010, from 2007 to 2009 there were 964 hip-fracture cases managed there, or around 450 cases per year.

There are four orthopaedic wards in Queen Mary Hospital; and the pilot testing will be conducted in the admission ward, for three months. Once an elderly hip-fracture patient is admitted to the ward, mini mental state examination (MMSE) will be performed by the case nurse and the cognitive function of the patient assessed. The reason for using MMSE is to recruit only cognitively
intact patients as subjects. MMSE results depend on the patient’s educational background, and once a patient is found to fit the inclusion criteria informed consent will be obtained. The confusion assessment method (CAM) will be used by the nurses as the diagnostic tool to identify patients with post-operative delirium; it will be performed as the baseline on admission and once the patient develops signs and symptoms of post-operative delirium. Routine blood taking will be done on admission, also contributing to the baseline. After that, the intervention will be implemented, focusing on the several risk factors leading to delirium. A checklist will be used to facilitate implementation, and include daily monitoring of the following risk factors until patients are transferred to the rehabilitation hospital: haemoglobin levels, signs of infection; maintaining oxygen saturation, hydration and nutritional status; adequate pain control and avoidance of polypharmacia and anticholinergic. Early treatment will be applied to correct any risk factors encountered.

After three months, the effectiveness of the intervention will be evaluated, by comparing its results with the prevalence of post-operative delirium found in other studies, and through feedback from workmates on their compliance with (and any perceived room for improvement in) the implementation.
CHAPTER 6: EVALUATION PLAN

This is the final chapter of the dissertation, where the evaluation plan for the intervention will be introduced. The objective of evaluation is to assess the effectiveness of the intervention in respect of its outcomes.

Intervention outcomes

The outcomes can be classified as the client’s outcomes and other outcomes (provider or system outcomes if relevant). Further detail follows.

Client outcomes

When elderly hip-fracture patients have undergone an operation, with the limitation of resources in the Queen Mary Hospital, patients are usually transferred to the rehabilitation hospital before day 7. It is therefore difficult to measure the length of post-operative delirium, and so the primary client outcome will be the incidence of delirium during hospitalisation.

Other outcomes

The other outcome will be an increase in nurses’ knowledge of post-operative delirium.

Outcome measurements

To assess client and other outcomes, different measurements will be taken, the confusion assessment method (CAM) (Inouye; Marcantonio; Vidán 2009) will be used as the tool to identify whether patients are suffering from post-operative delirium or not (see Appendix A). The CAM is composed of two sections: section one assesses the overall cognitive impairment of patients, whether the delirium has an acute onset and there is any inattention noticed; section two assesses four specific signs and symptoms of delirium which are found to have the greatest ability to distinguish delirium from other types of cognitive impairment. For a diagnosis of delirium by CAM, there is no cut-off score, but the patient must display the presence of acute onset and fluctuating discourse and inattention; and either disorganised thinking or an altered level of consciousness. The CAM is a highly standardised measurement tool for identifying patients with delirium. Waszynski (2001) states
that the concurrent validity with psychiatric diagnosis revealed a sensitivity of 94-100% and specificity of 90-95%. Elderly hip-fracture patients will be assessed by CAM on admission to delirium status, once they develop post-operative delirium during hospitalisation, the same tools being used again to confirm the diagnosis. Secondly, in order to assess nurses’ knowledge levels in respect of post-operative delirium and its management, a pre-test and post-test will be performed to assess them (see Table 10 and 11).

**Nature and number of clients involved**

**Eligibility criteria**

Patients aged over 60 who are cognitively intact and admitted to a public hospital with hip fractures will be recruited to the study. Informed consent will be gained in the ward.

**Sample size calculation**

It is important to calculate the sample size accurately. If it is too small, it may not have a wide enough range of participants to see a genuine result, or the result may simply happen by chance; on the other hand, if the sample size is too large, the costs will be increased and more funding may be needed. So an appropriate sample size can be sought from current studies. The sample size can be calculated by the UCSF Biostatistics: Power and Sample Size Programmes, in which ‘Comparing a proportion to a known value ’is selected to calculate it. First of all, the prevalence of post-operative delirium has to be known. According to Gustafson, Berрендre & Brannstrom (1988), a prevalence of post-operative delirium ranges between 25% and 65%, and 25% is considered as the value of p0. Secondly, the effect size of the intervention in reducing the incidence of post-operative delirium is 27.1% to 36 % (Marcantionio; Lundström 2007). Therefore, if the intervention is expected to reduce this by 27.1%, it will be 0.25 X 0.27 = 0.07, and so the intervention is expected to reduce the incidence of delirium in elderly hip-fracture patients by 7% overall. Because of this, the p1 will be 25%-7%= 18%, and 0.18 will be considered as the value of
p1; after the value of p0 and p1 is established, the sample size can be calculated: 281 subjects will be needed.

**Data analysis**

This analysis includes data collection and evaluation.

**Data collection**

When elderly hip-fracture patients are admitted, MMSE is performed to assess their cognitive function as the baseline, and CAM is used as the diagnostic tool for delirium, nurses conducting both these investigations. The intervention will be carried out from admission onwards; patients will be monitored for their haemoglobin levels, signs of infection, oxygen-saturation, hydration and nutritional status, and pain control levels; polypharmacia and anticholinergic will be avoided during hospitalisation. Therefore, blood taking, vital sign monitoring, assessment of pain and reviewing medication records all have to be carried out. Data of these parameters will be recorded in the clinical record by the nurses (see Table 12), and early treatment applied to correct any abnormal result. Once a patient is suspected of developing post-operative delirium - for example, showing signs and symptoms of the condition such as disturbed attention or changes in cognition and perception - CAM will be performed again to confirm the diagnosis. For a satisfactory diagnosis of delirium by CAM, the patient must display the presence of an acute onset and fluctuating discourse and inattention, and either disorganised thinking or altered level of consciousness. I will review the data daily. And I will be responsible for the data analysis and collection from elderly patients with post-operative delirium;

**Data evaluation**

The objective of the evaluation being to compare the data with the existing rates in the eight studies. The Statistical Package for the Social Sciences (SPSS) version 17 will be used to carry out statistical analysis. The data will be input and checked by the author and, according to the evaluation objectives, different methods of analysis will be used. Since the client outcome is a measurement of
the incidence of post-operative delirium during hospitalisation, 95% confidence interval are used to estimate the rate. For the other outcome, assessing the difference in nurses’ knowledge before and after the implementation, one sample t-test will be used.

**Criteria for effectiveness**

The criteria for the effectiveness of the multifactorial intervention are based on whether it can reduce the incidence of post-operative delirium during hospitalisation, and whether it can increase knowledge among nurses of the condition and its management (i.e. the intervention).

**Client outcomes**

It is expected that the clients will benefit from a decreased rate of post-operative delirium during hospitalisation. The effect size of the intervention in reducing the incidence of delirium is 27.1% to 36 (Marcantonio; Lundström 2007), and it is expected that the results of the client outcome in the real setting will fall within this range. The rate in the real setting is compared with the rate mentioned in the literature.

As mentioned above, the intervention is expected to reduce the incidence of delirium in elderly hip-fracture patients by 7% overall. Although this figure seems small, prevalence of 25% is reduced by one third and can greatly decrease the length of hospitalisation, in turn decreasing the financial burden.

**Other outcomes (process indicators)**

It is expected that nurses’ knowledge of post-operative delirium and its management (i.e. the multifactorial intervention) will be increased by comparing the results of the pre- and post-tests.

To conclude, this dissertation aims to demonstrate the significance of post-operative delirium and how it affects both the worldwide healthcare system and particularly Hong Kong’s. It shows that, although there is a well-organised delirium clinical guideline for doctors and nurses in the United States (National Institute for Health and Clinical Excellence), there is no such guideline for nurses in Hong Kong. The dissertation thus introduces a multifactorial intervention and assesses its
transferability to and feasibility in the clinical setting of Hong Kong. The importance of such an intervention is clear, because evidence shows that the effect size of reducing the incidence of post-operative delirium is from 27.1% to 36% (Marcantonio; Lundström 2007), thereby reducing the length of hospitalisation due to post-operative delirium and in turn decreasing the financial burden on the healthcare system. Moreover, nurses can do far more than is commonly assumed, since we are the ones who spend most time with the patients and better understand their condition; we not only carry out doctors’ prescriptions, but also have to understand the rationale of the intervention so that it can help us to assess the patients’ condition. And we can also develop and introduce more and more evidence-based clinical interventions to improve the quality of nursing care in Hong Kong, and so improve our professional development.
### Table 10

**Pre- and post-tests to assess nurses’ knowledge of post-operative delirium**

#### Part 1: Questions related to knowledge of delirium

<table>
<thead>
<tr>
<th>No.</th>
<th>QUESTION</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sedation is one of the commonest treatments for delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Patients who are difficult to rouse do not have delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Patients with delirium always present with physical and/or verbal aggression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Patients with delirium have a higher mortality rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Patients with delirium always present with perceptual disturbance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Altered sleep/wake cycle is one of the signs and symptoms of delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Symptoms of depression may mimic delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Patients with delirium always present with fluctuation between orientation and disorientation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 11

**Pre- and post-tests to assess nurses’ knowledge of post-operative delirium**

#### Part 2: Question related to the risk factors of post-operative delirium

<table>
<thead>
<tr>
<th>No.</th>
<th>QUESTION</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Risk of delirium is the same in patients with repair of a fracture of neck of femur and patients with elective hip replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A patient with impaired vision is at increased risk of delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Gender makes no difference to the development of delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dementia is the greatest risk factor for delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Males are more likely to develop delirium than females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Polypharmacia can lead to post-operative delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Dehydration can be a risk factor for delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hearing impairment increases the risk of delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Haemoglobin level is one of the risk factors of delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Inadequate pain control can lead to post-operative delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Inadequate nutritional status is related to delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Infection is one of the risk factors of post-operative delirium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Diabetes is a high risk factor for delirium</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 12
Template of clinical record (performed in daily basis during hospitalisation)

<table>
<thead>
<tr>
<th>BASELINE ASSESSMENT</th>
<th>Admission date</th>
<th>Operation date</th>
<th>Intervention</th>
<th>Post-operation day</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Mini-mental status examination scores</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Confusion assessment method result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MONITOR PARAMETERS

- Haemoglobin levels
- Sign of infection (e.g. increase in ESR, CRP, WBC, fever)
- Oxygen-saturation
- Hydration and nutritional status
- Pain control level (by visual analogue scale)
- Presence of polypharmacia and anticholinergic
- Signs and symptoms of post-operative delirium
- Review of Confusion assessment method
- Satisfactory diagnosis of post-operative delirium
Appendix A

Confusion assessment method (CAM) diagnostic algorithm

**Feature 1: Acute onset and fluctuating course**
This feature is usually obtained from a family member or nurse and is shown by positive responses to the following questions: Is there any evidence of an acute change in mental status? Did the abnormal behaviour fluctuate during the day? Did it tend to come and go, or increase and decrease in severity?

**Feature 2: Inattention**
This feature is shown by a positive response to the following question: Did the patient have attention difficulty, for example, being easily distractible?

**Feature 3: Disorganised thinking**
This feature is shown by a positive response to the following question: Was the patient's thinking disorganised or incoherent, such as irrelevant conversation, illogical or unclear flow of ideas, or switching from subject to subject?

**Feature 4: Altered level of consciousness**
Overall, how would you rate this patient's level of consciousness? (Normal, hyperalert, drowsy, easily aroused, difficult to arouse, or unarousable)

**Diagnostic of post-operative delirium:**
Patient must display with the presence of
ACUTE ONSET and FLUCTUATING DISCOURSE and INATTENTION;
AND EITHER
DISORGANISED THINKING or ALTERED LEVEL OF CONSCIOUSNESS

**Source:**
Reference


The Java Applets for Power and Sample Size. Retrieved from 04 April, 2013 http://homepage.stat.uiowa.edu/~rlenth/Power/


Division of Biostatistics, Department of Epidemiology and Biostatistics, the University of California, San Francisco. Retrieved from 20/04/2013: http://www.stat.ubc.ca/~rollin/stats/ssize/


