

Efficacy of hip protector in preventing fall-related hip fracture among elderly people

A literature review study

Xinghui Wu

DEGREE THESIS	
Arcada	
Degree Programme:	Human Ageing and Elderly Service
Identification number:	8279
Author:	Xinghui Wu
Title:	Efficacy of hip portector in preventing fall-related hip fracture of elderly people----A literature review study.
Supervisor (Arcada):	Elisabeth Kajander
Commissioned by:	Hoiva OY
Abstract:	
<p>Hip fracture among elderly people is identified as a serious health problem worldwide. Because of the potential immediate preventative effect, hip protector drew attention from research field. Plenty of researches were conducted for examining the efficacy of hip protector in preventing fall-related hip fracture among elderly people, and results are conflicting. This literature review study aims to sum up and analyze previous literature, and then provide an overall picture of existing researches results about efficacy of hip protectors. Reviewed articles were collected from Google Scholar, SAGE, Academic Search, PUBMED, and CINAHL. After checking with a structured checklist which is formed from suggestion of Polit et al (2001), 11 studies finally are taken into this literature review study. Inductive and deductive content analysis are employed as data analyzing method for answering three research questions: (1) what results previous literature obtained concerning the efficacy of hip protector in preventing fall-related hip fracture among elderly people? (2) Which factors affected results in reviewed literature concerning the efficacy of hip protector? (3) How reviewed literatures can be interpreted in terms of “quality of life”? The conclusion is (1) overall efficacy of hip protector is not yet established, since results of previous researches are conflicting; (2) factors affecting results of efficacy examination of hip protector could be: adherence, sampling size and resources, sampling processing, the biomechanical capacity of hip protector, hip fracture incidence, and one with high risk of hip fracture is not always likely to wear the protector; (3) quality of life can be directly weakened by fall and hip fracture in physical, mental aspects.</p>	
Keywords:	hip protectors, hip fracture, Hoiva Oy
Number of pages:	42
Language:	English
Date of acceptance:	

OPINNÄYTE	
Arcada	
Koulutusohjelma:	
Tunnistenumero:	
Tekijä:	
Työn nimi:	
Työn ohjaaja (Arcada):	
Toimeksiantaja:	
<p>Tiivistelmä: Kirjoita koko opinnäytteesi tiivistelmä tähän. Tekstin tulee olla sellaisenaan ymmärrettävä kuvaus tehdystä tutkimuksesta, ja siksi sen täytyy olla huolellisesti harkittu ja viimeistelty. Asiaa tuntemattomankin lukijan on saatava selkeät ja asialliset tiedot siitä, mitä opinnäyte käsittelee, mitä menetelmiä on käytetty ja minkälaisia tuloksia on saatu. Tiivistelmässä ei saa olla mitään sellaisia asioita, jotka eivät käy ilmi myös opinnäytteestä. Siinä ei myöskään tule olla mitään tarpeettomia selityksiä tai täytevirkeitä.</p> <p>Tiivistelmän tulee esitellä tutkimuksen tarkoitus, tutkimusongelma, tehtävärajaus, aineisto, käytetyt menetelmät, tärkeimmät viitteet sekä tulokset ja niiden pohjalta tehdyt päätelmät ja toimenpidesuositukset. Aluksi kuvataan lyhyesti aikaisempia tutkimuksia, teorioita tai käytännön tarpeita, joiden perusteella opinnäytteen kysymyksenasettelu on syntynyt.</p> <p>Tekstin pituus on 200–300 sanaa, ja se voidaan usein asetella yhdeksi kappaleeksi. Aikamuotona käytetään preesensia tai imperfektiä.</p> <p>Loppuun kirjoitetaan 4–8 avainsanaa, jotka antavat tiivistelmää silmäilevälle vihjeen opinnäytteen sisällöstä. Jos opinnäyte on yritykselle tehty tilaustyö, on yrityksen nimi yksi avainsanoista.</p>	
Avainsanat:	
Sivumäärä:	
Kieli:	
Hyväksymispäivämäärä:	

INNEHÅLL / CONTENTS

1	BACKGROUND	6
1.1	Hip fractures and its consequences	6
1.2	Current interventions for falls and hip fracture	9
2	RESEARCH AIMS AND QUESTIONS.....	10
3	THEORETICAL FRAME.....	11
4	METHOD OF STUDY	12
4.1	Justification of research method.....	12
4.2	Data collecting	13
4.2.1	<i>Literature searching strategy.....</i>	<i>13</i>
4.2.2	<i>Critical appraise on selected literatures</i>	<i>14</i>
4.3	Data analysis	19
5	ETHICAL CONCERNS.....	20
6	RESULTS OF STUDY	21
6.1	What results previous researches obtained	23
6.1.1	<i>Negative results of reviewed literatures</i>	<i>23</i>
6.1.2	<i>Positive results of reviewed literatures</i>	<i>25</i>
6.1.3	<i>Other results of reviewed literatures.....</i>	<i>26</i>
6.2	Which factors affect results of reviewed literatures	27
6.3	How reviewed literatures interpreted in term of quality of life.....	30
7	CRITICAL REVIEW OF STUDY	32
8	DISCUSSION	33
9	REFERENCES	35
	APPENDICES	41

Figures

Figur 1. Types of hip fracture.....	7
Figure 2: The hip protector.....	10
Figur 3. Factors may affect results of efficacy examinationf of hip protector	28
Figure 4. Fall, hip fracture and quality of life.....	31

Tables

Table 1. Literature seraching record.....	14
Table 2. 11 literatures which are taken into this review study.....	15

1 BACKGROUND

Hip fracture has been identified as a serious public health problem worldwide in many researches, since it causes sufferings to old people in physical, mental, and social aspects, thereby deteriorates the life quality of older people; as well, it brings about great challenge to health care professionals, research field, and societies. Thus plenty of researches have been launched, but results from them are conflicting.

1.1 Hip fractures and its consequences

“A hip fracture is a break near the top of the thighbone (femur) where it angles into the hip socket. Fall-related hip fractures usually occur when an individual, typically with insufficient soft tissue to absorb the shock, fails to generate an appropriate protective response and impacts the ground or other hard surface at or near the hip with a force that exceeds the fracture threshold of the proximal femur.”(Sveistrup & Lockett, 2003).

The hip can break in different positions. It is usually categorized into intracapsular (the bone within the joint capsule breaks) or extracapsular type. (The bone outside the joint capsule breaks). Clear indicators for hip fracture are immense pain around the injured place; unable to move the hip, stand or walk; the injured leg looks shorter than the normal one, and it looks turned outwards. (Patient UK, 2011). In most of hip fracture cases, hospital admission and surgery are needed.

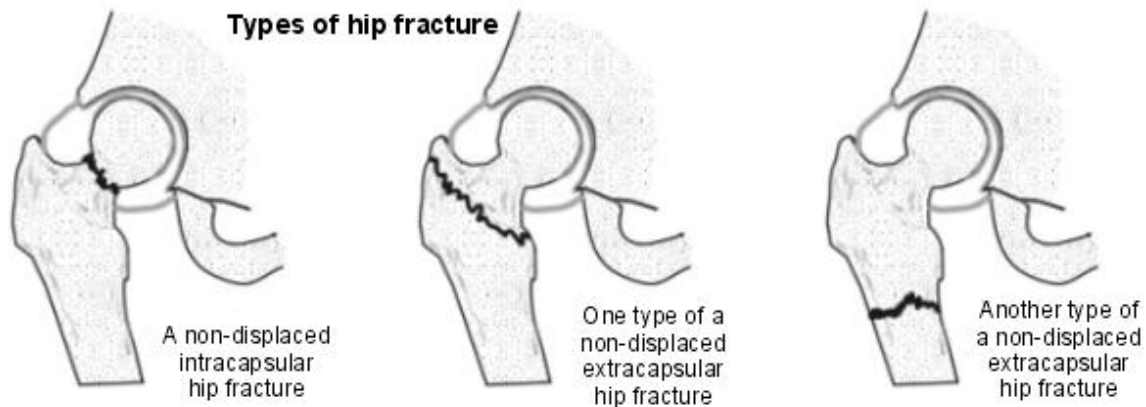


Figure 1: types of hip fracture (Patient UK, 2011)

Hip fracture predominantly occurs in older population, and the incidence increases exponentially with age, especially after the age of 60 years. (Kannus et al., 1999). It revealed that women are more susceptible to the hip fracture than men, since they occupied about 80 per centage of all patients. The mean age for hip fracture is 80 years old (Patient UK, 2011).

Moreover, Gullberg et al. (1997) estimated that totally 1.26 million people fractured their hip in year 1990, and the figure will be doubled to 2.6 million and tripled to 4.5 million by the year 2025 and 2050 respectively, as the population is getting old in every corner of the world.

This alarming statistic not only challenges public health sectors and societies economically, but also substantively implies high incidence of longstanding pains, functional impairment, disability, and death to the senior generation (Kannus et al 2005), for those it is impossible to put any price on.

Researches show, one year after the hip fracture, only around 50% people maintain same level of walking ability (Sernbo & Johnell,1993); 60% patients were affected by pains, over 30% of them had the pains to disturb their sleep, and the ability to perform

the daily activities also has been reduced. (Osnes et al., 2004) . As well, hip fracture results in high mortality. It was reported that “the risk of mortality in hip fracture patients (65 years or older) was 3-fold higher than that in the general population and included every major cause of death”. (Panula et al, 2011)

Furthermore, hip fracture may weaken mental health of older people greatly. As it suggested in Sernbo & Johnell’s (1993) work, that “decrease in walking capacity make patients more afraid to walk outdoors and for that reason impair even further the quality of life”. It is consistent with research of Salkeld et al. (2000),” 8% of women surveyed would rather be dead than experience the loss of independence and quality of life that results from a bad hip fracture”. In another word, hip fracture is one devastating illness which may result in isolation, dependence, vulnerability, lower self-image and confidence to older people, thus reduce the quality of life of them.

Due to deteriorating consequences of hip fracture which bring to elderly people, their families, caregivers, and the public health sectors, plenty of researches have been conducted for seeking causes and interventions for hip fractures of elderly people in last decades. Many researches stated that age-related osteoporosis and fall are major risk factors for hip fracture among elderly people. However, Parkkari et al. referred 98% of all hip fracture to the result of a fall which from the standing-height or less, and impact from the fall directly exerts on greater trochanter. This kind of sideways fall brings about 20 times higher possibility than other falls to sustain a hip fracture. (1999).

It is also stated that hip fracture mean threshold for the elderly is 2110N (Lotz & Hayes 1990), but this value much smaller than 5600N (see in Harada et al, 2001) which is estimated transfer from a fall to greater trochanter region. It indicates that without breaking a fall by hand or the like, elderly people are likely to sustain the hip fracture due to great impact pressed on the greater trochanter. This finding supports the result from Parkkari et al (1999) research in the mechanical aspect.

Accordingly, it seems that finding out the intervention either for preventing falls or for attenuating the impact from falling which directly acts on the greater trochanter, is a break-through point for preventing hip fractures among elderly people.

1.2 Current interventions for falls and hip fracture

Many interventions and programmes have been introduced into the practice of fall prevention, thereby preventing hip fracture, such as, balance and muscles exercises (Schardt, 2008, p11), medication review (Mackey& Nancarrow, 2006, p193), nutrition implement, (Mosekilde 2005, and Schardt , 2008, p10), vision examination and improvement (the college of optometrists, 2011), feet treatment and good footwear, (Mackey& Nancarrow, 2006, p195, and Menz,1999) and environmental risk factors exclusion (Akyol,2007; Garner, 1996; Johnson, 2010). Whilst a non-pharmacological method has attracted lots of attention from research field and health care practice, that is, external hip protector.

Hip protectors are a kind of protective clothing designed as the undergarment which containing pads at the side of the hip. Presently there are two types of hip protectors available in the market: 1) hard hip protectors which are designed for shunting impact of fall into the surrounding tissues, and 2) soft hip protectors which are meant to absorb the impact from a sideways fall. (Holzer et al, 2009). By wearing hip protectors, it is expected that impact transferred to hip area from a fall is reduced, thus the potential fracture and injuries on hip can be minimized.

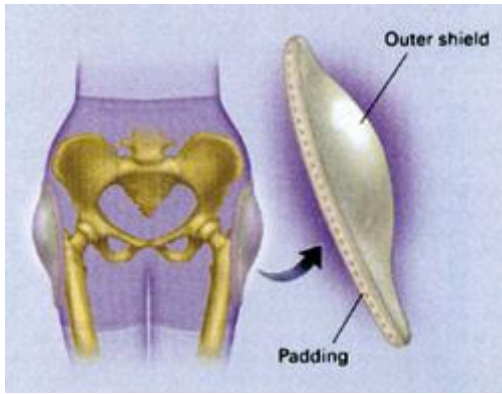


Figure 2: the hip protector: the two padded protectors are worn inside pockets on a stretchy undergarment. (Kannus et al, 2000)

2 RESEARCH AIMS AND QUESTIONS

In the light of potentially immediate effect on preventing hip fractures in elderly people, many researches have made efforts to explore the practical efficacy of hip protectors. Various methods have been employed, different aspects have been examined, and conflicting results obtained. In practice, the controversy about efficacy of hip protector may confuse the elderly people and health care professionals in application of the hip protector for preventing fall-related hip fracture among elderly people.

So that this literature review study means to sum up and present previous research results, thus provides an overall picture about efficacy of hip protector to elderly people and care professionals, as well tries to offer a theoretical reference to them for whether choosing the hip protectors as a part of intervention for hip fracture.

In guidance of this aim, the writer adopts the literature review as study method, through collecting and summarizing valuable information from related research field, attempts to answer following questions:

1. What results previous literatures have obtained concerning the efficacy of hip protector in preventing fall-related hip fracture among elderly people?
2. Which factors affected results in reviewed researches concerning the efficacy of hip protector?
3. How reviewed literature can be interpreted in term of “quality of life”?

3 THEORETICAL FRAME

This literature review study is undertaken on the theoretical basis of “quality of life”, since it has been a significant indicator in health care field for measurement of health outcomes, or consequences of care. (Bowling, 1998, p1)

There is no consensus over a definition of quality of life. Basically, “it is recognized as a concept representing individual responses to the physical, mental and social effects of illness on daily living which influence the extent to which personal satisfaction with life circumstances can be achieved.” ((Bowling, 1998, p6). In health-related aspect, this definition can be broken down into several dimensions, they are, physical, mental, social wellbeing, and personal satisfaction about life.

From current researches, the direct connection between hip fracture and life quality of older people can be easily traced, since several researchers have released pessimistic viewpoints about deteriorating effect on life quality following hip fracture (Randell et al, 2000; Salkeld et al, 2000; Jongjit et al, 2003, Fierens& Broos, 2006). Hence, it can be deduced that prevention of hip fractures among elderly people at least is beneficial to avoid the unnecessary loss of their quality of life.

Therefore, this review study is eager to find out a relatively intact picture about the efficacy of hip protector in preventing fall-related hip fracture of elderly people; in another word, seek possible intervention for securing the life quality of them.

4 METHOD OF STUDY

“Literature review is a comprehensive study and interpretation of literature that relates to a particular topic”. Through summarizing and analyzing the related research results, literature review seeks to present an overview picture of this research field. (Aveyard, 2007)

Working as a research methodology, literature review is required to be undertaken systematically to ensure the validity and reliability of the review. Thus the following issue should be clearly explained in a literature review study, for instance, how the research questions are identified? Why literature review is chosen as the research method? How to search for appropriate literature for answering the research questions? How the selected literatures are critiqued and finally how the information is brought together? Whilst processing of the above issue should be well documented. (Aveyard, 2007, p 16)

4.1 Justification of research method

To be a novice in geriatric care research field, it is hardly possible to conduct a randomised controlled trial (RCTs) which is commonly used to determine the effectiveness of a treatment or intervention in health care research (Aveyard, 2007 p 26), due to limitations in, such as, research experiences, time, financial funding, and accessibility to published literatures. So reviewing literature which adopts the method of randomized controlled trial and deal with the same research question(s) with the undertaking research study would be an optimal choice for the novice.

Secondly, literature review study can bring individual researches together to accomplish the jigsaw on one specific topic. It compensates the weakness of any individual research, since the real impact and study power of any single research cannot be determined. Thus literature review study is a good way for the novice researcher pursuing a

full picture on the studied field. In another way, it gives the possibility to provide overall and objective opinions from theoretical research to real life practice.

In conclusion, literature review as a research method, make up the new researcher's deficiency in experiences, time, funding, and accessibility to published and unpublished researches, etc. Also it reinforces the integration of the theory and practice for which is supposed to be the supreme aim for a polytechnic student. That is why literature review will be adopted in this study.

However, this is not a systematic review or meta-analysis, since the writer lacks in adequate ability and knowledge in launching neither systematic nor meta-analysis.

4.2 Data collection

4.2.1 Literature searching strategy

Articles involved in this review study were respectively collected from database SAGE, Academic Search Elite, CINAHL, Google Scholar and PUBMED, with the keyword of hip protectors, hip fracture or in combination. In addition, several articles were hand-searched by name which has been cross-referenced in selected articles from above databases.

The general inclusion criteria for selecting articles are:

1. English language only
2. Randomized controlled trial only
3. Published data only
4. Year 2000 onwards
5. Research based on either community or institutional aspect

The general exclusion criteria are:

1. Not directly relevant to research questions
2. Not the randomized controlled trail
3. Not accessible even displayed as “full text”.
4. Has repetitively appeared in other database.

Table1: literature searching record

Data-base	Searching engine	Keywords	Searching in	Limiters	Ob-tained	se-lected
SAGE	Advanced search	Hip protectors and hip fracture	abstract	none	4	3
Aca-demic Search Elite	Advanced search	Hip protectors	abstract or author-supplied abstract	1)full text 2)year 2003-2010	37	6
PUB-MED	Advanced search	Hip protectors and hip fracture	title/ abstract	free full text	24	4
CI-NAHL	Advanced search	Hip protectors	abstract	1)full text 2)2003-2011	18	2
Google le-scholar	Hand searching	literature name	none	none	11	11

4.2.2 Critical appraisal on selected literatures

All selected literatures should be carefully evaluated its strengths and weaknesses, and then determine its relevance and importance to the undertaking study. This is a process

which is taken by reading and re-reading selected literatures, and checking with the structured checklist.

Since all articles acquired for this study are quantitative research related to health care issues, so the critical appraisal tool suggested by Polit et al (2001) will be employed in this literature review study. It means all literatures will be critiqued from five dimensions which are listed below:

1. Substantive and theoretical dimensions
2. Methodological dimensions
3. Ethical dimensions
4. Interpretive dimensions
5. Presentation and stylistic dimensions

All 26 articles selected from mentioned database have been appraised critically by the checklist (see appendix) formed from these five dimensions. Finally 11 articles are taken into this literature review study.

Table 2: 11 articles which are taken into review study

Author	Randomized type	Sampling size(intervention/ control)	Follow-up period
Birks et al. (2003)	Pragmatic	182/184	Mean: 14 months
Birks et al.(2004)	Pragmatic	1388/2781 female	Mean: 28 months
Cameron et al. (2001)	Individual	86/88 female	18 months
Cameron et al. (2003)	Individual	302/298 female	2 years
Hallonran et al.(2004)	Cluster	40/87nursing home	72 weeks
Harada et al.(2001)	Individual	88/76 female	Mean:377 days
Kannus et al.(2000)	individual	650/1075	Over 18 months
Kiel et al. (2007) *	Cluster	37 nursing homes	20 months
Meyer et al.(2003)	Cluster	25/24nursing home	18 months

Von Schoor et al.(2003)	Individual	276/285	Mean:69.6 weeks
Woo et al. (2003)	Pragmatic	302/352	Mean:18.6/26.3 days

**Kiel et al (2007) recruited 37 nursing homes with totally 1042 subjects, and each of 1042 subjects was assigned to be either right/left sided hip protected. In other words, each of subjects is served as his or her own control.*

Birks et al. (2003) suggested that hip protectors did not benefit the older people with hip fracture history and living in community. 34% adherence rate was reported, and 6/2 (intervention/control) subjects sustained hip fracture again. One fractured the hip when hip protector was worn by falling, backwards. Fear of falling is slightly lower in intervention group than in control group. Reasons explaining the ineffectiveness of hip protector could be: 1) low hip fractures incidence, since subjects are relatively “healthy”, 2) low adherence.

Birks et al. (2004) published a pragmatic randomized controlled trial (RCTs). Old women living in community with high fracture risk and fall history were recruited. 39/66 (intervention/control) subjects fractured the hip, 2 of 39 worn the hip protector when they fell, and 1 fell backwards. 38% was the optimal adherence rate. It also reported less falls and fear of falling were found in intervention group. Conclusion made after data was analyzed by intention-to-treat method, that hip protectors provide no evidence of effect on hip fracture prevention. Reasons for ineffectiveness in this research were low adherence and low hip fracture incidence.

In Cameron et al. (2001) research, participants were female those with fall history, at least one hip without previous surgery, not bed-or chair-fasted residents, from either nursing home or hostel. 8/7 (intervention/control) hip fracture occurred; none sustained the fracture when protector was worn while falling. 57% adherence rate was reported, but it was counted by half of the day. Authors stated that the efficacy of hip protectors couldn't be firmly concluded because of small sampling; however, it appeared that hip protectors were technically able to prevent hip fracture, but the key issue is adherence.

In Cameron et al. (2003) research, old women living in community with sufficient cognitive function, fracture history and high fracture risk were randomly allocated to either intervention or control group. It was reported that 21/22 (intervention and control) subjects sustained hip fractures. With mean adherence about 53%, 3 subjects broke hip when hip protector was worn, 2 of 3 fell backwards. 5% subjects reported adverse effect. By intention-to-treat analysis, researchers concluded that hip protector prevented hip fracture when was worn at falling, but overall effectiveness was not established, because of incomplete adherence, limited statistics power and poor mechanical capacity of hip protectors.

Halloran et al. (2004) introduced hip protectors and related knowledge to eligible participants in intervention group, and compared the hip fracture incidence rate with control group. 85/163(intervention/control) got hip fractures, and 11 of them fractured while using protectors. The initial adherence is 37.2%. Conclusion is hip protectors did not reduce the hip fracture rate in nursing home. Reasons could be: 1) low adherence, 2) protectors was not efficacious 3) ones with hip fracture risk were not those most likely to wear the protectors. Intention-to-treat was employed as analysis tool.

Harada et al. (2001) examined female subjects who were categorized as living in high-level care nursing home, ADLs level is better than wheelchair-mobile, and have the ability to stand unaided. 1 and 8 hip fractures occurred in intervention and control group respectively, and this only one fracture in intervention group did not wear protector when he/she fell. Adherence is extraordinarily high, 70% of all subjects were worn 24h/day. They concluded that hip protector is an effective device for preventing hip fracture. But the sampling size was small, and fall severity was unclear.

Kannus et al. (2000) documented that hip fracture risk can be reduced by 60% by using hip protector. Subjects were ambulant but frail older people with high fracture risk, and living in institutions or homes but need assistance. In total, 13/67(intervention/control) subjects fractured their hip, 4 of 13 fractured when protector was worn. Mean adherence

is 48%, 17 subjects reported adverse event. Reasons for this optimistic result are: 1) compliance rate is preferable 2) hip protector biomechanical capacity is well documented 3) statistics power is high. However, this trial has refilled the subjects when dropout occurred, after randomization.

Kiel et al. (2007) conducted a unique trial, which 1-sided, energy-absorbing and energy-dispersing combined hip protector was assigned to targeted subjects who match criteria: 1) nursing home residents 2) attention to walk without assistance or get out from chair or bed in past 4 weeks 3) no terminal illness 4) no hip replacement and bilateral hip fractures 5) no contagious disease 6) no skin problem 7) hip circumference of 122 cm or less 8) absence of a nursing home staff recommendation not to enroll. Totally 21 fractures happened in protected hip and 17 happened on unprotected hip, at least 7 fractures happened when protector was worn at protected side. Adherence achieved 73.8%. By both intention-to-treat analysis and examination among subjects whose adherence is over 80%, they concluded that hip protector had no preventive effect on risk of hip fracture. 16 skin-related adverse events were reported, and mean change in the fear of falling was non-significant.

Meyer et al. (2003) reported hip protector resulted in 40% relative reduction of hip fracture. This cluster randomized controlled trial was taken in older people who live in institutions, with high risk of falling and poor physical condition. 21/42 (intervention/control) broken the hip, 4 was wearing the protector at fall event. No adherence was reported.

Von Schoor et al. (2003) inspected the hip protector effectiveness by following 561 older participants with low bone density, high fall risk and increasing dependence. Hip protectors and education were provided as interventions. Totally 18/20 (intervention/control) hip fractures occurred, and 4 persons broke the hip when protector was worn. The highest adherence rate was 61%. By both of intention-to-treat analysis and per protocol analysis, hip protector was not effective in preventing hip fracture.

Woo et al (2003) examined efficacy of a specially designed hip protector which suits Asian subjects and subtropical climate. Institutional residents with high risk of fall but ambulant were recruited. 2 and 13 hip fractures happened respectively in intervention and control group, 1 was fractured with protector. The conclusion was that this special designed hip protector could reduce hip fracture rate. And more interesting finding was that 77% of subjects believed that protectors against hip fracture in the event of fall.

4.3 Data analysis

“Content analysis is a research technique for making replicable and valid inference from texts (or other meaningful matter) to the contexts of their use”, Krippendorff stated in his works. (2004, p18).

Through content analysis, condensed and broad description of a phenomenon will be chased, new insights will be provided, and the understanding of this phenomenon certainly will be deepened. (Elo & Kyngäs, 2007)

Whilst, as a research technique, Krippendorff (2004, p18) believes that content analysis is a reliable and valid means to describe and qualify a phenomenon, if the inference which got from text can be replicated and scrutinized.

Content analysis can be applied to both qualitative and quantitative data in inductive or deductive way. (Elo & Kyngäs, 2007). Deductive approach works from more general theory to the more specific observation, the conclusion logically follows the premise; on the contrary, inductive approach moves from more specific observations to broader generalization and theories, and the conclusion made on the basis of premise. (Aqil Burney, 2008).

Due to the purpose and research questions set for undertaking this literature review study, both inductive and deductive content analysis will be taken as the methods to analyze data.

By inductive approach, it is expected that a comprehensive and reliable picture concerning factors which affect the result of effectiveness examination of hip protectors will be obtained. The approach is employed for answering the second research question in this study. And it starts from opening coding, then moves to create categories, and ends with abstraction, as Elo & Kyngäs (2007) suggested.

By deductive approach, the previous concept, theory or models are expected to be re-tested in the new context. This approach, as Elo & Kangäs (2007) discussed, starts with establishing a category matrix, and then code the data according to categories. Deductive approach is used in this study for answering the third research question.

5 ETHICAL CONCERNS

Kumar Ranjit cited the definition about “ethics” from Collin Dictionary, as “in accordance with principles of conduct that are considered correct, especially those of a given profession or group”. (2011, p242). Meanwhile he stated there is one crucial ethical consideration relating to the researcher should be always kept in mind while conducting a research, that is, avoid the bias. (P246-247).

Based on the nature of this ongoing literature review study, the writer puts efforts on avoiding any possible bias in aspects of searching, collecting, analyzing and presenting the data.

All involved articles were searched from reliable database with identical inclusion and exclusion criteria; hand researching articles were collected by cross-referencing from any article which takes the similar research questions and which is accessible to the

writer; and all selected literatures have been critically appraised by a well-structured checking list.

For analyzing related data, qualitative content analysis will be used as the method. The analyzing process will be performed under guidances of Elo & Kyngäs (2007)'. None hypothesis is allowed to go along with reviewing and analyzing selected literatures. All data which sums up from involved articles would be expressed in an original way as much as possible to avoid misinterpretation of original literature.

The result will be presented objectively without any hypothesis, any personal interests, and any pressure from the external environment.

This literature review study obtains the knowledge through reading and summarizing results from previous researches. It is not an empirical study where human beings act as study subjects, or data collected or classified from human beings (Arcada, 2010). Thus there is no need to apply for permission from Arcada ethics board concerning this point before conducting this study.

6 RESULTS OF STUDY

All eleven reviewed articles aimed to determine the efficacy of hip protectors in preventing fall-related hip fracture among elderly people. Researches have been respectively conducted from year 2000 to 2007 in America, Finland, Germany, Hong Kong, Japan, Netherland, two in Australia, and three in UK.

Randomized controlled trials (RCTs) was the fundamental method that has been adopted in these researches. However, based on the own research design, the method has been performed in different levels and patterns, such as cluster, individual and pragmatic randomized controlled.

Sample sizes involved in these 11 trials ranged from 164 to over 4000 persons or occupied beds. Four trials (Birks et al, 2004; Cameron et al, 2001; Cameron et al, 2003; Harada et al, 2001) only took female as research subjects. Three trials (Birks et al, 2003; Birks et al, 2004; Cameron et al 2003) recruited samples from community, also Kannus et al (2000) and Von Schoor et al (2003) partly enrolled their samples from homes for elderly or apartment house where assistances can be offered if needed. The remaining 6 trials recruited subjects from institutions.

The mean follow-up periods were varied from the shortest which was less than one month (Woo et al, 2003) and the longest which was over 2 years (Birks et al, 2004).

Interventions in researches mainly were provision of hip protectors to targeted subjects or groups, one of them was combined with structured education programme. (Meyer et al, 2003) However, in half of eleven trials, information about hip fracture risks, consequences, preventions, issue of hip protectors, and so on, more or less were introduced to people involved.

There are totally six researches (Birks et al,2003; Birks et al, 2004; Cameron et al,2001, Halloran et al,2004; Meyer et al,2003; Von Schoor et al, 2003) that used SafeHip as the experimental hip protector; two of all (Kannus et al,2000; Kiel et al,2007) adopted energy shunting and absorbing combined hip protector in their researches; Cameron et al (2003) undertook the experiment by a semirigid shield hip protector; Halloran et al (2004) examined a shell-shaped polypropylene hip protector; and Woo et al (2003) designed a specific hip protector for Asian body build and humid climate.

6.1 What results previous researches obtained

This section is concentrating on solving the first question of this literature review study, “what results previous researches obtained concerning efficacy of hip protector in preventing fall-related fracture among elderly people?”

All reviewed literatures seek to understand how the external hip protector help in the prevention of hip fractures. Since each of the research differed from each other in study method, sampling size and resources, follow-up period, interventions, and data analysis tool; results obtained from these researches consequently are different, and conflicting.

Six of all researches clearly stated that hip protector is not an effective device in prevention of hip fracture; three researches confirmed that hip protectors could reduce the incidence of hip fractures; Meyer et al (2003) concluded that hip protectors may reduce the number of hip fractures, because 40% relative reduction of hip fractures had been detected by providing education and free hip protectors to intervention group in his study; and Cameron et al (2003) said the overall efficacy of hip protectors was not established, but it would prevent hip fractures if protectors were worn at the time of falling.

6.1.1 Negative results of reviewed literatures

There are six researches that reported negative results of effectiveness of hip protectors in preventing hip fracture incidence. Four of them are individual randomized controlled trial, including two in which participants were enrolled from community and other two

from nursing home; the remaining two trials are cluster randomized controlled in which participants were taken from nursing homes.

In four individual randomized controlled trials, Birks et al. (2003) and Birks et al. (2004) shared several characters in common, for instance, participants were enrolled from communities and numbers of fall and hip fractures were self-reported by participants and then confirmed by general practitioners. However, there were differences between them, 1) the population and follow-up periods involved in Birks et al. (2003) were much less than in Birks et al. (2004), 2) Birks et al. (2004) only studied women population, and data were analyzed by the intention-to-treat analysis. Both of researches admitted that low adherence and incidence of hip fractures reduced their study power.

Cameron et al. (2001) launched an individual randomized controlled trial. Samplings were taken from nursing home or hostel, and the size was comparatively small. Therefore they came up with the conclusion---“that hip protectors were not effective in reducing the incidence of hip fracture in high-risk population”--- was limited by the low statistical power and incomplete adherence.

Another individual randomized controlled trial was performed by Von Schoor et al. (2003). Research team qualified participants by measuring their bone density with ultrasound, assessed their risks for hip fractures, and ensured the targeted population was those ones with low bone density and high risks for fracturing their hip. Data was analyzed by both methods of intention-to-treat and per protocol analysis, there was no significant reduction of hip fracture incidence was detected. Researchers thought that possible causes for this negative result including incomplete compliance, and lower impact effectiveness of hip protector than expected.

Halloran et al. (2004), Kiel et al. (2007) have executed cluster randomized controlled trials in which nursing homes acted as the clusters. Nevertheless two researches were totally distinct from each other. Halloran et al. (2004) is an ordinary one in which three

kinds of nursing homes were randomly allocated to either intervention or control group in a 1:2 ratio. Interventions were well introduced, related nursing staffs were encouraged to be involved, and even ineligible residents were replaced by new eligible entrants. After all, negative opinion about effectiveness in prevention of hip fracture was chased by intention-to-treat analysis. Researchers analyzed that three factors may respond to this result: 1) hip protectors was not always efficacious 2) low level of adherence 3) those most at risk were not those most likely to wear the protector.

Kiel et al. (2007) generated a very unique and original cluster randomized controlled trial. For avoiding the potential methodological bias which introduced by cluster and individual randomization, Kiel and his colleagues designed the 1—side with principle of energy-shunting and absorbing combined hip protector for research objects. Nursing home residents were assigned randomly either to wear left or right-side protected hip protector. It means everyone acted as his own control. To guarantee reasonably constant census of active residents, researchers introduced two weeks run-in period, as well replaced resident who withdrew from the study. Also research assistant visited the nursing home three times per week, in every shift and days of the week without announcement for examining adherence rate. Finally by the intention-to-treat analysis, the incidence rate of hip fracture on protected hips didn't differ from unprotected hips.

6.1.2 Positive results of reviewed literatures

There are three reviewed literature confirming the effectiveness of hip protector in preventing fall-related fractures, they are, Harada et al. (2001), Kannus et al. (2000) and Woo et al.(2003).

Harada et al. (2001) randomly assigned 164 female resident living in nursing home either to intervention or to control group. A shell-shaped protector was suggested to wear complete 24 hours per day. Though result of this research was positive, yet authors discussed that sampling size was small and limited generalization of this result in community, since it was obtained from high-level care nursing home.

Kannus et al. (2000) was an individual randomized controlled trial which conducted in Finland. Participant with high risks of hip fracture but ambulant were recruited from nursing home or outpatient care unit. It was reported that risk of fracture can be reduced by 60% with mean adherence of 48%. Whereas the drop-out study positions because of death, hip fractures, withdrawal of consent or onset of un-ambulant were refilled in this study, after randomization.

There was a specially designed hip protector for Asian subject and subtropical climate appeared in Woo et al. (2003) research. The conclusion from the research was this protector and shorts were useful in reducing fractures, particularly in rehabilitation setting. However it could not be ignored that follow-up period was short, incidence of hip fracture during the follow-up period was low, and also compliance was mentioned as the main problem.

6.1.3 Other results of reviewed literatures

There is an individual randomized controlled trial which was undertaken in older community living women in Australia by Cameron et al. (2003). On an intention-to-treat analysis, the risk of sustaining fracture during falls while wearing hip protectors, compared with a fall without wearing protector, was reduced 0.23. Therefore the author concluded that hip protectors prevented hip fracture if it is worn in the event of fall. Meanwhile, the author discussed, that due to the incomplete adherence, the inability of

hip protectors to prevent hip fracture in a few cases and limited statistics power in this research, the overall effectiveness of hip protector was not established.

Meyer et al. (2003) concluded in their cluster randomized controlled trial, that protector may reduce the number of hip fractures, because “increasing the use of hip protectors resulted in a relative reduction of hip fracture of about 40%”. But they also mentioned “failure to present adherence rate and fewer fallers in intervention group that remain open to various interpretations”.

6.2 Which factors affect results of reviewed literatures

This section strives to answer the second research question of this literature review study, that “What factors affected results in reviewed researches concerning the efficacy of hip protector?”

From reviewed articles, it can be concluded that, to date, evidences from randomized controlled trial are not yet determined as to whether hip protectors can prevent hip fracture among elderly people. However it does not necessarily mean that hip protector is not an effective device for preventing hip fracture among elderly people, since many factors have the potential to reduce effectiveness of hip protectors in the research. For clarifying factors which may influence results of hip protector efficacy examination, all related items appearing in result analysis from reviewed articles are listed below: (figure 3) , the inductive content analysis approach is used in this sector:

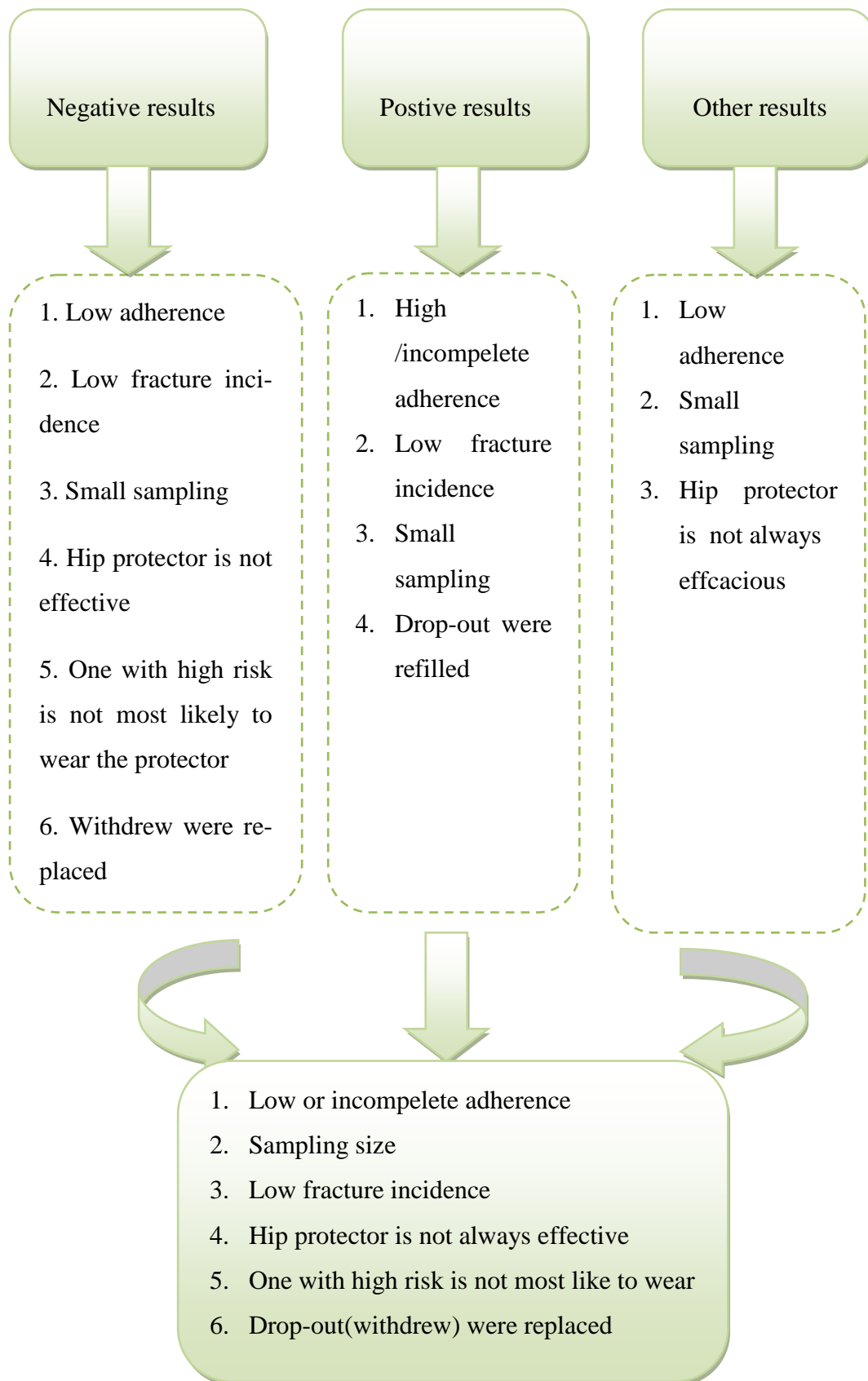


Figure 3: factors may affect results of efficacy examination of hip protector

From the figure 3, we can see that adherence rate has a great influence on the result of efficacy examination of hip protector. The principle of hip protector is a device designed for protecting great trochanter area by wearing it, thus it is impossible to detect its effectiveness without putting it on. It was presented from 30% to 73% of adherence in these reviewed articles. In a whole, 6 articles discussed that possible reason for results of ineffectiveness of hip protectors because of low or incomplete adherence (compliance). Woo et al. (2003) also admitted that adherence is main problem in their research, even though the figures was not reported. Only 3 trials reported satisfactory adherence rate. However, Meyer et al. (2003) failed to state the adherence rate either, but they argued that “increasing in compliance may not necessarily relate to an equivalent decrease in fractures”, since hip protectors are supposed to be most beneficial for those with high risk of fracture.

The second factor could be the sampling size. Big sampling size certainly enhances the power of study and validity of application of research result, but it greatly depended on funding, sampling inclusion criteria and scientific study capacity of researchers. Therefore it is not always realistic to have admirable sampling size for study, like it was mentioned in Birks et al. (2003), Cameron et al. (2001), and Harada et al. (2001).

The third factor could be the hip fracture incidence. Supposed hip protector was compliant at the event of fall, participants with high risks for sustaining the hip fracture theoretically to be more benefitted, such as Meyer et al. (2003) suggested. This conclusion is consistent with findings from Harada et al. (2001) and Halloran et al. (2004). Therefore when participants were enrolled from community (like Birks et al. (2003) and Birks et al. (2004)) or participants themselves were in comparatively better physical conditions, low hip fracture incidence occurring in the trial is comprehensible. That is one reason explaining result of ineffectiveness of hip protector.

The fourth factor which affects the result of examining hip protector efficacy is related to sampling processing. In Kannus et al. (2000), the drop-out positions were replaced by new eligible entrants after randomization. It was been criticized by Torgerson and Birks (2002), since it did not use intention-to-treat analysis.” it violated some important meth-

odological criteria for sound randomized trial”. Same flaw happened in Kiel et al. (2007) in which withdraw participants were refilled.

Other factor involves in presenting result of hip protector efficacy is biomechanical ability of hip protect itself. Besides Cameron et al. (2001) and Harada et al. (2001), every reviewed literature released numbers of hip fracture when hip protector was worn at event of fall. Moreover, there is only one participant fractured the hip in intervention group in Harada et al. (2001), and this one fractured without wearing the hip protector. Involuntarily it generates the question, does hip protector really have the capacity to protect the hip? Halloran et al. (2004) and Kannus et al. (2000) gave a negative point of view towards this question.

6.3 How literatures interpreted in terms of quality of life

This section answers the third research question of this literature review study, that is, “how reviewed literatures are interpreted in terms of quality of life”?

According to Bowling (1998, P6), quality of life refers to “individual responses to the physical, mental and social effects of illness on daily living which influence the extent to which personal satisfaction with life circumstances can be achieved”. It means quality of life as an item which aims to measure the level of acknowledge of people about their own and their life, is supposed to be examined or interpreted from three aspects, physical, mental and social aspect. Therefore all reviewed articles will be read through again according to these three categories of quality of life. Deductive content analysis approach will be adopted in this section. See figure 4.

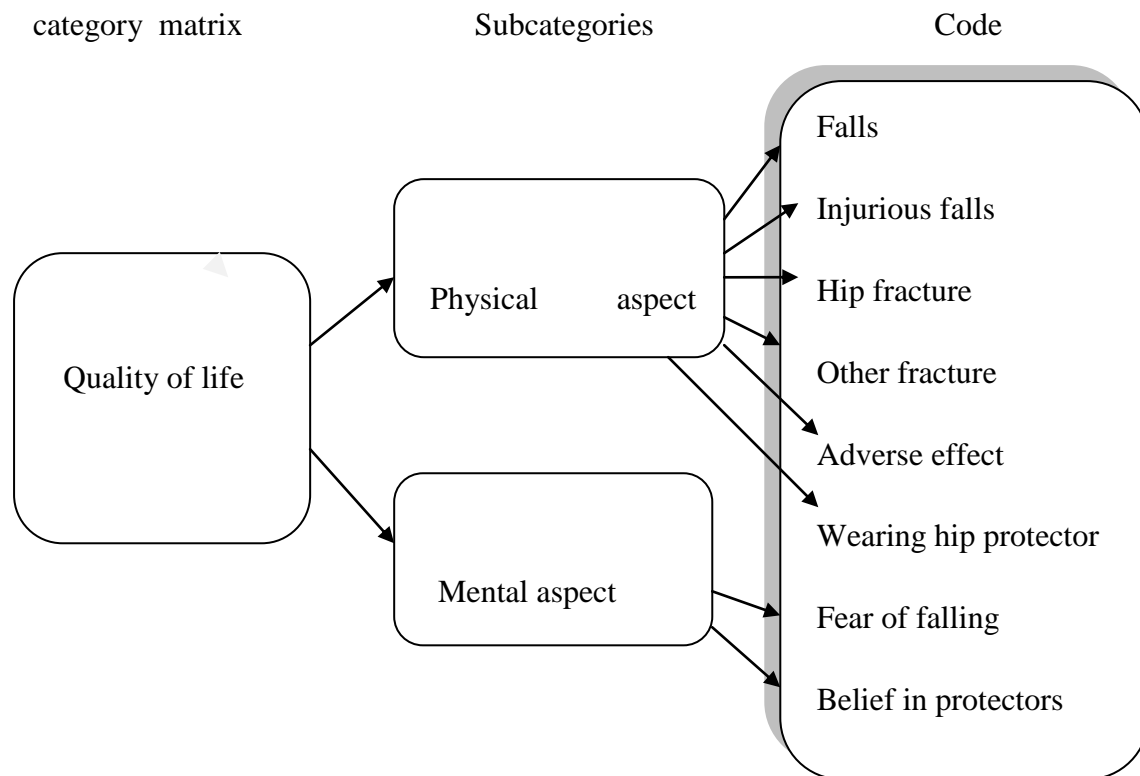


Figure 4: fall, hip fracture and quality of life

From this figure, we can see that quality of life indeed includes the physical aspect and mental aspect relating to the health of human being that is proven by 11 reviewed articles. In this case, the physical aspect of life quality embodies fall, injurious falls, hip fracture, other fracture, adverse effect reported from wearing the hip protector, and wearing hip protector itself. There is no need to explain more about how fall and fracture affect the quality of life in a negative way, since they have been discussed before in the study. Moreover, the adverse effect reported from wearing hip protector absolutely affects the physical health of older people, since skin gets irritated even broken from wearing it. As well, if hip protector is required to be worn all day and night, the discomfort resulted from wearing it certainly should be taken into account of physical aspect of life quality. Discomfort is one reason of low adherence.

11 articles also demonstrate the mental aspect of quality of life, since codes show that 77% subject believe that hip protector can protect the hip and fear of falling has declined by wearing the hip protector. It implies that with wearing hip protector, subjects

may be more confident in moving, walking out, performing the daily activities by themselves, and participating in social life which definitely benefit their mental and psychological health. Moreover, with wearing hip protector, it may cause aesthetic concerns to elderly people. This perhaps affects the mental aspect of life quality in a negative way.

The social aspect of quality of life is not directly shown in this figure. But it can be interpreted from codes which are selected from reviewed articles. When person has the sound physical and mental health condition, it without doubt enhances the possibility for elderly people to join in the society and preferable social life, it strengthens the feeling of “social belonging”, which is crucial for everybody, of course, also for elderly people.

7 CRITICAL REVIEW

Two main weaknesses cannot be ignored in this study. First of all, as a polytechnic student, the writer is not yet equipped with knowledge of some research method and statistical analysis tools mentioned in reviewed articles. Though by searching names of them, the write has already obtained and learnt about “intention-to-treat analysis”, “number needed to treat”, “content analysis process” and “pragmatic randomized controlled trial”, there is still shortage of knowledge on statistical analysis tools. It may result in incomplete or deficient understanding in knowledge which hides behind the numbers and figures in reviewed articles.

Another limitation is that the write is not capable to pursue all materials which may benefit this literature review study, since some of them are not available from the Arcada searching engine.

8 DISCUSSION AND CONCLUSION

The efficacy of hip protector in preventing fall-related hip fracture is not yet determined, since results from existing researches are conflicting. Even though efforts which have been put in researches concerning this issue should be appreciated and applauded, because the genuine intention behind these researches are promoting the life quality of elderly people, our senior generation, and one day ourselves.

However, there are some thoughts have been inspired by these reviewed literatures. By presenting them, the writer hopes to enlighten the future research with research ideas or topics.

First of all, there are three articles (Birks et al.,2003; Birks et al. 2004; Cameron et al.,2003) reported several cases that participants fractured hip with wearing the protector at the time of fall, backwards. As we all known that hip fracture is mainly resulted from a sideways fall which impact from the fall directly exerts on greater trochanter area. How backward fall results in hip fracture, is this just coincidence or there is some mechanism? This is an undiscovered field which needs to be explored in the future.

The second issue is still concerning the case of hip fracture when hip protector was worn at falling. Suppose, the purpose of research is finding out the real efficacy of hip protector in preventing hip fracture; so is it more reasonable in the future research that main outcome of trial measured by the item " number of hip fractures when hip protector is worn at time of fall" , instead of the item " number of hip fractures"?

In conclusion, totally 11 randomized controlled trials were read and analyzed for exploring the efficacy of hip protector in preventing fall-related hip fracture among elderly people. Until now, the overall efficacy of hip protector is not established yet, since results from reviewed articles are conflicting. But it has been explored during the literature reviewing which factors influence the result of efficacy examination of hip protectors, they are, adherence, hip fracture incidence, sampling size and resources, sampling processing, the biomechanical capacity of hip protector, and person with high risk is not

always the one wearing the protector. Meanwhile, quality of life concerning the issue of hip fracture and hip protection were examined from physical, mental and social aspects in these 11 articles.

Moreover, there are two suggestions for the future research concerning the hip protector efficacy are: 1) the connection between backwards fall and hip fracture should be explored; 2) the item of “number of hip fracture when hip protector is worn at the time of fall” supposed to be measured as the main outcome of trial which aims to investigate the efficacy of hip protector instead of the item “number of hip fracture”.

9 REFERENCES

Akyol Asiye Durmaz, *Falls in the elderly: what can be done?* International Nursing Review Volume 54, Issue 2, pages 191–196, June 2007

Aqil Berney S.M,2008. *Inductive and deductive research approach.*

<http://www.drburney.net/INDUCTIVE%20&%20DEDUCTIVE%20RESEARCH%20APPROACH%2006032008.pdf> (accessed on 25,11,2011)

Arcada. 27,01,2010. *Ethic committee.* <http://studieguide.arcada.fi/en/study-arcada/degree-thesis/-ethical-committee> (accessed on 17,11,2011)

Aveyard Helen.2007, *Doing a literature review in health& social care, a practical guide.* England: Open University press.

Birks Yvonne F, Hildreth Ruth, Campbell Peter, Sharpe Christine, Torgerson David J, Watt Ian, 2003. *Randomized controlled trial of hip protectors for the prevention of second hip fractures.* Age and ageing. Volume 32, No 4. British geriatric society.

Birks Yvonne F, Porthouse Jill, Addie Caroline, Loughney Karen, Saxon Lucy, Baverstock Mike, Francis Roger M., Reid David M., Watt Ian, Torgerson David J, 2004. *Randomized controlled trial of hip protectors among women living in community.* Osteoporosis international, 15:701-706.

Bowling Ann, 1997. *Measuring health: a review of quality of life measurement scales*. Open University Press. England and USA. ISBN 0-335-19754 X (pbk).

Cameron I D, Cumming R G, Kurrle S E, Quine S, Lockwood K, Salkeld G, Finnegan T, 2003. *A randomized trial of hip protector use by frail older women living in their own homes*. *Injury prevention* 9:138-141.

Cameron Ian D, Venman Jennifer, Kurrle Susan E, Lockwood Keri, Birks Carol, Cumming Robert G, Quine Susan, Bashford Guy. *Hip protectors in aged-care facilities: a randomized trial of use by individual higher-risk residents*. *Age and Ageing* 2001, 30:477-481.

Elo Satu & Kyngäs Helvi , 2007. *The qualitative content analysis process*. JAN research methodology. Blackwell Publishing Ltd.

Fierens J& Broos P.L.O,2006. *Quality of life after hip fracture surgery in the elderly*. *Acta Chir Belg*.106:393-396.

Garner Everald, 1996, *Preventing falls in public place, challenge and opportunity for local government*, ISBN 0 7310 5048 7

Gullberg B., Johnell O. I, Kanis J.A. *World-wide projection for hip fractures*. *Osteoporosis International* (1997) 7:407-413.

Halloran Peter D.O, Gran Gordon W., Beringer Timothy R.O., Kernohan George, Neill Ciaran O., Orr Jean, Dunlop Louise, Murray Liam J., 2004. *A cluster randomized controlled trial to evaluate a policy of making hip protectors available to residents of nursing homes*. *Age and ageing*, Vol 33:582-588.

Harada A, Mizuno M, Takemura M, Tokuda H, Okuizumi H, Niino N,2001. *Hip fracture prevention trial using hip protectors in Japanese nursing homes*. *Osteoporosis international*.12:215-221

Holzer Lukas A., von Skrbensky Gorbet, Holzer Gerold. *Mechanical testing of different hip protectors according to a European Standard*. *Care Injured* 40 (2009) 1172-1175.

Johnson Teddi Dineley, July 2010, *Safety tips can help you avoid a fall*, *The National's Health*

Jongjit Jithathai, Komsopapong Ladda, Songjakkeaw Pramook ,Kongsakon, Ronachai.(2003) *Health-related quality of life after hip fracture in the elderly community-dwelling*. *The southeast Asian journal of tropical medicine and public health*. Volume: 34, Issue :3, Page 670-674. PUBMED:15115149

Kannus Pekka, Leiponen Petri, Parkkari Jari, Palvanen Mika, Järvinen Markku, (2006). *A sideways fall and hip fracture*. *ELSEVIER: Bone* 39(2006) 383-384.

Kannus Pekka, Niemi Seppo, Parkkari Jari, Palvanen Mika, Vuori Ilkka, Järvinen Markku, 1999. *Hip fractures in Finland between 1970 and 1997 and predictions for the future*. *The Lancet*. Vol 353, March 6,1999.

Kannus Pekka & Parkkari Jari,(2006). *Prevention hip fractures with hip protectors*. *Age and ageing* 2006;35-s2:ii51-ii54. Doi:10.1093/ageing/af1087

Kannus Pekka, Parkkari Jari, Niemi Seppo, Pasanen Matti, Palvanen Mika, Järvinen Markku, Vuori Ilkka.(23.Nov.2000) *Prevention of hip fracture in elderly people with use of a hip protector*. *The New England journal of medicine*. Volume 343, No.21.

Kannus Pekka, Sievänen Harri, Palvanen Mika, Järvinen Teppo, Parkkari Jari. *Prevention of falls and consequent injuries in elderly people*. Lancet 2000; 366:1885-93

Kiel Douglas P, Magaziner Jay, Zimmerman Sheryl, Ball Linda, Barton Bruce A, Brown Kathleen M, Stone Judith P, Dewkett Dawn, Birge Stanley J, 2007. *Efficacy of a hip protector to prevent hip fracture in nursing home residents, the HIP PRO randomized controlled trial*. (Reprinted) JAMA, July 25, 2007. Vol 298, No 4.

Krippendorff Klaus, 2004. *Content analysis, an introduction to its methodology*. SAGE publications, Inc. Second edition. ISBN 978-0-7619-1544-7. P18

Kumar Ranjit, 2011. *Research methodology, a step-by-step guide for beginners*. SAGE. Third edition. ISBN 978-1-84920-300-5. P242

Lotz Jeffery & Hayes Wilson C, 1990. *The use of quantitative computed tomography to estimate risk of fracture of the hip from falls*. The journal of bone and joint surgery. Vol:72 A, No 5.

Mackey Hazel & Nancarrow Susan, 2006, *Enabling independence, A guide for rehabilitation workers*, Blackwell publishing, P193

Menz Hylton B. & Lord Stephen R. July, 1999. *Footwear and postural stability in older people*. Journal of the American Podiatric Medical Association. Volume 89. No.7.

Meyer Gabriele, Warnke Andrea, Bender R, Muhlhauser. January 11, 2003. *Effect on hip fractures of increased use of hip protectors in nursing homes: clustered randomized controlled trial*. BMJ:Volume 326.

Mosekilde Leif, *Vitamin D and the elderly*, *Clinical Endocrinology* (2005) **62**, 265–281

Osnes E.K, Lofthus C.M, Meyer H.E, Falch J.A, Nordsletten L, Cappelen I, Kristiansen I. S. *Consequences of hip fracture on activities of daily life and residential needs*. *Osteoporos Int* (2004) 15:567-574. DOI: 10.1007/s 00198-003-1583-0

Panula Jorma, Pihlajamäki Harri, Mattila Ville M, Jaatinen Pekka, Vahlberg Tero, Aarnio Pertti, Kivelä Sirkka-Liisa. *Mortality and cause of death in hip fracture patients aged 65 or older- a population based study*. *BMC Musculoskeletal Disorders* 2011, 12:105.

Parkkari J, Kannus P, Palvanen M, Natri A, Vainio J, Aho H, Vuori I, Järvinen M. *Majority of hip fractures occurs as a result of a fall and the impact on the greater trochanter of the femur: a prospective controlled hip fracture study with 206 consecutive patients*. *Calcif Tissue Int* (1999) 65:183–187

Patient UK, 2011. *Hip fracture*. Reviewed: 8 Sep 2011, DocID: 12410, Version: 2. <http://www.patient.co.uk/health/Hip-Fracture.htm> (access on 28, 11, 2011)

Polit Denise F, Beck Cheryl Tatono, Bernadette P, 2001. Hungler. *Essentials of nursing research, methods, appraisal and utilization*. The 5th edition. Lippincott. P416-421.

Randell AG, Nguyen TV, Bharlerao N, Silverman SL, Sambrook PN, Eisman JA. *Deterioration in quality of life following hip fracture: a prospective study*. *Osteoporos Int*. 2000; 11(5):460-6.

Salkeld G, Cameron I D, Cumming R G, Easter S, Seymour J, Kurrle S E, and Quine S, (2000) *Quality of life related to fear of falling and hip fracture in older women: a time trade off study*. BMJ; 320(7231): 341–346.

Schardt David ,*All fall down, how to cut your risk of falls*, Nutrition Action Helathletter, July/August 2008, P11

Sernbo I & Johnell O, 1993. *Consequences of a hip fracture: a prospective study over 1 year*. Osteoporos Int (1993) 3:148-153

Sveistrup Heidi & Lockett Donna. Oct, 2003. *Hip Protectors and Community-Living Seniors: A Review of the Literature*. Tools for Living Well Project. University of otta-wa.

The college of optometrists, 2011. The importance of vision in preventing falls. <http://www.college-optometrists.org/en/utilities/document-summary.cfm/docid/99A3825F-3E6C-44DA-994D4B42DC1AF5A4> (accessed on 12,11,2011)

Torgerson David & Birks Yvonne. *Purity, pragmatism and hip protector pads*. Age and Ageing. 2002, 31:319-325

Von Schoor Natasja M., Smit Johannes H, Twisk Jos W.R, Bouter Lex M, Lips Paul. *Prevention of hip fractures by external hip protectors, a randomized controlled trial*. JAMA. April 16,2003. Vol 289. No.15. 1957-1962.

Woo J, Sum C, Yiu HH, Lp K, Chung L, Ho L, 2003. *Efficacy of a specially designed hip protector for hip fracture prevention and compliance with use in elderly Hong Kong Chinese*. *Clinical rehabilitation* 17:203-205.

10 APPENDICES

First step: substantive and theoretical dimension	Yes	No
--	------------	-----------

1. Does research question contribute to existing body of knowledge?
2. Is there an appropriate study design?
3. Does research question fit for larger theoretical context?

Second step: methodological dimension

1. Is research question well addressed by designed method?
2. Are the criteria for sampling well documented?
3. Is the method for sampling appropriate?
4. Is there bias in sampling?
5. Is the sampling size adequate?
6. Is the way for data collection the best one for solving research question?
7. Is the data analysis suitable for this research?
8. Are tables and figures understandable and logically presented?
9. Are the results clearly presented?

Third steps: ethical dimension

1. Is there any ethical problem in the research?

Forth steps: interpretive dimension

1. Is there conclusion or interpretation for all important results?
2. Is there any limitation of research been discussed?
3. Is there any explanation for results been discussed?
4. Is there any recommendation or/and implication for practice been discussed?

Fifth steps: presentation and stylistic dimension

1. Does the title adequate capture the key concepts of the research?
2. Does the abstract adequately summarize the research problem, study methods and important findings?
3. Is the writing in research clear, concise and well organized?

