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Compression Stockings: Are we doing it right?

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This thesis is worth 30 study points

Summary

The word's population is ageing. Life expectancy has been in a rapid rise in the past decades and the world is facing a tremendous challenge with an increasing elderly population. Norway alone is expecting 1.3 millions of old people (> 70 years) in the year 2060. With an advancing age the risk of arterial and venous diseases also increases. These means an increasing demand in compression stockings therapy, as it is the golden standard in treating venous leg ulcers. But one major pitfall in compression therapy is prescribing to a patient with reduced blood flow in the limb due to medical condition called peripheral arterial disease (PAD) and this mistake can be avoided if Ankle Brachial Index (ABI) assessment is done prior to initiation of compression stockings. Modern medical technologies are continuously emerging but ABI procedure with the use of Doppler ultrasound still remain the corner stone in diagnosing PAD. The Ankle Brachial Index procedure has high accuracy with over 50 % rating in detecting serious ischemia. ABI assessment plays an important role in compression stocking therapy for the reason that this procedure detects PAD.

Currently, Norwegian's primary health care guiding principles in prescribing compression stockings is the present of palpable pulses in the feet and ankles. This clinical practice is in contrast compared to other countries where ABI was integrated in the protocol and the result of the assessment determines the requirements of compression stockings.

This study will try to investigate the use of ABI in compression stockings through literature review. Systematic literature search was made in major medical and health data bases for the period of 1995 to 2018 which yielded sixteen relevant articles. Thematic analysis was chosen as a method for analysing and summarizing the evidence. Preferred Reporting Items for Systematic reviews and Meta analysis (PRISMA) statement was utilized to serve as a guide in complying and demonstrating the review.

The results of this review revealed that there was a wide variation of practice existing in this particular area and the knowledge and skills was relatively low among health care professionals. These statements were supported by a number of researchers in the identified literature. In addition it also identified the role Ankle Brachial Index in compression stockings therapy. Furthermore, some researcher in the literature suggested that policy regarding prescribing compression stockings needed to be scrutinized in order to foster safe and quality care to the patients in this particular field.

Analysis of the literature identified two main themes. The first theme is “ABI as a clinical tool”, and the benefits and significance of ABI procedure in compression stocking therapy was elaborated in this theme. The second theme was “Pillars of success”, and the results of the review pointed out that in order to succeed in venous leg ulcers and compression stockings therapy, primary health care must go through the four pillars of success which were discussed further in this theme.

Another important issue identified in this review was the role of Nurse Practitioners in wound treatment and compression therapy. An expert claimed that with their competence and authority, there is a better chance in giving holistic care to the patient. Nurse Practitioner’s role is an emerging in Nordic countries, understanding their clinical capacity is essential in establishing the new role of Nurse Practitioner in Norway and might be one of the solutions to the problem that primary health care is facing today and the in the future.

As the aim of this review was primarily to explore the literature about the use of ABI in compression stockings, it had also an opportunity to explore evidence based practice (EBP) within this area which hopefully will provide the reader with wider insights in this particular field. The author also desires that by reading this review it will encouraged the reader to reflect and self evaluate their clinical practice in this particular field of science.

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Abbreviations

For the purpose of this literature review abbreviations of words that has been used in this study is listed below.

ABI = Ankle Brachial Index

ABPI = Ankle Brachial Pressure Index

APN = Advance Practice Nurse

CNSs = Clinical Nurse Specialist

CH = Compression Hosiery

EGS = Elastic Compression Stockings

EBP = Evidence Based Practice

GCS = Graduated Compression Stocking

LPN = Licensed Practical Nurse

RN = Registered Nurse

NP = Nurse Practitioner

PAD = Peripheral Arterial Disease

PHC = Primary Health Care

VLU = Venous Leg Ulcer

WHO = World Health Organization

QECD = Organization for Economic Cooperation and Development

1 Introduction

Compression stocking as the gold standard in treatment of chronic venous insufficiency is widely used in hospitals and primary health care settings. Some studies provide strong evidence about the benefits' of compression stocking, addressing different health conditions including venous and lymphatic disorders in the lower extremities, varicosities, lymph oedema, leg ulceration, venous eczema, deep vein thrombosis and post thrombi syndrome (Lim and Davies, 2014; Mayor, 2001). However, Evidence suggests that there is a wide variation of practice regarding this area (Furlong, 2015). Countries like Canada and United Kingdom integrate Ankle Brachial Index (ABI) assessment as one of the first steps before prescribing compression stocking in order to identify possible contraindications (Atkin et. al., 2015; Coull and Clark, (2015), while countries like Norway does not follow this practice.

In 2017, I was given an opportunity by the University of South-Eastern Norway with the cooperation of McMaster University to perform a clinical field observation practice in Hamilton, Ontario, Canada. This was in connection with establishing the new role of Nurse Practitioner in Norway. A lot of things cached my attention, but one particular clinical procedure left an impression. It was the prescription of compression stockings where ABI assessments played a central role before compression stockings initiation. Immediately, I started wondering why primary health care in Norway does not have the same protocol compared to Canada. Questions were rushing into my mind such as "*What if some patients with undiagnosed peripheral arterial disease (PAD) wore compression stockings which will result to further injury or may even lead to amputation"?* I started to fear for all Norwegian patients who daily wore compression stockings who did not undergo ABI assessment and who might be suffering from consequences from this type of practice.

Guttormsen and Smith (2016) stipulated that, "*failure to recognise arterial disease or incorrect interpretation of ABPI result can result in the unsafe application of high compression therapy and can lead to serious injury"* (p.23). This statement highlighted the crucial clinical connection between ABI testing and application of compression

stockings. Day (2015) insinuated that, anterior and posterior tibial pulses are still present or palpable in patient with venous leg ulcer and for this reason it should be apart in the assessment. On the other hand, Moffatt and O'Hare (1995) revealed that palpable pulses was not enough to confirm whether the limb has a sufficient blood flow and concluded that this is not a reliable test in detecting the presence of peripheral arterial disease. The question is *"Where does Norwegian primary health care stand between these two points of views?"*

In Norway, particularly in primary health care, ABI assessment is not a part of clinical procedure prior to initiation of compression stocking, which might lead to unnecessary practice. Currently we measure the size of the feet and limb in terms of diameter & length before initiation of graded compression stockings. The guiding principle today is "*presence of palpable peripheral pulse indicates safe compression stocking utilization"* (https://www.slidesshare.net>srbehandling), but the biggest question is *"Are we doing it right*?" What if this current practice in Norway leads to burden and fewer benefits for the patient?

The Norwegian Municipal Health Care Act Section 4 §4-1, Requirements for professional conduct, patient safety and quality states that:

> *4.1 Each patient or health care user is offered comprehensive and coordinated health and care services*
> *4.2 Each patient or healthcare user is offered worthy services*
> *4.3-4.4 The health care personnel who provide the service are able to perform their statutory duties with adequate expertise (*Ministry of Health and Care Services, 2012, section 34).

According to the law stated above, health care personnel has the responsibility to provide comprehensive, proper health care services and performed their duties with sufficient competence. My questions are" *Is our daily practice in this matter in*

accordance with the law?, and "*Does our clinical decisions in terms of initiation of compression stocking is in line with evidenced based practice (EBP)?*

Literally, ambiguities exist in this area and there is a need to explore in the topic. These inquiries has led to my research question in this study which is "*What does the research literature say about the use of ABI in compression stocking therapy*"?

1.1 Background of the Study

Life expectancy has rapidly increased in the past decades. The geriatric population is increasing rapidly around the globe. The world is expecting two billion old people over 60 years in 2030 and Norway alone it is estimated that elderly population aged >70 years old will reached over 1.3 million in 2060 (Storeng, Sund, and Krokstad, (2018).

The world is facing a tremendously challenge. High elderly population rate implies a huge impact on the health system. This means a population with higher demands for health care with complex health problems (Storeng, Sund, and Krokstad, (2018).
With an advancing age venous disease and peripheral arterial disease become very common health problems (Mohler III et al., 2004). This could also mean an increasing demand in compression stocking therapy, as it is the golden standard in treating venous leg ulcers (Wounds UK Best Practice Statement, 2015). In addition, understanding the crucial role of ABI in compression stocking is significant because this procedure is essential in diagnosing peripheral arterial disease which is one of the major contraindication in prescribing compression stockings therapy (Lim & Davies, 2014).

For many years compression therapy has been the standard treatment of venous disease and leg ulcers but in the presence of peripheral arterial disease (PAD) it will complicate the treatment (Guttomsen & Smith, 2016). It has been reported that 10-20% of people with leg ulcers have a mixed aetiology of venous and arterial disease (Vowden, 2001; Guttomsen & Smith, 2016). This is the reason why reassessment in an interval of 3 months is recommended to all patients receiving any kind of compression therapy and that ABI (ankle brachial index) should be integrated in this process in order to detect the presence of PAD (RCN,2006; Guttomsen & Smith, 2016).
This literature review will explore what does literature says about the use of ABI in compression stockings therapy.

1.2 Theoretical Framework

This chapter will try to provide an overview about theories, previous research and current knowledge about compression stockings and its clinical relevance in Ankle Brachial Index assessment. It will demonstrate the role of Primary health care in provision of adequate primary health care to the population.
In addition, it will also provide some theoretical/ clinical insights as well as international research about the emerging role of Nurse Practitioner (NP) in Norway.

1.2.1 Compression stocking and mechanism of action

Compression stocking is especially designed to help increase blood flow to the heart. It is designed to squeeze the leg tissue by exerting the greatest degree of compression at the ankle and help the blood return to the heart instead of refluxing downwards the feet. The initiation of appropriate graduated compression will decrease the diameter of major veins which in return augment the velocity and volume of blood flow towards the heart. Although the mechanism of action still remain vague, compression stockings also trigger complex physiological and biochemical effects which involve the venous, arterial and lymphatic systems counteracting the force of gravity (Lim & Davies, 2014).

1.2.2 How compression stocking is graded

Classification of compression stocking is based according to pressure given by the compression stocking at the ankle level.
The pressures exerted by the stocking are determined by the manufacturer based on laboratory measurements. The classification of standard is based on the degree of pressure exerted by the stockings but unluckily there is no single international standard use worldwide. Generally, low compression indicates exerting pressure from 20-30 mm Hg or class 1. Medium compression indicates pressure from 30-40 mm Hg or

class 2. The third type is a strong support stocking exerting pressure from 40- 50 mmHg also called class 3. The last is the stocking which provide a very strong support exerting a pressure from 50- 60 mm Hg also called class 4 stocking (de Carvalho et al., 2016).

1.2.3 Types of compression stockings

1.2.3.1 Graduated or medical compression stockings

These types of stockings are designed for ambulatory patients and the composition of the stockings is in accordance to exact specification. Graduated compression stockings provide specific pressure in the ankle and the pressure gradually reduces in the upper part of the stocking. Products special implications are patients suffering from chronic venous disease and leg oedema (Lim & Davies, 2014).

The table below shows the different classes of compression stockings and its pressured exerted according to de Carvalho et al. (2016).

Table 1: Grading of Compression Stocking

Stockings	Description	Pressure exerted
Class 1	**Light support**	**20-30 mm hg**
Class 2	**Medium support**	**30-40 mm hg**
Class 3	**Strong support**	**40-50 mm hg**
Class 4	**Very strong support**	**50-60 m hg**

1.2.3.2 Anti-embolism stockings

Another type of compression stockings is anti- embolism stockings. These types of stockings are particularly designed for non-ambulatory patients and do not have the same technical specification compared to graduated compression stockings which are particularly designed for ambulatory patients. They provide gradient compression and are used to lower the risk of DVT of bed ridden patients (Lim & Davies, 2014).

1.2.3.3 Non-medical support hosiery

The third type of compression stocking are non-medical support stockings. These include flights socks and elastic support stockings. Unlike graduated compression stockings and anti-embolic stockings which have a gradient pressure, pressure provided by support stocking is uniform throughout the whole garment. These types of stockings are often used to give comfort for heavy and aching legs and do not have the medical and technical specification compared to the other types of stockings (Lim & Davies, 2014).

1.3 Indication and contra-indication of Compression Stocking

Lim & Davies (2014) enumerated clinical indications in using compression stockings. This includes patient suffering from chronic venous disease with symptoms like leg pain, heaviness, itchiness, oedema, eczema, lipodermatosclerosis, thrombophlebitis, and leg ulcers. Compression stocking is also indicated in prevention of non-complicated varicose veins, reducing the risk of deep vein thrombosis in hospitalized patients and occurrence of posthrombic syndrome. Evidence exist supporting chronic venous ulcers heal faster with compression therapy compare to those patient who were not receiving any form compression.

The contraindications of graduated compression stockings includes, confirmed peripheral arterial disease (PAD), extensive leg oedema, pulmonary oedema from congestive heart failure, asymmetry of the legs which hinder that CGS fits correctly, history of peripheral bypass grafting, intolerance to stocking material, peripheral neuropathy, and skin conditions such as fragile skin, gangrene, weeping dermatitis and serious cellulites (de Carvalho et al. 2016).

1.4 Problems associated with Compressions Stockings

The stockings are often safe to use but with poorly fitted compression stockings it can lead to discomfort and even pressure necrosis. Use of graduated compression stocking in patients suffering from undiagnosed PAD with reduced arterial flow can worsen ischemia (de Carvalho et al. 2016).

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1.5 Information to be given when wearing Graduated Compression Stocking

Non-compliance rate in patients using graduated compression stockings has been estimated to be 30% to 65%. Frequently reported reasons why compliance is low are pain, discomfort, difficulty in putting on the stockings, personal perception/ doubts about effectiveness of the stockings, excessive heat, skin irritation and cost of the product (Lim & Davies, 2014). Moreover, the authors also pointed out some factors that might help to increase compliance of graduated compression stockings includes letting the patient understand the reasons behind why they have to use it regularly and sufficient information about medical benefits. In addition, patient education such as general instructions in how to apply GCS correctly, length of use, taking care of the product and when to contact medical help encase of unwanted adverse effect was also essential in increasing compliance rate (Lim & Davies, 2014).

1.6 What is an Ankle Brachial Index?

Ankle Brachial Index (ABI) is a comparative systolic blood pressure from two anatomic locations, the systolic blood pressure of the ankle and the systolic blood pressure of the brachial artery. ABI is also called ankle brachial pressure index (ABPI) is a corner stone in diagnosing peripheral arterial disease (Guttormsen & Smith, 2016; NICE, 2012; Aboyans et al., 2012; Armstrong et al., 2010; Scottish Intercollegiate Guidelines, 2006).

It was first recognized by Neuman in 1930, but Winsor was the first who tested the procedure on patients with PAD in the year 1950. It did take another two decades before it was observed that there was a clinical association with PAD and the markdown of ABI assessment results, but it was Yao who recognized the clinical connection between the degradation of ABI result and the severity of PAD in 1970 (Guttormsen & Smith, 2016; Aboyans et al., 2012; Khan et al., 2008; Caruna et al., 2005).

Peripheral arterial disease can be both symptomatic and asymptomatic and an indicator of systemic atherosclerosis. In most cases it is typically asymptomatic and under diagnosed. PAD has been related to three to six times increased risk of mortality from cardiovascular disease but with the use of ABI in clinical practice, peripheral arterial disease can be diagnose and quantified. An ABI result that is equivalent or less than 0.9 is considered abnormal and serves as the basis of the diagnosis (Davies, Kenkre, & William, 2013). A result of a study showed that symptomatic patients who were manifesting claudication were estimated around 30 % and had a 5 year mortality rate and the prevalence of asymptomatic patients was also relatively high with high mortality rate (Mohler III et al., 2004).

1.7 ABI as a clinical tool

Ankle Brachia Index is computed in each leg using systolic pressures of the anterior tibial and posterior tibial arteries and dividing the highest pressure of the ankle by the highest brachial pressure (Guttormsen & Smith, 2016; NICE, 2012; Aboyans et al., 2012; Armstrong et al., 2010; Scottish Intercollegiate Guidelines, 2006).

A Doppler ultrasound ranging from 5-8 MHz is use to detect the return of the blood flow in the blood vessels by hearing an audible bounce of high frequency sound waves (Guttomsen & Smith 2016: Donelly et al., 2000). The abnormal result of ABI has a high specificity and sensitivity for peripheral arterial disease and was validated by contrast angiographic methods (Mohler III et al., 2004).
Measurement guidelines and calculation of ABI are available from a wide variety of sources, some are more precise than the others, but all of them share the same method and equation which is shown below (Davies et al., 2013, p.19).

Below is the Standard formula used in obtaining ABI ratio.

Ankle	The highest systolic pressure in the ankle (mmHg)
Brachial	The highest systolic pressure in the arm (mmHg)

Normally, systolic blood pressure in the ankle is equivalent or a small scale higher than the systolic pressure in the arm. Under extremities' pressure is greater because of the location of muscular peripheral arteries and the aggregation of reflected pressure waves. In case of arterial constriction of the arterial lumen, pressure decrease will develop which can further be spotted by the use of ABI (Guttomsen & Smith 2016; Caruna et al., 2005).

de Carvalho et al. (2015) described the correlation of ABI result to the severity of arterial peripheral disease and this will be shown in table 2.

Table 2: Description of ABI value to the severity of the disease

Index (mmHg)	***Severity of the disease***
1.0>1.3	Lower extremity venous disease (LEVD) with no arterial disease
>0.8-0.95	LEVD with mild arterial disease
>0.6-0.8	Borderline for LEVD
<0.5	Severe ischemia
<0.4	Critical ischemia
>1.3 abnormally high	Vessel calcification.

Table 3 describe the amount of compression needed in relation to ABI result according to de Carvalho et al. (2015).

Table 3: Pressure recommended according to ABI result

ABI result	***Compression Pressure management***
1.0>1.3	Apply high pressure compression exerting 30-42 mm Hg
>0.8-0.95	Apply high pressure compression exerting 30-42 mm Hg
>0.6-0.8	Referral to vascular service. Reduced compression 23-30 mmHg
<0.5	Referral to vascular surgeon. Do not apply any compression
<0.4	Referral to vascular surgeon. Do not apply any compression

1.8 Patient preparation before Ankle Brachial Procedure

The patient should rest and refrain from walking 10-15 minutes prior to the procedure this will allow normalization of systolic blood pressure. Select the right size of the cuff according to the patient size. The patient should be in supine position during the procedure but semi- reclined is also acceptable if supine position is impossible. Clinicians should practice measures that are suggested above, by not doing so validity of the result will be questionable (Guttormsen & Smith, 2016).

1.9 Factors Influencing Ankle Brachial Result

Day (2015) highlighted some factors that might affect ABI results. These includes patient emotional state (anxiety), wrong positioning of patient's feet while doing the procedure, failure to rest before the procedure, inappropriate size and positioning of the cuff, irregular pulse, calcification of the vessels due to diabetes and renal failure, and failure to determine brachial systolic pressures of both arms.

1.10 ABI utilization in Clinical practice

Davies, Kenkre & Williams (2014) conducted a study to determine the use of ABI procedure in general practice across Wales. The study includes, who performed ABI procedure, how frequent the procedure was done, rationale behind the procedure, methods utilized in carrying out the procedure, procedural training of health care personnel who performed the procedure and follow up policy for those patients who were diagnose with PAD. The study found out that ABI measurement was primarily carried out by nurses related to wound care and wound management. The utilization prevalence rate was low. ABI procedure was done very seldom, less than 4 times a month, and often carried out incorrectly. The percentage of general practitioners who

reported the result of ABI was equivalent or less than 0.9 who needed aggressive cardiovascular risk modification was only 59 % and 16 % came from the nurses. The study concluded that ABI measurement is a procedure that was under-utilized and frequently carried out incorrectly. The authors also concluded that prior to the integration of ABI procedure in cardiovascular risk stratification, a massive training is needed in order to foster accuracy and consistency of the result (Davies et al., 2014).

Another study was done in USA by Mohler III et al. (2004) aiming to identify clinicians' pre-defined factors that will perceive to foster acceptance of the procedure or barriers that will affect the implementation of ABI in primary care. An ABI utilization survey was done on clinicians working in primary care who participated in the PARTNERS Program. PARTNERS Program was a study about the utilization of ABI measurement to evaluate the prevalence of PAD in targeted high-risk population. This was done to 6979 patients in 350 primary care offices in 25 cities nationwide. The main aim of this program was to examine the feasibility in detecting PAD in primary level, and to evaluate physician's and patient's level of awareness in PAD diagnosis. The result of the survey demonstrated that it was easier to accept the role/ responsibility in performing ABI procedure when training and education was involved in the process. In addition the survey also provided a fruitful insight that time constrain was one of the barriers that affected the integration of ABI in daily clinical practice (Mohler III et al., 2004)

Staines (2018) reported a result from a workshop held at Wounds UK annual conference which stated that, ABPI also called ABI is a procedure that is done very little in the clinical field. The low prevalence rate of ABI conduction was related to lack of knowledge and skills of the clinicians about the procedure and due to the reasons that clinicians were constantly working under time pressure. In addition, it was also stated that the more seldom the procedure was done the longer time it takes to do the procedure. Another important issue that was raised in this report was the availability and accessibility of ABI equipment. It was concluded that suitable ABI equipment was also an influencing factor in the said result.

1.11 Clinical Evidence of ABI

Peripheral arterial disease in the lower limb is common with advancing age and with increasing elderly population it is predicted that the rate will increase in the coming years (Mohler III et al., 2004).

Prevalence of PAD is estimated around 13% among people aged over 50 and it can be both symptomatic and asymptomatic. In the Western population it is estimated that 5% of the population aged between 55 and 74 years are affected by asymptomatic arterial disease. The most initial symptoms of PAD include muscle pain during exercise that subsides during rest. The pain can be explained by the reduction of blood flow to the lower limb due to atherosclerotic disease (Crawford, Welch, Andras &Chappell, 2016).

In cases with advanced peripheral arterial disease symptoms such as leg ulceration, pain at rest and gangrene is often present. The ankle brachial Index is widely used by different medical professionals including nurse specialists, doctors, surgeons, and podiatrist who work in different health care settings both in primary and secondary health care (Crawford et al., 2016).

A literature review was conducted by Cochrane Vascular group in 2016 aiming to estimate the clinical evidence about the diagnostic test accuracy of ABI in patients suffering from symptomatic PAD (Individuals experiences leg pain in walking and relieved by rest). The result of the review found a small amount of evidence indicating that the ABI test is accurate in the diagnosis of symptomatic PAD among people experiencing intermittent claudication. However, it was stated in the limitation of the review that the researchers identified only one study that fitted the inclusion and therefore concluded that robust conclusion cannot be drawn from the study (Crawford et al., 2016). Another author in the same systematic review who evaluated the accuracy of ABI for diagnosis of PAD claimed that, accuracy depends on the purpose of the study. The result of the study was that ABI has a high accuracy in terms of detecting serious stenosis with a rating >50% (Dachun, 2013; Crawford et al., 2016).

1.12 World Health Organization and Norwegian Primary health care

World Health Organization defines primary health care (PHC) as, “essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible and families in the community through their full participation and at a cost that the country and community can afford”(https://who.int>primary-health).

Norwegian primary health care system is organized and framed on the principle of equality, accessibility, independency of social status, location and financial matters. The municipalities have the responsibilities in providing primary care, but the Ministry of Health and Care Services has the overall responsibility regarding health policy, public health, health care services and health legislation. The municipalities has the obligation to provide social services, provision of care for the elderly, disabled, home care, nursing homes, social support, leisure activities, day care services and social security benefits. The Municipalities Primary health Care System has the responsibility to ensure adequate and efficient medical services to the entire population of the community (Helgøy, 2005).

1.13 Work forces of primary care

The health workforce is the core of primary health care in providing health services to the people. The daily workforce in Norwegian primary care level comprises of general practitioners GP (*tilsynslege/fastlege*), registered nurses (RNs), advance practiced nurse (APN), nurses with a specialized area, nursing assistant (*hjelpepleier*), and the assistant.

1.14 Work Forces Educational Background

Registered nurses (RN) are one of the primary workforces at primary care level. RNs educational background comprises of 3 years bachelor degree program. The educational learning method is related to both theoretical knowledge and clinical practice in different areas of health care. Clinical practice includes hospitals, home for the aged and home based primary care in the community (www.utdanning.no).

Schober and Affara (2006) describe scope of practice "as the range of activities associated with recognized professional responsibilities that are in keeping with the limitations imposed by regulatory provisions in the setting where practice occur" (p.26).

Stubberud (2018) described the scope of responsibilities of nurses in Norwegian health care system and this includes direct patient management such as performing physical examination, medication administration and taking medical history prior to critical decisions. Furthermore nurses also collaborate with other medical staffs in both primary & secondary level. They are also involved in palliative management, preventive measures, rehabilitation, some are leaders in an organization, and some are involved in competency empowerment through development of policies and procedures, and research.

Licensed Practical Nurse (LPN) known in Norwegian primary health care as *hjelpepleier/helsefagarbeider* is an essential part of the daily team. The 2 years educational program for LPN provides them with the training and education that is necessary to wear the title. They work under the supervision of an RN or APN. The LPN provide basic and daily routine care such as checking the vital signs, changing bandages, wounds dressings, feeding and giving medication (https://utdanning.no/yrker/beskrivelse/helsefagarbeider).

Another important part of the primary team is the assistant. They may or may not have the formal education within health related sciences. Their responsibilities are providing the most basic needs of the patient. They work under supervision of APN, RN or LPN. They are responsible for bathing, feeding and ensure the well being of the patient throughout the entire admission phases (https://utdanning.no/yrker/beskrivelse/personlig_assistent).

Some specialized units like rehabilitation in the community might include physical therapists and other group of professional interrelated to multi-disciplinary teams.

Another essential part of the daily workforce at the municipal level is nurses with expanded titles and education. According to North American model there are four professional titles of nurses with expanded education. One is the Clinical Nurse Specialist, two is the Certified Nurse Anaesthetists, and three is Certified Nurse Midwife and fourth is Advanced Clinical Nurse (Nurse Practitioner) known in Nordic countries *as Avansert Klinisk Sykepleier* (AKS) (Schober & Affara, 2006; Hamric, 2009; Fagerstrøm et al., 2019).

There is a confusion regarding the differences and similarities between a Clinical Nurse Specialist and Nurse Practitioner (Furlong & Smith, 2005; Fagerstrøm et al., 2019). Normally a Clinical Nurse Specialist has a specific specialization in a certain field and work in a specialized unit with a specific group of patient, while a Nurse Practitioner deals with different group of patient with complex health problems. The NPs have competency to evaluate and treat undiagnosed patients and have more defined authority compared to Clinical Nurse Specialists (Robert, Davies & Read, 2011; Daly & Carnwell, 2003; Fagerstrøm et al., 2019).

1.15 Nurse Practitioner

A Nurse Practitioner/ Advance Practice Nurse is defined by ICN (2002*) as a registered Nurse who has acquired the expert knowledge, complex decision-making skills and clinical competencies for expanded practice, the characteristics of which are shaped by the context and or country in which she or he is credentialed to practice. A master's degree is recommended for entry level.*

1.16 Characteristics of International Nurse Practitioner

In order to promote common understanding, ICN identified characteristics of advance nurse practitioner (APN) which are stated below (ICN, 2002; Schober & Affara, 2006, p23).

1. Educational preparation which encompasses:

- Advanced level
- Formal recognition of educational programs preparing nurse practitioner/advanced nursing practice roles accredited or approve.
- Formal system of licensure, registration, certification and credentialing

2. Nature of practice which comprises:

- Integrates research, education, practice and management
- High degree of professional autonomy and independent practice
- Case management/ own case load
- Advanced health assessment skill, decision making skills and diagnostic reasoning skills
- Recognized advanced clinical competencies
- Provision of consultant services to health providers

- Plans, implementation and evaluates programs
- Recognized first point of contact for clients

3. Regulatory mechanism- Country specific regulations underpin NP/APN practice

- The right to diagnose
- Authority to prescribe medication
- Authority to prescribe treatment
- Authority to refer clients to other professionals
- Authority to admit patients to hospital
- Legislation to confer and protect the title "Nurse Practitioner/ Advanced Practice Nurse"
- Legislation or some other form of regulatory mechanism specific to advanced practice nurses
- Officially recognized titles for nurses working in advanced practiced role

1.17 Nurse Practitioner in Nordic Countries

The emersion of Nurse Practitioner role in Nordic countries take a slower phase compared to other countries for a reason that there was no deficit of physicians in the said countries (Lorensen et al., 1998: Schober & Affara, 2006). In Sweden the NP master programme started in 2003 while Denmark already seeks national approval for definition of advanced practiced nursing in 2005. In Nederland, NPs role was first recognized and implemented in hospitals way back 1997 (Schober & Affara, 2006). The Nordic definition of Nurse Practitioner is based on three different contexts. It is a combination of ICNs definition and description of NP, Hamric's (2009) model about competence of Advanced Clinical Nursing and based on results from international research. Stated below is the Nordic definition of NP according to Fagerstrøm et al. (2019).

> *<<En sykepleier med en avansert klinisk kompetanse skal selvstendig kunne bedømme, diagnostisere og behandle vanlige akutte helseproblemer og sykdomstilstander samtidig ta ansvar for å ivareta oppfølging og pleie av kroniske helseproblemer. Hun/han arbeider kunnskapsbasert og kan systematisk utføre en omfattende klinisk undersøkelse av pasienten og utrede pasientens helsehistorie og helsebehov på et avansert nivå. Med utgangspunk i denne kliniske bedømmingen har hun/han beredskap og evne til å kunne ta beslutninger om pasientens helsebehov og utføre de sykepleier og behandlings tiltak som kreves. Hun/han forordner undersøkelser som laboratorieprøver og røntgenundersøkelser og forordner legemiddelbehandling, henviser samt skriver inn og ut pasienter, der vil si gir en helhetlig personorientert pleie, omsorg og behandling. Hun/han tar ansvar for, leder og koordinerer helsefremmende og forebyggende arbeid. Andre viktig ansvarsområder er evaluering og utvikling av virksomhet, kvalitetssikring og forskning innen eget fagområde. En avansert sykepleier har bachelor utdanning i sykepleier, tilstrekkelig arbeids erfaring samt en utdanning tilsvarende mastergrad innen avanserte klinisk sykepleier >>.* (Fagerstrøm et al., 2011; Fagerstrøm et al., 2019 p.44)

The Ministry of Health's report to the parliament, *the primary health and care services of tomorrow localised and integrated* (Meld.ST.26 (2014-2015) it is stated that, there is an increasing demand for higher competence in the municipal level in order to sustain in provision of high quality care. This demand will further counter claim to increase the numbers of health personnel with higher expertise and personnel with different kinds of expertise working together as a team. Moreover, it was also stated in the same document that the Nurse Practitioner model should be used in stabilizing the new type of expanded education for nurses those who were seeking master degree. This new group of professionals with their clinical competence will help to solve the complex health problems in the community (Meld.ST.26, 2014-2015 pp.60-61).

1.18 Nurse Practitioner Scope of Practice

The scope of practice of Nurse Practitioner's is broad and there are multiple ways to organize and stabilize the role in primary health care (Schober & Affara, 2006)
The Nurse Practitioner roles that will be presented below are based from the results of international research and some are adjusted according to the current policies in Norwegian health care system (Bing-Jonsson, 2019).

1.18.1 Smooth Transition between levels of Care

One function of a Nurse Practitioner in primary health care is to ensure a smooth transition of care between primary, secondary and tertiary care within the health care system. In this way it will foster continuities of care and promote better case management (Bing-Jonsson, 2019).
Romøren, Torjesen & Landmark (2011) claimed that, Norwegian health care sectors which mean primary, secondary, tertiary level still demonstrate inadequacy in terms of collaboration of services despite of several implementations of different types of policies which was supposed to promote better integration in the last 15 years. Furthermore, Steihaug, Paulsen & Melby (2017) stated that primary health care in Norway is not well organized and it is divided by fraction of units in which collaboration make it hard between sectors. In this case, Nurse Practitioner can act as a mediating person to facilitate better patient collaboration within the health care system thus ensuring safety and better cooperation among the health care workers.

1.18.2 Delivering Primary Care right through the door steps

Helgøy (2005) reported that, The Norwegian Board of Labour Market discovered that there is a large amount of work load pressure within health care personnel who work in home based service system. Imbalances exist between the number of home care facilities and in terms of number in staffing. In addition she also stated that the core problem is the lack of competency among health care provider in the municipal health sector.

Nurse Practitioner's competence can be use in development of individualized nursing care plans together with their nearest relatives in order to evaluate and predict possible future health care demands needed from the community. He or she can do home visiting and perform nursing intervention within his scope of practice and based upon his clinical level of competence (Bing-Jonsson, 2019).

In addition, Nurse Practitioner's competence can also be utilized in regaining patient's dependency by using holistic approach, performing systematic physical examination, looking closely to medical history, things such as medication induce adverse effect can be easily discover. Connecting the dots between somatic symptoms and present physical state might help to increase quality of life for frail patient still living at home (Bing-Jonsson, 2019).

1.18.3 Home Rehabilitation

Another role of Nurse Practitioner in primary level is home based rehabilitation. The purpose is to provide holistic care and interdisciplinary approach to those patients suffering from multiple complex health problems. The interdisciplinary team will consist of NP, psychiatrist, nurse assistant, geriatrist nurse, social carer, and physiotherapist. Together they will share responsibility, skills and knowledge in accordance to their area of competence for the purpose of interdisciplinary discipline. NP will performed systematic physical examination to evaluate possible factors that will prevent effective rehabilitation (Bing-Jonsson, 2019).

There is an evidence exist implicating that preventive measures which was done in primary health care level leads to the reduction rate of acute hospital services utilization and improves the management of chronic illnesses (Clancy et al., 2013).

1.18.4 Person Centred Plan Development

Bing-Jonsson (2019), pointed out that one way to utilize Advance Practice Nurse (APNs) competence is through delivering person centred care. Patient-centred care approach is believed to be effective method in reducing the prevalence of coercion in frail elderly patient.

This result was from a study done in the US in ten years period of time. In the mentioned study, APN uses their competence by empowering health personnel's evaluation technique in discovering possible triggering factors (psychosocial behaviour) which resulted in the use of coercion. APNs efforts and interventions leads to the reduction of coercion without increasing the number of health personnel. In addition, it also decreases the usage of medicines and reduces the prevalence rate of fall (Bourbonniere and Evans 2002; (Bing-Jonsson, 2019).

1.18.5 Physician's Right Hand

Another role that a Nurse Practitioner can commence in primary care is being additional resource personnel besides to the attending physician in an institution. With NPs competence he/she will perform systematic physical examination, initiate interventions in the absence or in behalf of attending physicians. The NP will start treatment that will hinder further reduction of patient's physical state and prevent unnecessary admission to the hospital. Nurse Practitioner is a part of the medical team in the institution where there is a transparent collaboration between NPs and doctors that are involved in patient care (Christian & Baker, 2009; Bing-Jonsson, 2019).

1.18.6 Right place, Right time and Right competence

With the implementation of Collaboration Reform plan in 2012 the Norwegian primary health care services experienced tremendous amount of challenges with shortened hospital admission and increase responsibilities to solve complex problems. With shortened hospital admission, many cases have been reported that early discharge of multi morbid patient has worsened their physical state even before the admission (Steihaug, Paulsen & Melby (2017).

The implementation of Collaboration Reform policy counterclaimed higher expertise in the municipal level and with Nurse Practitioner's clinical expertise might be the solution of the existing problem by creating Nurse Practitioner team. Every member of the team will insure that the patient receive medical intervention and treatment in the right time, right place and with the right competence (Bing-Jonsson, 2019). A study about association of primary health care and unplanned admissions in a Norwegian context pointed that, a solid and active primary health care could prevent and treat chronically sick elderly patient in municipal level and could hinder hospitalization and acute situation by discovering early warnings of health deterioration (Deraas, Bertsen, Jones, Førde & Sund (2015).

1.18.7 Nurse Practitioner Clinics

Another way in optimizing Nurse Practitioner's clinical competence is stabilizing Nurse Practitioner Clinic in the community. The Nurse Practitioner works independently or works collaboratively with multidisciplinary team including general practicing physician (*fastlege*), or other municipal health care facilities.

The Nurse Practitioner's clinic will deliver services such as, comprehensive and holistic approach to every consulting patient, health promotion, rehabilitation and disease prevention, and management of chronic diseases.

In New Zealand, it has been identified that patient with heart and kidney failures has more benefits in such services. In this regard, the Nurse Practitioner has the responsibility as a case manager.

He/she will provide holistic services from the time the patient was discharge from the hospital, until the patient recuperates or until the health condition has stabilized. Moreover, Nurse Practitioner will provide health teachings that will promote self esteem and self satisfaction that might lead in regaining self dependency. In addition, the Nurse Practitioner will provide support and collaborate with other health care providers towards promotion of coordinated and holistic health care services (Bing-Jonsson, 2019).

1.19 Impact of Advance Practice Nurse in Primary Health Care according to QECD

The international policy maker made a list of expectations to every Nurse Practitioner wearing the title. These expectations are the following:

- Every NP who undertakes an expanded role in the community should be able to increase quality of the services that has been already offered by the physicians (Bing-Jonsson, 2019).

- Each NP should substitute services offered by a physician in a safe way which will lead to a reduction of physician consultation and every NP is expected to reduce costs and resources compared to physicians (Laurant et al., 2014; Bing-Jonsson, 2019).

The care rendered by an APN has been evaluated and compared versus the quality provided by a physician in four aspects.

These four aspects include: Outcomes in clinical effectiveness, mortality, secondary prevention and patient satisfaction.

Results of a large range systematic literature review showed that the quality of care rendered by Advance Practice Nurses was equivalent or better to the care provided by the physicians. This trial was done in a special group of patients who were suffering from chronic diseases. The result also showed that mortality rate tends to be lower in a group of patient attended by APN compared to the patient attended by physicians. In addition there was a significant reduction in the risk of mortality and decrease rate of hospital admissions (Matinez & Gonzalez, 2014; Bing-Jonsson, 2019).
The result of measurement in terms of patient satisfaction showed that, it was generally higher in patient attended by an APN compared to those of physicians. The result of the study showed that Nurse Practitioner tend to use more time during patient consultation and provided more information and counselling compared to the physicians. This can be one of the factors that will explain why the satisfaction rate of NP was higher compared to physicians (Laurant et al., 2014; Bing-Jonsson, 2019).

This section has attempted to provide relevant theories that were essential in understanding the core context of this study.
The next chapter describes the procedure and methods used in investigating the research question which is, "*what does literature says about the use of ABI in compression stockings?"*

2 Methods

This chapter will convey every aspect that was undertaken in order to achieve systematic and comprehensive approach of the literature review, in order to answer the research question which is *what does literature says about the use ABI in compression stocking?*.

This section includes research design, criteria that were used in the selection process, and the method that was used in analyzing and summarizing the evidence.

2.1 Purpose

The purpose of the study is to explore what the research literature says about the use of ABI in compression stocking therapy. A systematic literature review strategy was used in this study aiming to answer the research question which is stated below.

2.2 Research Question

What does the research literature says about the use of ABI in compression stocking therapy?

Literature review is defined "*as a critical summary of research on a topic of interest, often prepared to put a research problem in context"* (Polit and Beck, 2017 p. 733). The purpose of the review is to secure knowledge in the existing studies in the field of interest and demonstrate that knowledge into a written report. By doing literature review will help the researcher to build knowledge and identify gaps in the existing research in the topic of interest (Aveyard, H. 2014).

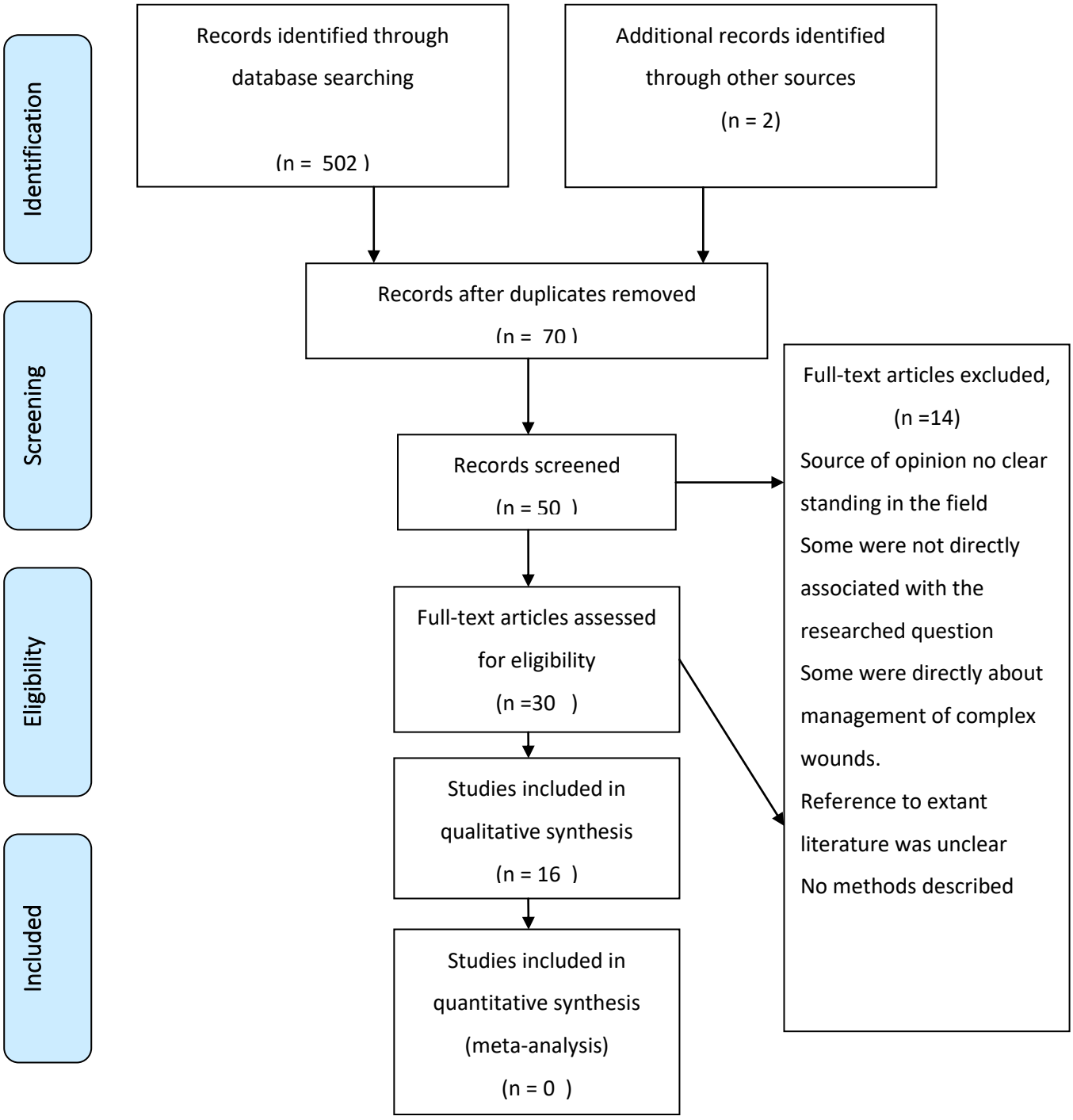
Evidence shows that there is a wide variation of practice exists in this particular field (Mayor, 2001). In an attempt to answer the research question, literature review was apprehended as the most appropriate method in doing this study. By doing so, the

researcher aims to gain wider insights and knowledge about the use of ABI in compression stockings both nationally and internationally, which might lead to identifying the best practice in this particular field.

2.3 Design

A systematic literature review strategy was used in this study and preferred Reporting Items for Systematic reviews and Metaanalysis (PRISMA) statement was utilized to serve as a guide in complying and demonstrating the review (http://www.prisma-statement.org).

The PRISMA statement includes a 27-item checklist and a four-step flow diagram which is shown below.


Identification
Screening
Eligibility
Included
Records identified through database searching (n = 502)
Additional records identified through other sources (n = 2)
Records after duplicates removed (n = 70)
Records screened (n = 50)
Full-text articles excluded, (n =14)
Source of opinion no clear standing in the field
Some were not directly associated with the researched question
Some were directly about management of complex wounds.
Reference to extant literature was unclear
No methods described
Full-text articles assessed for eligibility (n =30)
Studies included in qualitative synthesis (n = 16)
Studies included in quantitative synthesis (meta-analysis) (n = 0)

2.4 Selection criteria

Inclusion Criteria:

- Studies regarding main concept compression stocking, compression hosiery, compression garments related to ABI.
- Studies involving ABI in prescribing of compression stocking.
- Studies including clinical trials of guidelines and protocol involving ABI integration assessment in prescribing compression stocking.
- Studies that were conducted and published from year 1995 until present.
- Studies written in Norwegian, Filipino and English.

Exclusion Criteria:

- Studies that were published and conducted earlier than 1995.
- Studies that were written in foreign language other than English, Filipino and Norwegian.

2.5 Search Strategy

A systematic literature search was done in major medical and health related electronic databases using CINAL complete thru EBSCO, Pub Med, Cochrane, Sve Med, BMJ, UP to Date, Epistemonikos and Google Scholar. In addition, in order to ensure that no relevant articles were overlooked other search strategies were used, such as reference list search and ancestry approach. Search terms used were compression stocking, compression hosiery, compression garments, prescription, initiation, criteria, utility, variation, selection, guidelines and ABI.

Combining search term using Boolean operators (AND, OR) were used in order to expand and narrow the searched. The searched were filtered to articles written in English, Filipino and Norwegian language.

Year 1995 was set as a starting point of the search because this is exactly the same year when Moffatt & O'Hare (1995) first published their research revealing that ankle pulses alone is not enough to detect impaired arterial pulses. The inclusion and exclusion criteria were identified. Inclusion criteria were: All studies involving ABI testing related to prescriptions of compression stockings. All major studies involve compression stockings. Studies conducted and published from year 1995 until present. Studies were written in Norwegian, Filipino and English. Exclusion Criteria were: Studies published and conducted earlier than 1995.Studies that were written in foreign language other than English, Filipino and Norwegian.

The systematic search produced sixteen articles which were further criticized for their eligibility. The Quality checklist by Joanne Briggs Institute (http://joannabriggs.org/research/critical-appraisal-tools.html) and Polit & Beck (2017) guidelines were used in this process.

An inductive method of coding was used in the entire coding process. It is also called a bottom up approach which means that the codes and the themes are derived from the data. It is defined as the conversion of raw data, qualitative data into more useful quantitative data. Another type of coding is deductive analysis also called top down approach. In this type of coding the researchers brings to the data a series of themes, ideas, topics that they use to code and interpret the data. In contrast to inductive coding it does not involved testing pre conceived hypothesis but it allows theory to merge from the content of raw data (Cooper et al., 2012 p.58).
Condensing the codes in terms of similarity, differences, relationships, patterns and organizing into wider themes was done under the supervision of my supervisor.

2.6 Thematic Analysis

In aiming to summarize and combine the evidence, thematic analysis was used in summarizing the literature. Thematic analysis is a method for systematically analyzing, identifying, organizing and providing insights within the data (Braun and Clark, 2006). The authors claim that it should be the first qualitative method to be learned as it gives the basic knowledge and skills in conducting many other kinds of analysis (Braun & Clark, 2006).

An advantage in this kind of process is that, it is a method rather than a methodology which means it differs from other qualitative methodologies which are tied to specific kind of epistemological or theoretical perspective. It also makes it a very flexible method in terms of learning and teaching aspect. Thematic analysis aimed to identify themes, patterns in the data that is essential and use these themes to address the research question in the field of interest (Braun & Clark, 2006).

There are a lot of approaches that can be use in dealing with thematic analysis. In this study I followed Braun & Clark (2006) six phase framework guide for thematic analysis for the reasons that I found it more useable and simpler compared to other types of approaches (Braun & Clark, 2006).

The six steps approaches below served as a guide throughout the entire process.

Step 1: Become familiar with the data.

In this step includes familiarizing with the data. It means reading, re-reading and getting to know the entire body of the data. At this stage I jotted down my first impression of the data, and highlighted some potential interest. This phase starts the critical and analytical reading while the researches try to understand the core meaning of the data. The purpose of this stage is to intimately know your data and begin to notice things which are relevant to the research question.

Step 2: Generate initial codes.

With step 2 begins the systematic analysis of the data. This process includes generating themes in an inductive way of coding. In this stage I started to arrange my data in a

systematic and meaningful way. I used open coding which means I did not have a pre-set of codes but rather let codes emerge directly from the raw data of the results section. Coding was done by hand. Codes were developed, altered modified and discussed with my supervisor throughout the process.

Step 3: Search for themes.

Theme is a pattern that captures something important about the research question. Braun and Clark (2006) differentiate between two levels of themes, the semantic themes and the latent themes. A semantic theme lies within the explicit nature of the data and the researches are not looking for anything beyond what is has been said or written. On the contrary, a latent theme tries to identify and examine beyond the context of the underlying ideas, assumptions, conceptualization and ideologies (Braun & Clark, 2006). Given the contrast between the two types of themes, I can say that I have sets of semantic themes.

In this stage I scrutinized and condensed the codes in terms of similarity, differences, relationships and patterns which capture important meaning. At the end of this process, codes has been put together and organized into wider themes that seemed significant and related to the research question.

Step four: Review themes.

During step four, I reviewed each theme in terms of coherency and association to the data. I also read back each data associated to each theme and examined whether the data supported the theme.

Step five: Define themes.

This step is the final refinement of themes. This includes identifying the core of what each theme is all about. Sub themes were developed and examined according to the way they were related to the main theme or how they interacted with the main theme. Questions were asked such as, what is the theme saying? Does the theme relate to each other? And how do they interact with each other?

Steps Six: Writing up

This stage is considered the end point of the analysis. The researcher is in the process of writing up the report.

Writing up a report using thematic analysis should provide a concise, coherent, logical, non-repetitive and interesting review (Braun & Clark, 2006).

Table 4 below is a demonstration of the coding process, and the emersion of sub-themes and the evolution of main themes

Table 4: Coding and Condensing Data

Article	Raw Data	Initial Codes	Sub- Theme	Main Theme
Art. 2 Pg.8	*ABI measurements must be performed in all patients with VLU*	Mandatory ABI	Association of ABI in compression stocking	ABPI as a clinical tool
Art. 15 Pg.5	*Findings indicate that the level of health care professional knowledge, attitude & practice regarding GCS is of concern.*	Competence regarding CGS is concerning	Bridge the Gap	Pillars of success
Art.12 Pg.41	*With an ever growing elderly population, nurses need to be highly skilled and motivated*.	Increasing geriatric population entail expertise	Competence	Pillars of success
Art.2 Pg.51	*If done properly, compressive therapy can significantly change the speed of ulcer healing and aid in recurrence prevention*	Correctly done leads to healing & non recurrence	Benefits	ABPI as a clinical tool

2.7 Trustworthiness and Credibility

One of the major weaknesses in using thematic analysis in summarizing and combining results is that, if it is done poorly it will lead to lack of consistency and coherency of the themes and the credibility of the entire work will be at stake (Cooper et al., 2012).
In order to avoid the above mentioned weakness of thematic analysis, precautions were done regarding this matter, in order to avoid this pitfall in thematic analysis that is why coding, and generating themes were done under the strict supervision of my supervisor.

2.8 Strength of Evidence

The author is aware in this study that some articles that were included in this study were expert opinions and generally considered weaker according to the hierarchy of evidence However, Aveyard, (2007) argued that the most robust form of evidence for addressing a particular research question will be determined by *that of research question* and therefore every researcher are encourage to established his own hierarchy of evidence and this is based on the evidence needed to answer a particular question (Aveyard , 2007 pg. 68). Thus, I chose to include expert opinions in the review.

This chapter began by describing the design that was used in the study, steps that were undertaken in achieving systematic literature and the method that was used in summarizing the evidence.

In the next section, I will present another significant aspect of this review and this is the demonstration of the principal findings of the study and it will begun by introducing the analytical aspect in criticizing the selected literature.

3 Results

In this chapter I will elaborate the results of the systematic literature review through thematic analysis with an aim to answer the research question which is, "*what does literature says about the use of ABI in compression stockings?"*

Two main themes emerged after synthesizing the selected sixteen articles with their respective subthemes and this will be divulged later in this chapter. But first, this chapter will try to convey the process in criticizing the literature and the tools that was used in the process.

3.1 Literature's Critical Appraisal

According to Aveyard (2014) "critical appraisal is what separates the literature review from a traditional essay and the most crucial features of a literature review" (p.106).

In criticizing the literatures, Joanna Briggs Institute Critical Appraisal tools and Polit & Beck guidelines was used in this process.
The Joanna Briggs Institute (JBI) is the not-for-profit, research and development centre within the Faculty of Health Sciences at the University of Adelaide, South Australia. "*The engine that drives JBI's worldwide effort to promote and support the use of the best available evidence to inform decisions made at the point of care"* (www.joannabriggs.org).

As a novice researcher this was one of the many challenging task I encountered. Sorting out literatures was undeniable a confusing job but using critical tools helped to lighten the task. The process started with getting to know my literature which meant reading thoroughly and getting familiar with the contents of each study. In this stage I tried to notice the relevance of each study to the research question and simultaneously considering the evidence of each paper in regards to the hierarchy of evidence. This is the phase where I critically considered the strengths and the weaknesses in each

literature and had established a good understanding in relation to main findings and results of the literature. At the end of this process I came up with sixteen relevant articles which I presumed will help to answer my research question which is *"what does literature says about the use of ABI in compression stockings".*

Table 5 and 6 below shows the process of criticizing the literature in accordance to the design that was used in the study.More table (table 8) in the annexes section.

Table 5: Critical Appraisal for Case Series

JBI Critical Appraisal Checklist for Case Series	Art. 1: The leg ulceration pathway impact of implementation
Were there clear criteria for inclusion in the case series?	Yes
Was the condition measured in a standard, reliable way for all participants included in the case series?	Yes
Were valid methods used for identification of the condition for all participants included in the case series?	Yes
Did the case series have consecutive inclusion of participants?	Yes
Did the case series have complete inclusion of participants?	Yes
Was there clear reporting of the demographics of the participants in the study?	Yes: Mid Yorkshire England
Was their clear reporting of clinical information of the participants?	Yes
Were the outcomes or follow up results of cases clearly reported?	Yes
Was there clear reporting of the presenting sites/clinics/ demographic information?	Yes
Was statistical analysis appropriate? Comments: Sample size: 34	Yes

Table 6: Critical Appraisal Checklist for Case Reports

JBI Critical Appraisal Checklist for Case Reports	Art. 1: The Compression Therapy in the Community
Were patient's demographic characteristics clearly described?	Yes
Was the patient's history clearly described and presented as a timeline?	Yes
Was the current clinical condition of the patient on presentation clearly described?	Yes
Were diagnostic tests or assessment methods and the results clearly described?	Yes
Was the intervention(s) or treatment procedure(s) clearly described?	Yes
Was the post – intervention clinical condition clearly describe?	Yes
Were adverse events (harms) or unanticipated events identified and described?	Yes
Does the case report provide takeaway lessons? Comments: With increasing elderly population, Nurses should be highly skilled in order to provide evidenced based practiced & best quality care.	Yes

Table 7: Critical Appraisal for Literature Review

Polit & Beck guidelines for Critiquing Literature Reviews:	Article 1: Graduated Compression Stocking	Article 2: All about Compression
Is the review thorough? Does in include major studies on the topic? Does it include major research (studies within previous 2-3 years) Are the studies from other related disciplines included, if appropriate?	Yes: Includes major trials (RCTs). Areas /topic about CS included. Other discipline Systematic R., Meta analysis & RCTs.	Yes: Includes major studies in the topic. Recent research conducted in 2015. Other discipline: systematic review.
Does the review rely mainly on primary source research articles? Are the articles from peer reviewed journals?	Yes: The review relies on primary source. It includes peer reviewed journals.	Yes: Relies on primary source No: no peer reviewed journals.
Is the review merely a summary of existing work? Does it critically appraise and compare key studies? Does the review identify important gaps in the literature?	Yes Only summary of existing knowledge Yes	Yes No comparison of major studies. Yes
Is the review well organized? Is the development of ideas clear?	Yes Yes	Yes Yes
Does the review use appropriate language, suggesting the tentativeness of prior findings? Is the review objective? Does the author paraphrase, or there is overreliance on quotes from original source?	Yes: It did used appropriate language & the article shows no over reliance on quotes from primary source.	Yes: It did use appropriate language & the authors paraphrase. The article shows no over reliance on quotes from primary source.

If the review is a part of a research report for a new study, does the review support the need for the study?	No: Article was not a part of new study & did not suggest further study in the field.	The review did not suggest further study.
If it is a review designed to summarize evidence for clinical practice, does the review draw reasonable conclusions about practice implications?	Yes: Conclusion seems reasonable & implication of practiced was clearly stated.	Yes: The conclusion was clear & reasonable in regards to implication of practiced.

Below is Figure 1 and 2. This shows the process of thematic analysis and the emersion of the main themes from the sub-themes and from the codes.

Figure 1: Process of Thematic Analysis

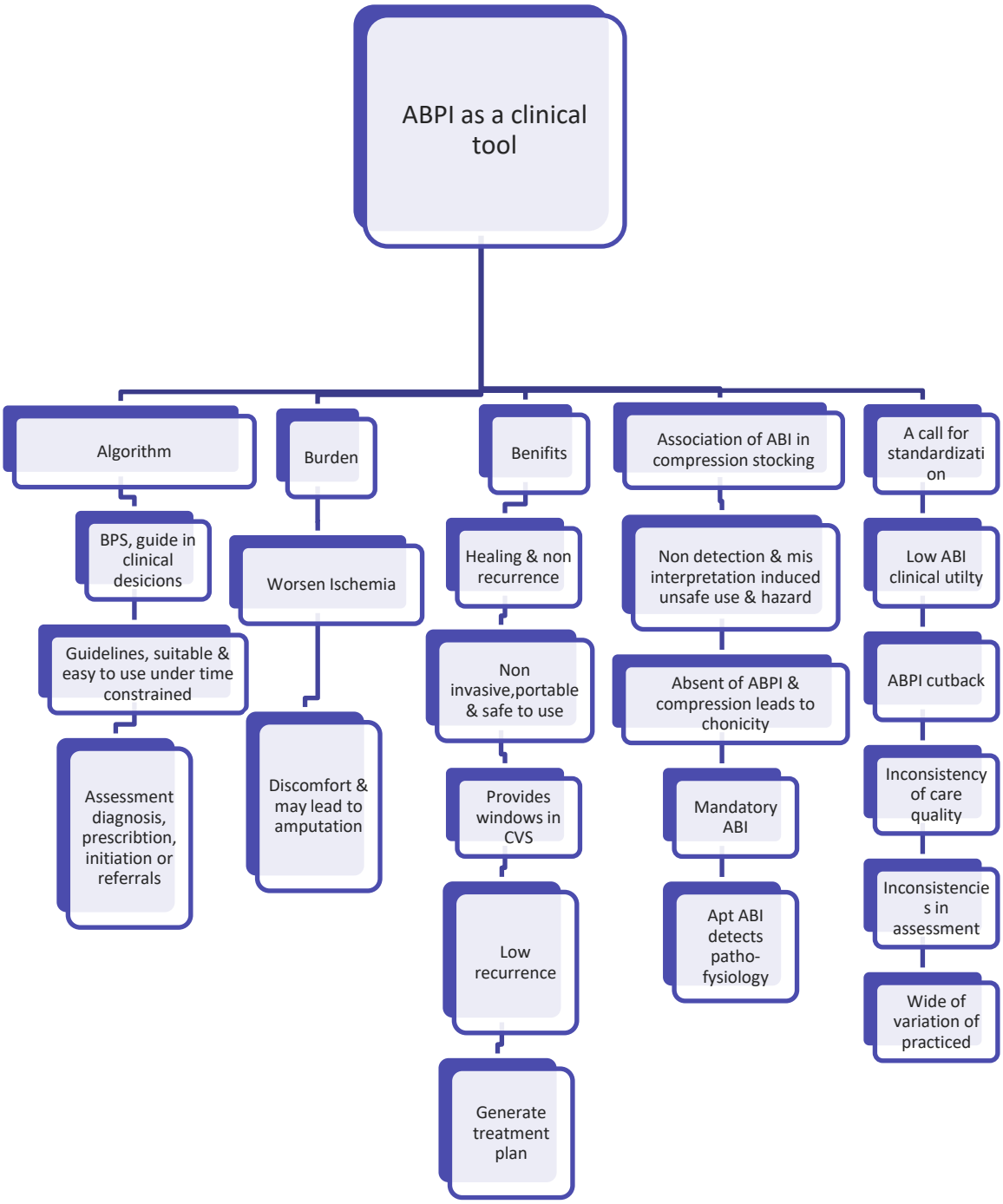


Figure 2: Process of Thematic Analysis

The result of the study identified two main themes after condensing the selected sixteen articles using thematic analysis as a method in pursuing to answer the research question which is" *what does literature says about the use of ABI in compression stockings".*

The two main themes are "ABI as a clinical tool" and "Pillars of success". Under each main theme are sub themes. Main theme ABI as a tool has three sub themes while the other main theme Pillars of success has four sub-themes.

3.2 ABI as a clinical tool

In attempt to summarize the evidence using thematic analysis, ABI as a clinical tool emerged as one of the main themes and sub-themes which are the association of ABI in compression stockings, a call for standardization and algorithm.

In this section it will try to demonstrate the clinical connections between ABI procedure and compression stockings.

3.2.1 Association of ABI in compression stocking

Guttormsen & Smith (2016) support the integration of ABI in the initiation of compression stockings in clinical practice, as it is non- invasive, portable and easy to use. It offers benefits to both the patient and the clinicians as it can provide a window to the cardio vascular system, detect path physiology of the arteries and further predict disease severity. The authors also highlighted that compression without ABI can result in non-healing leg ulcers. For this reason, it was pointed out that a mandatory ABI assessment should be done in all patients suffering from venous leg ulcers before compression stockings are applied. However, Haynes et al. (2015) highlighted the importance of the pre-assessment of skin, limb and circulation prior to ABI testing indicating that the result of these assessments would aid in determining ABI necessity. Although these two pivotal studies were contradicting about the timing of ABI assessment, both implicated the importance of an ABI assessment in initiation of

compression stockings. They contributed in raising the significance of the question "*when is the right timing of ABI assessment*"? And "*What is the best practice in this area?*

3.2.2 A call for standardization

Staines (2018) reported a result from an annual Wound UK conference affirming that ABI assessments are not carried out enough in clinical practice due to several reasons such as time constraints and clinicians' lack of competence in carrying out the procedure. This report was crucial in comprehending the reason why ABI assessment utilization rate was low in the clinical field. In addition it also helps in finding solutions and develops strategies towards addressing the issue and in return improves the usage and efficacy of the procedure.

Mayor (2001) pointed out that a wide variation of practice exists regarding the prescription of compression stockings and the utility of ABI assessment. Furlong (2015) found revealing data through a cross-sectional survey depicting that discrepancy occurred in assessment of patient with the same risk factors in different regions in England. These findings were crucial because the results are calling for standardization of practice in the field of compression therapy. This result will serve as important research as to why a wide variation exists and what measures can be done to eliminate these inconsistencies.

3.2.3 Algorithm

A best practice statement (BPS) established by Coull & Clark, (2005) that highlights the utilization of an algorithm in prescribing compression stockings. This BPS was important because it guided clinicians through evidenced based practiced. However, some recommendations from the BPS were not supported by literature at that time and were only endorsed by a panel of experts. Given the fact that this BPS was

developed 14 years ago, it is likely that changes and innovations have developed and evolved in this particular field of knowledge and some, if not all recommendations are now supported by research literature.

Mosti (2017) in his case report studied the efficacy of a BPS of compression therapy in the community. The author implied that the used of BPS in daily practice can be confusing to the community to the staff that are under time pressure in dealing with the complexity of the problem. He also pointed out that the best way to give high quality care to the patient was to stay up to date with the literature and current guidelines. However, the author fails to conclude about the significance or insignificance of the integration of an algorithm in daily practice.

Furthermore, Atkin & Critchle (2017) in their case series report studied the impact of the implementation of a leg ulceration pathway which is somehow similar to an algorithm. The authors found that with the use of the pathway where ABI testing had an active role, healing rates of leg ulcers were raised and nursing requirements decreased. These findings are essential in illustrating the importance of pathways/ algorithm in daily practice which will serve as a guide in providing the best clinical decision. Although the sample size was small (N= 34) and the study was done only once in one community, the results do provide some amount of evidence.

3.3 Pillars of Success

Pillars of success emerged as one of the main themes and identified four sub-themes. These four factors are crucial in achieving success in compression stockings therapy which are the following holistic approach, quality assessment, bridged the gap and competence.

3.3.1 Holistic Approach

De Carvalho et al. (2015) made an important point that in order to succeed in venous leg ulcer (VLU) treatment nurses should have a wide perception regarding the scope of the problem. This understanding is vital since nurses are the primary care givers. The

authors concluded from this pivotal research that if things were done appropriately the healing of VLU would improve and reoccurrence of leg ulcer will be prevented. The authors also described the essentiality of establishing a diagnosis before prescribing compression hosiery and the result of a clinical assessment should lead clinicians to develop a treatment plan.

Haynes et al. (2015) pointed out that the criteria in selecting GCS should be based on the assessment of the limb, patient tolerance and preferences. The assessment should also be done by a competent practitioner. The key implication that can be drawn from these studies is that a holistic approach should be applied to all patient suffering from leg ulcers prior to initiation of compression hosiery, for only then we will be able to succeed in dealing with the complexities in the clinical field.

3.3.2 Quality Assessment

Another essential factor to succeed in compression stocking therapy was quality assessment**.** Guttormsen & Smith (2016) stated that there should be a quality assurance in carrying out the ABI procedure. Controlled criteria should be met such as understanding the rationale behind the procedure, ensuring clinicians' competence to perform and read the result, and taking measures to exclude all contraindications before initiating the procedure.
These criteria are significant in ensuring that only the best care is delivered to the patient. The authors also highlighted that incompetency such as failure to interpret ABI results and inability to identify PAD can result to unsafe use of CGS which in return can expose the patient to undesirable adverse effects.

Furlong (2015) concluded that the use of a tool such as a risk chart can provide a full overview in planning, organizing and referring the patient's care. These two finding are significant in exhibiting the use of different strategies in maintaining quality and fostering quality assurance.

3.3.3 Bridge the Gap

Mayor (2001) claimed that ambiguity exists in the field of compression stocking therapy. In his study he found that clinicians had trouble in distinguishing the level of compression and its respective indication. In addition, there was a lack of consensus in the hospital and in primary health care in terms of common grading system. AlGahtani, Al-Diad and Isnani (2009) in their cross sectional survey from Saudi Arabia found that the competency of physicians who were involved in prescribing elastic compression stocking needed improvement. Furthermore, the authors pointed out that initiation of elastic compression stockings needs to be scrutinized. Xu, Wang, Zhao, Wang, and Zhao (2018) investigated the knowledge, attitude and practice of health care professionals in application of GCS. Findings showed uncomfortable evidence which revealed that competence in initiation of GCS was alarmingly low and awareness of the proper use of GCS is needed. These surveys had a large number of respondents (n-1444) and can be considered strong studies.

The three different types of studies mentioned above had a definite conclusion that a gap of knowledge exist in this area. Based on evidence provided, I speculate that the knowledge gap can be one of the factors contributing to the low prevalence rate of ABI utilization which was describe by Staines (2018). This can create a cause and effect relationship for ABI assessment and prescription of compression stocking, which comes hand in hand according to the leg ulceration pathway by Atkin & Critchiey (2017).

A question that needs to be asked is "*How can we narrow the gap"?* Xu et. al. (2018) proposed some solutions and actions that might help narrow the gap and this includes strategies such as service training and continuing education that will foster augmentation of competence in this particular field.

3.3.4 Competence

Mosti (2017) implied that the geriatric population is expanding and increasing therefore it is crucial that nurses should be equipped with knowledge, skills and the right attitude in order to meet the demands in the future. My question is "*are we ready"?* This inquiry is vital because the author is giving us a message that we need to prepare to face the challenges that lies ahead.

Carvalho et.al. (2015) pointed out that a nurse's competence is essential in dealing with the disease complexities because VLU and PAD are often infused. The authors also implied that in daily clinical decisions, expertise in the field is often a requirement and nurses play an important role as the primary care giver in health care.

JCN Journal of community nursing (2014) concluded that if clinicians have the confidence and expertise, compliance of compression stocking was increased. The authors wanted to convey that with increased clinicians' competence the quality of care that was provided also increased, resulting in better understanding and increased cooperation from the patient.

Popoola (2003) pointed out that when it comes to taking care of wounds many physicians have handed over the responsibility to the nurses despite the limitation of nurses' authority. She also highlighted the value of nurse practitioners who have both the competence and the prescriptive authority to ensure that holistic care is given to the patient. According to the author, with NPs' competence and authority, NPS have the capacity in choosing the appropriate compression stocking that is more suited to the patient and patients are best serve with this kind of approach.

On the other hand Furlong (2015) emphasized the competence of clinical nurse specialist (CNSs) in risk assessment and risk stratification. The foundation of their competence was based upon evidence base practice and when it comes to their ability in identifying risk factors that affected the reduction of ABI was remarkable.

As far as the main findings of this study are concerned, the results showed that there is a crucial clinical connection between ABI assessment and compression stockings prescription. Evidence base practice demonstrated a clinical path which was ABI assessment should be done before compression stocking utilization. In addition, In order to succeed in compression stockings therapy, shared responsibility should be practice in which I mean institutional leader should see to it that current clinical policies are in line with evidence base practice and nurses should be updated with the current evidence.

The next chapter is the discussion section. In this section, it will try to discuss and interpret the significance of my findings together with other related literature. In addition, it will also try to discuss implication of practice in the clinical field and as well as the limitation of the study.

4 Discussion

A systematic literature review strategy was used in this study aiming to answer the research question which was "*what does the research literature says about the use of ABI in compression stockings therapy?"* The results of the literature searched identified 16 articles which were criticized according to each method using quality checklist by Joanne Briggs Institute and Polit & Beck. Thematic Analysis was the method of choice in analysing the results which resulted two main themes and nine sub- themes with their respective codes.

The result of this review demonstrates that ABI assessment is an essential procedure in initiation of compression stockings. This was supported by Carvalho et. al. (2015) in their literature review pointing out the value and the significance of ABI assessment in prescribing compression stockings. This is the reason why authors suggested that mandatory ABI testing should be done to all patients who were prescribed to wear compression stockings in order to exclude peripheral arterial disease. According to these authors mixed aetiology of VLU and PAD added disease complexities and are often seen together in the clinical field. They also emphasized that if things are done correctly it will increase ulcer's healing time and it will prevent ulcer recurrence.

Guttormsen & Smith (2016) also showed in their study the clinical use and significance of ABI integration in clinical practice. The authors enumerated some benefits of ABI tools as non-invasive, easy to use and portable, which is why it can be used in different patient settings such as hospital bedsides and home care in the community. They also implicated the clinical significance of ABI as it can diagnose PAD which is very important before initiating compression stockings. Incompetency such as inability to recognize symptoms of PAD and mis-interpretation of ABI can lead to unsafe application of high compression therapy which can further results to serious damage. In addition it can reveal disease severity that correlates the increased risk of limb amputation and mortality. These pivotal studies implicated the crucial role of ABI assessment in initiation of compression stockings, and contributed in raising the

question "*when is the right timing of ABI assessment*"? And "*What is the best practice in this area?*

The results revealed that the authors have different insights about the timing of ABI assessment. While some authors implicated mandatory ABI testing to all patients in initiation of compression stockings, some authors suggested another path of compression stocking initiation, pointing out that the result of leg assessment should be the indicator of ABI requirement. This is supported by Coull et al. (2005) in their best practice statement for compression hosiery. Authors highlighted the significance of clinical assessment so that factors that may interfere in the appropriate selection of compression stocking will be eliminated. Another BPS was developed ten years after Coull et al. (2005) released this BPS.

Haynes et al. (2015) developed another best practice statement that aimed to provide practical information that will serve as a guide in clinical decisions regarding compression stockings or compression hosiery. The authors implicated that pre-assessment should be carried out by a competent clinicians who has the ability to provide holistic care and resources for making further referrals if necessary. Furthermore, they also stated that the result of pre-assessment test will serve as a basis or guidelines whether the patient will undergo ABI testing or not. The above mentioned studies were contradicting about the timing of ABI assessment but have the same common understanding that ABI assessment was compulsory in compression stocking initiation. These argument is important in understanding what is the best practice in this area and even more significant in avoiding some major pitfalls in compression stocking utilization. On the other hand, Lim and Davies (2014) stipulated some complications and adverse effects from wearing GCS such as allergic reactions and skin necrosis. The authors also highlighted the major pitfall of using compression stockings in patient with impaired arterial flow such worsening of ischemia and this can be avoided by conduction of ABI procedure.

The review also provided a significant result where treatment pathway or algorithm was used in dealing with VLU and compression stocking initiation which resulted to positive results. Atkin & Critchiey (2017) in their study measured the impact of implementation of leg ulceration pathway where ABI testing had an active role before initiation of compression stockings. The authors found out that implementation of leg ulceration pathway in daily clinical practice in the community has led to numbers of benefits including increase ulcer healing rates and decline of nursing hours visits. The weakness of this study was the sample size was small. However, the positive result using clinical pathway from this study was hard to ignore but more studies is needed in order to provide solid and robust evidence regarding this matter.

One of the most intriguing results of this study was the expansive gap of knowledge in this particular field. This was revealed in AlGahtani, Al-Diad & Isnani, (2009) and Xu et al. (2018). AlGahtani et al. (2009) in their cross-sectional survey in Saudi Arabia found out that prescribing physicians who were involved in deep vein thrombosis management needed more information such as benefits of ECS, timing of initiation, therapy duration and degree of compression. Even though the sample of the study was low (n-38), all participants included were physicians who were involved in the treatment of deep vein thrombosis, high competence from this group of professionals was expected, but the result of the study showed otherwise. The authors concluded that there was a need to scrutinize the protocol of the institution regarding prescribing of elastic compression stockings.

In another similar study conducted in China by Xu et al. (2018) the authors found that health care providers' competence regarding graduated compression stocking was significantly low and alarming. They concluded that knowledge about the indication and use of graduation compression stockings needed more empowerment and establishing policies in how to maintain competence in the area was needed.

The most surprising result of this study is that, since 1995 it was already concluded and agreed that palpation of ankle pulses alone was not sufficient in excluding arterial

components and that ABI procedure was needed, but until today palpation alone is still the guiding principles in Norwegian primary health care. The result of the study by Atkin & Critchiey (2017) may provide clues for strategies and developing policy regarding initiation of compression stockings in primary care in Norway.

The result of the review also identified one of the most significant and inevitable problems that the primary health care services will be facing in the next decades. With continuously increasing elderly population there will be a patient population with multiple complex health problems and a high demand for primary health care. These trends were also mentioned by Mosti (2017) in her case report, who pointed out the demand for nurses with high competence in the field in order to sustain and maintain quality care. In Norway alone, it is predicted that elderly population will reach to 1.4 million in the year 2050. Norwegian primary health care will need many health care professionals and could benefit from new groups of professionals so that intervention and care will be conducted interdisciplinary. Popoola, (2003) emphasized in her study the role of NPs in wound care. She stipulated that NPs have the competence, training and authority to be able to provide holistic care and with this kind of approach the patient will be served with outmost care. This was also supported by another study by Furlong (2015) where the results of the study highlighted the competence of clinical nurse specialist (CNSs) in risk assessment and risk stratification. The foundation of their competence was based upon evidence based practice (EBP) and their ability in identifying risk factors that affected in the reduction of ABI was remarkable.

These studies were correlated in a sense that both authors were describing two different expanded roles for nurses but with similar aspect which is the competence in their field of expertise. They could be pointing out a ratio of an equation towards finding a solution to the problem of an increasingly elderly population in the future. The weakness of Popoola (2003) argument is that this came from expert opinion. It could have been supported if the argument was founded in an experiment.

4.1 Nurse Practitioner Role and implication of practice

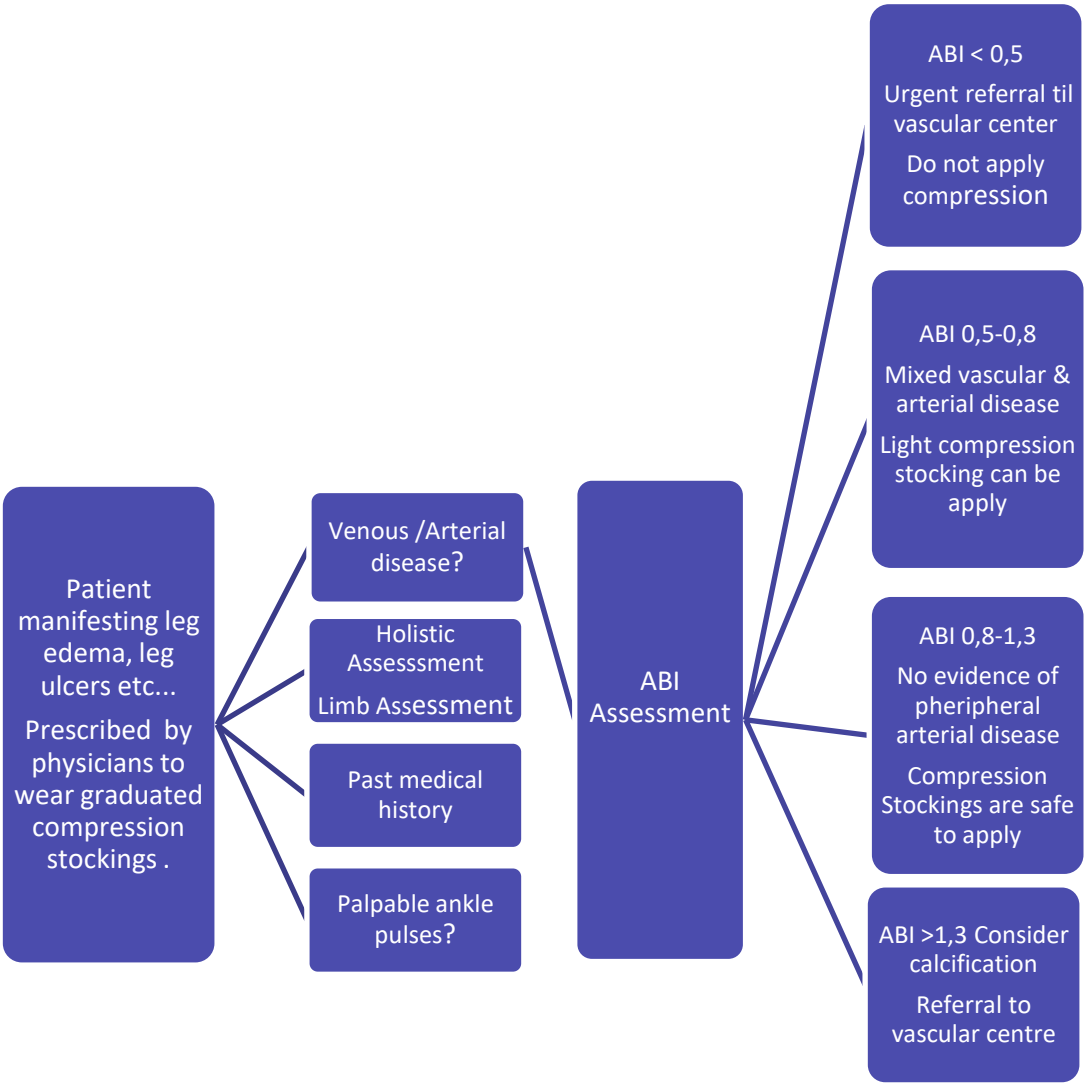
In Norway NPs are very new. What role they will play in Norwegian primary care in the future is still unclear. The results of the studies discussed above seen together with the models of working as depicted by Bing-Jonsson (2019), may give us clues and understanding towards establishing NPs new roles in this field in primary health care in Norway.

One way could be that Nurse Practitioners who work in primary health care could tackle the responsibility in ABI procedural assessment prior to initiation of compression stocking. In this way NPs may prevent ischemic leg wounds before they develop and intervene early to assess if the patient needs compression stockings or not.

In Lier Municipality where I work, some newly graduated Nurse Practitioners are currently working as a team called the(*Innsatsteam)*. This does not, however, prove to be a way to best approach patients with leg ulcers or in need of ABI assessment. According to Bing-Jonsson (2019) one way to utilize NPs' competence is to establish Nursing Clinics where other health personnel have the opportunity to seek guidance in a particular field of expertise. In accordance to the idea presented above, a Vascular Clinic should be one way of reaching out to many patients and give guidance to other health personnel. In this way an NP could be consulted first to do systematic physical assessment and ABI measurement to all the patients suspected suffering from VLU, symptomatic PAD, chronic leg ulcers, and leg oedema and specifically before prescribing GCS.

Finally, going back to the title of this thesis; Compression *Stockings, Are we doing it right*?, I would conclude that so far we have not been doing it right, but propose that a NPs in Lier Municipality could change this by undertaking necessary assesments of whether a patient needs compression stocking therapy. I suggest that a simplified algorithm described below should be put into practice for the purpose of guiding NPs in Lier Municipality in clinical decisions before compression stocking initiation. The development of the Algorithm was based on the Best Practice Statement by Wound UK (2014) and leg ulceration pathway by Atkin & Critchiey from this review (2017).

Figure 3: Suggestion for algorithm in Compression Stocking Initiation



4.2 Study Limitations

En every study has an equal share of limitations and this thesis will never be an exception. In this section I will try to divulge some limitations that may or may not impact the overall result of this study.

The first potential limitation of this study is the method of the study itself. According to Aveyard (2014) stated that, a more detailed systematic review will only be attain with the presence of a team/researcher to review every sources, reference and literature that were extracted according to each relevance to the research question. In this case, this was a solo task and overcoming the endeavour was overwhelming. However, this will be an opportunity for improvement and a recommendation should be made that every adviser should check the final selected literature in accordance to its relevance to the research question.

Another limitation of the study is that some of the selected literature came from an expert opinion and in general rule it is subjective to bias, but due to the context difficulty or nature of the research question I did not identified studies such as randomised controlled trial (RCT) and non randomised control study (NRS).

The major potential limitation of this study is the search of the literature did not identify studies that were done in Norway or in Nordic countries. Understanding the level of competence among nurses and physicians in primary health care in this area was impossible to know, thus understanding barriers and outcomes of implementation in the said countries are unknown.

Further quantitative research would be required to address unanswered questions such as what is the level of clinical competence in primary health care regarding this area and how often are we performing ABI procedure for those who were prescribed to wear compression stockings.

5 Conclusion

Increasing elderly population is a worldwide primary health care challenge. Norway is expecting 1, 3 million old people (>70) in the year 2020. In this regard, with an advancing age venous and peripheral diseases are very common medical problems due to valve insufficiently and atherosclerosis respectively. In this case, there will be an increase demand of compression stocking therapy as it is the golden standard treatment of venous valve insufficiency and ABI assessment should be put in practice before compression stockings utilization for the reason that this procedure confirms the perfusion of the limb and further provide information whether the patient should wear compression stockings or not.

Norwegian's primary health care clinical principles in prescription of compression stockings, is the present of palpable pulses in the lower extremities. This practice was certainly in contrast in compare to other countries like United Kingdom and Canada where ABI assessment play a central role prior to initiating compression stockings. Moreover, Norwegian clinical practice is not in line with evidence base practice.

The main finding of this review is that ABI assessment played a crucial role in initiation of graduated compression stockings and studies showed that with the use of treatment pathway where ABI assessment was integrated, this had shortened the time of ulcer healing and decreased nursing requirements. Performing ABI will also prevent the major pitfall in prescribing compression stockings like unsafe clinical practice and worsening ischemia.

Furthermore, the results of this review concluded that in order to succeed in venous leg ulcer treatment and compression stocking therapy in primary health care, health personnel should provide holistic care, care given to the patient should be assessed in terms of quality, competence among health care worker and the leader of the institution should evaluate the existing knowledge and skills in order to identify gap of knowledge in order to identify effective measures that will narrow the gap.

The results of the review was pointing to the direction that Norwegian primary health care might need to integrate ABI assessment before initiating compression stockings by using algorithm in clinical practice. By doing so our clinical practice will be in line with evidence base practice and best practice statements develop by Wound UK (2015).

References

AlGahtani, F. H., Al-Diab, A. I., & Isnani, A. C. (2009). Practices and Perceptions of Physicians to Prescribing Elastic Compression Stockings in a single center in Riyadh, Saudi Arabia (pp. 1465-1468)

Atkin, L., & Critchley, A. (2017). The leg ulceration pathway: Impact of implementation. *Wounds UK, 13*(4), 107-112

Aveyard, H. (2014*). Doing a Literture Review in Health and Social Care: A practical guide.* (3 ed.) Great Britain Glasgow: Bell and Bain Ltd

Bing-Jonsson, P.C. (2019). Avansert Klinisk Sykepleier i Helse og Omsorgstjenester i Kommunene: Kompetanse i helse og omsorgstjenester kommunene i Norge: Avansert Klinisk Sykepleie:(Red.), Føringer for kompetanse i helse og omsorgstjenester i kommunene i Norge (1 utgave, s.161-176). Oslo: Gyldendal Akademisk

Braun, V. & Clarke, V. (2006). Using Thematic Analysis in Psychology; Qualitatitive Research in Psychology: APA handbook of Research Methods in Psychology (Vol.2 pp 57-60). Washington DC: American Psychological Association

Crawford, F., Welch, K., Andras, A., Chapell, FM. (2016). Ankle brachial index for the diagnosis of lower limb peripheral arterial disease. *The Cochrane Database of Systematic Review (*9) doi.org: **https://10.1002/14651858**

Coull, A. & Clark, M. (2015). Best Practiced Statement for Compression Hosiery. *Wounds UK, Vol 1*. (pp. 70-76). *Retrieved from: http://www.wounds-uk.com/best-practiced-statements/compression hosiery- second-edition (accessed 01.11.2018)*

Davies, J., Kenkre, J., & Williams, M. (2014).Current Utility of the Ankle- Brachial Index (ABI) in general practice: Implications for its use in Cardiovascular Disease screening. *BMC* Family *Practice.* doi.org: **https://doi.org/10.1186/1471-2296-15-69**

Deraas, T.S., Berntsen, G.R., Jones, A., Førde, O.H. & Sund.E.R. (2014). Associations between

Primary Healthcare and Unplanned Medical Admissions in Norway. A Multilevel Analysis of the Entire Elderly Population. *BMJ Publishing Group*. **doi.org: https://doi.org/10.1136/bmjopen-2013-004293**

Day, J. (2015). Diagnosing and Managing Venous Leg Ulcers in Patients in the Community. *British Journal of Community Nursing,* 20 (Sup12), pp.22-30. **doi.org: https//doi.org/10.12968/bjcn.2015.20**

de Carvalho, M. R., de Andrade, I. S., de Abreu, A. M., Leite Ribeiro, A. P., Peixoto, B. U., & de Oliveira, B. G. R. B. (2016). All bout Compression: A literature review. *Journal of Vascular Nursing,* 34(2), 47-53. **doi.org: https://doi.org/10.1016/j.jvn.2015.12.005**

Elwell, R. (2018). European Class Compression Hosiery: A new range of garments. *Journal of Community Nursing, 32*(3), pp 40-44.

Everett, E.L., & Furseth, I.(2012) *Masteroppgaven: Hvordan Begynne - Og Fullføre*. (2. Utg. ed.). Oslo: Universitetsforlaget

Furlong, W. (2015). Recommended frequency of ABPI review for patients wearing compression hosiery. *British Journal of Nursing, 24*, pp. 18-23. doi.org: **https://doi.org/10.12968/bjon.2015.24**

Fagerström, L., & Deborah, M. (2019) *Avansert Klinisk Sykepleie*. 1. Utgave. ed. Oslo: Gyldendal Akademisk

Guttormsen, K., & Smith, L. (2016). WHAT IS AN ANKLE BRACHIAL PRESSURE INDEX? *Diabetic Foot Journal, 19*(2), 22-28.

Helgøy, I. (2005) Active Ageing and the Norwegian Health Care System. *Stein Rokkan Centre for Social Studies.*

How to select the best compression hosiery for your patient. (2014). *Journal of Community Nursing, 28*(3), 86-90.

Lim, C. S., & Davies, A. H. (2014). Graduated Compression Stockings. *Canadian Medical Association Journal, 186*(10), E391-E398. doi.org: **https://doi.org/10.1503/cmaj.131281**

Maylor, M. E. (2001). Compression award. Accurate selection of compression and antiembolic hosiery. *British Journal of Nursing, 10*(18), 1172-1178.

Ministry of Health and Care Services. (2012).The Norwegian Public Health Act. (Act-2011-06-24-29). Retrieved from htpps://www.regjeringen.no/globalassets/upload/hod/hoeringer-fha_fos/123.pdf

Moffett, C., & O'Hare, L. (1997). Graduated Compression Hosiery. *Journal of Wound Care, 6*(Sup1), 11-14. doi.org**: https://doi.org/10.12968/jowc.1997.6**

Moffatt, C., & O'Hare, L. (1995). Ankle pulses are not sufficient to detect impaired arterial circulation in patients with leg ulcers. *Journal of Wound Care, 4*(3), 134-138.

Mosti, G. (2017). Compression Therapy in the Community. *Journal of Community Nursing, 31*(5), 36-42.

MohlerIII,E.,Jacobson, D., Reilly,M., Cunningham, K.,Miani,M.,Criqui,M.,...Hirsch,A. (2004). Utility and barriers to performance of the ankle – brachial index in primary care practice. *Vascular Medicine* (9)253-260. doi.org: **https://doi.org/ 101191/1358863x04vm55oa**

Norge Helse- Og Omsorgsdepartementet. (2015) *Fremtidens Primærhelsetjeneste Nærhet og Helhet*. (Meld. St. 26 2014-2015). Retrieved from: https://www.regjeringen.no/no/dukumenter/meld.-st.-26-2014-2015/id240980/

Popoola, M. M. (2003). A Holistic approach to therapy for venous stasis leg ulcers. *American Journal for Nurse Practitioners, 7*(7), 9-18.

Ritchie, G., & Taylor, H. (2018). Understanding compression: part 2 -- holistic assessment and clinical decision-making in leg ulcer management. *Journal of Community Nursing, 32*(3), 22-29.

Schober, M., & Affara, F. (2006). *International Council of Nurses : Advanced Nursing Practice*. Oxford: Blackwell

Staines, K. (2018). Safe compression and accurate ABPI – overcoming barriers. Lead Nurse, Wound Care/Education, Accelerate CIC. *(pp. 64-67). United Kingdom. SB Communications Group*

Steihaug, S., Paulsen, B. & Melby. L. (2017). Norwegian General Practitioners' Collaboration with Municipal Care Providers – a Qualitative Study of Structural Conditions." *Scandinavian Journal of Primary Health Care*. **doi.org: https:doi/org 10.1080/02813432.2017.1397264**

Storeng, S.H., Sund, E.R., & Krokstad, S. (2018). Factors Associated with Basic and Instrumental Activities of Daily Living in Elderly Participants of a Population-based Survey: The Nord-Trøndelag Health Study, Norway. *BMJ Publishing Group* **doi.org: https:doi.org/10.1136/bmjopen-2017-018942**

Stubberud, D.G.(2018). *Kvalitet og Pasient Sikkerhet: Sykepleierens Funksjon og Ansvar for Kvalitetsarbeid.* Oslo. Gyldendal Akademisk

Xu, Y., Wang, W., Zhao, J., Wang, J., & Zhao, T. (2018). Knowledge, Attitude, and Practice of Healthcare Professionals toward clinically applying Graduated Compression Stockings: Results of a Chinese web-based survey. *Journal of Thrombosis and Thrombolysis*. doi.org: **https://doi.org/10.1007/s11239-018-1749-4**

Wounds UK Best Practice Statement (2015) Compression hosiery (2nd edn). London. *Wounds UK, May Vol 1 pp. 70-76.* Retrieved from*: http://www.wounds-uk.com/best-practiced-statements/compression hosiery- second-edition (accessed 01.11.2018)*

Web sites:

http://joannabriggs.org/research/critical-appraisal-tools.html

https://www.unisa.edu.au

http://www.prisma-statement.org

https://www.slidesshare.net>srbehandling

https://who.int>primary-health

www.utdanning.no

https://utdanning.no/yrker/beskrivelse/personlig_assistent

http://icn-apnetwork.org/

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