

# Use of ankle-brachial pressure index to assess patient suitability for lower limb compression

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## Abstract

- **Background:** In 2018, approximately 250 million patients globally received compression therapy as it is proven to be a safe and effective treatment for lower leg conditions such as lymphatic insufficiency and venous hypertension. The most common method of arterial assessment is the calculation of a patients Ankle Brachial Pressure Index (ABPI) and the measurement/recording of this is embed within many policies and best practice statements. ABPI compares the arterial flow of the arms (brachial artery) and the legs (Dorsalis Pedis artery and/or posterior tibial artery) providing a ratio to determine the presence and severity of Peripheral Artery Disease (PAD), therefore ensuring suitability for compression therapy.
- **Aim:** To critically review and analyse findings from contemporary literature to evaluate the effectiveness of the ABPI screening tool when identifying and assessing patients requiring lower limb compression therapy.
- **Method:** A structured literature review, using a narrative approach.
- **Results:** Four studies were identified for inclusion. The four studies included a total of 152 healthcare clinicians, including both medical, nursing, and allied health professional staff in both primary (n= 148) and secondary (n= 4) care settings with a total of 51 patients. Analysis from the four studies were grouped into seven shared themes. These included: appropriateness of ABPI tool, clinician education, competence, referral process, associated costs, role definition, access to appropriate equipment and lack of time to conduct the assessment.
- **Conclusion:** ABPI is the most used assessment tool to ensure early identification, diagnosis and management of PAD and lower limb conditions requiring compression therapy. The review highlighted the importance of undertaking a holistic assessment of patients, incorporating the ABPI assessment of all patients where not contraindicated. Analysis of the included papers has highlighted the need for further research which explores patient experience and safety, when assessing a patient's suitability for lower limb compression therapy.

**Key Words:** Ankle Brachial Pressure Index (ABPI), Compression Therapy, Lower Limb & Patient Safety

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In 2018, approximately 250 million patients globally received compression therapy as it is proven to be a safe and effective treatment for lower leg conditions such as lymphatic

insufficiency and venous hypertension (Fortune Business Insights, 2020). The most common method of arterial assessment is the calculation of a patient's Ankle Brachial Pressure Index (ABPI) and the measurement/recording of this is embedded within many policies and Best Practice Statements. ABPI compares the arterial flow of the brachial artery in the arm and the dorsalis pedis artery and/or posterior tibial artery in the leg, providing a ratio determining the presence and severity of peripheral artery disease (PAD), therefore assessing an individual's suitability for compression therapy alongside an in-depth holistic leg assessment (Song et al., 2019).

Lower limb disorders and leg ulcers are identified as some of the most common conditions treated in the United Kingdom (UK) by the National Health Services (NHS) (Heatley et al., 2020). It is estimated that 1.5% of the adult population are living with an active leg ulcer and around 80% of these classed as a venous leg ulcer (VLU), the cost of managing these patients within the NHS is estimated to be around £2 billion each year (Heatley et al., 2020; Todd, 2019; National Institute for Health and Care Excellence [NICE] 2020). With nursing visits being the largest cost factor, the need to improve accuracy of diagnosis, ensuring effective evidence-based treatments are implemented is paramount to help improve the financial burden (Phillips et al., 2020). The costs to the NHS for managing these patients within the UK has been estimated as ranging from £698 - £3998 per patient for a healed VLU and between £1719 to £5976 per patient for unhealed VLU (Guest et al., 2016). Trevethan (2018) suggest that the health concerns and rising costs associated with the management of VLU are not just a concern isolated to UK healthcare systems but is also a dominant global concern.

**Aim:**

The aim of this review is to critically review and analyse findings from contemporary literature to evaluate the effectiveness of the ABPI screening tool to assess patient's safety of the application of compression therapy.

**Methods:**

A structured literature review, using a narrative approach to review a variety of documents including research, practice, and policy literature. This format was chosen to allow for a systematic review of both the theoretical and contextual aspects of the subject topic (Da Cost et al., 2020).

#### **Search Strategy:**

A systematic approach using five electronic databases, between September 2021 and November 2021. These included: CINAHL, Summon, MEDLINE, Cochrane Library & PubMed.

Key Terms used:

#### **Ankle Brachial Pressure Index (ABPI)**

#### **Compression Therapy**

#### **Lower Limb**

#### **Patient Safety**

Search inclusion criteria were limited to publications written in English, relevant to ABPI assessment, and empirical research. Search exclusion criteria included literature reviews, expert opinion statements, editorials, and non-English papers. There were no restrictions placed on the country of publication as long as the paper was written in English. Published research after September 2016 was only included in the search, as that was when the last Cochrane Review was published reviewing the use of ABPI in diagnosis of lower limb peripheral arterial disease (Crawford et al., 2016).

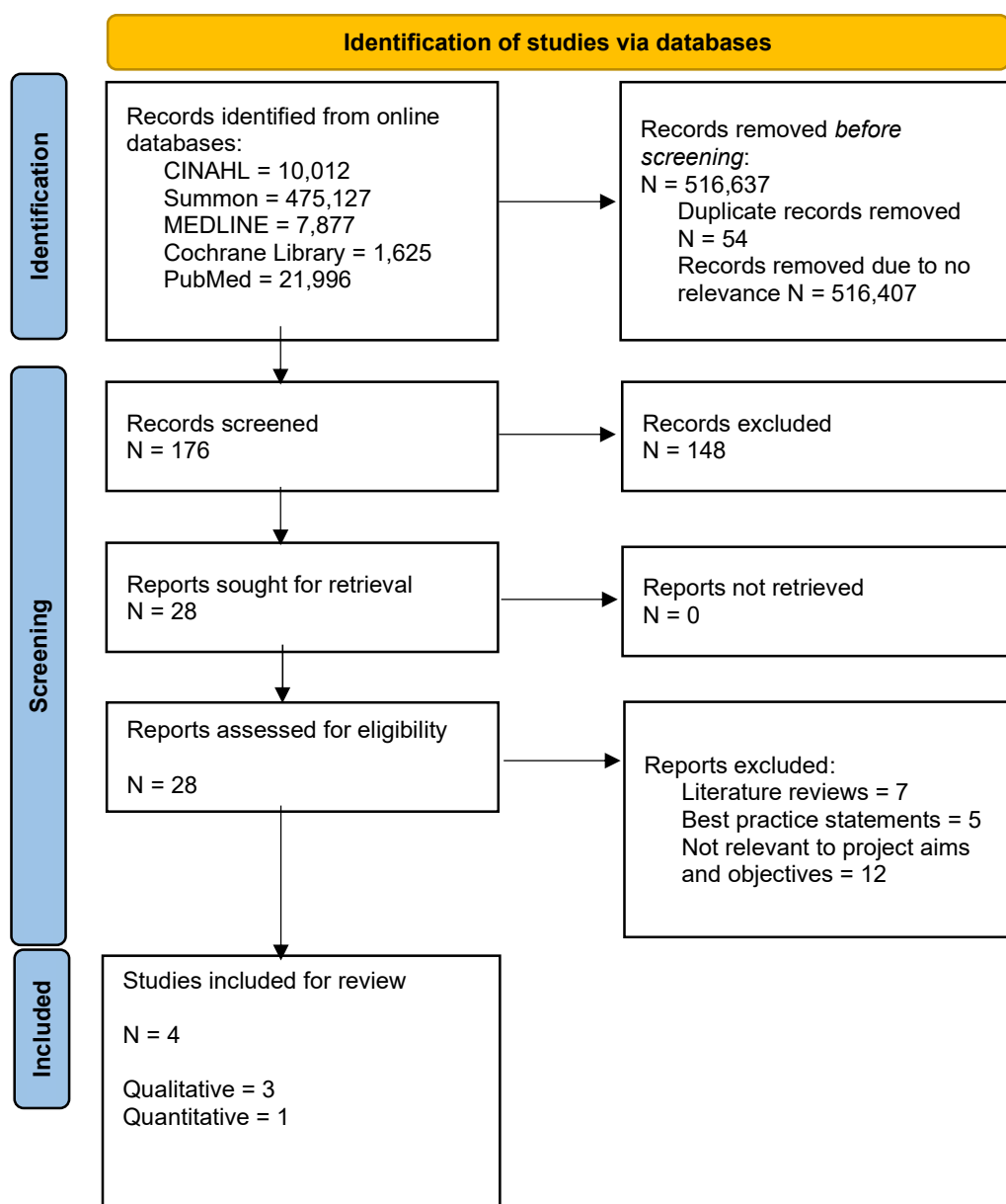
The refinement of the search results are documented using a PRISMA flow chart (Figure 1).

#### **Critical Appraisal of Literature:**

The critical appraisal tool selected to be used within the literature review was CASP (2021) tool. CASP (2021) tool is a systematic and structured assessment tool, comprising of several questions to undertake an in-depth analysis of a piece of research. This tool is recommended for the novice researcher, endorsed by Cochrane Qualitative and Implementation Methods Group and is commonly used when appraising health-related qualitative evidence (CASP, 2021; Long et al., 2020).

The CASP (2021) tool was employed to critical appraise the chosen studies. This process ensured quality assurance, with each studies considered to be of suitable quality and appropriate to be included within the literature review (Long et al., 2020). Each of the chosen studies had a clear research aim, methodology and clear understandings of the findings, see Figure 2.

**Figure 1: PRISMA Flow Chart**



**Results:**

Four studies were identified for inclusion (Ding & Lloyd, 2021; Kannan et al., 2016; Scott et al., 2019; Weller et al., 2019) with a range of methodologies, see figure 2. The four studies included a total of 152 healthcare clinicians, including both medical, nursing, and allied health professional staff in both primary (n= 148) and secondary (n= 4) care settings with a total of 51 patients. Sample sizes varied from 13 to 91 participants in the chosen studies for review. All studies were conducted in western countries, UK (n=2) (Kannan et al., 2016; Scott et al., 2019), New Zealand (n=1) (Ding & Lloyd, 2021) and Australia (n=1) (Weller et al., 2019). Due to the variation in interventions and methods of data analysis, it was not possible to undertake a meta-analysis, therefore, a thematic analysis of the studies was undertaken. Analysis from the four studies were grouped into eight shared themes: appropriateness of ABPI tool, clinician education, competence, referral process, associated costs, role definition, access to appropriate equipment and lack of time to conduct the assessment.

**Figure 2: Table of findings**

<b>Author(s) &amp; date of publication</b>	<b>Design</b>	<b>Method</b>	<b>Sample Size</b>	<b>Key Themes Identified</b>	<b>Key Findings</b>
Ding & Lloyd (2021)  Conducted in New Zealand	Qualitative analysis	Face to face semi-structured interviews	13 Health Professionals 9 = GPs (Primary Care) 2 = Vascular surgeons (Secondary Care) 2 = Allied Health Professionals (Secondary Care)	Appropriateness of ABPI tool  Clinician education  Competence  Lack of time to conduct the assessment  Referral process  Associated costs  Role definition  Access to appropriate equipment	<ul style="list-style-type: none"> <li>• ABPI was beneficial in diagnosing PAD and implementing appropriate management.</li> <li>• No formal training to undertake ABPI assessment</li> <li>• ABPI is beneficial in primary care compared to secondary care in reducing unnecessary referrals to services and improving access to community treatment.</li> <li>• Barriers to use in primary care include associated costs, time</li> </ul>

					<p>allocation, and perceived low patient need.</p> <ul style="list-style-type: none"> <li>• Specialist role to undertake ABPI assessments in General practice.</li> </ul>
<p>Kannan et al. (2016)</p> <p>Conducted in UK</p>	<p>Quantitative analysis</p>	<p>Survey questionnaire</p>	<p>91 questionnaires completed out of 118 offered</p> <p>All GPs</p>	<p>Appropriateness of ABPI tool</p> <p>Clinician education</p> <p>Lack of time to conduct the assessment</p> <p>Competence</p> <p>Role definition</p> <p>Associated costs</p>	<ul style="list-style-type: none"> <li>• ABPI was mainly performed by community nursing staff.</li> <li>• ABPI is more useful when screening PAD in those symptomatic rather than asymptomatic.</li> <li>• Time constraints on appointments are a limitation with clinicians being allocated between 5 – 15 minutes per appointment.</li> <li>• Staff willingness to perform ABPI.</li> <li>• A less time-consuming test for PAD should be considered.</li> </ul>
<p>Scott et al. (2019)</p> <p>Conducted in UK</p>	<p>Qualitative analysis</p>	<p>Semi-structured interviews and observations</p>	<p>13 Nurses (Practice nurses &amp; Research nurses) were observed with 51 patients</p>	<p>Appropriateness of ABPI tool</p> <p>Clinician education</p> <p>Competence</p> <p>Role definition</p>	<ul style="list-style-type: none"> <li>• ABPI is recognised as a simple and non-invasive procedure.</li> <li>• ABPI is cost effective for screening for PAD and can detect severe disease.</li> <li>• Multi-site photoplethysmography (MPPG) is an alternative assessment</li> </ul>

					<p>method reducing pain and anxiety in patients and could be more cost effective than ABPI.</p> <ul style="list-style-type: none"> <li>• Nurses felt in an uncomfortable position when they were unable to interpret the ABPI reading results and provide a diagnosis.</li> <li>• ABPI requires considerable dexterity to perform the test effectively and poor technique can lead to inaccurate measurements.</li> <li>• Acknowledges no standardised approach to training.</li> </ul>
<p>Weller et al. (2019)</p> <p>Conducted in Australia</p>	<p>Qualitative analysis</p>	<p>Face to face semi-structured interviews &amp; Telephone interviews</p>	<p>35 Primary care clinicians</p> <p>15 GPs</p> <p>20 Practice nurses</p>	<p>Appropriateness of ABPI tool</p> <p>Clinician education</p> <p>Role definition</p> <p>Access to appropriate equipment</p>	<ul style="list-style-type: none"> <li>• Many patients receiving VLU management had not had a vascular assessment undertaken including ABPI.</li> <li>• Equipment was not routinely available in General practice to conduct an ABPI assessment.</li> <li>• Only patients with large non-healing wounds were screened using ABPI for suitability of compression therapy.</li> </ul>

					<ul style="list-style-type: none"> <li>• Collaborative approach to referral between GP's and Practice nurses.</li> <li>• Lack of clear guidelines to inform practice with clear recommendations for assessment and management of VLU's.</li> <li>• Gaps in primary care clinician's (GPs &amp; Practice nurses) knowledge around wound care and theory-informed interventions.</li> </ul>
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**Themes:**

**Theme 1 – Appropriateness of ABPI tool**

A recurrent theme in all studies was the relevance and appropriateness of ABPI as a screening tool for PAD. All studies acknowledged that ABPI is the most frequently used investigation tool globally, alongside a holistic assessment to assist the diagnosis of PAD and assess a patient's suitability for lower limb compression therapy. As well as being efficient, non-invasive, and providing valid, accurate and reliable results (Ding & Lloyd, 2021; Kannan et al., 2016; Scott et al., 2019; Weller et al., 2019). The studies focused on primary care staff, medical and nursing staff, and their experiences of ABPI assessment (Kannan et al., 2016; Scott et al., 2019; Weller et al., 2019), with one study examining the experiences of secondary care clinicians, medical and allied health care professionals (Ding & Lloyd, 2021). Across all studies the clinicians interviewed had an awareness of ABPI. Ding and Lloyd (2021) acknowledge that international guidelines recommend the use of ABPI in both primary and secondary care settings when undertaking a vascular assessment or initiating treatment for VLU's. The four studies conducted in the UK (Kannan et al., 2016; Weller et al., 2019) acknowledge that ABPI is recognised within national guidance and best practice statements as gold standard practice and is predominately undertaken within primary care settings, including General Practitioners (GP) practices and specialist community services facilitated by community nurses, practice



nurses and specialist tissue viability nurses. Kannan et al. (2016) highlighted that ABPI can be used to assess both asymptomatic and symptomatic presentations of PAD, with ABPI being more useful when assessing at risk patients, such as the elderly, diabetics, smokers, and chronic renal failure patients, compared to assessing healthy patients. Although this theme suggests that ABPI is recognised as the gold standard assessment tool, it also highlights the lack of research and investigation of alternative methods such as automated devices, multi-site photoplethysmography or risk identification screening frameworks (Scott et al., 2019; Welsh et al., 2016). Amongst the studies there is also an acknowledgement of the contraindication and limitations of the use of ABPI assessment, however there is lack of clarity in the papers of alternative assessment methods.

## **Theme 2 – Clinician education**

Education was a recurring theme identifying variations among clinicians practice, highlighting inconsistencies within standards of baseline training, post registration education and clinical exposure to performing ABPI assessments, potentially impacting on the care delivery and patient experience (Ding & Lloyd, 2021; Kannan et al., 2016; Scott et al., 2019; Weller et al., 2019). These studies further acknowledge the need for a universal standard approach in education and training to undertake ABPI assessment to ensure consistency of patient care delivery and experience. The knowledge gap is further explored by Weller et al. (2019) and Ding & Lloyds (2021) who commented there is lack of investment within staff training and development due to demand for services, high staff turnover, in house training and associated costs of conducting the assessment that cannot be reimbursed in New Zealand and Australia. Knowledge gaps between clinical staff undertaking the assessment within the UK were also discussed (Kannan et al., 2016; Scott et al., 2019). Scott et al. (2019) suggested in-depth knowledge can improve clinician confidence, when enabling them to provide a comprehensive diagnosis, with an accurate ABPI result giving further reassurance. This theme highlights the need to further address the knowledge gap and to develop standardised training packages that are incorporated into both undergraduate and postgraduate education to ensuring secure foundations and implementation of theory-informed clinical practice (Weller et al., 2019).

### **Theme 3 – Referral process**

Ding & Lloyd (2021) consider the referral process for clinicians and need for support from specialist services when providing primary care services. Ding & Lloyd (2021) examining the value of a clear referral criteria and pitfalls experienced by clinicians, when there is a lack of consistent practice and underpinning clinical information to support an appropriate referral. Ding & Lloyd (2021) acknowledge that practice within New Zealand, sees clinicians referring on to secondary care specialists to make diagnoses and to initiate treatment, due to unclear guidelines and best practice statements to inform clinical decision making. Alternatively, Kannan et al. (2016) suggested that within the UK, there is minimal clinical involvement of specialist clinicians, potentially due to NICE guidance and supplementary best practice guidance, with many VLU patients being managed by nursing staff, and having successful healing outcomes. Both studies suggest that unclear diagnostic and referral guidance is an overarching problem, highlighting the need for consistency in both the diagnosis and management of both PAD and VLU's, ensuring the quality of patient care is consistent and overcomes the distorted role definition of clinicians and ensure that referral processes are simple and transparent for both the referring clinician and patient alike.

### **Theme 4 – Access to appropriate equipment**

The studies included within the review alluded to ABPI being presented as a challenge within their clinical area due to access to inadequate equipment, which impacts ABPI assessment globally and directly impacting patient assessment and treatment outcomes (Ding & Lloyd, 2021; Weller et al., 2019). Both studies suggest that universally there is no standard equipment requirement or request to present to commissioning groups and practice partners to meet service need. Furthermore, this is voiced through lived experiences of GPs and general practice nurses, suggesting that equipment requested to undertake an accurate ABPI assessment is withheld or not freely available due to the few patients that require assessment with VLU's, thus requiring a referral to secondary care settings for assessing (Ding & Lloyd, 2021; Weller et al., 2019). Weller et al. (2019) suggests that this equipment is only available for services providing diabetic screening and monitor services due to patient risk factor, questioning the equity in service provisions for those not diabetic.

### **Theme 5 – Lack of time to conduct the assessment**

Although making every contact count has been of great importance to all clinicians, time constraints have been voiced as a challenge to utilising ABPI tool by clinicians within the studies examined, with from Ding & Lloyd (2021, p168) stating:

“You don’t have much time in general practice. You have people coming through, and you don’t want something that’s going to slow you down”

“You’ve got to balance that with doing ABPI’s in your consult, as well as not holding up the next person”

Ding & Lloyd (2021) and Weller et al. (2019) admit that many clinicians believe they are assigned insufficient time to perform the ABPI assessment and that most of the consultation is taken up with dressing the wound, and potentially not providing holistic care. Weller et al. (2019) study suggest that an allocation of a ten-minute appointment slot for both GPs and nursing appointments is not long enough, and it is worth noting that in reality appointments last up to thirty-minutes, and often require further investigation. Highlighting the financial implications faced by primary care providers as reimbursement for this additional time is not available, despite ABPI being classed as a specialised tool (Weller et al., 2019).

### **Theme 6 – Competence**

Four of the studies found that clinician competence impacted their willingness to conduct an ABPI assessment due to a lack of exposure to the assessment tool and lack of support to interpret the results and make a confident diagnosis (Ding & Lloyd, 2021; Kannan et al., 2016; Scott et al., 2019). This theme closely linked with clinician education and need to develop clear diagnostic guidance and clinician competence framework to align practice to. Ding & Lloyd (2021) explored this through clinician experience, suggesting that a ABPI assessment is met by resistance from clinicians due to not performing the assessment regularly, therefore lacking a consistent approach to diagnosis, with an over reliance on the presentation of symptoms rather than an ABPI reading. Similarly, Scott et al. (2019) argues the different experiences of non-specialist staff and the skills mix required, including dexterity, knowledge, and experience to improve patient experience by reducing anxiety and discomfort experienced, and knowledge to interpret the results and develop an appropriate management plan. All four studies, recognise the need for collaboration between GP practices, community nursing services, specialist services to develop and enhance educational needs to perform ABPI correctly and enhance

wound care services (Ding & Lloyd, 2021; Kannan, 2016; Scott et al., 2019). Ding & Lloyd (2021) suggested that there is a need for a lead role within GP practices, with the development of a specialist clinician to undertake ABPI assessment, delivering a more consistent assessment approach, whilst ensuring the examining clinician feels confident in their decisions making skills.

### **Theme 7 – Associated costs**

Initial investment in clinical equipment and education, with the additional cost of maintenance and unforeseen associated costs, having a long-term financial burden on already stretched primary care services both globally and in the UK have been a contributing factor in the reluctance to provide ABPI assessment services (Ding & Lloyd 2021; Kannan et al., 2016). Nevertheless, it is highlighted that despite initial costly expenses, early diagnosis would help to reduce the overall financial burden of VLU's and hard to heal wounds, improving service therefore will have a positive impact on patient outcomes (Weller et al., 2019).

### **Theme 8 – Role definition**

The need for recognition of ABPI as a specialist skill, requiring additional targeted training and role recognition, empowering staff was explored (Ding & Lloyd, 2021; Kannan et al., 2016; Weller et al., 2019). Kannan et al. (2016) suggests that ABPI fits into the remit of nursing as nurses are often the front-line facing staff and have regular ongoing patient contact through the patient's journey. Weller et al. (2019) propose that ABPI should be undertaken by a clinician with a specialist interest and training who can facilitate a lead role to oversee the practices of ABPI assessment to ensure consistency and provide quality assurance.

### **Discussion:**

**Is ABPI a safe an effective screening tool for PAD?**

ABPI is recognised as a non-invasive, valuable, and comprehensive assessment and diagnosis tool for PAD, utilised in westernised countries providing public funded healthcare provisions (Crawford et al., 2016; Ding & Lloyd, 2021; Guest et al., 2018; Kannan et al., 2016; Scott et al., 2019; Weller et al., 2019; Welsh et al., 2016). The most recent publication of British Lymphology Society ([BLS], 2018) guidance further strengthened and supported the use of ABPI assessment as part of routine assessment where not contraindicated for the implementation of compression therapy. All four research papers examined acknowledged and referred to supporting governing guidelines supporting clinical practice, however these lacked clarification and consistency. Guest et al. (2018), Welsh et al. (2016), Kannan et al. (2016) and Scott et al. (2019) acknowledge best practice statements and NICE guidance suggesting that ABPI assessment is considered fundamental when screening for PAD, diabetic foot assessment, non-healing wounds and, when considering compression therapy as per gold standard practice (NICE, 2019). The review found that despite clinical recommendations practice varied impacting on the care experienced by patients. The findings from this review suggest that despite the publication of national guidance and supplementary best practice statements from key opinion leaders, there is a need for universal guidance and referral policies to ensure the consistency of practice and patient experience. This is required both within UK and international policy to promote consistency when identifying at risk patients and undertaking ABPI assessment.

### **Is ABPI the most appropriate method of assessing suitability for compression?**

The review found that many clinicians referred to use of ABPI as the only means of assessing a patient's suitability for lower limb compression therapy. Throughout the four studies ABPI was mostly recognised for supporting the diagnosis of PAD and assessing suitability for compression therapy, however there was a lack of acknowledgement for the need of a holistic patient assessment, rather the focus being the need for a numerical reading, again adding to the hesitance of clinicians to perform the assessment due to not being able to obtain this reading. Guest et al. (2018) and Welsh et al. (2016) agreed the need for a holistic assessment to be conducted as part of the leg assessment. A holistic assessment should consider a full medical history review, lifestyle assessment and physical examination of the lower limb (Payne, 2019). Furthermore, ABPI may be a contraindication for some patients due to the inability to tolerate the assessment or other comorbidities which means they are not suitable for this form of assessment. However, emphasising the needs for a compression therapy suitability screening

tool so that patients at high risk receive equitable and timely treatment to manage their condition. The review highlighted that many clinicians felt that ABPI was a specialist skill and required specialist training with some suggesting that it should be a specialist role to ensure correct assessment and attainment of readings. Many clinicians lacked confidence as it was not performed regularly, again acknowledging the need for an alternative screening tool that would be more user friendly and require less resourcing. Guests et al. (2018) highlighted that despite not having the correct ABPI assessment conducted or recorded and not receiving compression therapy VLU's still healed successfully furthermore questioning the use of compression therapy in low-risk group patients, such as those with no past medical history, as their rates of healing were comparable to those that did not receive compression therapy. This requires further research to be conducted to examine more measurable outcomes and required the examination of clinical practice.

### **Conclusion:**

The findings from this review conclude that implications for clinical practice are the lack of clinician education and maintenance of competency, time constraints faced by front line clinicians, lack of clear supporting diagnosis and referral guidance and the access to appropriate equipment to perform the assessment correctly. The qualitative approach of this review meant that perceptions and lived experiences from both clinicians and patients were examined. Further quantitative research should be conducted to provide more measurable outcomes to further support the development and implementation of recommendations for clinical practice. ABPI is the most used assessment tool to ensure early identification, diagnosis and management of PAD and lower limb conditions requiring compression therapy. The review highlighted the importance of undertaking a holistic assessment of patients, incorporating the ABPI assessment of all patients where not contraindicated. Analysis of the included papers has highlighted the need for further research which explores patient experience and safety, when assessing a patient's suitability for lower limb compression therapy.

## Recommendations for Practice

- Regulate implementation of universal procedure guidance to ensure consistency of practice when using ABPI assessment within clinical services.
- Need for a competence framework to ensure specialist educational training and standards for clinicians, to ensure consistency of practice.
- Need for standardised equipment checklist for clinical services performing the procedure.
- Risk assessment screening tool to enable clinicians to assess a patient's suitability for ABPI assessment, acknowledging contraindications and treatment recommendations alongside holistic leg assessment.
- Further research to be conducted to acknowledge the use of automated ABPI measurements as a formal assessment and the possibility to use this as ongoing monitoring.
- Further research into the role of ABPI as a specialist role for clinicians.

### **Limitations of the study:**

Only papers written in English were retrieved which may have excluded key papers.

### Key Points

- ABPI is an effective assessment screening tool for early identification of PAD and assessing suitability for lower limb compression therapy.
- ABPI should not be an assessment tool used in isolation and a holistic patient assessment must be undertaken.
- There are several barriers that impact ABPI assessment including clinician confidence and access to appropriate equipment.
- The evidence suggests that ABPI assessment is often undertaken by community nurses and further education and guidance is required to ensure a consistent approach to ABPI assessment and improve patient experience.
- Further research is required to examine the use of alternative assessment

### CPD Reflective Questions

- How often do you undertake ABPI assessment in your clinical practice and what do you feel would help to develop your confidence in undertaking the assessment?
- Can you identify barriers and enablers that impact on the implementation of lower limb compression therapy in your clinical area?
- What important things can be learned from this review?



**Conflict of interest: None**

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