NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Medical Technologies Evaluation Programme

Sponsor submission of evidence:

Evaluation title: Parafricta (Bootees and Undergarments) to reduce skin breakdown in people with frail skin, or are at risk of pressure ulcers
Sponsor: APA Parafricta Ltd.

Date sections A and B submitted: 12th February 2014

Date section C submitted: 12th March 2014

August 2011

Contents

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE 1
Medical Technologies Evaluation Programme 1
Contents 2
Instructions for sponsors 4
Document key 5
List of tables and figures 6
Glossary of terms 7
Section A – Decision problem 9
1 Statement of the decision problem 9
2 Description of technology under assessment 13
3 Clinical context 15
4 Regulatory information 21
5 Ongoing studies 22
6 Equality 23
Section B – Clinical evidence 25
7 Published and unpublished clinical evidence 25
7.1 Identification of studies 26
7.2 Study selection 27
7.3 Complete list of relevant studies 30
7.4 Summary of methodology of relevant studies 34
7.5 Critical appraisal of relevant studies 46
7.6 Results of the relevant studies 51
7.7 Adverse events 58
7.8 Evidence synthesis and meta-analysis 60
7.9 Interpretation of clinical evidence 61
Section C – Economic evidence 68
8 Existing economic evaluations 68
8.1 Identification of studies 68
8.2 Description of identified studies 73
9 De novo cost analysis 78

9.1 Description of the de novo cost analysis 78
9.2 Clinical parameters and variables 85
9.3 Resource identification, measurement and valuation 90
9.4 Approach to sensitivity analysis 97
9.5 Results of de novo cost analysis 103
9.6 Subgroup analysis 113
9.7 Validation 115
9.8 Interpretation of economic evidence 115
References 118
Appendices 120
10.1 Appendix 1: Search strategy for clinical evidence (section 7.1.1) 120
10.2 Appendix 2: Search strategy for adverse events (section 7.7.1) .. 123
10.3 Appendix 3: Search strategy for economic evidence (section 8.1.1) 125
10.4 Appendix 4: Resource identification, measurement and valuation (section 9.3.2) 126
11 Related procedures for evidence submission 128
11.1 Cost models 128
11.2 Disclosure of information 129
11.3 Equality 131
12. Sponsor Submission Appendices 132
Appendix 5: Data from Section 7 studies 132
Appendix 6 – The NICE CG29 Pressure Ulcer Guidelines 139
Appendix 7 - Flowchart for Hospital Model 140
Appendix 8 - Flowchart for Community Model 141

Instructions for sponsors

This is the template for submission of evidence to the National Institute for Health and Care Excellence (NICE) as part of the Medical Technologies Evaluation Programme process for developing NICE medical technologies guidance. Use of the submission template is mandatory.

The purpose of the submission is for the sponsor to collate, analyse and present all relevant evidence that supports the case for adoption of the technology into the NHS in England, within the scope defined by NICE. Failure to comply with the submission template and instructions could mean that the NICE cannot issue recommendations on use of the technology.

The submission should be completed after reading the 'Medical Technologies Evaluation Programme Methods guide' and the 'Medical Technologies Evaluation Programme Process guide' available at www.nice.org.uk/mt. After submission to, and acceptance by, NICE, the submission will be critically appraised by an External Assessment Centre appointed by NICE.

Under exceptional circumstances, unpublished evidence is accepted under agreement of confidentiality. Such evidence includes 'commercial in confidence' information and data that are awaiting publication ('academic in confidence'). When data are 'commercial in confidence' or 'academic in confidence', it is the sponsor's responsibility to highlight such data clearly. For further information on disclosure of information, submitting cost models and equality issues, users should see section 11 of this document 'Related procedures for evidence submission'.

The submission should be concise and informative. The main body of the submission should not exceed 100 pages (excluding the pages covered by the template and appendices). The submission should be sent to NICE electronically in Word or a compatible format, not as a PDF file.

The submission must be a stand-alone document. Additional appendices may only be used for supplementary explanatory information that exceeds the level

of detail requested, but that is considered to be relevant to the case for adoption. Appendices will not normally be presented to the Medical Technologies Advisory Committee when developing its recommendations. Any additional appendices should be clearly referenced in the body of the submission. Appendices should not be used for core information that has been requested in the specification. For example, it is not acceptable to attach a key study as an appendix and to complete the economic evidence section with 'see appendix X'.

All studies and data included in the submission must be referenced. Identify studies by the first author or trial ID, rather than by relying on numerical referencing alone (for example, 'Trial 123/Jones et al.[126], rather than 'one trial[126]').Please use a recognised referencing style, such as Harvard or Vancouver.

The sponsor should provide a PDF copy of all studies included in the submission. For unpublished studies for which a manuscript is not available, provide a structured abstract about future journal publication. If a structured abstract is not available, the sponsor must provide a statement from the authors to verify the data provided.

If a submission is based on preliminary regulatory recommendations, the sponsor must advise NICE immediately of any variation between the preliminary and final approval.

Document key

Boxed text with a grey background provides specific and/or important guidance for that section. This should not be removed.

Information in highlighted black italic is to help the user complete the submission and may be deleted.

The user should enter text at the point marked 'Response' or in the tables as appropriate. 'Response' text may be deleted.

List of tables and figures

TABLES

A1 Statement of the decision problem
B1 Selection criteria used for published studies
B2 Selection criteria used for unpublished studies
B3 List of relevant published studies
B4 List of relevant unpublished studies
B6 Summary of methodology for observational studies
1: Differences in Pressure Ulcer Incidence in Patient Pathways Cohort 1 versus Cohort 2 – showing #of patients per cohort
B8 Critical appraisal of observational studies
B9 Outcomes from published and unpublished studies
2: – Summary of WUK2010 study
B10 Adverse events across patient groups
C1 Selection criteria used for health economic studies
C2 Summary list of all evaluations involving costs
C3 Quality assessment of health economic studies
C4 Key features of model not previously reported
C5 Summary of variables applied in the cost model
C6 Costs per treatment/patient associated with the technology in the cost model
C7 Costs per treatment/patient associated with the comparator technology in the cost model
C8 List of health states and associated costs in the economic model
C9 List of adverse events and summary of costs included in the cost model
C10.1 Variables used in one-way scenario-based deterministic sensitivity analysis
C10.2 Variables used in multi-way scenario-based sensitivity analysis
C10.3 Variable values used in probabilistic sensitivity analysis
C11 Base-case results
C12 Summary of costs by category of cost per patient
C13 Summary of costs by health state per patient
C14 Summary of costs by adverse events per patient

FIGURES

Fig.1 Variation in friction coefficient with sliding distance – Parafricta fabric and linen
Fig. 2 Patient pathways in JWC2010
Fig. 3 – Patient Flow by Cohort
Fig. 4 – Summary of PU results JWC2010
Figs 5-7 HFU Scan results from JCN2009

Glossary of terms

Term	Definition
Erythema	Non-specific redness of the skin which may be localised or general in nature.
Eschar	Dead, dry, thickened, black tissue
Extrinsic forces	External forces applied perpendicular ('pressure') or parallel ('shear') to the skin
Friction	Friction is the force that resists the relative motion of two objects that are touching. The term is frequently used to mean the action of one object rubbing against the other
Friction - Coefficient of	The measurement of the amount of friction existing between two surfaces
Non-blanching hyperaemia	Persistent redness when light finger point-pressure is applied to an area of reactive hyperaemia, indicating a disruption to the microcirculation. In lightly pigment in individuals this would be classified as a Stage 1 PU.
Pressure ulcers (also known as decubitus ulcers or pressure sores)	are defined as an area of localised damage to the skin and underlying tissues caused by pressure, shear, or friction (European Pressure Ulcer Advisory Panel 1998) and are caused by a local breakdown of soft tissue as a result of compression between a bony prominence and an external surface (European Pressure Ulcer Advisory Panel (EPUAP) 2003). They are most commonly found at bony prominences of the body such as the sacrum, heels, shoulders and hips. They can give rise to serious complications where deeper layers of tissue, muscle or bone become damaged. Infection can lead to blood poisoning or disseminated infections of the bone.
Pressure ulcer classification	Pressure ulcers are commonly classified a grades or stages 1, 2, 3 and 4 in accordance with the recommendations of the European Pressure Ulcer Advisory Panel (EPUAP). Grade/stage 1 is the least and grade 4/stage 4 is the most severe.
Risk assessment tools	These are commonly used to identify those at increased risk of developing pressure ulcers: Norton scale; Braden scale; Waterlow scale; Gosnell scale; 4-factor model; Risk Assessment Pressure Sore (RAPS) scale. The risk assessment tools vary slightly but all provide a risk score intended to allow the selection of appropriate pressure-redistribution support. The choice of tool is often a matter of person preference but their clinical sensitivity and specificity may be poor. The Waterlow scale is the most commonly used risk assessment tool in the UK.
Shear	Shear (stress) results from the application of a force parallel to the surface while the base of the object stays stationary. Shear stress causes the object to change shape (deform). In the context of decubitus ulcers stiction contributes to the development of shear stresses by tending to keep the skin in place again the support surface

	whilst the rest of the patient's body moves. The relative movement of the skin and underlying tissues causes shear stresses to develop in the soft tissues overlying bony prominences such as the sacrum or heel bone.
Stiction (blend of static and dynamic friction)	The increased force needed to overcome skin sticking to a surface before sliding. Stiction is a threshold, not a continuous force, so this build-up results in a tug or jerk to the skin.

Section A – Decision problem

Section A describes the decision problem, the technology and its clinical context. There is also information about ongoing studies, regulatory information and equality issues.

Sponsors should submit section A before the full submission (for details on timelines, see the NICE document 'Guide to the Medical Technologies Evaluation Programme process', available from www.nice.org.uk/mt

1 Statement of the decision problem

The decision problem is specified in the final scope issued by NICE. The decision problem states the key parameters that should be addressed by the information in the evidence submission. All statements should be evidence based and directly relevant to the decision problem.

Table A1 Statement of the decision problem

	Scope issued by NICE	Variation from scope	Rationale for variation
Population	People (adults or children of any age) in a community or hospital setting who: ○ have a grade 1 or 2 pressure ulcer and are at risk of progressing to grade 3 or 4 pressure ulcer ○ do not have a pressure ulcer but are at risk of developing pressure ulcers caused by friction and shear forces, including but not limited to patients who: ○ have frail skin and are at risk of skin breakdown or damage ○ have impaired sensation and are at risk of skin breakdown or damage ○ have peripheral arterial disease, who have a very high risk of developing ulcers ○ have medical conditions where skin frailty is a primary factor and where friction and shear could cause skin damage.	Exclude very small children and babies	Undergarments and Bootees do not fit very small children. They are usually accommodated by our Baby Nest and Sheets which are not in the scope of this document
Intervention	In all settings: □ Pressure-reducing devices used in standard NHS clinical practice, primarily: – dynamic or static high-specification pressure-relieving mattresses and overlays or – dynamic or static high-specification pressure-redistributing mattresses and overlays but may also include: – dynamic or static high-specification pressure-relieving beds or – dynamic or static high-specification pressure-redistributing beds or – silicone gel pads. **AND** □ Parafricta Bootees (slip on and Velcro fastening)* specifically used to protect the heel and ankle □ Parafricta Undergarments (slip-on-boxer, slip-on brief, and Undergarment with Velcro closure)* specifically used to protect the sacrum, buttocks and hips. *The Parafricta Bootees and Undergarments are intended to be used as an adjunct to pressure-reducing devices currently used in standard NHS clinical practice.		

Comparator(s)	In all settings, and used without Parafricta: □ pressure-reducing devices used in standard NHS clinical practice (as listed in the Interventions) or □ pressure-reducing devices plus sheepskin **or** □ pressure-reducing devices plus pressure-relieving Bootees.		
Outcomes	Relevant outcome measures include: □ incidence of grade 1 or 2 pressure ulcers progressing to grade 3 or 4 □ incidence of developing pressure ulcers □ incidence of skin breakdown □ severity of pressure ulcers □ length of hospital stay □ time-to-healing for those who present with an existing pressure ulcer □ patient compliance with pressure ulcer management interventions □ patient comfort: including ability to move and self-reposition in bed □ quality of life □ morbidity □ device-related adverse events.		
Cost analysis	• The Bootees and Undergarments are primarily intended to be used as an adjunct to the current pressure-reducing devices. The cost analysis should compare the costs and consequences of the use of pressure-reducing devices with and without the use of Parafricta garments in all settings. Pressure-reducing devices in standard NHS clinical practice are detailed in the Interventions section. • Parafricta products are re-usable, and therefore costs of care and laundry of the products should be considered. • Costs will be considered from an NHS and personal social services perspective. • The time horizon for the cost analysis will be sufficiently long to reflect any differences in costs and consequences between the technologies being compared. • Sensitivity analysis will be undertaken to address uncertainties in the model parameters, which will include scenarios in which different numbers and combinations of devices are needed.		
Subgroups to be considered	□ people with restricted mobility who may be bedbound □ people who may have skin damage due to musculoskeletal or neurological conditions where repetitive motion is present.		

Special considerations, including issues related to equality	It should be noted that people with chronic wounds, including pressure ulcers, may be protected under the Equality Act 2010. The device may have particular advantages for people who have chronic wounds and may be classed as having a disability under the 2010 Equality Act. Other groups covered by the Equality Act are people with diabetes who may have foot ulcers as a result and people who have spinal injuries and may have pressure ulcers. This device would not restrict the access for treatment for these groups of people.		

2 Description of technology under assessment

2.1 Give the brand name, approved name and details of any different versions of the same device.

1 Parafricta® Bootees – Velcro Closure and Slip-On formats, sizes XS to XL; all CE marked as a Class 1 Medical Device

2 Parafricta® Undergarments – Velcro Closure, and Brief and Boxer Slip-On formats, sizes XS to XL; all CE marked as a Class 1 Medical Device

2.1 What is the principal mechanism of action of the technology?

"Pressure" ulcers (decubitus ulcers) (PU) are caused by a combination of exposure to extrinsic factors and intrinsic factors relating to the condition of the patient. The principal extrinsic factor has long been considered to be pressure or *perpendicular* force usually as a result of a bony prominence pushing down on the support surface and compressing and internally shearing the various layers of tissue and skin. In recent years there has been a growing realisation that surface friction caused by contact between the skin and the support surface also contributes *tangential* force that leads to shearing of the more superficial layers of tissue and skin. This has led some authors (Lahmann, Tannen et al. 2011, Lahmann and Kottner, 2011) to conclude that there is a distinction between ulcers that are caused by pressure leading to deep tissue damage and those caused by skin surface friction leading to superficial skin breakdown (even advocating use of the term "friction" ulcer). In many cases it may be assumed that *both* pressure and friction play a role in the skin breakdown that manifests itself as various grades of decubitus ulcer. Friction can exert damaging effects on the skin both through its dynamic element and its static element ("stiction"). Static friction causes the skin to *stick* to the surface until the force is overcome by gravity or movement leading to a sudden jolt or wrench. Dynamic friction comes into play as the skin moves over another surface such as a polycotton

sheet (for example as a patient rubs a heel against the bed or slides down from a propped up position in bed).

Parafricta Bootees and Undergarments are made from proprietary Parafricta® fabric. This textile is selected to reduce the impact of friction associated with contact between the skin and the support surface. It has a friction coefficient[1] value of 0.2 (a value of zero would mean no friction at all). Uniquely this does not only reduce the effects of dynamic friction but it also reduces the stiction between skin and surface that can otherwise lead to wrenching and jolting damage as it is overcome. In comparison to Parafricta® fabric the (dynamic) friction coefficient of polycotton is 3 to 5 times greater, whilst the stiction coefficient is 7 times greater (Pike 2003, NPL 2009).

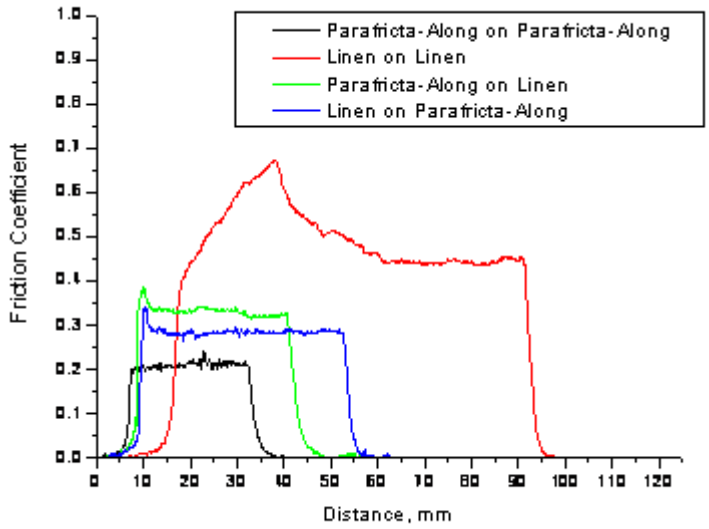


Figure 1, Variation in friction coefficient with sliding distance – Parafricta fabric and linen

The Bootees provide protection for the heel, ankle and upper foot. The Undergarments provide protection for the sacrum, buttocks and hips. This applies to patients at risk of decubitus ulcers and in people with frail skin or who have a predisposition to skin breakdown.

[1] The measurement of the amount of friction existing between two surfaces.

The textile is breathable and washable in conditions routinely used in domestic and institutional settings. The devices are double layered and have been designed with patients and carers so that supporting non-slip panels under the foot and back of the Undergarment prevent the patient from slipping in the bed.

3 Clinical context

3.1 Provide a brief overview of the disease or condition for which the technology is being considered in the scope issued by NICE.

The Parafricta Bootees and Undergarments are intended to reduce friction and consequent shear damage to skin and underlying tissues, specifically in people who have, or are at risk of having pressure ulcers or for people with frail skin or who have medical conditions where skin frailty is a primary factor.

Pressure ulcers most commonly develop on skin covering bony prominences such as the sacrum, heels, shoulders and hips. Pressure ulcers affect just under half a million people in the UK who develop at least one pressure ulcer in any given year. These are usually people with underlying health conditions. Around 1 in 100 people who are admitted to hospital with an acute (sudden) illness will develop a new pressure ulcer and at any given time 1 in 20 patients in acute hospitals will be suffering a pressure ulcer. The incidence is generally higher in community hospitals and nursing homes. The cost in the UK NHS annually is estimated at £1.4-2.1bn [4% of the NHS budget] (Bennett et al. 2004) and is rising (Dealey et al. 2012). Infected pressure ulcers deaths were associated with 4,708 people between 2003 and 2008; almost as many as died from MRSA (Dr Foster 2011). Pressure ulcers have been highlighted as a national priority to address through several campaigns and incidence is reported at Board level in several NHS trusts.

Paediatric and older patients may have increased skin frailty. The thinner skin is likely to sustain injury more easily and take longer to heal. Both paediatric and older patients with significantly limited mobility, risk of nutritional deficiency, an inability to reposition, a neurological condition or significant cognitive impairment are at increased risk of skin damage. Maintenance of

functional areas relating to nutrition, mobility, cognition, pain management and continence, is integral to the management of skin integrity.

3.2 Give details of any relevant NICE or other national guidance or expert guidelines for the condition for which the technology is being used. Specify whether the guidance identifies specific subgroups and make any recommendations for their treatment. If available, these should be UK based guidelines.

As can be seen in the current NICE Clinical Guideline 29 (NICE CG29)[2], Pressure Ulcer Management, the guideline requires the evaluation of the potential impact of friction and shear, however there is no guidance on how to mitigate against these factors as there was no product available to specifically reduce the impact of friction and shear. Current devices are aimed at reducing and dissipating pressure.

Pressure Ulcer Management (NICE GC29), is being updated and NICE has published a draft guideline for consultation. The draft updated guideline recommends that when a person presents with, or is at increased risk of developing a pressure ulcer an initial risk assessment should be performed in first episode of care (within 6 hours) by a registered healthcare professional. Risk should be assessed and documented taking into consideration all the recognised risk factors including pressure, *shear and friction*; the level of mobility; sensory impairment; continence; level of consciousness; acute, chronic and terminal illness; co-morbidity; pain; location and management interventions; posture; previous pressure damage; extremes of age; nutrition and dehydration and moisture to the skin. Risk should be reassessed on an on-going basis and in particular if the person's circumstances change. CG29 recommends that once risk has been assessed, mobilising, positioning and repositioning interventions (including those in beds, chairs, and wheelchair users) should be considered for people who have, or are at risk of developing pressure ulcers, to prevent damage or further skin damage from occurring. Pressure-relieving/pressure-reducing devices should be chosen by a registered healthcare professional on the basis of risk assessment. All

[2] See Appendix 12

vulnerable people should receive, as a minimum provision, a high specification foam mattress (pressure relieving), and any ulcer should be closely observed for deterioration. As a minimum provision, people with a grade 3-4 pressure ulcer should receive a bed with an alternating pressure mattress or high specification foam mattress with an alternating pressure overlay, or a sophisticated continuous low pressure system.

Prevention of pressure ulcers is also a core strategy for various organisations and NHS initiatives, such as Commissioning for Quality & Innovation CQUIN, Quality, Innovation, Production, Prevention (QUIPP), NHS Harm Free Care programme, Safety Thermometer and the SSKIN Care Bundle (Skin Inspection, Surface, Keep Moving, Incontinence, Nutrition), Stop the Pressure and Patient Safety First campaigns.

Of note, several other clinical guidelines address the importance of managing friction and shear. Friction and Shear are assessed within the Braden criteria for assessing the risk of pressure ulcers. EPUAP (2009) guidelines on Pressure Ulcer Prevention and Treatment explicitly address the importance of selecting interventions for shear reduction. Some NHS Trusts have already incorporated the use of Parafricta within their local treatment protocol.

3.3 Describe the clinical pathway of care that includes the proposed use of the technology.

The proposed use of Parafricta Technology fits naturally into the NICE CG29 Pressure Ulcer Guidelines, as shown on the modified Quick Reference Guide chart in Appendix 6 (Section 12), relating to the issues of friction and shear as extrinsic risk factors. The Quick Reference Guide can be found at http://guidance.nice.org.uk/CG29/QuickRefGuide/pdf/English

3.4 Describe any issues relating to current clinical practice, including any uncertainty about best practice.

Parafricta is designed to reduce friction and shear forces. Although identified as risk factors mitigation of these factors are not addressed in current standards of care, and care pathways published by NICE [CG29 2005 being currently revised] that are targeted only at pressure reduction or dissipation.

The European Pressure Ulcer Advisory Panel/National Pressure Ulcer Advisory Panel (EPUAP/NPUAP) 2009 guidance states "A pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear." Internal shearing stresses can be caused by pressure related compression of tissues. Parafricta uniquely addresses the shear stresses that are caused by stiction and dynamic friction between the skin and the contact surface, which are manifested in superficial skin breakdown and category I and II decubitus ulcer formation.

Recent studies by Lahmann & Kottner (2011) and Lahmann et al. (2011) audited 28,299 hospital patients and 17,666 long-term care residents and concluded that "Friction & Shear was the strongest predictor for Grade 2 pressure ulcers"

The major UK, EU and USA initiatives are aimed at the target of 'No Avoidable Pressure Ulcers'; however there has been a lack of awareness and acknowledgement about the importance of friction and shear. The Lahmann & Kottner studies have highlighted the effect of these extrinsic factors and the need to mitigate the effect they have on skin breakdown.

3.5 Describe the new pathway of care incorporating the new technology that would exist if the technology was adopted by the NHS in England.

As stated before and in the Scope, Parafricta products are an adjunct to the Care Pathway shown in the NICE Quick Reference Guide. The products are introduced into the pathway when the skin assessment of at-risk patients

indicate that friction and shear are extrinsic factors likely to cause skin breakdown and pressure ulcers; or may contribute to progression of Grade 2 pressure ulcers to a higher grade.

An amendment of the Quick Reference Guide of NICE CG29 – Pressure Ulcers, accompanies this submission,[3] showing where Parafricta should be assessed for use in the prevention of pressure ulcers, and the treatment of pressure ulcers. Particular clinical judgement should be employed to determine if there are factors that indicate a high risk of friction and shear damage to feet or to sacral/buttock areas.

Unlike dressings the Parafricta devices are readily removed to inspect the ulcer without disrupting the healing process.

3.6 Describe any changes to the way current services are organised or delivered as a result of introducing the technology.

There is minimal disruption to the way current services are organised or delivered. The only change would be the provision and wearing of a Parafricta Bootee or Undergarment – depending on the at-risk area of skin breakdown the patient has. The items employed should be inspected whenever the patient is inspected and replaced with a clean item if there is any evidence of soiling, but this is no more burdensome than replacing an incontinence pad or changing a dressing as part of routine care.

3.7 Describe any additional tests or investigations needed for selecting or monitoring patients, or particular administration requirements, associated with using this technology that are over and above usual clinical practice.

The decision to select the appropriate Parafricta product would be part of the ongoing care and assessment of the at-risk patient; particularly addressing any heightened concern over friction and shear at the skin/contact surface interface. Where a patient was identified as being at risk of friction and shear

[3] A copy of the amendment of CG29 is shown in Appendix 6, Section 12. However for better clarity, an Adobe document will be provided in the package that includes the other documents requested by MTEP

damage to the skin, Parafricta Bootees or Undergarment would be introduced. The Bootees and Undergarments are very simple to use and simple training can be provided.

3.8 Describe any additional facilities, technologies or infrastructure that need to be used alongside the technology under evaluation for the claimed benefits to be realised.

The products are used as an adjunct to pressure ulcer preventing and skin breakdown interventions used routinely. With respect to Parafricta, the only issue is the availability of the right product and size for the specific patient, which is best addressed by holding a pool of items ready for use on each ward or that can be called up from a central equipment pool.

Products can be laundered using standard domestic or institutional laundry procedures.

3.9 Describe any tests, investigations, interventions, facilities or technologies that would no longer be needed with using this technology.

At the moment this does not replace any current technologies with similar evidence of clinical efficacy but addresses an unmet medical need which was not being sufficiently addressed by current practices or products. In some cases, for example, it will be the case that dressings are currently being used *preventatively* where risk of friction and shear damage is assessed to be high, which will no longer be required if Parafricta items are employed.

3.10 Describe how the NHS in England can disinvest from tests, investigations, interventions, facilities or technologies described in section 3.9 that would no longer be needed with using this technology.

The use of Parafricta as part of the pressure ulcer prevention or treatment strategy would decrease the incidence of pressure ulcers, and the costs associated with treating them over an extended period of time – including

nurse time, hospital bed utilisation, antibiotics, pain-killers and pressure relieving surfaces provision.

4 Regulatory information

4.1 Provide PDF copies of the following documents:

- instructions for use
- CE mark certificate or equivalent UK regulatory approval such as EC declaration of conformity
- quality systems (ISO 13485) certificate (if required).

PDF copies of these documents should be submitted at the same time as section A.

4.2 Does the technology have CE mark for the indication(s) specified in the scope issued by NICE? If so, give the date that authorisation was received. If not, state current UK regulatory status, with relevant dates (for example, date of application and/or expected approval dates).

The Parafricta Bootees and Undergarments first received a CE mark in 2006 and are classified as a Class 1 Medical Device; with the intended use being to reduce friction and shear in people with frail skin and those who have, or are at risk of developing pressure ulcers.

The Bootees and Undergarments are listed in the Drug Tariff Part IX and are thus available for GPs and qualified community nurses to prescribe.

4.3 Does the technology have regulatory approval outside the UK? If so, please provide details.

The Bootees and Undergarments are also registered with the United States FDA[4] as a Class 1 Medical Device. They are also registered with the Australian TGA.

[4] Food and Drug Administration (Federal body responsible for medical devices)

4.4 If the technology has not been launched in the UK provide the anticipated date of availability in the UK.

N/A

4.5 If the technology has been launched in the UK provide information on the use in England.

The products have been used in over 43 Acute and Community Hospitals, Nursing Homes and Hospices and 254 Community locations to date.

5 Ongoing studies

5.1 Provide details of all completed and ongoing studies on the technology from which additional evidence relevant to the decision problem is likely to be available in the next 12 months.

The Tissue Viability Nurse at St Helen's & Knowsley NHS Trust has introduced the Parafricta slip-on Bootee into the care pathway for patients considered at risk of a heel pressure ulcer as an alternative to a protective hydrogel dressing (where a suitable Bootee is available). The number of Bootees in use across the Trust has increased since the initial introduction of the Bootees in a number of high risk wards in 2012 led to a promising reduction in heel pressure ulcer incidence. Starting in 2013 the hospital-wide number and root causes of grade 2 heel pressure ulcers have been specifically audited by the Tissue Viability Team (in addition to the data on Grade 2 pressure ulcers at all sites which is routinely collected for the NHS Safety Thermometer). It is likely that the correlation between the declining incidence of Grade 2 heel pressure ulcers and the increasing use of Parafricta Bootees will form the basis of future publications. It will also be possible to better quantify the normal hospital usage cost consequences (as opposed to those implied in a clinical trial setting). A number of hospital trusts and community institutions are currently considering the evaluation of the products although these are not likely to be the subject of publications.

5.2 If the technology is, or is planned to be, subject to any other form of assessment in the UK, please give details of the assessment, organisation and expected timescale.

The Burns Unit at The Bristol Trust and Bristol University had planned to undertake a study comparing the use of a Parafricta low-friction bed sheet with current standard hospital sheet to evaluate if there was a positive outcome in the reduction in the number of skin grafts displaced. Whilst this involves the Parafricta bedsheet rather than the Bootees or Undergarments), the outcome, if positive, will reinforce the skin protective benefits of Parafricta technology in an indication where the loss of a skin graft may be painful, costly to reinstate and extends the hospital stay. The study was initially submitted to the SSCIF fund administered by NHS England, but with SSCIF indefinitely postponed an alternative application is being considered by the Research for Patient Benefit (R.fP.B.) scheme.

6 Equality

NICE is committed to promoting equality of opportunity and eliminating unlawful discrimination on the grounds of age, disability, gender reassignment, race, religion or belief, sex, and sexual orientation, and to comply fully with legal obligations on equality and human rights.

Equality issues require special attention because of NICE's duties to have due regard to the need to eliminate unlawful discrimination, promote equality and foster good relations between people with a characteristic protected by the equalities legislation and others.

Any issues relating to equality that are relevant to the technology under assessment should be described. This section should identify issues described in the scope and also any equality issues not captured in the final scope.

Further details on equality may be found in section 11.3 of this document.

6.1 Describe any equality issues relating to the patient population and condition for which the technology is being used.

It should be noted that people with chronic wounds may be protected under the Equality Act 2010. The device may have particular advantages for people who have chronic wounds and may be classed as having a disability under the 2010 Equality Act. Other groups covered by the Equality Act are people with diabetes who may have foot ulcers as a result and people who have spinal injuries and may have pressure ulcers. This device would not restrict the access for treatment for these groups of people.

6.2 Describe any equality issues relating to the assessment of the technology that may require special attention.

As above

6.3 How will the submission address these issues and any equality issues raised in the scope?

As above

Section B – Clinical evidence

7 Published and unpublished clinical evidence

Section B requires sponsors to present published and unpublished clinical evidence for their technology.

Sponsors should read section 6 of the Medical Technologies Evaluation Programme methods guide on published and unpublished evidence, available from www.nice.org.uk/mt

All statements should be evidence-based and directly relevant to the scope. Reasons for deviating from the scope should be clearly stated and explained in table A1.

Sponsors are required to submit section B in advance of the full submission (for details on timelines, see the NICE document 'Guide to the Medical Technologies Evaluation Programme process', available from www.nice.org.uk/mt

7.1 Identification of studies

Published studies

7.1.1 Describe the strategies used to retrieve relevant clinical data from the published literature. Exact details of the search strategy used should be provided in section 10, appendix 1.

As detailed in Section 10, Appendix 1 we used a 3-level Boolean strategy combined with manual scanning to retrieve relevant published clinical evidence of three types:

1. Full database literature review for specifically Parafricta-related records ("Records of specific relevance identified through database searching")

2. Collection and review of specifically Parafricta-related extant and published studies that were not identified above ("Additional records of specific relevance identified through other sources")

3. Additional literature review to scope core concepts of friction and shear, and benefits from reducing these with fabrics ("Additional records identifying the general state of the art but not of specific relevance")

All published data relevant to the decision problem must be included. A PDF version of all published studies included in the submission must be provided by the sponsor.

Unpublished studies

7.1.2 Describe the strategies used to retrieve relevant clinical data from unpublished sources.

We took two core approaches to retrieve relevant unpublished clinical evidence:

1. Discussion with partners and experts to identify any unpublished clinical data or analysis specifically relevant to the evidence review process.

2. Boolean searches combined with manual scanning to identify and review any further, specifically relevant or identifying the general state of the art, extant data and studies in progress or unpublished.

7.2 Study selection

Published studies

7.2.1 Complete table B1 to describe the inclusion and exclusion criteria used to select studies from the published literature. Suggested headings are listed in the table below. Other headings should be used if necessary.

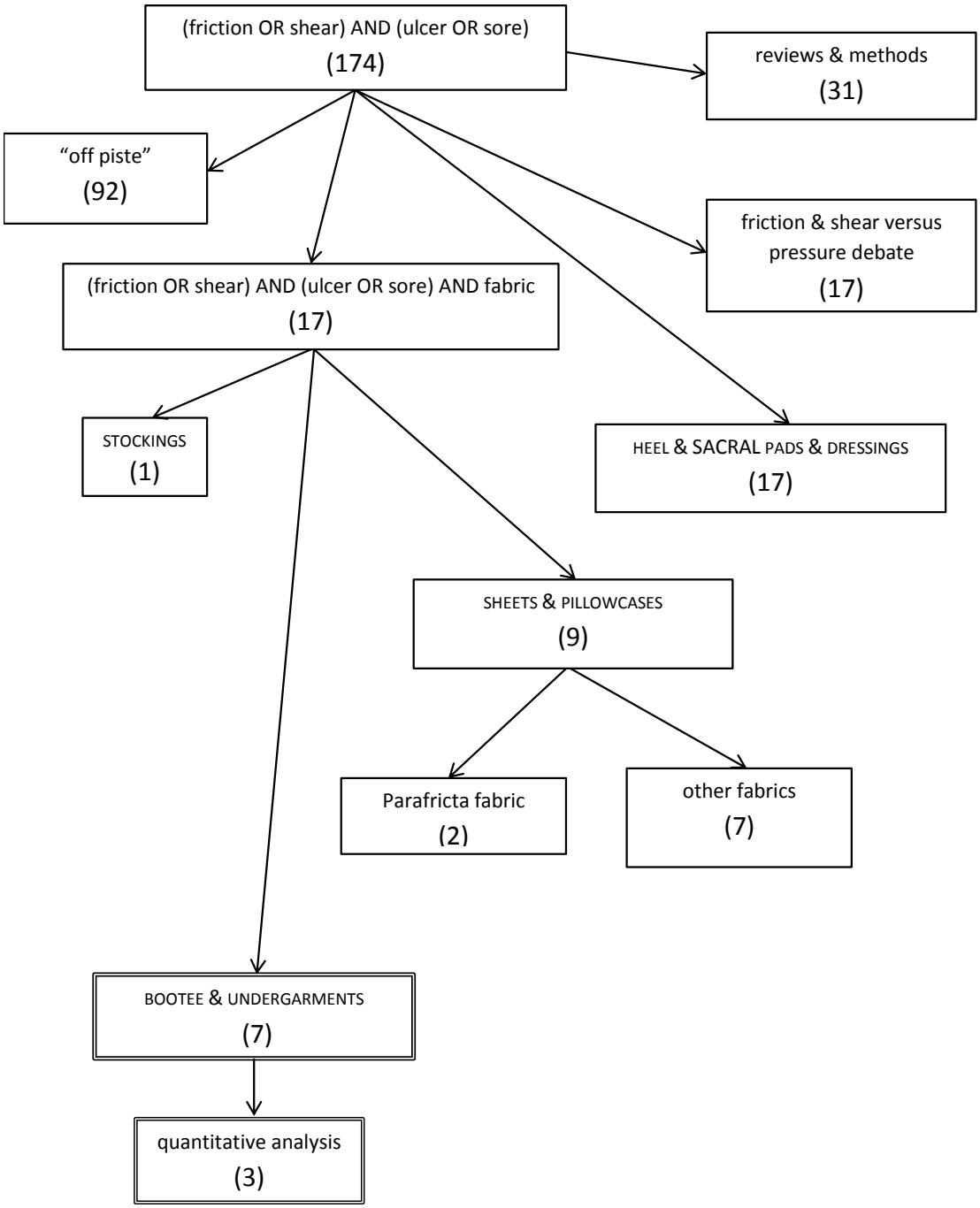
Table B2 Selection criteria used for published studies

Inclusion criteria	
Population	People (adults or children of any age) in a community or hospital setting who: ○ have a grade 1 or 2 pressure ulcer and are at risk of progressing to grade 3 or 4 pressure ulcer ○ do not have a pressure ulcer but are at risk of developing pressure ulcers caused by friction and shear forces, including but not limited to patients who: o have frail skin and are at risk of skin breakdown or damage o have impaired sensation and are at risk of skin breakdown or damage o have peripheral arterial disease, who have a very high risk of developing ulcers, have medical conditions where skin frailty is a primary factor and where friction and shear could cause skin damage.
Interventions	In all settings: ○ Parafricta bootees (slip on or Velcro fastening) specifically used to protect the heel and ankle and/or ○ Parafricta undergarments (slip-on-boxer, slip-on brief, or undergarment with Velcro closure) specifically used to protect the sacrum, buttocks and hips. In conjunction with pressure-reducing devices used in standard NHS clinical practice, primarily: – dynamic or static high-specification pressure-relieving mattresses and overlays or – dynamic or static high-specification pressure-redistributing mattresses and overlays but may also include: – dynamic or static high-specification pressure-relieving beds or – dynamic or static high-specification pressure-redistributing beds or – silicone gel pads.
Outcomes	○ incidence of grade 1 or 2 pressure ulcers progressing to

	grade 3 or 4 ○ incidence of developing pressure ulcers ○ incidence of skin breakdown ○ severity of pressure ulcers ○ length of hospital stay ○ time-to-healing for those who present with an existing pressure ulcer ○ patient compliance with pressure ulcer management interventions ○ patient comfort: including ability to move and self-reposition in bed ○ quality of life ○ morbidity ○ device-related adverse events.
Study design	Any
Language restrictions	English
Search dates	2005 onwards
Exclusion criteria	
Population	None
Interventions	Any which the use of Parafricta is combined with an additional intervention that materially changes the type or quality of nursing and/or wound care provided
Outcomes	None
Study design	None
Language restrictions	Non-English
Search dates	Before 2005

7.2.2 Report the numbers of published studies included and excluded at each stage in an appropriate format.

Flowchart showing breakdown of records screened



Unpublished studies

7.2.3 Complete table B2 to describe the inclusion and exclusion criteria used to select studies from the unpublished literature.

Suggested headings are listed in the table below. Other headings should be used if necessary.

Table B2 Selection criteria used for unpublished studies

No unpublished studies on the Parafricta Undergarment and Bootee were excluded

Inclusion criteria	
Population	Identical to Table B1 above
Interventions	
Outcomes	
Study design	
Language restrictions	
Search dates	
Exclusion criteria	
Population	Identical to Table B1 above
Interventions	
Outcomes	
Study design	
Language restrictions	
Search dates	

7.2.4 Report the numbers of unpublished studies included and excluded at each stage in an appropriate format.

No unpublished reports on Parafricta Bootees and Undergarments were found

7.3 Complete list of relevant studies

The sponsor should provide a PDF copy of all studies included in the submission. For unpublished studies for which a manuscript is not available, provide a structured abstract about future journal publication. If a structured abstract is not available, the sponsor must provide a statement from the authors to verify the data provided.

7.3.1 Provide details of all published and unpublished studies identified using the selection criteria described in tables B1 and B2.

Table B3 List of relevant published studies

Primary study reference	Study name (acronym)	Population	Intervention	Comparator
Study 1: Smith and Ingram (2010) - Clinical and cost effectiveness evaluation of low friction and shear garments; Journal of Wound Care Vol. 19, no 12, December 2010, pp.535-42.	JWC2010	Hospital Patients in medical and orthopaedic wards(with a Waterlow score of ≥15 (i.e. patients at high or very high risk of pressure ulceration) with or without pressure ulceration on admission who were unable to reposition independently.)	Parafricta Bootee or/and Undergarment added to standard pressure ulcer preventative measures in the clinical centre on at risk patients : Cohort 2	Cohort 1: standard pressure ulcer preventative measures (without the addition of Parafricta)
Study 2: Sylvie Hampton et al - Parafricta fabric: Can it reduce the potential for pressure ulcer damage; Journal of Community Nursing, April 2009, Vol. 23, Issue 4, pp. 28-31.	JCN2009	25 Nursing Home residents (Grade 1 or 2 Pressure Ulcer damage to sacrum and/or heel. 28 measurements in total).	Parafricta Bootee or Undergarment added to standard preventative measures at week 0, according to damage location.	For heel: the comparator was the patients untreated other heel. For sacral ulcers, comparisons were made with scans of normal skin. Bootee

Study 3: Stephen-Haynes et al - Clinical outcomes using a low friction and shear garment in the care home setting; Wounds UK, 2011, Vol. 7, No 4, pp. 76-84.	WUK2011	25 Nursing Home patients at-risk of or with a pressure ulcer of category 2 or less (EPUAP, 2009) Identified by contributory factor causing skin damage.	○ Parafricta Bootee or/and Undergarment added to standard approach. ○ All patients were treated with the standard approach to the prevention and management of pressure ulcers i.e. as outlined by the NICE guidance (2005), EPUAP (2009) and the Institute for Healthcare Improvement (IHI) (2011).	○ Standard intervention of patient turning and positioning on foam or an alternating air flow mattress. ○ All patients were treated with the standard approach to the prevention and management of pressure ulcers i.e. as outlined by the NICE guidance (2005), EPUAP (2009) and the Institute for Healthcare Improvement (IHI) (2011).
Study 4:Sylvie Hampton, Nursing & Residential Care December 2007, Vol. 9, No 12, pp 2-4.	NRC1	Nursing Home patient (Grade 2 buttocks pressure ulceration, standard intervention of turning and on a pressure reducing/redistributing surface)	Parafricta Undergarment added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface	• Added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface. • Photograph of starting skin condition.
Study 5: A Kerr, Nursing & Residential Care, January 2008, Vol. 10, No 01, pp. 626-628.	NRC2	Nursing Home patient (Grade 2 buttocks pressure ulceration and skin maceration, standard intervention of turning and on a pressure reducing/redistributing surface)	Parafricta Undergarment added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface.	• Added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface. • Photograph of starting skin condition.
Study 6: AnCathie Bree-Aslan and Sylvie Hampton, Nursing & Residential Care, January 2008, Vol. 10, No 01, pp.626-628.	NRC3	Nursing Home patients (Grade 4 heel pressure ulceration, standard intervention of turning and on a pressure reducing/redistributing surface.)	Parafricta Bootee added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface.	• Added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface. • Photograph of starting skin condition.

Study 7: LOEHNE, H.B. (2013). Clinical Study of Device to Assist in Prevention of Heel and Foot Pressure Ulcers. *Poster presentation,* SAWC Spring Meeting (USA).	SAWC1	Nursing Home patients	Parafricta Bootee added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface.	• Added to standard intervention of patient turning and positioning on a pressure reducing/redistributing surface. • Photograph of starting skin condition.

Table B4 List of relevant unpublished studies

There are no unpublished studies

Data source	Study name (acronym)	Population	Intervention	Comparator

7.3.2 State the rationale behind excluding any of the published studies listed in tables B3 and B4.

- The work at St. Helen's & Knowsley is excluded as there is no access to the level of audit data and patient records that would be required to properly interpret the reported 32% reduction in heel pressure ulcers.(See section 5.1)
- Related studies using Parafricta sheets or pillowcases have been omitted as these are not the subject of the evaluation.

7.4 Summary of methodology of relevant studies

7.4.1 Describe the study design and methodology for each of the published and unpublished studies using tables B5 and B6 as appropriate. A separate table should be completed for each study.

Table B5 Summary of methodology for randomised controlled trials

Study name	**N/A**
Objectives	**N/A**
Location	**N/A**
Design	**N/A**
Duration of study	**N/A**
Sample size	**N/A**
Inclusion criteria	**N/A**
Exclusion criteria	**N/A**
Method of randomisation	**N/A**
Method of blinding	**N/A**
Intervention(s) (n =) and comparator(s) (n =)	**N/A**
Baseline differences	**N/A**
Duration of follow-up, lost to follow-up information	**N/A**
Statistical tests	**N/A**
Primary outcomes (including scoring methods and timings of assessments)	**N/A**
Secondary outcomes (including scoring methods and timings of assessments)	**N/A**

Table B6 Summary of methodology for observational studies

Study name	**JWC2010**
Objective	To determine the effectiveness of Parafricta low-friction garments in reducing the incidence and prevalence of pressure ulceration and to evaluate the curative aspects of these products on pre-existing skin breakdown within a hospital setting.
Location	St. Mary's Hospital, Isle of Wight Trust
Design	Comparative Cohort study (consecutive cohorts)

Duration of study	6 months – Cohort 1 (Control): 3 months and Cohort 2 (Active) : 3 months
Patient population	Two medical wards and one orthopaedic ward in a UK district general hospital.
Sample size	A total of 650 patient case records were reviewed. A total of 369 patients met the entry criteria for use of Parafricta products: Cohort 1, Control: 204 patients meeting the criteria for use of the Parafricta products in the 3 months prior to the start of the evaluation. Cohort 2, Active: 165 patients meeting the same criteria during the period when the garments were added to the standard pressure ulcer prevention protocol.
Inclusion criteria	Patients with a Waterlow score ≥15 (i.e. patients at high or very high risk of pressure ulceration) with or without pressure ulceration on admission who were unable to reposition independently.
Exclusion criteria	Patients whose Waterlow scores were below 15 were not included in the data analysis. Patients who died were excluded from the data analysis as it was agreed that the additional use of the Parafricta products would be of questionable benefit to these patients; if the at-risk site on the body was not the sacrum, buttocks, hip, heel or foot, the patient data was excluded from the analysis.
Intervention(s) (n =) and comparator(s) (n =)	Intervention, Cohort 2: n=165 Comparator control, Cohort 1: n=204
Baseline differences	The patients who were included in the trial pre-Parafricta products introduction (control group referred to as Cohort 1 in the study) and the patients included in the trial after Parafricta products (treatment group, Cohort 2) showed no statistical difference in the following measures; Waterlow score; grading of ulcer; number of times patient was assessed and longest period between re-assessments. In addition looking at the longest periods between assessments there was no significant differences (Table 3[5] in Appendix) between the two groups. The only area where there was evidence of a significant difference was the number of times assessed (average 4.11 for Cohort 1 to 3.44 for Cohort 2) P= 0.015.This indicates that the pre-Parafricta cohort were assessed more often than the post-Parafricta cohort which suggest that the patients once they were on the product may have required less intervention as their outcome improved. Comparing a sub-set of patients from both cohorts where no Pressure Ulcer developed there was no significant difference in number of times assessed.
How were participants followed-up (for example, through pro-active follow-up or passively). Duration of follow-up, participants lost to follow-up	Patients are actively followed up. There is an established system through which the wards submit returns of pressure ulcer incidence reporting at patient discharge or death to the tissue viability nurse who records each incident of pressure ulceration or patient at risk (near miss) on the risk management software. Three months of incidence data was extracted prior to using the Parafricta products in those areas, as a control. Parafricta products were used for 3 months.

[5] See Appendix 12 JWC 2010Table 3

	2 and 6 outcomes were unrecorded in Cohorts 1 and 2 respectively and lost to follow up.
Statistical tests	1. The results, with the significance test used, for the analysis of the Waterlow score and Ulcer Grading are presented in Tables 1 and 2 (in Appendix 5, Section 12) 2. The results of the statistical analysis of the differences between the two cohorts with respect to the longest period between ulcer assessments are presented in Table 3 (in Appendix 5, Section 12.). 3. Statistical analysis using z test of proportion, chi square and t tests were applied to determine statistical significance and confidence intervals (CIs) for the relevant data.
Primary outcomes (including scoring methods and timings of assessments)	The primary outcome for patients were: 1. Prevention of new pressure ulcers (a reduction of incidence in pressure ulcers was being measured) 2. Reduction of severity of new or existing pressure ulcers (measured by clinical assessment) Economic factors were also measured within the study context. In terms of assessment, the improvement or decline of the pressure ulcer status was monitored for all patients with a pressure ulcer. a. Patient admitted with ulcer Yes/ No If 'Yes' grade of ulcer b. Did Patient develop further ulceration after admission -Grade of ulcer - Location - Time to pressure ulcer development (days from date of admission) c. Did ulcer deteriorate or improve (or remain same) - Grade of PU - location of PU - Time to change (days) d. Number of documented reassessments e. Longest period between reassessments
Secondary outcomes (including scoring methods and timings of assessments)	● Difference in median length of stay between 4 patient pathways ● Cost-effectiveness: whether any reduction in treatment costs out-weigh initial item cost. ● Prevalence of pressure ulcer

Study name	**JCN2009**
Objective	To safely demonstrate the clinical effectiveness of Parafricta™ material in reducing the effects of shear in residents at risk of pressure damage due to shear.
Location	Wound Healing Centre, Eastbourne and Nursing Homes in Eastbourne
Design	Cohort Study
Duration of study	10 months
Patient population	25 Patients had Pressure Ulcers, Grade 1 and above, related to friction and shear.
Sample size	25 patients: 10 with heel pressure ulcers; 18 with sacral pressure ulcers in this group of 25
Inclusion criteria	Pressure Ulcers, Grade 1 and above, related to friction and shear. On heel, sacrum or buttocks
Exclusion criteria	None
Intervention(s) (n =) and comparator(s) (n =)	Heel pressure ulcer interventions with other heel as comparator (n=10) Sacral pressure ulcer interventions (n=18) – no comparator
Baseline differences	Each patient was their own baseline at week 0; either the other foot without the Bootee or the sacral High Frequency Ultrasound [HFU][6] measurement. Each patient had a HFU normal scan for comparison.
How were participants followed-up (for example, through pro-active follow-up or passively). Duration of follow-up, participants lost to follow-up	Participants were followed for 4 weeks with active examinations at 0, 2 and 4 weeks.
Statistical tests	A separate document reviews the statistical analysis of the results[7]. All HFU ultrasound pixel scan data analysis was converted to cumulative percentage data for each treatment, based on the mean effects across all patients. Analysis was conducted using the Kolmogorov-Smirnof 2 sample test.
Primary outcomes (including scoring methods and timings of assessments)	**Comparisons between the normal heel and treated heel after using the Bootee over 4 weeks** (The 3 parameters were measured at time 0, 2, and 4 weeks). 1. Tactile assessment was used to measure skin 'bogginess' over the study period with the aim of reducing this bogginess 2. Assessment by the qualified Tissue Viability Nurse of the photographic staging aims to qualify a reduction in erythema.

[6] High Frequency Ultrasound scans record the level of oedema in the tissue, caused by shear forces damage

[7] Ingram, Raynor, Paulraj & Young: An assessment of friction and shearing prevention treatment in the management of pressure ulcers based on the study conducted by Hampton et al 2009 within a long term nursing home environment. *Data on file*

	3. HFU Scan data collected over the 4 week period aims to quantify the outcome as the summarised scan pixel data returning to a normal status scan profile. **Comparisons between the sacrum and normal tissue after use of the Undergarment over 4 weeks** (The 3 parameters were measured at time 0, 2, and 4 weeks). 1. Tactile assessment was used to measure skin 'bogginess' over the study period with the aim of reducing this bogginess 2. Assessment by the qualified Tissue Viability Nurse of the photographic staging aims to qualify a reduction in erythema. 3. HFU Scan data collected over the 4 week period to quantify the outcome as the summarised scan pixel data returning to a normal status scan profile.
Secondary outcomes (including scoring methods and timings of assessments)	N/A

Study name	**WUK2011**
Objective	The objective was to determine the effectiveness of the low friction garments (Parafricta) at protecting friction and shear damaged skin in conjunction with current treatment in patients who had developed pressure ulcers up to Grade 2. Additional assessment of the acceptability by the patients and the utility by the staff
Location	6 Nursing Homes in Worcestershire
Design	Case Controlled study
Duration of study	6 months
Patient population	Nursing Home patients with up to Grade 2 pressure ulcers (10 Grade 2, 10 Grade 1, 5 'at risk' of PU due to repetitive motion) and input from their nursing staff
Sample size	25 patients
Inclusion criteria	Patients at-risk of or with a pressure ulcer of category 2 or less (EPUAP, 2009); aged 18 years or over and had agreed to take part; residing in a care home.
Exclusion criteria	N/A
Intervention(s) (n =) and comparator(s) (n =)	n = 25
Baseline differences	N/A
How were participants followed-up (for example, through pro-active follow-up or passively). Duration of follow-up, participants lost to follow-up	N/A
Statistical tests	N/A
Primary outcomes (including scoring	Scores recorded on the following parameters: 1. Ease of Use [by staff]

methods and timings of assessments)	2. How easy to keep the garments in place [by staff] 3. Effectiveness at preventing friction damage [by staff] 4. Product Comfort 5. Improvement of Skin [by staff]
Secondary outcomes (including scoring methods and timings of assessments)	N/A

Study name	**Summary of NRC1/2/3**
Objective	
Location	3 Nursing Homes in Eastbourne
Design	Case studies
Duration of study	Between 1-2 weeks
Patient population	Nursing Home patients with up to Grade 2 pressure ulcers
Sample size	3 patients
Inclusion criteria	Patients with a pressure ulcer of category 4 or less (EPUAP, 2009) and had agreed to take part; residing in a care home.
Exclusion criteria	N/A
Intervention(s) (n =) and comparator(s) (n =)	n = 3
Baseline differences	N/A
How were participants followed-up (for example, through pro-active follow-up or passively). Duration of follow-up, participants lost to follow-up	N/A
Statistical tests	N/A
Primary outcomes (including scoring methods and timings of assessments)	By physical and photographic comparisons, the patients' skin damage was shown to have improved
Secondary outcomes (including scoring methods and timings of assessments)	

Study name	**SAWC1**
Objective	Assessment of heel skin breakdown protection using Parafricta Bootees
Location	2 Nursing Homes in Georgia, USA
Design	Case studies

Duration of study	30 days
Patient population	Nursing Home patients with friction and shear damage
Sample size	6 patients
Inclusion criteria	Patients with a pressure ulcer of category 4 or less (EPUAP, 2009) and had agreed to take part; residing in a care home.
Exclusion criteria	Excluded were residents with or at-risk for pressure ulcers on the heel and/or foot due to pressure only.
Intervention(s) (n =) and comparator(s) (n =)	n = 6
Baseline differences	N/A
How were participants followed-up (for example, through pro-active follow-up or passively). Duration of follow-up, participants lost to follow-up	N/A
Statistical tests	N/A
Primary outcomes (including scoring methods and timings of assessments)	By physical and photographic comparisons, the patients' skin damage was shown to have improved
Secondary outcomes (including scoring methods and timings of assessments)	

7.4.2 Provide details on data from any single study that have been drawn from more than one source (for example a poster and unpublished report) and/or when trials are linked this should be made clear (for example, an open-label extension to randomised controlled trial).

In study JWC2010, using data from the original study we also independently undertook a subgroup analysis comparing the following:

- Differences in gender
- Location of admission (home vs. non-home (nursing, residential care, other) – these patients may have had different comorbidities)
- Whether the patients were on medical or orthopaedic wards (these patients had different predisposing conditions)

We compared study participants in Cohort 1 and Cohort 2 in two separate subgroups – those admitted with a pressure ulcer, and those who did not have a pressure ulcer on admission. We did not find statistically significant differences in any of the above. See Appendix 5

7.4.3. Highlight any differences between patient populations and methodology in all included studies.

The major differences between the studies was the nature of the care setting (hospital or nursing home), the size of the study (between 1 and 600 patients), the detail of the study design, and detail of how the outcome was measured.

In all studies Parafricta Bootees or Undergarments were used as an adjunctive intervention to the standard pressure ulcer prevention and treatment regimen used in the establishment, in patients evaluated to be at risk of developing a pressure ulcer or with a pressure ulcer in the heel or sacral/ buttock area.

Study location:

JWC2010 – Hospital, high risk of PU wards

JCN2009 – Nursing Homes

WUK2011 – Nursing Homes

NRC1 – Nursing Home

NRC2 – Nursing Home

NRC3 – Nursing Home

SAWC1 – Two long term care facilities in the USA

Other key factors remain broadly similar, including:

- Inclusion criteria: Patient at risk of pressure ulcer according to risk scale, or graded according to pressure ulcer grade
- Assessment of Patients' Pressure Ulcer risk and Delivery of Care – Nurse [Community or Hospital based]

- Standard of Pressure Ulcer Prevention Care – routine assessment; regular turning; provision of pressure reducing/redistributing surfaces – foam or air flow mattress

7.4.4. Provide details of any subgroup analyses that were undertaken in the studies included in section 7.4.1. Specify the rationale and state whether these analyses were pre-planned or post-hoc.

Planned sub-group analyses were not undertaken in the context of these studies.

7.4.5. If applicable, provide details of the numbers of patients who were eligible to enter the study(s), randomised, and allocated to each treatment in an appropriate format.

The diagrams below [Figures 2 & 3] and Table 1 shows the patient status description and flow in the study #1 – JWC 2010

A total of 650 patient cases were initially reviewed. Of these, 204 met the criteria for use of the products in the 3 months prior to the start of the evaluation (cohort 1) and 165 patients met the criteria during the period when the Parafricta garments were used (cohort 2); the total per cohort is shown in bold in the table, and their subsequent paths.

Figure 2 Patient pathways in JWC2010

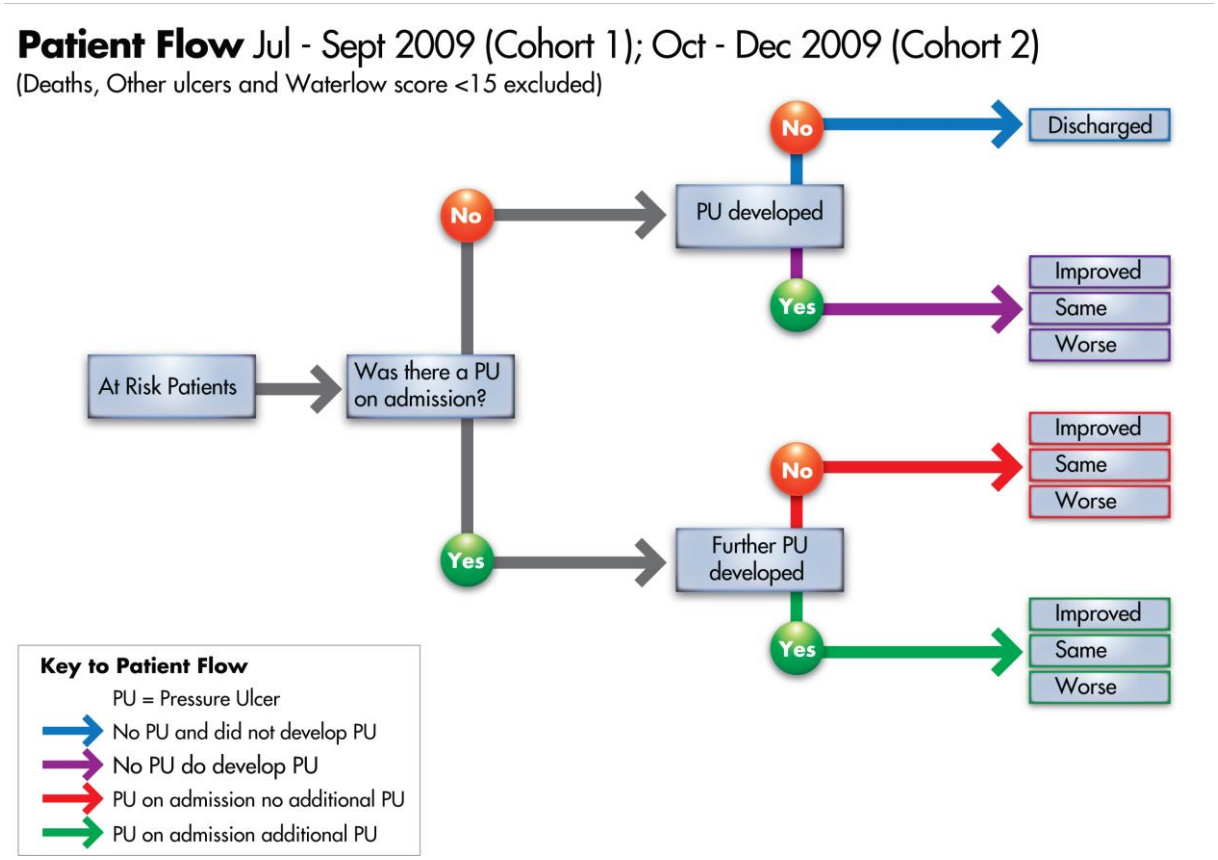
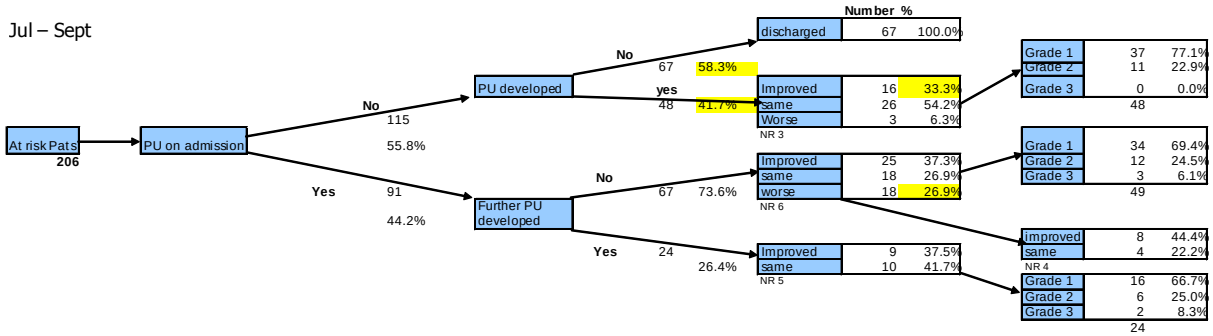


Figure 3 – Patient Flow by Cohort

Cohort 1

Jul – Sept



Cohort 2

OCT - DEC

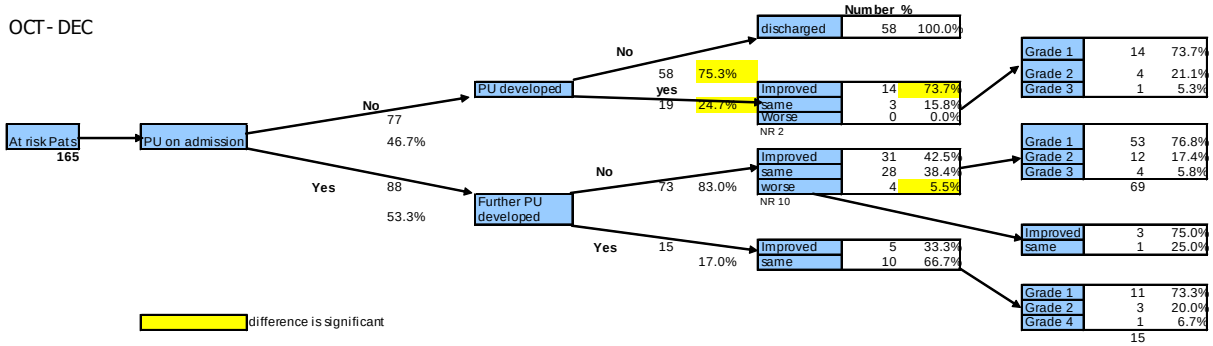


Table 1: Differences in Pressure Ulcer Incidence in Patient Pathways Cohort 1 versus Cohort 2 – showing #of patients per cohort

Selected Patient's Pathways			Cohort 1 (C1)		Cohort 2 (C2)		% Difference C2 – C1	p-value	CI at 95% (±)	
			Incidence	%	Incidence	%			C1	C2
No PU on admission	Did not develop PU		67	59	58	75	16	0.0286	9.1	9.6
	Developed PU		46	41	19	25				
PU on admission	No additional PU developed		67	74	73	83	9	0.1838	9.1	7.9
	Additional PU developed		24	26	15	17				
Total Cohort			**204**		**165**					
No PU on admission	Developed PU	Improved	16	33	14	74	41	0.0065	13.3	19.8
		Same or worse	32	67	5	26				
PU on admission	No additional PU developed	Deteriorated	18	27	4	6	-21	0.0012	10.6	5.2
		Same or improved	49	73	69	94				

CI: Confidence interval
PU: Pressure ulcer

7.4.6. If applicable provide details of and the rationale for, patients that were lost to follow-up or withdrew from the studies.

Study #1 JWC2010: Of the 650 patients reviewed for both Cohorts, those who had pressure ulcers in locations other than heel, foot, sacrum and buttocks, had a Waterlow Score below 15, or died, were excluded from the analysis.

7.5 Critical appraisal of relevant studies

7.5.1 Complete a separate quality assessment table for each study. A suggested format for the quality assessment results is shown in tables B7 and B8.

Table B7 Critical appraisal of randomised control trials

Study name		
Study question	**Response (yes/no/not clear/N/A)**	**How is the question addressed in the study?**
Was randomisation carried out appropriately?	N/A	
Was the concealment of treatment allocation adequate?	N/A	
Were the groups similar at the outset of the study in terms of prognostic factors, for example, severity of disease?	N/A	
Were the care providers, participants and outcome assessors blind to treatment allocation? If any of these people were not blinded, what might be the likely impact on the risk of bias (for each outcome)?	N/A	
Were there any unexpected	N/A	

imbalances in drop-outs between groups? If so, were they explained or adjusted for?		
Is there any evidence to suggest that the authors measured more outcomes than they reported?	N/A	
Did the analysis include an intention-to-treat analysis? If so, was this appropriate and were appropriate methods used to account for missing data?	N/A	
Adapted from Centre for Reviews and Dissemination (2008) Systematic reviews. CRD's guidance for undertaking reviews in health care. York: Centre for Reviews and Dissemination		

The critical appraisal of the observational studies was carried out by:

- Professor Peter H Sönksen – Emeritus Professor of Endocrinology, Division of Medicine , The Medical & Dental School of Guy's, King's and St Thomas' Hospitals; Visiting Professor of Endocrinology, University of Southampton School of Medicine
- Dr Ali Hasan - Regional Medical Director (London & the South-East), Bupa

Table B8 Critical appraisal of observational studies

Study name JWC2010		
Study question **"Did use of Parafricta in acute hospital setting favourably effect ulcer management and be cost effective?"**	**Response yes/no/not clear/N/A)** Yes	**How is the question addressed in the study?** Cohort study involving an historical control cohort and a study cohort. Financial modelling of results to evaluate financial benefit
Was the cohort recruited in an acceptable way?	Yes	Clear inclusion criteria are set out for the recruitment of each cohort and were adhered to during the study. Analysis was undertaken to ensure that both cohorts did not have statistically significant differences which would influence the study outcomes. . Successive 3 month cohorts – all meeting inclusion criteria

		included.
Was the exposure accurately measured to minimise bias?	yes	Exposure to the intervention consisted of either use or non-use of the Parafricta products. The study included all patients with given level of risk over two separate three month periods with detailed measurements recorded by trained staff and analysed appropriately
Was the outcome accurately measured to minimise bias?	yes	Detailed outcome measures were made on all. Quality of data appears to be good
Have the authors identified all important confounding factors?	not clear	The study itself does not refer to any specific potential or realised confounders in its text. The sponsors are not aware of any confounders that have been highlighted by the study authors. All patient records are available and confounding factors noted there
Have the authors taken account of the confounding factors in the design and/or analysis?	n/a	Study participant recruitment was set up to minimise the effect of confounding variables by including patients on one site in three chosen wards (where nursing intensity/ quality may have been a confounder, as may different levels of patient morbidity). By ensuring that all patients who meet criteria were included this minimises the chance of having "different" patient subsets.
Was the follow-up of patients complete?	yes	Excellent compliance with observations and measurements. 6 patients were lost to follow-up.
How precise (for example, in terms of confidence interval and p values) are the results?	yes	The three main outcome measures reaches statistical significance at p< 0.03, <0.007 and <0.001 showing that the use of Parafricta reduced risk of new ulcer formation (prevention), increased chances of ulcers healing and reduced risk of existing ulcers deteriorating
Adapted from Critical Appraisal Skills Programme (CASP): Making sense of evidence 12 questions to help you make sense of a cohort study		

Study name JCN2009		
Study question **"Can Parafricta reduce potential for pressure damage?"**	**Response** **yes/no/not clear/N/A)**	**How is the question addressed in the study?** 25 nursing home residents with early signs of pressure ulceration had Parafricta Bootees or Undergarments added standard preventative measures
Was the cohort recruited in an acceptable way?	not clear	We are not told how the 'sample' of 25 were selected. with early signs of trouble on heels or sacrum

Was the exposure accurately measured to minimise bias?	yes	'We are not told how the 'sample' of 25 were selected.
Was the outcome accurately measured to minimise bias?	yes HFU Ultrasound assessments	Ultrasound evaluation was undertaken by trained operators and was reported to have been executed effectively. Trained tissue viability nurses made assessments of skin condition but noted some practical difficulties in measurement of skin condition related to subjective assessments of bogginess and redness.
Have the authors identified all important confounding factors?	Not clear	The standardisation of lighting for the clinical photos The limited information on the sample group that is used and lack of discussion on this topic makes it difficult to assess whether they authors have explicitly addressed this.
Have the authors taken account of the confounding factors in the design and/or analysis?	yes	Two clinicians making clinical judgement plus photographs and ultrasound. Subjectiveness of some measures acknowledged appropriately
Was the follow-up of patients complete?	yes	Each resident entered to study completed the study with measurements at 2 and 4 weeks
How precise (for example, in terms of confidence interval and p values) are the results?	Yes	Subjectiveness of photographs and clinical signs acknowledged. Ultrasound data quite precise but no analysis of data presented just examples as in a case study. The ultrasound data shows reversal of tissue damage when Parafricta is used but there are no summary statistics nor p values
Adapted from Critical Appraisal Skills Programme (CASP): Making sense of evidence 12 questions to help you make sense of a cohort study		

Study name WUK2011		
Study question "Can the use of Parafricta Undergarments and Bootees favourably effect management of early pressure ulceration in nursing home residents?" "How easy is it to use the Parafricta appliances?"	**Response** **yes/no/not clear/N/A)**	**How is the question addressed in the study?** 25 people resident in a primary care nursing home with early signs of tissue damage indicating high risk of ulcer development given Parafricta Bootees, Undergarments or both. As an adjunct to routine prevention heels and sacral areas monitored by 'clinicians' and surveys carried out on ease of use of devices.

Was the cohort recruited in an acceptable way?	yes	Residents in nursing home with early signs of tissue damage over heels or sacrum
Was the exposure accurately measured to minimise bias?	yes	They all continued in their high risk situations
Was the outcome accurately measured to minimise bias?	yes	Clinical judgement is subjective but invaluable but no attempt was made at statistical analysis
Have the authors identified all important confounding factors?	yes	Involuntary movements, spasms, steroid use, frail skin, age, multiple sclerosis, CVA, Parkinson's disease – these are all 'typical' of the nursing home environment where pressure ulcers are a major hazard
Have the authors taken account of the confounding factors in the design and/or analysis?	yes	
Was the follow-up of patients complete?	yes	
How precise (for example, in terms of confidence interval and p values) are the results?	Yes	Clinical judgement not precise measurement but appropriate to the environment.
Adapted from Critical Appraisal Skills Programme (CASP): Making sense of evidence 12 questions to help you make sense of a cohort study		

No critical analysis was made of the 3 NRC Case or SAWC1 studies

7.6 Results of the relevant studies

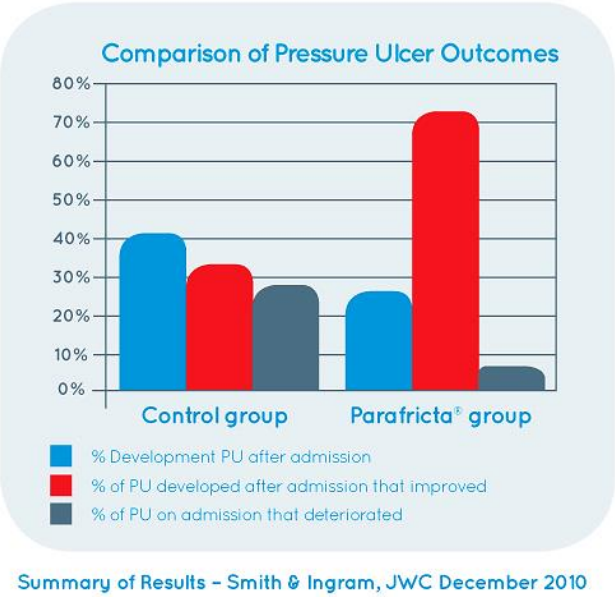
7.6.1 Complete a results table for each study with all relevant outcome measures pertinent to the decision problem. A suggested format is given in table B9.

Table B9 Outcomes from published and unpublished studies

Study name		**JWC2010: see Table 1 above**
Size of study groups	**Treatment**	165 patients
	Control	204 patients
Study duration	**Time unit**	6 months – Cohort 1 (Control): 3 months and Cohort 2 (Active) : 3 months
Type of analysis	**Intention-to -treat/per protocol**	Per protocol
Outcome	**Name**	Reduction of incidence of pressure ulcers with use of Parafricta
	Unit	Recording of pressure ulcer using Grade scale 1-4 EPUAP/NICE
Effect size	**Value**	1. Incidence of patients developing pressure ulcers was 16% higher in Cohort 1 [control] vs Cohort 2 [Parafricta] for patients who entered hospital without a pressure ulcer (41% versus 25%), indicating that patients using Parafricta products were less likely to develop a PU after admission 2. For patients who entered hospital with a pressure ulcer the Incidence of patients developing further pressure ulcers was 9% less in Cohort 2 [Parafricta] vs Cohort 1 [Control]
	95% CI	1. Cohort 1 = +/- 9.1% ; Cohort 2 = +/-9.6% 2. Cohort 1 = +/-9.1% ; Cohort 2 = +/- 7.9%
Statistical test	**Type**	Statistical analysis using z test of proportion, chi square and t tests were applied to determine statistical significance and confidence intervals (CIs) for the relevant data.
	p value	p = 0.0286 p =0.1838
Other outcome	**Name**	1. Severity of pressure ulcer The improvement or decline of the pressure ulcer status was monitored for all patients with a pressure ulcer. 2. Length of Stay Difference in median length of stay between 'No PU on admission, did not develop PU' and 'No PU on admission, developed PU' was 11 days. Therefore if a PU is avoided the length of stay is significantly reduced
	Unit	1. Rating of pressure ulcer status for improvement, staying the same, or deteriorating 2. Length of stay in days
Effect size	**Value**	1. For patients who developed a pressure ulcer after admission, the incidence of PU that

		improved in Cohort 2 (Parafricta) was 41% higher than in Cohort 1 (control) (74% versus 33%) indicating that patients using Parafricta products had a better outcome. 2. The difference between the cohorts is 41% 3. Although there was no significant difference between the cohorts in terms of the *incidence* of additional PUs for patients who had a PU on admission, there was a statistically significant difference in terms of the outcome of the ulcer in patients who did not develop additional ulcers. 4. In Cohort 1 (control), 21% more of the ulcers deteriorated compared to Cohort 2 (27% versus 6%), indicating less deterioration -a better outcome - for patients using Parafricta products.
	95% CI	1. Cohort 1: +/-13.3%; Cohort 2: +/-19.8% 2. Cohort 1: +/-10.6%; Cohort 2: +/-5.2%
Statistical test	**Type**	Statistical analysis using z test of proportion, chi square and t tests were applied to determine statistical significance and confidence intervals (CIs) for the relevant data.
	p value	1. p=0.0065 2. p=0.0012
Comments		The authors stated "Evaluation of the findings indicated that the products provided a clinical benefit to patients, as well as a cost effective solution for the hospital. and the products have been recommended for purchase by the local PCT for both hospital and community use. On the basis of these data, there were significant improvements that justify the purchase and widespread use of Parafricta products (Undergarments and Bootees) in the NHS environment."

Figure 4 – Summary of PU results JWC2010



Summary of Results – Smith & Ingram, JWC December 2010

Study name		JCN2009
Size of study groups	Treatment	28 in total; 10 with heel PU and 18 with sacral PU
	Control	28 in total: n =10 with heel (each patient was their own control –one heel active , one control) and the sacral n =18: comparison to the patients normal tissue scan.
Study duration	Time unit	10 months duration with each patient being assessed at 0, 2, and 4 weeks
Type of analysis	Intention-to -treat/per protocol	Per protocol
Outcome	Name	Reduction in shear induced oedema [a] in the heel compared to other heel [b] sacral PU compared to normal tissue scan (Both groups show a return to normal tissue values compared to the oedematous shear damage of the control)
	Unit	The mean pixel data across all patients for each treatment and stage was converted to a cumulative percentage for heel and sacral measurements. If the oedema, showing shear damage, reduces and disappears, the scan will return to the normal – as shown in Figures 5, 6 and 7 below; plus further analysis is shown in Appendix 5 , Section 12
Effect size	Value	**[a] Heel** • Analysis of the active heel results shows that there was a significant difference between the heel at the start of treatment and the normal heel (D= 29.7 and P =0) - probability that the difference was due to error = 0 %. By the end of the treatment process that difference had reduced (D= 9.4 and P=0.2). • The difference between the heel at treatment 0 and 4 weeks was significantly different, (D = 31.25 and P = 0) demonstrating the effectiveness of the Parafricta in reducing oedema. • Comparing the control and treated heels at both t=0 and 4 weeks showed very similar pixel distributions (D=3.91 P=0.98**)** and were significantly different from the readings for the normal curve (D=30.40 and P= 0). • A significant difference between the treated and the control samples (D=34.38 and P=0).could be observed post 4 weeks of treatment of the test subjects. • From these results it could be concluded that the symptoms of the treated heel had improved significantly over time when compared to the control heel at times 0 and 4 weeks and the level of oedema as measured by ultrasound mean pixel distribution had moved significantly towards the profile for that of the normal heels.

		[b] Sacral • The results of the sacrum study are presented in Figure 7 below; plus further analysis is shown in Appendix 5 , Section 12 Without any control in this section of the study the analysis concentrated on charting the progress of the treated sacrum over the four week study period towards a normal distribution curve. • The results show a significant improvement from start of treatment to week 4 (D= 14.84 p=0.006). This difference was also initially apparent after two weeks with the D value reducing over time. The cumulative distribution graph shows a clear movement of the curve to the normal away from Time 0.
	95% CI	N/A
Statistical test	**Type**	See statistical analysis detail in Appendix 12
	p value	[a] p = 0.2
Other outcome	**Name**	N/A
	Unit	N/A
Effect size	**Value**	N/A
	95% CI	N/A
Statistical test	**Type**	N/A
	p value	N/A
Comments		The authors stated “Friction and shear are recognised as contributory factors in the development of pressure ulcers and reducing these forces together with the effects of pressure are instrumental in ulcer prevention within current clinical guidelines. This study has shown a significant correlation between a reduction in oedema and inflammation, as measured by HFU associated with pressure ulcers and the use of the Parafricta™ products - which were designed to reduce the effect of shear and friction.”

Figures 5-7 HFU Scan results from JCN2009

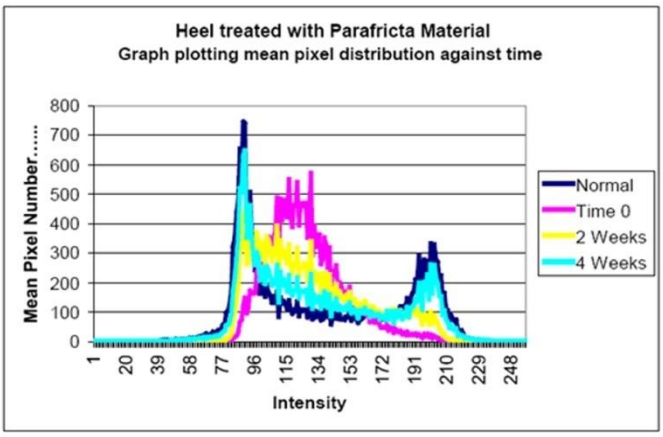


Figure 5.
The right 'study' heel. Normal is shown as the dark blue line and it can easily be seen how each week the tissues grow toward the normal line and by week 4 the turquoise line matches the dark blue line. This demonstrates how the right heels all gradually improved weekly.

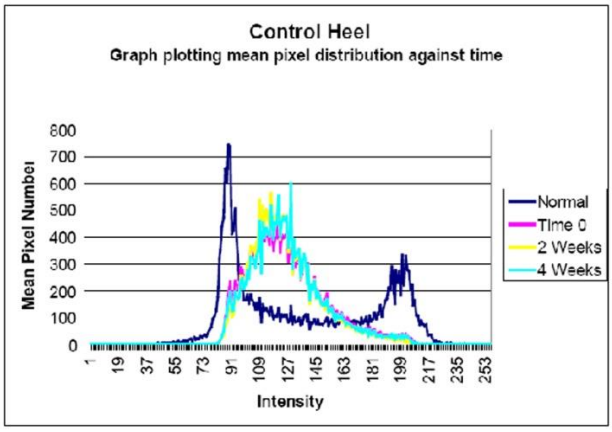
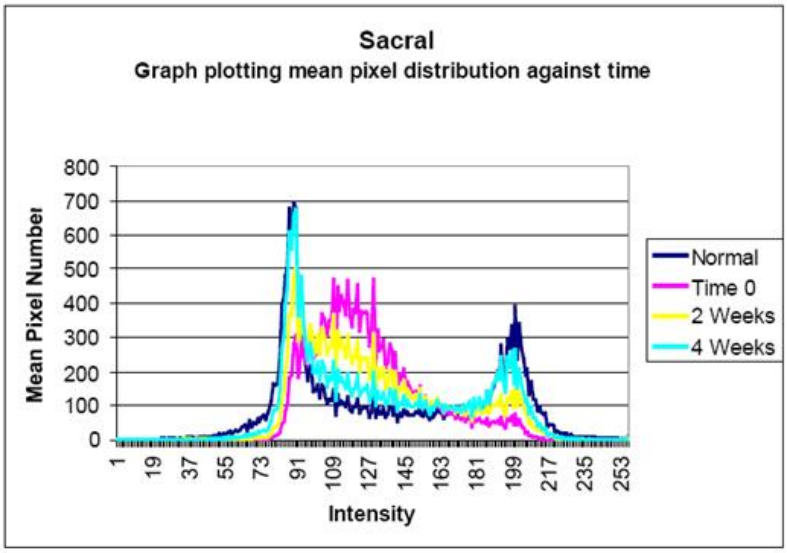


Figure 6
The left 'control' heel does not progress from inflammation to 'normal' as seen in the right foot. In fact, it remains very static and where it was oedematous on day 1 it remained oedematous at week 4.



The graph clearly shows that the tissues regain 'normal' status by week 4 when the turquoise line achieves the same pathway as the dark blue or normal tissue line.

Figure 7.

Study name		WUK2011
Size of study groups	Treatment	25 patients
	Control	N/A
Study duration	Time unit	6 months
Type of analysis	Intention-to-treat/per protocol	Per protocol
Outcome	Name	Rankings in the 6 categories shown in Table 2 below.
	Unit	N/A
Effect size	Value	N/A
	95% CI	N/A
Statistical test	Type	N/A
	p value	N/A
Other outcome	Name	N/A
	Unit	N/A
Effect size	Value	N/A
	95% CI	N/A
Statistical test	Type	N/A
	p value	N/A
Comments		The authors stated "The results support the conclusion that low friction garments can assist in both the prevention and management of up to category 2 pressure ulceration for those who are unable to reposition themselves."

Table 2 – Summary of WUK2010 study

#	Category				
1	Ease of Use	Very Easy to Use	Easy to Use	Fairly Easy to Use	Difficult to Use
	%	64%	16%	16%	4%
2	How easy to keep the garments in place	Very Easy to keep in place	Easy to keep in place	Fairly Easy to keep in place	Difficult to keep in place
		48%	16%	20%	16%
3	Effectiveness at preventing friction damage	Prevented friction	Did not prevent friction		
		88%	12%		
4	Product Comfort	Very comfortable	Comfortable		
		76%	24%		
5	Improvement of Skin	Improved skin	The same	No skin improvement	
		76%	8%	16%	

- The 3 NRC Case Studies showed marked improvement of skin status following the use of Parafricta.
- The SAWC poster stated ”After 30 days, none of the residents had developed pressure ulcers or re-opening of closed wounds, including one patient who had a recurrent wound for over two years. The results of the Study clearly indicated that there is an option for an intervention for assistance in preventing heel pressure ulcers caused by friction and shear. This device is efficacious, patient comfortable, user friendly, and economical. It fills the gap now present in our armamentarium for prevention of heel pressure ulcers.”

7.6.2. Justify the inclusion of outcomes in table B9 from any analyses other than intention-to-treat.

N/A

7.7 Adverse events

In section 7.7 the sponsor is required to provide information on the adverse events experienced with the technology being evaluated in relation to the scope.

For example, post-marketing surveillance data may demonstrate that the technology shows a relative lack of adverse events commonly associated with the comparator.

7.7.1 Using the previous instructions in sections 7.1 to 7.6, provide details of the identification of studies on adverse events, study selection, study methodologies, critical appraisal and results.

7.7.2 Provide details of all important adverse events reported for each study. A suggested format is shown in table B10.

No adverse events have been reported for the use of Parafricta Bootees and Undergarments in either the studies listed or in post-marketing surveillance. A medical device vigilance scheme is in place with the ability to report adverse events.

Table B10 Adverse events across patient groups

	Time period 1			*Time period 2 etc.*		
	Intervention **% of patients (n = *x*)**	***Comparator*** **% of patients (n = *x*)**	**Relative risk (95% CI)**	***Intervention*** **% of patients (n = *x*)**	***Comparator*** **% of patients (n = *x*)**	**Relative risk (95% CI)**
Class 1 (for example, nervous system disorders)						
Adverse event 1	none	none	none	none	none	none
Adverse event 2	none	none	none	none	none	none
Class 2 (for example, vascular disorders)						
Adverse event 3	none	none	none	none	none	none
Adverse event 4	none	none	none	none	none	none
CI, confidence interval Adapted from European Public Assessment Reports published by the European Medicines Agency						

7.7.3. Describe all adverse events and outcomes associated with the technology in national regulatory databases such as those maintained by the MHRA and FDA (Maude).

None reported

7.7.4 Provide a brief overview of the safety of the technology in relation to the scope.

Parafricta is a low friction technology utilising a fabric which is non-allergenic, breathable and comfortable to wear. Due to the low friction nature of the material, care must be taken when a patient is transferring from a bed to a chair, whilst wearing a Bootee; albeit the Bootee has a non-slip sole. However no incidences of falls, or other issues, have been referred to APA Parafricta in over 4 years of continuous use.

Parafricta Bootees and Undergarments have been carefully designed in conjunction with patients and carers to ensure careful positioning of the non-low friction pads on the base of the Bootee Undergarment to minimise patient slippage and risk of patient falls.

7.8 Evidence synthesis and meta-analysis

When more than one study is available and the methodology is comparable, a meta-analysis should be considered.

Section 7.8 should be read in conjunction with the 'Medical Technologies Evaluation Programme Methods Guide', available from www.nice.org.uk/mt

7.8.1 Describe the technique used for evidence synthesis and/or meta-analysis. Include a rationale for the studies selected, details of the methodology used and the results of the analysis.

N/A (no adverse events reported for Parafricta or any analogous products)

7.8.2 If evidence synthesis is not considered appropriate, give a rationale and provide a qualitative review. The review should summarise the overall results of the individual studies with reference to their critical appraisal.

No adverse events reported for Parafricta or any analogous products.

7.9 Interpretation of clinical evidence

7.9.1 Provide a statement of principal findings from the clinical evidence highlighting the clinical benefit and any risks relating to adverse events from the technology.

The studies presented here demonstrate that Parafricta undergarments or bootees can be used as an adjunctive intervention to current standard NICE procedures for prevention and treatment of pressure ulcers in the heel and sacral region. They reduce skin breakdown in people with frail skin by reducing friction, shear and stiction and the resultant tissue damage.

For prevention of pressure ulcers, the evidence provided demonstrates a reduction in the incidence of pressure ulcers in patients who are at risk of developing pressure ulcers. The evidence also demonstrates an improvement in outcome (reduction in the overall severity) of pressure ulcers which form in patients who are at risk, when patients use Parafricta products, compared to when patients do not.

For treatment of pressure ulcers, the evidence provided demonstrates an improvement in the outcome of pressure ulcers when Parafricta products are used. The severity of the ulcers are reduced.

The products can be used for **at-risk patients in the home, primary or secondary care settings.** Product effects have been demonstrated to be statistically significant in an inpatient context and we believe that our supporting evidence supports that this effect will be significant in primary care settings.

In frail and fragile skin the studies demonstrate that when patients use Parafricta, the skin returns more quickly to less oedematous, more “normal” skin condition (HFU measurements).

No adverse events have been recorded within the course of these studies or following these studies. The nature of the medical device means that adverse events are unlikely.

7.9.2 Provide a summary of the strengths and limitations of the clinical-evidence base of the technology.

We have highlighted the most prominent strengths and weaknesses below.

Strengths:

- Statistical significance reached in studies #s 1& 2 (JWC2010 & JCN2009) for core endpoints of reduction of the incidence of pressure ulcers, reduction of progression/ improvement of healing of pressure ulcers, and the reversal of shear induced tissue damage
- For a class 1 medical device, intended as an adjunctive intervention, a controlled patient cohort study is a sound design.
- Reasonable patient enrolment across studies (total of 422 patients) – particularly in landmark JWC2010 study
- Acceptable treatment pathway – simple, easy to use as part of the preventative approach to pressure ulcers
- Efficacy has been evaluated in both hospital and community settings
- Quantifiable data presented and evaluated.
- A clear link can be made between the results demonstrated in this research, improving the quality of clinical care, and improving the cost of care provided to patients

Weaknesses:

- **Domestic single-site studies only:** We are aware of the variation of pressure ulcer morbidity across different NHS trusts which could impact on its effects; however, conversely, the use of single sites minimised the impact of this.

- **Type and duration of follow-up:** Whilst positive results achieved in these studies were statistically significant (including both incidence of new ulcers and improvement of existing ulcers), these studies focussed on one core endpoint. Longer follow-up periods – particularly in the community - may also have provided further confidence in how precisely benefits are estimated, and the potential longer-term effects of Parafricta in longer-term healing and prevention of pressure ulcers.

- **Detail of core patient base:** The studies were clear on the inclusion criteria for patients but further information and analyses on sub-groups – including those with pre-morbid conditions (e. diabetes) would be of use. In the case series papers, the selection criteria for included patients were not clearly stated.

7.9.3 Provide a brief statement on the relevance of the evidence base to the scope. This should focus on the claimed patient- and system-benefits described in the scope.

The evidence base applies well to the scope and demonstrates its outcomes adequately. Specifically:

Population, intervention, and comparator: The population matches the scope-defined population well. Patients in studies – particularly JWC2010 – were found to be at risk of skin breakdown and damage (by nature of their higher Waterlow risk scores). We acknowledge that we cannot confirm specific effects in those where impaired sensation or peripheral arterial disease against populations who do not have these factors, but believe that Parafricta is likely to be effective in both these populations. As described in the scope, Parafricta functions as an adjunctive therapy in all studies. Statistical evidence of the effects in in-patient population is provided with

supporting evidence in other care settings and logical explanation of why extrapolation to other care settings is applicable.

Outcomes: The most important outcomes defined in the scope are adequately illustrated in JWC2010 – including incidence and severity of pressure ulcers – which we believe provide adequate evidence to support the core scope of Parafricta. Some evidence is present for the remainder of outcomes including time-to-healing (based on the proxy ultrasound measurements in [study]).

The demonstrated benefits of Parafricta to patients are:

- A reduction in the likelihood of getting a pressure ulcer (as evidenced by a reduced incidence)
- A reduction in pressure ulcer severity if a pressure ulcer has/ does develop
- Parafricta products are easy to use and comfortable.

These benefits reduce pain and discomfort in the patient resulting in an improved quality of life, potentially leading to reduced complications from pressure ulcers, decreased duration of hospitalization and improved compliance.

The benefits to the healthcare system are:

- **Demonstrated improvement in overall quality of care**
  - **A reduction in the incidence, prevalence and severity of pressure ulcers**
  - **Demonstrable improvements in several NHS targets and initiatives including** Commissioning for Quality & Innovation CQUIN, Quality, Innovation, Production, Prevention (QUIPP), NHS Harm Free Care programme, Safety Thermometer and the SSKIN Care Bundle (Skin Inspection, Surface, Keep Moving, Incontinence, Nutrition), Stop the Pressure and Patient Safety First campaigns.
  - Satisfaction to carers: providing prevention and treatment for a current unmet medical need – reduction of the impact of friction and shear.

Further benefits include

- **Reduction of length of stay for hospitalised patients** through prevention of pressure ulcer formation and reduced pressure ulcer incidence. Hospital acquired pressure ulcers result in lengthened hospital stays[8]; increased costs and patient complications, such as infections.
- **Increased resource opportunity:** if the length of stay is reduced by using Parafricta products, this reinforces the opportunity cost of that bed being used for another patient.
- **A decrease in overall health system costs due to the reduction of both incidence and severity of pressure ulcers which leads to**
  - reduced expenditure on pressure redistribution preventative technology, such as special mattresses and beds; nurse time and bed occupancy cost quicker return of patients to the community or community long-term care
  - reduced pressure ulcer incidence resulting in reduced costs of nursing care, dressings, anti-biotic and pain killer use, and rehabilitation
  - The potential savings shown in one hospital study centre by using Parafricta Bootees and Undergarments would equate to annual savings of £200M+ across the UK

7.9.4 Identify any factors that may influence the external validity of study results to patients in routine clinical practice.

We believe that these results are broadly applicable to routine clinical practice, and that Parafricta can be routinely used for populations at-risk of pressure ulcers in both primary and secondary care settings.

Although the largest study was conducted in a hospital environment, the risk factors and aetiology of pressure ulcers and the procedures used to prevent and treat the pressure ulcers in patients at risk are the same. The specialist

[9] Source: NPSA (National Patient Safety Agency) Quarterly Data Summary Issue 11 (Feb 2009) and http://www.npsa.nhs.uk/corporate/news/nhs-to-adopt-zero-tolerance-approach-to-pressure-ulcers/?locale=en

conducting study JWC2010 is responsible for treating pressure ulcers in both hospital and community settings and states that the conclusions are valid for both settings. (The choice of the hospital setting for the study ensured better control over variable parameters.)

The ease of use, comfort and similarity to everyday wear – (socks and pants) of the Parafricta devices makes them particularly suitable for use in the community and nursing homes and will aid patient compliance.

Study JWC2010 was conducted in a hospital trust with a very low underlying incidence of pressure ulcers and low staff turnover. If statistically significant improvements in the severity and incidence of pressure ulcers can be demonstrated in such an environment, it would seem logical that the use of Parafricta in centres with a higher underlying incidence would produce at least comparable improvements in the prevention and treatment of PU.

The risk of adverse events is extremely low.

7.9.5 Based on external validity factors identified in 7.9.4 describe any criteria that would be used in clinical practice to select patients for whom the technology would be suitable.

The current guidelines issued by NICE & the RCN [CG29] and EPUAP/NPUAP can continue to be used to identify patients at risk of developing a pressure ulcer as a result of friction and shear. The Risk Scores mentioned earlier, for the assessment of pressure ulcers in patients, such as the Norton scale, Braden scale, Waterlow scale. Gosnell scale, 4-factor model, Risk Assessment Pressure Sore (RAPS) scale – would allow the selection of patients who are suitable for Parafricta. This would be allied to the PU grading scales Grade 1-4 scale referenced in the Guidance issued by NICE & the RCN [CG29] and EPUAP/NPUAP.

The benefit is that clinicians now have an intervention to manage the risk posed by friction and shear as well as the other “at risk “factors.

Patients at particular risk of developing pressure ulcers as a result of friction, shear and rubbing would especially benefit from the use of Parafricta e.g.

- People with or at particular risk of heel or sacral ulcers, orthopaedic patients who use one heel to provide leverage to move themselves
- People with repetitive motion
- Patients with cognitive impairment, for example, who do not find Parafricta devices strange or upsetting
- Patients with restricted mobility who find they can reposition using the devices (anecdotal evidence from specialist user groups)

Section C – Economic evidence

Section C requires sponsors to present economic evidence for their technology.

All statements should be evidence-based and directly relevant to the decision problem.

The approach to the de novo cost analysis expected to be appropriate for most technologies is cost-consequence analysis. Sponsors should read section 7 of the Medical Technologies Evaluation Programme Methods guide on cost-consequences analysis, available from www.nice.org.uk/mt

Sponsors are requested to submit section C with the full submission. For details on timelines, see the NICE document 'Guide to the Medical Technologies Evaluation Programme process', available from www.nice.org.uk/mt

8 Existing economic evaluations

8.1 Identification of studies

The review of the economic evidence should be systematic and transparent and a suitable instrument for reporting such as the PRISMA statement (www.prisma-statement.org/statement.htm).

A PDF copy of all included studies should be provided by the sponsor.

8.1.1 Describe the strategies used to retrieve relevant health economics studies from the published literature and to identify all unpublished data. The search strategy used should be provided as in section 10, appendix 3.

The strategy was essentially the same as employed in the search for relevant published clinical studies "(friction OR shear) AND (ulcer OR sore)" with the addition of the search terms "(cost OR economic OR budget)". The aim was to identify any health

economic publications related to Parafricta or to other low friction fabrics that have been used to protect against development of sores or ulcers.

The outcome was to identify only one publication, previously cited in the Clinical Evidence section (see table C2)

Given that the scope includes use of Parafricta adjunctively to pressure-reducing devices used in standard NHS clinical practice, an alternative search strategy was tested to include “pressure” as a search item in place of “friction OR shear”. This had the effect of identifying many health economic publications particularly related to the use of pressure reducing mattresses and other pressure reducing devices. It did not reveal any other health economic studies that have included Parafricta or other low friction fabrics as an intervention.

8.1.2 Describe the inclusion and exclusion criteria used to select studies from the published and unpublished literature. Suggested headings are listed in the table below. Other headings should be used if necessary.

Table C1 Selection criteria used for health economic studies

Inclusion criteria	Same as in table B1
Population	People (adults or children of any age) in a community or hospital setting who: • have a grade 1 or 2 pressure ulcer and are at risk of progressing to grade 3 or 4 pressure ulcer • do not have a pressure ulcer but are at risk of developing pressure ulcers caused by friction and shear forces, including but not limited to patients who: o have frail skin and are at risk of skin breakdown or damage o have impaired sensation and are at risk of skin breakdown or damage o have peripheral arterial disease, who have a very high risk of developing ulcers, have medical conditions where skin frailty is a primary factor and where friction and shear could cause skin damage.
Interventions	In all settings: o Parafricta bootees (slip on or Velcro fastening) specifically used to protect the heel and ankle and/or o Parafricta undergarments (slip-on-boxer, slip-on brief, or undergarment with Velcro closure) specifically used to protect the sacrum, buttocks and hips. In conjunction with pressure-reducing devices used in standard NHS clinical practice, primarily: – dynamic or static high-specification pressure-relieving mattresses and overlays or – dynamic or static high-specification pressure-redistributing mattresses and overlays but may also include: – dynamic or static high-specification pressure-relieving beds or – dynamic or static high-specification pressure-redistributing beds or – silicone gel pads.
Outcomes	o incidence of grade 1 or 2 pressure ulcers progressing to grade 3 or 4 o incidence of developing pressure ulcers o incidence of skin breakdown o severity of pressure ulcers o length of hospital stay o time-to-healing for those who present with an existing

	pressure ulcer ○ patient compliance with pressure ulcer management interventions ○ patient comfort: including ability to move and self-reposition in bed ○ quality of life ○ morbidity ○ device-related adverse events. Any reported health economic outcome including cost of use, cost benefit, cost effectiveness
Study design	Any
Language restrictions	English
Search dates	2005 onwards
Exclusion criteria	**Same as in table B1**
Population	None
Interventions	Any which the use of Parafricta is combined with an additional intervention that materially changes the type or quality of nursing and/or wound care provided
Outcomes	None
Study design	None
Language restrictions	Non-English
Search dates	Before 2005

8.1.3 Report the numbers of published studies included and excluded at each stage in an appropriate format.

The main database search using ("friction OR shear") identified 45 (Cochrane Library) and 29 (PubMed) records. As agreed with NICE, due to the payment requirement of the other databases being onerous for a small SME, the search has been limited to these databases.

After duplicates were removed this was reduced to 72 records.

All of these records were screened and 70 excluded

2 full text articles were assessed for eligibility.

1 article was excluded because it was a critical appraisal of the other by the Centre for Reviews and Dissemination (NHS Economic Evaluation Database)

The follow-up search using (“pressure”) identified 545 in the Cochrane Library of which 91 were selected as being economic evaluations. In Pub Med 1346 the search revealed 1346 records of which 265 were reviews.

10 of the 91+265 economic evaluations or reviews were screened as they had titles including words suggestive of protecting areas that may be protected by Parafricta (heels and sacrum) or of the role of fabric in causing/preventing skin damage. 9 of these were excluded on further review.

The remaining 1 article was the same critical appraisal excluded in the other search.

It is recommended that the number of published studies included and excluded at each stage is reported using the PRISMA statement flow diagram (available from *www.prisma-statement.org/statement.htm*)

8.2 Description of identified studies

8.2.1 Provide a brief review of each study, stating the methods, results and relevance to the scope. A suggested format is provided in table C2.

Table C2 Summary list of all evaluations involving costs

Study name (year)	Location of study	Summary of model and comparators	Patient population	Costs	Patient outcomes	Results
Clinical and cost effectiveness evaluation of low friction and shear garments. Smith G, Ingram A. JWC 2010, Vol. 19(12).	Two medical wards and one orthopaedic ward in a district general hospital on Isle of Wight UK	Model compared two cohorts using data from the cohort study. In the study, Parafricta was used as adjunct (Cohort 2; N=165). This had the same standard PU prevention procedures as Cohort 1 (N = 204).	Patients with a Waterlow score of ≥15 (i.e. patients at high or very high risk of pressure ulceration) with or without pressure ulceration on admission who were unable to reposition independently.	• Bed stay costs/day (£325) • Dressing costs/day (weighted average £0.74) • Pressure relieving mattress cost/day (£2.37 or £0.30, weighted average 0.59) • Cost of Parafricta garments (£35.14 per unit)	• Pressure ulcers avoided, 16 per 100 at risk patients.(p=0.029) • Deterioration of existing pressure ulcers avoided, 15 per 100 at risk patients.	• Result was net saving from adjunctive use of Parafricta defined as incremental cost of bed days + pressure mattress+ wound dressings) for Cohort 1; minus cost of Parafricta garments. . • Base case model net saving of £63,715 per 100 patients identified on admission as at risk of pressure ulceration

8.2.2 Provide a complete quality assessment for each health economic study identified. A suggested format is shown in table C3.

Table C3 Quality assessment of health economic studies

Study name ***Clinical and cost effectiveness evaluation of low friction and shear garments JWC 2010, Vol 19 (12).***		
Study design	Comparative Cohort Study (Consecutive Cohorts)	
Study question	**Response (yes/no/not clear/N/A)**	**Comments**
1. Was the research question stated?	Yes	The study objectives were "To determine the effectiveness of Parafricta low-friction garments in reducing the incidence and prevalence of pressure ulceration and to evaluate the curative aspects of these products on pre-existing skin breakdown within a hospital setting" and the associated cost effectiveness.
2. Was the economic importance of the research question stated?	Yes	The authors state in the introduction that there is high cost of treating pressure ulcers in the UK (£1.4-2.1bn) and a large proportion of this cost is resource associated. Interventions that can prevent pressure ulceration will therefore significantly benefit health-care resources and improve quality of life. As above, any intervention such as Parafricta that can reduce pressure ulcer incidence will reduce resource use and the cost of treatment of PU to the NHS. This evaluation therefore set out to provide preliminary evidence on whether the reduction in pressure ulcer incidence achieved with the use of Parafricta Bootees and Undergarments is associated with savings outweighing the costs involved in a district general hospital.
3. Was/were the viewpoint(s) of the analysis clearly stated and justified?	Yes	A NHS hospital perspective was adopted. The authors stated their objective was "to provide preliminary evidence on the reduction in pressure ulcer incidence achieved with their use and their associated cost effectiveness in a district general hospital".

4. Was a rationale reported for the choice of the alternative programmes or interventions compared?	Yes	Parafricta was an adjunctive intervention added in Cohort 2 to the standard PU prevention procedure utilised in Cohort 1.
5. Were the alternatives being compared clearly described?	Yes	As above, it is clear that Parafricta is being used as an adjunct to the standard PU prevention procedure.
6. Was the form of economic evaluation stated?	Yes	Yes, this was described by the authors as a cost-effectiveness study. It could also be described as a cost consequences study.
7. Was the choice of form of economic evaluation justified in relation to the questions addressed?	Yes	The objective was to determine whether it will be cost effective (i.e. cost saving) to use Parafricta garments in the hospital environment and whether their extra cost is offset by the additional savings made following a reduction in ulcer incidence, improvement in ulcer outcome and reduction in length of hospital stay.
8. Was/were the source(s) of effectiveness estimates used stated?	Yes	Yes, the study authors obtained costs for the major resource elements – cost per day per bed occupation, pressure reducing surface costs, and dressing costs – from the Trust's Finance Department.
9. Were details of the design and results of the effectiveness study given (if based on a single study)?	Yes	
10. Were details of the methods of synthesis or meta-analysis of estimates given (if based on an overview of a number of effectiveness studies)?	N/A	
11. Were the primary outcome measure(s) for the economic evaluation clearly stated?	Yes	Reduction in incidence of PU and resultant shorter length of stay in the hospital bed, reduction in use of the pressure relieving surfaces and reduction in use of dressings to treat a PU formed.
12. Were the methods used to value health states and other benefits stated?	Yes	
13. Were the details of the subjects from whom valuations were obtained given?	Yes	Isle of Wight Primary Care Trust Finance Department
14. Were productivity changes (if included) reported separately?	N/A	Productivity was not reported
15. Was the relevance of	N/A	

productivity changes to the study question discussed?		
16. Were quantities of resources reported separately from their unit cost?	Yes	
17. Were the methods for the estimation of quantities and unit costs described?	Yes	As per [8] above
18. Were currency and price data recorded?	Yes	Price and Cost of resources were obtained from the Finance Department – as [8] above.
19. Were details of price adjustments for inflation or currency conversion given?	No	The data for the prices and cost are 2009/2010 prices including the list price for the Parafricta garments at the time.
20. Were details of any model used given?	Yes	Costs and Cost reduction tables are used to populate the cost model
21. Was there a justification for the choice of model used and the key parameters on which it was based?	Yes	The results of the data analysis were used to build a cost-effectiveness model to determine the financial impact of using the low-friction garments. The objective was to determine whether the extra cost is offset by the additional savings made following a reduction in ulcer incidence, and consequent reduction in length of hospital stay, use of dressings and employment of pressure reducing mattresses. The authors noted that bed stay (including nurse time) has the largest impact on costs, whilst the cost of dressing and mattress have a small financial impact.
22. Was the time horizon of cost and benefits stated?	12 months maximum	The products were assumed to have an asset life of 12 months with at least 3 reuses
23. Was the discount rate stated?	No	Not applicable given 12 months time horizon
24. Was the choice of rate justified?	No	Not applicable
25. Was an explanation given if cost or benefits were not discounted?	No	Unnecessary given 12 months time horizon
26. Were the details of statistical test(s) and confidence intervals given for stochastic data?	Yes	
27. Was the approach to sensitivity analysis described?	Yes	
28. Was the choice of variables for sensitivity analysis justified?	Yes	

29. Were the ranges over which the parameters were varied stated?	Yes	
30. Were relevant alternatives compared? (That is, were appropriate comparisons made when conducting the incremental analysis?)	Yes	
31. Was an incremental analysis reported?	Yes	
32. Were major outcomes presented in a disaggregated as well as aggregated form?	Yes	
33. Was the answer to the study question given?	Yes	
34. Did conclusions follow from the data reported?	Yes	The authors stated "Evaluation of the findings indicated that the garments were of clinical benefit to the patients and cost-effective for the hospital." It was also stated "the low-friction garments reduced the risk of skin breakdown and therefore, in turn, the length of stay."
35. Were conclusions accompanied by the appropriate caveats?	Yes	The authors quoted other authors that stated "any evaluations that use length of stay as a cost component should be conservative".
36. Were generalisability issues addressed?	Yes	The authors comment that "the results are likely to hold true for other clinicians expecting to replicate these results when using these low-friction products"
Adapted from Drummond MF, Jefferson TO (1996) Guidelines for authors and peer reviewers of economic submissions to the BMJ. The BMJ Economic Evaluation Working Party. British Medical Journal 313 (7052): 275–83. Cited in Centre for Reviews and Dissemination (2008) Systematic reviews. CRD's guidance for undertaking reviews in health care. York: Centre for Reviews and Dissemination		

9 De novo cost analysis

Section 9 requires the sponsor to provide information on the de novo cost analysis.

The de novo cost analysis developed should be relevant to the scope.

All costs resulting from or associated with the use of the technology should be estimated using processes relevant to the NHS and personal social services.

Note that NICE cites the price of the product used in the model in the Medical Technology guidance.

9.1 Description of the de novo cost analysis

9.1.1 Provide the rationale for undertaking further cost analysis in relation to the scope.

The cost analysis is to clarify the cost savings delivered to the NHS by reducing the incidence of pressure ulcers (PU) in the hospital and community settings and thus reducing the extra resource usage and cost the treatment of PU requires.

Smith and Ingram (2010) have measured and published substantial clinical data on the reductions in hospital stay and development of pressure ulceration that are achieved by use of Parafricta bootees and undergarments. However, their cost analysis was limited in scope and did not lend itself to quantitative analysis of the potential for cost-saving benefits and its sensitivity to the relevant operational parameters.

Our *de novo* cost analysis provides a tool that:

a. Provides quantitative cost and cost-sensitivity (both deterministic and probabilistic) analysis in the hospital environment, based on the Smith and Ingram (2010) data.

b. Provides a framework for analogous cost and sensitivity analysis in the community environment and quantitative results based on projection of the hospital data.

Patients

9.1.2 What patient group(s) is (are) included in the cost analysis?

The patient groups are:

People (adults or children of any age) in a community or hospital setting who:

- have a grade 1 or 2 pressure ulcer and are at risk of progressing to grade 3 or 4 pressure ulcer
- do not have a pressure ulcer but are at risk of developing pressure ulcers caused by friction and shear forces, including but not limited to patients who:
    - have frail skin and are at risk of skin breakdown or damage
    - have impaired sensation and are at risk of skin breakdown or damage
    - have peripheral arterial disease, who have a very high risk of developing ulcers
    - have medical conditions where skin frailty is a primary factor and where friction and shear could cause skin damage.

Whilst the focus is on the JWC 2010 hospital study and data, extrapolation is made to the impact on the community costs of PU with the projected treatment costs when a patient leaves the hospital to return to the community.

Additionally, the higher incidence of PU in the primary care setting[9] (pressure ulcers are said to affect up to 20 per cent of patients in acute care, 30 per cent of people in the community and 20 per cent of people in nursing and residential) means that any intervention that can decrease the incidence, and hence resource use and cost, will

---

[9] The measurement of the amount of friction existing between two surfaces.
[9] See Appendix 12
[9] A copy of the amendment of CG29 is shown in Appendix 6, Section 12. However for better clarity, an Adobe document will be provided in the package that includes the other documents requested by MTEP
[9] Food and Drug Administration (Federal body responsible for medical devices)
[9] See Appendix 12 JWC 2010Table 3
[9] High Frequency Ultrasound scans record the level of oedema in the tissue, caused by shear forces damage
[9] Ingram, Raynor, Paulraj & Young: An assessment of friction and shearing prevention treatment in the management of pressure ulcers based on the study conducted by Hampton et al 2009 within a long term nursing home environment. *Data on file*
[9] Source: NPSA (National Patient Safety Agency) Quarterly Data Summary Issue 11 (Feb 2009) and http://www.npsa.nhs.uk/corporate/news/nhs-to-adopt-zero-tolerance-approach-to-pressure-ulcers/?locale=en

significantly benefit the NHS. Savings are likely to be material given the average cost of a community nurse visit is £61 (excluding cost of qualification)[10].

The cost of treating a pressure ulcer varies from £1,214 (Grade or Category 1) to £14,108 (Grade or Category IV). Costs increase with ulcer severity because the time to heal is longer and the incidence of complications is higher in more severe cases.[11] The NHS Institute for Innovation and Improvement adopted a higher value of £24,214 for a grade 4 ulcer.[12]

Technology and comparator

9.1.3 Provide a justification if the comparator used in the cost analysis is different from the scope.

As per the Scope statement:

The Parafricta bootees and undergarments are intended to be used as an adjunct to other pressure-reducing devices currently used in standard NHS clinical practice.

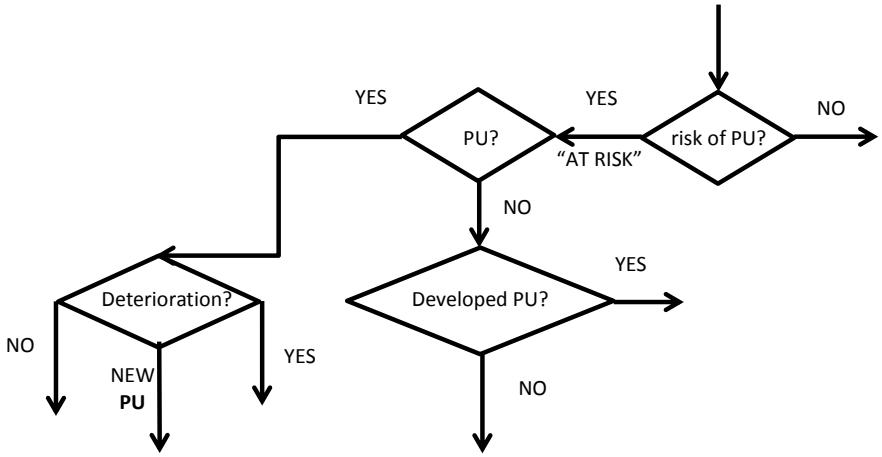
Model structure

9.1.4 Provide a diagram of the model structure you have chosen.

Flowcharts detailing the hospital model and its community extension are included in Section 12, Appendix 7.

In both the clinical study and our modelling of hospital care patients were assessed on admission for risk of pressure ulceration (Waterlow score threshold of 15) and proceeded according to the five patient pathways summarised on the following diagram

[10] Source: Personal Social Services Research Unit, Unit Costs of Health and Social Care 2012
[11] Journal of Woundcare 2012 Jun; 21(6):261-2, 264, 266.The cost of pressure ulcers in the United Kingdom. Dealey et al
[12] http://www.institute.nhs.uk/building_capability/general/your_skin_matters.html



Current clinical practice was maintained at all times with the Parafricta used adjunctively.
The endpoint was the end of each patient episode with benefits being computed per 100 at-risk patients.
In the modelling extension to the community the end-point and measure of benefits were the total costs over 1 year.

9.1.5 Justify the chosen structure in line with the clinical pathway of care identified in response to question 3.3.

The structure outlined in MTEP section 3.3 – the NICE CG29 Pressure Ulcer Guidelines – is considered to be the normal care pathway with the cost elements focused on the actions and resources targeted only at pressure reduction or dissipation.[13] As stated above, Parafricta is an adjunct to this and an additional cost that must be justified by reducing the incidence of ulcers and associated complications including infections of the bone and blood system – and hence costs of the percentage of at-risk of PU patients who go on to develop PU – by a significant factor. The hard to quantify measure of reversing progression of PUs in the active Parafricta patient group is the improved quality of life, including reduced pain, which is beneficial in patients whose PU improves [or at least does not deteriorate].

9.1.6 Provide a list of all assumptions in the cost model and a justification for each assumption.

The Cost Model assumes:

[13] See also http://pathways.nice.org.uk/pathways/pressure-ulcer-management?

- That if a patient develops a PU, within the hospital, the treatment of that PU will require an extended length of stay [and hence resource use] for that patient[14].

- The central assumption in the model for cost of a bed day associated with an extended stay owing to a pressure ulcer is £325. JWC2010 uses £350 which was obtained from the Trust's finance department at that time. The NHS National Reference Cost Schedule 2012-13 states that the average cost per elective excess bed stay is £349, whilst the cost per non-elective excess bed stay is £265 (weighted average £273).The weighted average of the cost per excess bed stay in Trauma and Orthopaedic wards (as for 1 out of 3 wards used in JWC2010) is £277. Parafricta's justification for using £325 as the central assumption is that excess bed days for patients with pressure ulcers are likely to be more costly because of the time that will be spent assessing and treating the patient's pressure ulcer.

- The model allows for other assumptions to be made and tested.

- The base case cost saving calculation in JWC 2010 considers each Bootee or Undergarment being used in 3 patient episodes and that is adopted in the model as the base case. However, the model allows complete flexibility to consider all possibilities. Each patient in the community is assumed to use 3 garments and there are no laundry related costs. In hospital each patient is assumed to have access to six garments, each is washed weekly and each garment is used by 3 patients successively, as a minimum.

- Our model allows complete flexibility to consider all possibilities.

14

- The management of pressure ulcers in primary and secondary care; NICE A Clinical Practice Guideline. September 2005
- Smith et al: JWC 2010
- Posnett et al, 2009: The resource impact of wounds on health-care providers in Europe, Journal of Wound Care 18:4; 154-161

- In fact, experience in that Trust has shown that the items may be used in significantly more [10+ patient-episodes] within the 12 month life-cycle of the product in the hospital environment. This will be explored in the sensitivity analysis.
- That part of the prevention, and treatment if a PU develops requires:
    - A pressure redistributing/reduction surface
    - A dressing to cover and treat the pressure ulcer
    - Ward Nurse time and activity to assess and record the ongoing status of the patients skin and PU and to turn the patient on the prescribed cycle intervals
    - A Tissue Viability Nurse to provide specialist advice
    - If infection develops antimicrobial medication and possible referral to surgeon.
- If a patient develops a PU, within the community, the treatment of that PU will require intervention [and hence resource use] for that patient, with the resource elements being as above, i.e.
    - A pressure redistributing/reduction surface
    - A dressing to cover and treat the pressure ulcer
    - Relative or Carer time and activity to turn the patient on the prescribed cycle intervals
    - If infection develops management may require hospitalisation
- Community Nurse time and activity to assess and record the ongoing status of the patients skin and PU, plus dress the PU, over a series of visits until the PU is resolved. This period can be from 28 days for a Grade 1 PU up to 155 days for a Grade 4 PU according to Dealey et al.

9.1.7 Define what the model's health states are intended to capture.

The model's health states are intended to capture the different possible pathways with respect to PUs that a patient's hospital stay may follow:

- Admitted without [PU(s)] and remained without
- Admitted without but developed a PU in hospital
- Admitted with PU(s) which did not deteriorate in hospital
- Admitted with PU(s) which deteriorated
- Admitted with PU(s) and developed an additional PU in hospital.

9.1.8 Describe any key features of the cost model not previously reported. A suggested format is presented below.

Table C4 Key features of model not previously reported

Factor	Chosen values	Justification	Reference
Time horizon of model	12 months	Product life span	Sponsor
Discount of 3.5% for costs	Not applicable	Benefits are immediate.	
Perspective (NHS/PSS)	NHS only	Benefits from reduced demand for Personal Social Services were not measured in any of the clinical studies because of the additional data collection issues this end point presents. The measured benefits are thus judged to be conservative by failing to capture these wider savings.	JWC 2010
Cycle length	Not applicable		
NHS, National Health Service; PSS, Personal Social Services			

9.2 Clinical parameters and variables

9.2.1 Describe how the data from the clinical evidence were used in the cost analysis.

The framework used by Smith and Ingram (2010) to collect their clinical evidence was exactly mapped into the Excel algorithm that comprised the model, with named data variables corresponding to each of the parameters reported in the clinical, resource and cost evidence.

9.2.2 Are costs and clinical outcomes extrapolated beyond the study follow-up period(s)? If so, what are the assumptions that underpin this extrapolation and how are they justified?

By their nature the grades 1 to 3 pressure-ulcer events that formed the basis of the clinical study are relatively short-term and there was no follow-up into

the community on discharge. Thus our hospital- based model does not include community care.

The simpler community model does provide a framework for modelling cost-savings and their sensitivity in the community and makes use of hospital data to estimate certain input parameters that it requires.

The input parameters used in the model have been cross-checked for their consistency with the most recently published National Schedule of Reference Costs for the NHS in England

9.2.3 Were intermediate outcome measures linked to final outcomes (for example, was a change in a surrogate outcome linked to a final clinical outcome)? If so, how was this relationship estimated, what sources of evidence were used and what other evidence is there to support it?

No

9.2.4 Were adverse events such as those described in section 7.7 included in the cost analysis? If appropriate, provide a rationale for the calculation of the risk of each adverse event.

No adverse events were reported

9.2.5 Provide details of the process used when the sponsor's clinical advisers assessed the applicability of available or estimated clinical model parameter and inputs used in the analysis.

- *Clinical Advisers*

The selection of Glenn Smith, who is the Clinical Nurse Specialist for Nutrition and Tissue Viability (TVN) for the Isle of Wight Trust, was due to his interest in preventing tissue damage and pressure ulcers. He has been TVN in the Isle since 2005 and has a 1st Class Honours degree in Nursing. He was also familiar with the previous work of Sylvie Hampton and Dr Steve Young on the effect of Parafricta in reversing tissue damage in pressure ulcer Grade 2 patients. In addition, Mr Smith has responsibility for both the hospital and the community tissue viability service delivery on the Isle of Wight and understands the continuity of care that has to be provided to stop patients being admitted/readmitted to hospital from the community. Other TVNs had recommended Mr Smith and this setting due to the fact that the collection of data on at-risk of pressure ulcer patients and pressure ulcer incidence in the IoW Trust was highly effective and efficient and the risk of extraneous variability in nursing techniques and data recording was known to be particularly low, providing increased clarity of showing a significant effect on pressure ulcer incidence due to the adjunctive intervention with Parafricta. Given that the pre-existing expertise and stability of the Trust militates against PU problems it could be argued that the PU preventative benefits of Parafricta demonstrated in Smith and Ingram's study would be even greater in other circumstances.

Andy Ingram was appointed to work with Glenn Smith, after we approached NHS Innovations, London (NHSIL) to discuss the involvement of an independent health economist to work with Mr Smith, in the procedure of recording and analysing the resultant data from the study. Mr Ingram was part of the Xcelerate Health Outcomes group within (NHSIL) and has over 20 years' experience in healthcare industry working within, data analysis, patient and medical databases, health economics, epidemiology and market

research. He now runs Xcelerate independently, following the demise of NHSIL.

- *the number of experts approached*

We discussed the possibility of doing studies like JWC2010 with other centres, such as the Welsh Wounds Centre in Cardiff, but decided on this location. In addition discussions with other leading TVNs, such as Sylvie Hampton[15], Pauline Beldon[16] and Jackie Stephen-Haynes[17] identified key cost elements of preventing and treating PU in the NHS.

- *the number of experts who participated*

Besides the involvement of Messrs Smith and Ingram, the manuscript was reviewed by Kinapse Ltd. Kinapse provides expert consulting and outsourcing services to the life sciences industries.

- *declaration of potential conflict(s) of interest from each expert or medical speciality whose opinion was sought*

There was no potential conflict of interest.

- *the background information provided and its consistency with the totality of the evidence provided in the submission*

The authors were made aware of all previous publications on the use of Parafricta.

- *the method(s) used to collect and collate the opinions*

The data collection and analysis of pressure ulcer incidence, severity and the path of care was in place when the study was started. Other experts were contacted face-to-face.

---

[15] Director, Wound Healing Centres Ltd; author of two tissue viability books, 'Tissue Viability: A comprehensive guide', and 'A-Z Dictionary of Wound Care and Major Tissue Viability: A Comprehensive Guide'; author of several book chapters and over 250 publications in tissue viability.

[16] Pauline Beldon has been the Chair of the Tissue Viability Nurses Association and is currently on the Board of Trustees for Wound Care Alliance UK

[17] Professor of Birmingham City University Wound Healing Practice Development Unit; Past Chair of the Wound Care Society, Vice Chair of Wound Care Alliance UK and is the Chair of the newly developed charity Healing Wounded Heroes. Jackie is consultant advisor to Leg Club Foundation and has previously advised Primary Care Live, Wound Expo, Wounds UK and undertaken national representation for NHS Procurement, as well as being a member of the editorial board of British Journal of Nursing, British Journal of Community Nursing's Wound Care supplement and Wounds UK. Jackie has won several awards, including United Wound Management Education Forum and Wounds UK award in compression (2010 and 2011), wound management, exudate management, chronic oedema and infection control in tissue viability.

- *the medium used to collect opinions (for example, was information gathered by direct interview, telephone interview or self-administered questionnaire?)*

All information was collected, as shown by Table 1 of the JWC 2010 paper, during the two cohort periods during the evaluation. The data were kept anonymous to protect patient confidentiality and to meet the information governance requirements for sharing information with commercial organisations according to local guidance and policy. Other experts were contacted face-to-face.

- *the questions asked*

As above

- *whether iteration was used in the collation of opinions and if so, how it was used*

N/A

- *the uncertainly around these values should be addressed in the sensitivity analysis.*

See analysis

9.2.6 Summarise all the variables included in the cost analysis. Provide cross-references to other parts of the submission. A suggested format is provided in table C5 below.

Table C5 Summary of variables applied in the cost model

Variable	Value		Range or 95% CI (distribution)	Source
Hospital: **Core costs** Bed day costs General dressing Mattress Nimbus mattress Av. Mattress cost **Hosp.general.costs** PU category1 dressing PU category2 dressing PU category3 dressing **Av.PU.dressing** Cost of garment Garments per patient Patients per garment **Cost per garment per patient**	**Hospital:** £325.00 £0.74 £0.30 £2.37 £0.59 **£326.33** £0.48 £1.11 £2.59 **£0.74** £35.14 6.00 3.00 **£72.28**	 £/day £/day £/day £/day £/day £/day £/day £/day £/day £/day £/unit number per patient-episode number of patient-episodes **£/patient**	Impact of potential price changes can be assessed by use of sensitivity analysis function in model.	Bed day cost from NHS Ref. costs 2012/13 Mattress and dressing costs from JWC (2010). Garment costs from NHS Drug Tariff.
Community: Nurse/carer intervention	£61 per visit		±£10	PSSRU
CI, confidence interval				

9.3 Resource identification, measurement and valuation

NHS costs

9.3.1 Describe how the clinical management of the condition is currently costed in the NHS in terms of reference costs and the payment by results (PbR) tariff.

Treatment spells for pressure ulcers or damage to fragile skin do not create specific separate reference costs or appear in the Payment by Results (PbR) tariff. However a non-severe pressure ulcer requiring day case treatment or

admission would may be coded as HRG JD03A or B or C[18], carrying elective spell tariffs of £2,622, £1,569 and £908 respectively (2013/4).

9.3.2 State the Office of Population, Censuses and Surveys Classification of Surgical Operations and Procedures (OPCS) codes for the operations, procedures and interventions relevant to the use of the technology for the clinical management of the condition.

W04.8 and W04.9 specify reconstruction procedures to the hindfoot. A flap reconstruction of a non-healing grade 4 pressure ulcer of the heel would fall into this category. Similar reconstructive procedures of pressure ulcers in other locations would carry the appropriate OPCS code.

Resource identification, measurement and valuation studies

9.3.3 Provide a systematic search of relevant resource data for the NHS in England. Include a search strategy and inclusion criteria, and consider published and unpublished studies.

We have applied costs specific to the location and have checked national cost and tariff databases to ensure these generalise to similar settings in England

9.3.4 Provide details of the process used when clinical advisers assessed the applicability of the resources used in the model[19].

As 9.2.5 above

[18] Health & Social Care Information Centre (HSCIC) Healthcare Resource Groups v4 [HRG4] used for reference costs in PbR
HRG J03A = Intermediate Skin Disorders category 2 with Major CC
HRG J03B = Intermediate Skin Disorders category 2 with Intermediate CC
HRG J03C = Intermediate Skin Disorders category 2 without CC

[19] Adapted from Pharmaceutical Benefits Advisory Committee (2008) Guidelines for preparing submissions to the Pharmaceutical Benefits Advisory Committee (Version 4.3). Canberra: Pharmaceutical Benefits Advisory Committee.

Technology and comparators' costs

9.3.5 Provide the list price for the technology.

The Drug Tariff Price for the Parafricta Bootee and Undergarment was £34.74 excluding VAT at commencement of listing in February 2011; it is now (2014) £35.14 excluding VAT. The UK Retail List Price in 2009/2010 was £39.95 excluding VAT; it is now £40.75

9.3.6 If the list price is not used in the de novo cost model, provide the alternative price and a justification.

The cost model in JWC 2010 used a price of £39.95 per unit of Parafricta Bootee or Undergarment – which was the UK Hospital List price at the time. The de novo cost model uses the current Drug Tariff price, £35.14.

9.3.7 Summarise the annual costs associated with the technology and the comparator technology (if applicable) applied in the cost model. A suggested format is provided in tables C6 and C7. Table C7 should only be completed when the most relevant UK comparator for the cost analysis refers to another technology.

Table C6 Costs per treatment/patient associated with the technology in the cost model

Items	Value	Source
Price of the technology per treatment/patient	£35.14 per Bootee or Undergarment [excludes VAT]	Current Drug Tariff and Hospital list supply price.
Consumables (if applicable)	N/A	Products have no consumable element
Maintenance cost	£0.50 per item washing cost	St. Helen's & Knowsley Trust; HSJ April 2011 plus other Trust statements as references[20]
Training cost	£0	Integrated into PU prevention training which is standard for all hospital and community nurses.
Other costs	£35.14 per Bootee or Undergarment [excludes VAT] X 2 = £70.28; X 3 = £105.42	Provision of sufficient Parafricta Bootees or Undergarments per patient to ensure products are available for patient to wear. Based on hospital ward having standby stock for at-risk patients being admitted or washing of soiled item (i.e. X2 items per patient). For community, work on X3 items per patient (wear/wash/standby)
Total cost per treatment/patient	If Parafricta garments are made available 2 per patient X 2 = £70.28 + £0.50 per wash. If Parafricta garments are made available 3 per patient Cost is X 3 = £105.42 + £0.50 per	It should be noted that the cost saving calculation in JWC 2010 uses the factor of each Bootee or Undergarment being used in 3 patient episodes and in fact experience in that Trust has shown that the items may be used significantly more times [10+ patients] within the 12 month life-

[20] http://www.hsj.co.uk/news/finance/nhs-outsourcing-shows-significant-savings-lobby-group-claims/5028839.article#.Uxhsd2fivIU ; Imperial Tender Price per item (2008) was £0.34; Bassetlaw [Doncaster] Trust report price £0.412 internal laundry, £0.33 external laundry tender

	wash. Choice of strategy depends on local conditions and policy. Our model has the flexibility to simulate all strategies.	cycle of the product in the hospital environment. This will be incorporated in the sensitivity analysis.

Table C7 Costs per treatment/patient associated with the comparator technology in the cost model

Items	Value	Source
Cost of the comparator per treatment/patient	N/A as Parafricta is used adjunctively	
Consumables (if applicable)		
Maintenance cost		
Training cost		
Other costs		
Total cost per treatment/patient		

Health-state costs

9.3.8 If the cost model presents health states, the costs related to each health state should be presented in table C8. The health states should refer to the states in section 9.1.7. Provide a rationale for the choice of values used in the cost model.

Table C8 List of health states and associated costs in the economic model

Health states	Items	Value	Reference
Pressure Ulcer treatment including use of Parafricta products	**Technology cost**	1. £0.30 per day 2. £2.37 per day £72.28 per patient episode	1. Foam Mattress cost (used with 86% of study groups) 2. Airflow Mattress cost (used with 14% of study groups) **JWC 2010** Typical cost based on data given in Table C6. Depends on local policy (no. units per patient, reuse, washing cycles)
	Staff	£0	Included in per diem cost below
	Hospital costs	£325 per day for bed stay. £0.74 per day (average for general	NHS NRCS

		dressings etc.,)	
	Wound Care dressing	£0.74 per day	Weighted cost of providing dressing for PU treatment across Grade (Category) 1-3 PU. Isle of Wight PCT finance department (JWC 2010).
	Laundry	£0.50 per wash	St. Helen's & Knowsley Trust
	Total	£326.40 per patient-day (+ £0.74 per day if patient already has a PU) plus £72.28 per patient-episode	Computed from figures above.

Adverse-event costs

9.3.9 Complete table C9 with details of the costs associated with each adverse event referred to in 9.2.4 included in the cost model. Include all adverse events and complication costs, both during and after longer-term use of the technology.

Table C9 List of adverse events and summary of costs included in the cost model

Adverse events	Items	Value	Reference
Adverse event 1	**Technology**	N/A	
	Staff	N/A	
	Hospital costs	N/A	
No adverse events have been reported	***[Other items]***	N/A	
	Total	N/A	

Miscellaneous costs

9.3.10 Describe any additional costs and cost savings that have not been covered anywhere else (for example, PSS costs, and patient and carer costs). If none, please state.

None

9.3.11 Are there any other opportunities for resource savings or redirection of resources that it has not been possible to quantify?

Costs for pharmaceutical products used for PU patients were not included in the calculation – pain-killers and antibiotics [for infection cover].

Also the potential costs for complications of PU occurrence e.g. MRSA, cellulitis, osteomyelitis, related surgery which have been identified as significant cost additions by Dealey et al[21], have not been added.

The continued use of hospital beds by patients with extended length of stay due to PU impacts the cost efficiency of that hospital bed – by removal of the availability of that bed for other patients' procedures and revenue streams for the hospital; reducing staff time for other clinical activities; introducing uncertainty in bed resource planning by the variability in length of stay. Whilst hard to quantify, the positive benefit of Parafricta reducing the incidence of PU and hence the bed occupation for any ward in total per annum, would counter these issues. In the community the increased time demands on carers would also be a cost that is present, even if it is hard to quantify.

Also:

- The bed cost may be an underestimate for the most basic NHS bed care
- We have not attempted to quantify incremental costs that may manifest themselves in the hospital - in doctor care, TVN and other nursing care, surgical procedures, and other clinical care. Following the hospital, costs may manifest themselves in terms of intermediate care or nursing care at home
- These incremental costs may be significantly higher, particularly in severe cases, e.g., where wound sepsis may occur and ITU is required, or if a patient cannot be discharged without nursing care

[21] DEALEY, POSNETT AND WALKER (2012) The cost of pressure ulcers in the United Kingdom. Journal of Wound Care Vol. 21 No. 6 pp 261-266

- We have also not financially quantified the benefits that patients who do not experience pressure ulcers experience, either in terms of avoidance of pain, QALYs added, subjective experience, or broader economic contribution
- The presence of pressure ulcers has been associated with an increased risk of secondary infection and a two to four fold increase of risk of death in older people in intensive care units (ITUs) (Bo M, Massaia M et al, 2003). The clinical study was not powered to capture these reductions and did not include the most sick patients in ITUs
- PUs are prevalent in nursing homes. It has not been possible to quantify the benefit of using Parafricta in this setting through lack of study data, However, given people over 70 years old are particularly vulnerable to pressure ulcers as they are more likely to have mobility problems and ageing of the skin[22], use in this setting may realise even greater befits.

9.4 Approach to sensitivity analysis

Section 9.4 requires the sponsor to carry out sensitivity analyses to explore uncertainty around the structural assumptions and parameters used in the analysis. All inputs used in the analysis will be estimated with a degree of imprecision. For technologies whose final price/acquisition cost has not been confirmed, sensitivity analysis should be conducted over a plausible range of prices.

Analysis of a representative range of plausible scenarios should be presented and each alternative analysis should present separate results.

[22] NHS Choices http://www.nhs.uk/conditions/pressure-ulcers/Pages/Introduction.aspx

9.4.1 Has the uncertainty around structural assumptions been investigated? State the types of sensitivity analysis that have been carried out in the cost analysis.

Structural assumptions implicit in the clinical study of Smith & Ingram may impact on the economic model. However in addition to peer-review of the published paper, the authors have investigated all identified questions in this respect and concluded that none is of concern. This work has been made available to us in full detail, and has been reviewed by our clinical advisors and made available by us to NICE.

Our model for hospital use of Parafricta follows exactly Smith and Ingram's structure.

The extension to community use includes an assumption used to translate hospital-derived data into the community situation. It has been accepted by reviewers, including the UK Drug Tariff that the assumption made is sufficiently prudent to give satisfactory assurance that estimates of cost benefits dependent on its use will err on the low side. The assumption is further stress-tested by a deterministic sensitivity analysis reported below.

9.4.2 Was a deterministic and/or probabilistic sensitivity analysis undertaken? If not, why not? How were variables varied, and what was the rationale for this? If relevant, the distributions and their sources should be clearly stated.

All scenarios and/or ranges of variables must be justified. The executable that is provided as part of this submission has facilities for both deterministic and probabilistic sensitivity analyses, separately for each of the hospital and community models. All four of these capabilities have been tested and used.

In general there are two types of variable: central values, e.g. medians or means, and confidence intervals (C.I.'s). The C.I.'s are used for probabilistic analyses and central values for both.

If the C.I.'s in the probabilistic tool are all set to zero it becomes a means of conducting deterministic sensitivity investigations.

Central values may be sourced from the literature, in which case they are referenced at the point of use, or they may be values selected for "what-if" investigations.

If a number of different referenced values for the same parameter are known, or if, e.g. for a cost, a parameter is characterised by its range, the central value may be taken as a mid-point in the range that may not correspond to any of the actual values that the parameter is known to take.

C.I.'s taken from the published literature are noted and referenced as such when used. C.I.'s have also been used to define the span of a variable to check sensitivity to that variable across its possible range.

To facilitate the latter application we have used 99.9% C.I.'s since this effectively covers the whole span (±3.09σ) of a normal distribution rather than 95% C.I.'s, which span ±1.645σ.

Consistency with published C.I.'s, primarily Smith & Ingram's, has been checked and confirmed whenever appropriate.

In practice the probabilistic tools were found to be generally more useful since they are, in effect, also deterministic analyses over a large number of points.

The deterministic tools were more convenient for probing sensitivity at the extreme limits of parameter values.

9.4.3 Complete table C10.1, C10.2 and/or C10.3 as appropriate to summarise the variables used in the sensitivity analysis.

Table C10.1 Variables used in one-way scenario-based deterministic sensitivity analysis

Variable	Base-case value	Range of values

Table C10.2 Variables used in multi-way scenario-based sensitivity analysis

HOSPITAL	Hospital general costs GBP per day	Cost of Parafricta garments GBP per patient-episode	Weighted LoS values for Smith & Ingram (2010) patient pathways *without* use of Parafricta	Weighted LoS values for Smith & Ingram (2010) patient pathways *with* use of Parafricta
Base case	326.33	72.28	Aggregate = 16.2353 days Complete matrix supplied	Aggregate = 13.6970 days Complete matrix supplied
26 scenarios (excluding base case) provided by the 27 combinations of the variables in columns 2 and 3 and the pair of variables in columns 4 plus 5	244.75	54.21	Aggregate = 17.6520 days Complete matrix supplied	Aggregate = 12.4576 days Complete matrix supplied
	407.91 (±25% of base case value)	90.35 (±25% of base case value)	Aggregate = 14.8186 days Complete matrix supplied	Aggregate = 14.9364 days Complete matrix supplied
			Without-Parafricta LoS increased and with-Parafricta LoS decreased Without-Parafricta LoS decreased and with-Parafricta LoS increased	

COMMUNITY	Cost of Parafricta provision GBP per year per at-risk patient	Cost of interventions GBP per week (no. of visits X cost per visit)	Prevalence ratio Pf/notPf used in mapping hospital data to community
Base case	80	113.46 (1.86[23] X £61)	0.37
20 scenarios (excluding base case) provided by the 21 combinations of the variables in columns 2 and 3	80 120 160 240 320 360 480 combinations of £(80±40) cost and (3±1) number of garments	85.10 113.46 141.83 Base case ±25%	0.37
What if Parafricta is much less effective in the Community than	80 120 160 240 320 480	113.46	0.685 (50% reduction in the impact on community-based PUs compared to the value implied by the base case value of Pf/notPf)

[23] A September 2008 audit of the Isle of Wight district nursing teams reported a prevalence of 43 patients, requiring an average of 1.86 visits per week

implied by base case value of Pf/notPf?			

Table C10.3 Variable values used in probabilistic sensitivity analysis

HOSPITAL

Variable	Base-case value	Distribution
Hospital general costs GBP per day	326.33	normal
Cost of Parafricta garments GBP per patient-episode	72.28	normal
Aggregate weighted LoS value for Smith & Ingram (2010) patient pathways *without* use of Parafricta	16.2353	normal
Aggregate weighted LoS value for Smith & Ingram (2010) patient pathways *with* use of Parafricta	13.6970	normal
All other variables listed in Table C5		Not stochastic

COMMUNITY

Variable	Base-case value	Distribution
Cost of Parafricta provision GBP per year per at-risk patient	80.00	normal
Cost of interventions GBP per week (no. of visits X £ per visit)	113.46	normal
Ratio of at-risk patients to prevalence in the community	3.00	normal

9.4.4 If any parameters or variables listed in section 9.2.6 were omitted from the sensitivity analysis, provide the rationale.

All of the parameters and variables listed in section 9.2.6 were included in our sensitivity analyses.

Some, which only appear in a single fixed arithmetical combination, were normally treated as a single combined variable, shown in bold type in Table C5. Nevertheless they were retained as variables whose values could be changed if desired, in order, for example, to check the effect of an extreme change in one such variable or as a means of checking the functioning of the program.

It is acknowledged that some model parameters may be excluded from sensitivity analysis considerations, for example, because they can be considered 'constant' or because evidence exists about unbiased and accurate measurement.

9.5 Results of de novo cost analysis

Section 9.5 requires the sponsor to report the de novo cost analysis results. These should include the following:

- costs
- disaggregated results such as costs associated with treatment, costs associated with adverse events, and costs associated with follow-up/subsequent treatment
- a tabulation of the mean cost results
- results of the sensitivity analysis.

Base-case analysis

9.5.1 Report the total costs associated with use of the technology and the comparator(s) in the base-case analysis. A suggested format is presented in table C11.

Table C11 Base-case results

HOSPITAL	Total per patient cost (£)
With Parafricta	£4,549.65
Without Parafricta	£5,306.76

COMMUNITY	Total annual per prevalence cost (£)
With Parafricta	£2,444.93
Without Parafricta	£5,899.92

9.5.2 Report the total difference in costs between the technology and comparator(s).

The Parafricta products under review are intended to be used adjunctively, i.e. in addition to existing standard practice. It is therefore a smaller added cost that brings net savings by reduction of a larger pre-existing cost.

For example, in the hospital base case a cost of £5,306.76 per patient is reduced to £4,476.39 at the cost of an expenditure of £73.26.

9.5.3 Provide details of the costs for the technology and its comparator by category of cost. A suggested format is presented in table C12.

Table C12 Summary of costs by category of cost per patient

Not applicable (no comparator)

Item	Cost *intervention (X)*	Cost *comparator (Y)*	Increment	Absolute increment	% absolute increment
Technology cost	*Xtech*	*Ytech*	*Xtech – Ytech*	*|Xtech – Ytech|*	*|Xtech – Ytech|/ (Total absolute increment)*
Mean total treatment cost	*Xtreat*	*Ytreat*	*Xtreat – Ytreat*	*|Xtreat – Ytreat|*	*|Xtreat – Ytreat|/ (Total absolute increment)*
Administration cost	*Xadmin*	*Yadmin*	*Xadmin – Yadmin*	*|Xadmin – Yadmin|*	*|Xadmin – Yadmin|/ (Total absolute increment)*
Monitoring cost	Y		*Xmon – Ymon*	*|Xmon – Ymon|*	*|Xmon – Ymon|/ (Total absolute increment)*
Tests					
[Additional items]					
Total	*XTotal*	*YTotal*	*XTotal – YTotal*	*Total absolute increment*	*100%*
Adapted from Pharmaceutical Benefits Advisory Committee (2008) Guidelines for preparing submissions to the Pharmaceutical Benefits Advisory Committee (Version 4.3). Canberra: Pharmaceutical Benefits Advisory Committee					

9.5.4 If appropriate, provide details of the costs for the technology and its comparator by health state. A suggested format is presented in table C13.

Table C13 Summary of costs by health state per patient

– not applicable (no comparator)

Health state	Cost *intervention (X)*	Cost *comparator (Y)*	Increment	Absolute increment	% absolute increment
Health state 1	*XHS1*	*YHS1*	*XHS1 – YHS1*	*|XHS1 – YHS1|*	*|XHS1 – YHS1|/ (Total absolute increment)*
Adapted from Pharmaceutical Benefits Advisory Committee (2008) Guidelines for preparing submissions to the Pharmaceutical Benefits Advisory Committee (Version 4.3). Canberra: Pharmaceutical Benefits Advisory Committee					

9.5.5 If appropriate, provide details of the costs for the technology and its comparator by adverse event. A suggested format is provided in table C14.

Table C14 Summary of costs by adverse events per patient

No comparator. No adverse events reported for this technology

Adverse event	Cost *intervention (X)*	Cost *comparator (Y)*	Increment	Absolute increment	% absolute increment
Adverse event 1	N/A	N/A	N/A	N/A	N/A
Adverse event 2	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A
Adapted from Pharmaceutical Benefits Advisory Committee (2008) Guidelines for preparing submissions to the Pharmaceutical Benefits Advisory Committee (Version 4.3). Canberra: Pharmaceutical Benefits Advisory Committee					

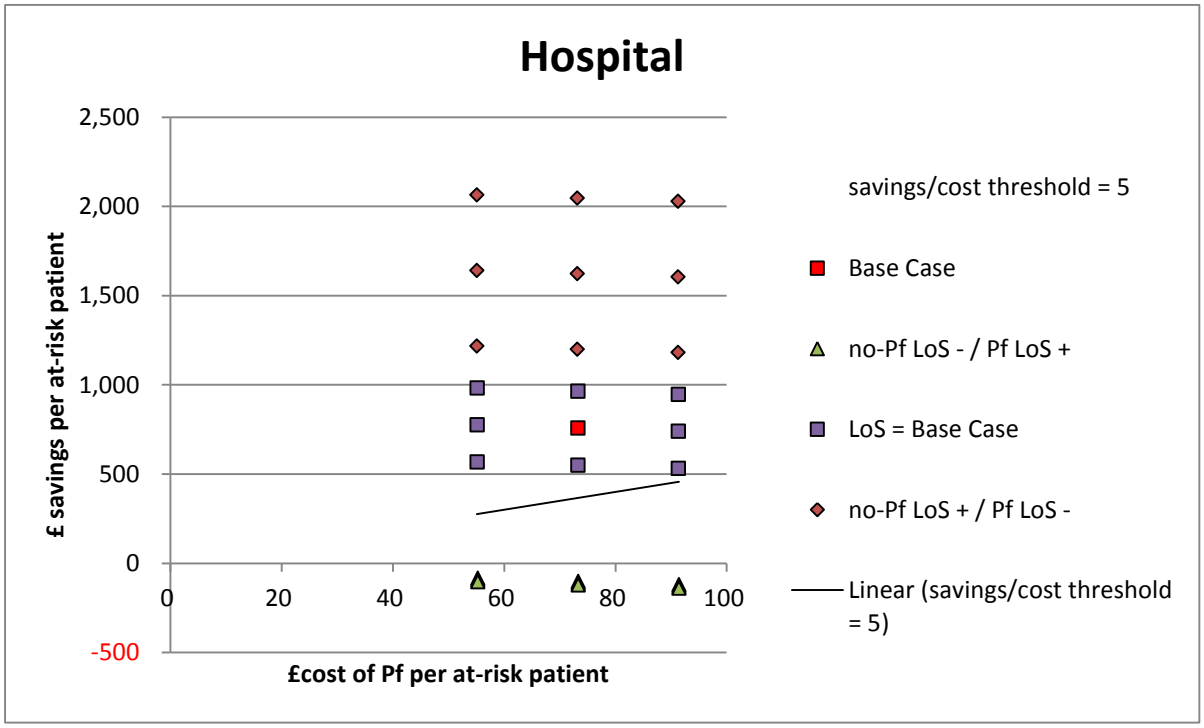
Sensitivity analysis results

9.5.6 Present results of deterministic one-way sensitivity analysis of the variables described in table C10.1.

N/A

9.5.7 Present results of deterministic multi-way scenario sensitivity analysis described in table C10.2.

Results for the Hospital deterministic sensitivity analysis, cf. table C10.2:

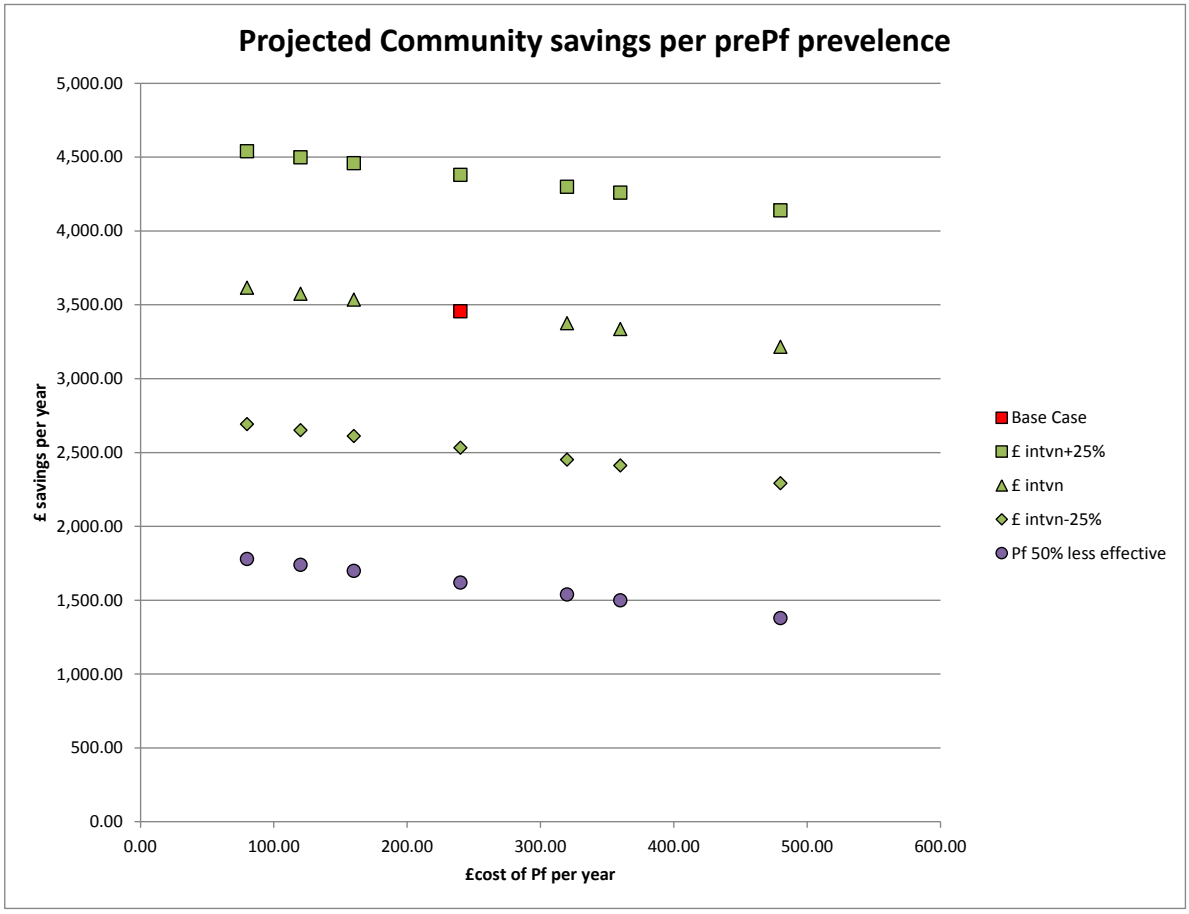


Note that each of the three green triangles in the negative region below the (arbitrary) savings to cost threshold of 5 comprises three almost overlapping points.

This sensitivity plot shows that:

- With the performance of Parafricta reduced by 25% and that of the non-PF situation increased by 25%, the Parafricta has reached its limits and offers no improvement.
- The vertical lines of dots show the effect of changes in the hospital general costs with the aggregate cost of the Parafricta kept fixed.
- The horizontal lines of dots show the effects of changes in the aggregate cost of the Parafricta with the hospital general costs kept constant.

Results for the Community deterministic sensitivity analysis, cf. table C10.2:



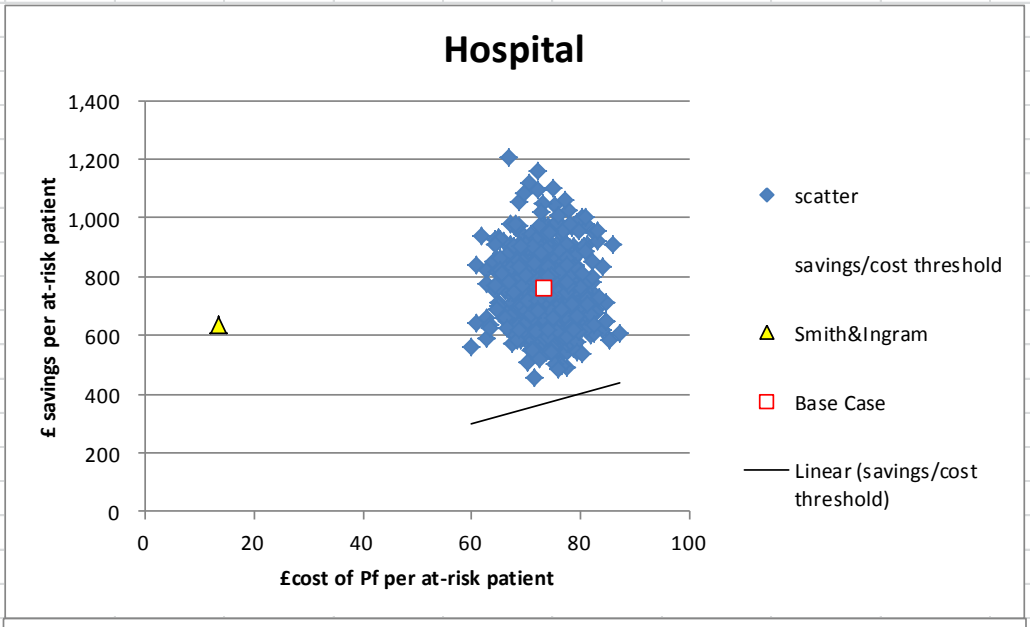
- The vertical lines of dots show the effect of changes in weekly cost of care with the cost of Parafricta garments kept fixed.
- The sloping lines of dots show the effect of changes in the cost of the Parafricta garments for three levels of the cost of weekly care.
- Arguably the weakest point of our Community model is the ratio used to translate the hospital results into a prevalence ratio for Parafricta in the Community. However the results of our deterministic analysis indicate that even if Parafricta were 50% less effective than we thought, there is still a good ratio of savings to costs.

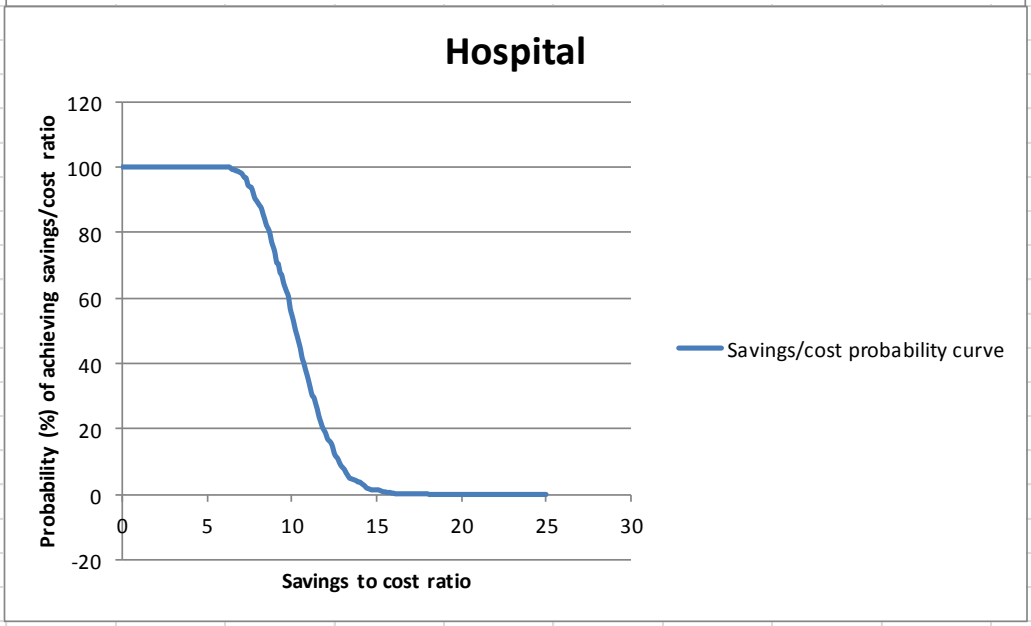
9.5.8 Present results of the probabilistic sensitivity analysis described in table C10.3.

Results for the Hospital probabilistic sensitivity analysis, cf. table C10.3:

		99.9%C.I.'s (±)			
Hosp.gen.costs =	326.33	75		savings/cost threshold =	5
Pf aggr. cost =	72.28	15			
Σ(duration X fraction):				99.9%C.I.'s (±%)	
ch1.all =	16.2353	0.8118	av.duration ch 1	20	
ch2.all =	13.6970	0.6848	av.duration ch 2	20	

Smith & Ingram	
13.32	637
Base Case	
73.26	757.11





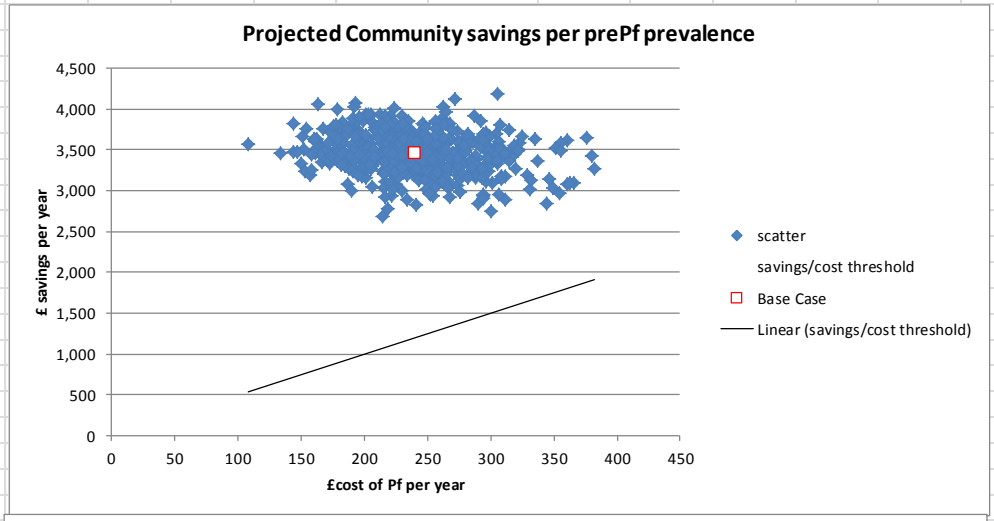
- A valuable aspect of the probabilistic analysis is its ability to provide both easy visualisation of the impact of variations in parameters and a quantitative indication of the savings to cost ratios that can be obtained.

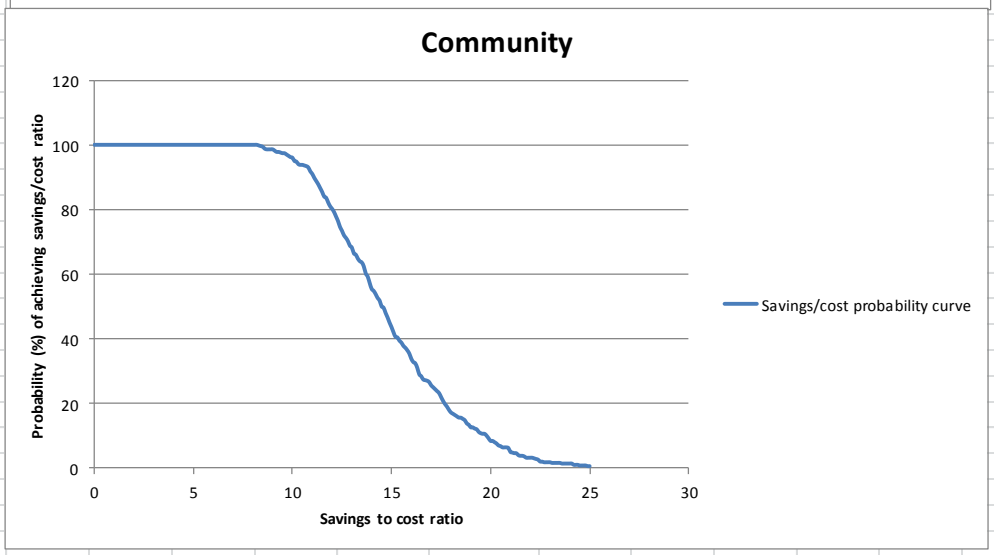
- The plots shown above and below are indicative that Parafricta garments have the capability to deliver cost savings ranging from over 5X upwards.

- In the Hospital scatter diagram we show for reference the cost saving calculated by Smith & Ingram. This is markedly to the left of ours because of the advice we have received that the number of Parafricta garments required by patients is likely to be higher than the one per patient they assumed. However, as is clear from the scatter diagram, their conclusions are robust enough to withstand this change. Furthermore we have good empirical evidence via feedback from our customers that the reusability of the garments may be higher than the 3X suggested in Smith and Ingram's paper, which could significantly reduce the effective cost. Our executable model contains the flexibility to evaluate any combination of numbers of garments per patient and number of times each garment may be reused in a new patient episode.

Results for the Community probabilistic sensitivity analysis, cf. table C10.3:

		99.9%C.I.'s (±)						
at-risk/prePf-prevalence =	3.00	1.00					savings/cost threshold =	5
Pf.GBP.pyear.ppatient =	80.00	40.00						
Calculated intervention saving =	3,694.99	739.00	±20.0	(% sensitivity to *interventions per week* x *cost per intervention*)				
interventions/week =	1.86							
cost/intervention =	61.00							
	Base Case							
	240.00	3,454.99						





9.5.9 What were the main findings of each of the sensitivity analyses?

- Our analyses confirm and strengthen the fundamental conclusion of JWC (2010), namely that the use of Parafricta garments in the prevention and

treatment of pressure ulcers in the sacral and foot regions will generate savings many times the relatively small additional outlay.

- We have challenged this conclusion by looking at the effect of extreme values both of external costs and the natural variance of clinical parameters and found it to be robust.

9.5.10 What are the key drivers of the cost results?

The requirement of extra bed days in hospital when a PU is developed and the cost of community nurse visits when in the community.

Miscellaneous results

9.5.11 Describe any additional results that have not been specifically requested in this template. If none, please state.

None

9.6 Subgroup analysis

For many technologies, the capacity to benefit from treatment will differ for patients with differing characteristics. Sponsors are required to complete section 9.6 in accordance with the subgroups identified in the scope and for any additional subgroups considered relevant.

Types of subgroups that are not considered relevant are those based solely on the following factors.

- Subgroups based solely on differential treatment costs for individuals according to their social characteristics.
- Subgroups specified in relation to the costs of providing treatment in different geographical locations within the UK (for example, if the costs of facilities available for providing the technology vary according to location).

9.6.1 Specify whether analysis of subgroups was undertaken and how these subgroups were identified. Cross-

reference the response to the decision problem in table A1 and sections 3.2 and 7.4.4.

The subgroups included in the Scope include patients who have fragile skin, limited mobility or neurological issues that cause skin breakdown due to repetitive motion or movement. The use of Parafricta has shown benefits in preventing the skin breakdown but the experience has been anecdotal and no analysis of the quantitative aspects has been carried out. The benefits have however been demonstrated in a wide group where the aetiology spans from Epidermolysis Bullosa, Huntington's, Muscular Dystrophy and on through to Parkinson's Disease.

There is currently no information correlating the use or benefits of Parafricta garments with these specific subgroups. The choice of designs of Parafricta bootees and undergarments (both slip-on and Velcro closure variants) facilitates their use by a very wide range of individuals.

Thus subgroups were subsumed within the overall population both in the clinical study that we drew evidence from, and in our cost analysis.

9.6.2 Define the characteristics of patients in the subgroup(s).

- people with restricted mobility who may be bedbound
- people who may have skin damage due to musculoskeletal or neurological conditions where repetitive motion is present.

9.6.3 Describe how the subgroups were included in the cost analysis.

N/A

9.6.4 What were the results of the subgroup analysis/analyses, if conducted? The results should be presented in a table similar to that in section 9.5.1 (base-case analysis).

N/A

9.6.5 Were any subgroups not included in the submission? If so, which ones, and why were they not considered?

N/A

9.7 Validation

9.7.1 Describe the methods used to validate and cross-validate (for example with external evidence sources) and quality-assure the model. Provide references to the results produced and cross-reference to evidence identified in the clinical and resources sections.

- The model explicitly computerises the peer-reviewed work of Smith and Ingram, who kindly provided good access to their raw data and details of their analysis. We verified that when their exact assumptions and input data were used our program gave *exactly* the output reported by Smith and Ingram.
- All variables were named to facilitate checking of code and to ensure as far as possible that any changes propagated to all relevant cells.
- All code was checked independently of its writing to ensure that errors were not 'read through' particularly with respect to bracket nesting. Hand-worked examples were prepared and used as a check.

9.8 Interpretation of economic evidence

9.8.1 Are the results from this cost analysis consistent with the published economic literature? If not, why do the results from this evaluation differ, and why should the results in the submission be given more credence than those in the published literature?

As mentioned above, our model gives results consistent with the one relevant publication (JWC 2010)

9.8.2 Is the cost analysis relevant to all groups of patients and NHS settings in England that could potentially use the technology as identified in the scope?

Yes.

The Hospital module is directly applicable to the estimation of potential cost savings and the analysis of research data and is relevant across the whole span of the hospital sector

Our Community module is a first attempt to project such analysis into the Community situation.

Overall the concept could readily be configured to be easy to use by a wide range of operators and in any setting.

9.8.3 What are the main strengths and weaknesses of the analysis? How might these affect the interpretation of the results?

Strengths:

- Based on real patient pathways modelled without oversimplification
- Easy to visualise and interpret output
- Simple but flexible self-contained software widely deployable
- Considers complementary nature of deterministic and probabilistic sensitivity analyses.

Weakness:

- Community extension lacks a strong underpinning by data collected from within that sector.

Conclusions from the Community model should thus be treated with greater caution.

9.8.4 What further analyses could be undertaken to enhance the robustness/completeness of the results?

Collection of data on prevalence and corresponding numbers of at-risk individuals from within the Community sector.

References

BENNETT, DEALEY and POSNETT. (2004) The cost of pressure ulcers in the UK. *Age and Ageing.* 33(3) pp. 230-5.

BREE-ASLAN, A. AND HAMPTON, S, (2008). Parafricta and the prevention of shearing forces: heel ulcers. *Nursing & Residential Care*, Vol. 10, No 01, pp.626-628

DEALEY, POSNETT AND WALKER (2012) The cost of pressure ulcers in the United Kingdom. Journal of Wound Care Vol. 21 No. 6 pp 261-266

DR FOSTER (2011). http://www.telegraph.co.uk/health/healthnews/8613764/Hospitals-named-and-shamed-on-bedsores-record-which-costs-NHS-4bn-a-year.html

EPUAP (2009). *Treatment of Pressure Ulcers: Quick Reference Guide.* http://www.epuap.org/guidelines/Final_Quick_Treatment.pdf.

HAMPTON, S. (2007). Reducing Shearing Forces: Parafricta Fabric. *Nursing & Residential Care*, Vol. 9, No 12, pp 2-4.

HAMPTON, S., YOUNG, S., BREE-ASLAN, C.and COLBURN A. (2009) Parafricta fabric: Can it reduce the potential for pressure ulcer damage. *Journal of Community Nursing*, Vol. 23, Issue 4, pp 28-31.

KERR, A. (2008). Reducing Shear and Friction: Parafricta Undergarments. *Nursing & Residential Care*. Vol. 10, No 01, pp. 626-628.

LAHMANN, N. A., TANNEN, A., DASSEN, T. and KOTTNER, J. (2011) Friction and shear highly associated with pressure ulcers of residents in long-term care – Classification Tree Analysis (CHAID) of Braden items. *J Eval Clin Pract.* 17(1) pp.168-73.

LAHMANN, N.A. and KOTTNER, J. (2011) Relation between pressure, friction and pressure ulcer categories: A secondary data analysis of hospital patients

using CHAID methods. *International Journal of Nursing Studies* 48, pp. 1487-1494.

LOEHNE, H.B. (2013). Clinical Study of Device to Assist in Prevention of Heel and Foot Pressure Ulcers. *Poster presentation,* SAWC Spring Meeting (USA).

NPL (2009). Unpublished measurements at the National Physical Laboratory, Teddington, UK.

PIKE, A.B. (2003). GB Patent 2403149

POSNETT et al, (2009): The resource impact of wounds on health-care providers in Europe, *Journal of Wound Care* 18:4; 154-161

SMITH, G. AND INGRAM, A. (2010) Clinical and cost effectiveness evaluation of low friction and shear garments. *Journal of Wound Care* Vol. 19, no 12 pp. 535-42

STEPHEN-HAYNES, J. AND CALLAGHAN, R. (2011). Clinical outcomes using a low friction and shear garment in the care home setting. *Wounds UK*, Vol. 7, No 4, pp. 76-84.

Appendices

10.1 Appendix 1: Search strategy for clinical evidence (section 7.1.1)

The following information should be provided:

10.1.1 The specific databases searched and the service provider used (for example, Dialog, DataStar, OVID, Silver Platter), including at least:

- **Medline**
- **Embase**
- **Medline (R) In-Process**
- **The Cochrane Library.**

Parafricta products are class 1 adjunctive medical devices that rely on a physical effect to deliver their benefits. Aiming for wide-ranging but focussed coverage the databases selected were:

- PubMed/Medline/MedlinePlus
- Cochrane Library
- NIH Clinical Trials Register
- CINAHL
- NIH Clinical Center
- Medline In-Process
- FDA (including Maude)
- NHS Evidence
- NICE (including Duets)
- BNI
- MHRA
- YHEC CRD and PROSPERO
- EU Clinical Trials Register
- WHO ICTRP
- Current Controlled Trials metaRegister
- Google Scholar

Searches were performed by an in-house staff member (Professor of Material Science, former Director of R&D for a major public listed company) except for one, which because of restricted access was conducted on behalf of the Company by a qualified researcher.

10.1.2 The date on which the search was conducted.

Searches were conducted between 01 and 07 February 2014 inclusive

10.1.3 The date span of the search.

2004 to 2014

10.1.4 The complete search strategies used, including all the search terms: textwords (free text), subject index headings (for example, MeSH) and the relationship between the search terms (for example, Boolean).

The approach adopted was a Boolean search strategy augmented with manual scanning, and aimed to focus down in three levels onto the specific target of Bootees and Undergarments using Parafricta technology:

A: (friction OR shear) AND (ulcer OR sore)

B: (friction OR shear) AND (ulcer OR sore) AND fabric

C: Parafricta

Wherever possible whole text was searched, with restrictions to 2004 and later, and to English language. These restrictions were recommended on advice, based on the newness of our technology and its current market penetration being largely in the UK and to a much lesser extent the USA.

Preliminary searches were conducted to confirm that the above Boolean strings were correctly interpreted by the databases and the chosen searchwords produced the desired effect of producing all relevant positives with only a manageable number of false positives. The one database that declared in its instructions for use that it did not recognise brackets was dealt with by searching the four possible “AND” combinations from A separately.

False positives were small enough in number and obvious enough to be eliminated by hand. In many cases they were small groups so far from the target search that they could conveniently be removed by repeating A or B with the addition of:

… AND NOT<*searchword unique to false positives*>

For example:

((friction OR shear) AND (ulcer OR sore)) AND NOT aortic AND NOT patellar

In addition to hits that were very wide of the mark, records relating to the following were eliminated:

- Diabetes and diabetic feet except if also relevant to pressure ulcers
- Studies in biomechanics unless adjunct to clinical studies
- Computer modelling unless adjunct to clinical studies
- Duplicates and reviews subsequently updated

The records thus eliminated are assigned to the "off-piste" box in the Flowchart of section 7.2.

10.1.5 Details of any additional searches, such as searches of company or professional organisation databases (include a description of each database).

A survey of the grey literature was conducted by use of:

- Google
- Docstoc
- Ebookbrowsee

- Our own information and databases were also searched.

10.1.6 The inclusion and exclusion criteria.

Studies were included for detailed analysis only if:

1. They reported adjunctive prevention or treatment of pressure ulcers on either the heel or the sacral region by use of fabric boot(ee)s or undergarments respectively;
   AND
2. They reported quantitative data relevant to at least one of the outcomes listed in Table A1

10.1.7 The data abstraction strategy.

The number of relevant studies being small, data was abstracted by hand as required for analysis and reporting in Section 7 above.

10.2 Appendix 2: Search strategy for adverse events (section 7.7.1)

The following information should be provided.

10.2.1 The specific databases searched and the service provider used (for example, Dialog, DataStar, OVID, Silver Platter), including at least:

- **Medline**
- **Embase**
- **Medline (R) In-Process**
- **The Cochrane Library.**

In addition to the extensive searching reported in Appendix 1 above, specific additional searching was undertaken in the FDA Maude and MHRA Medical Device Alerts databases

10.2.2 The date on which the search was conducted.

Between 01 and 07 February 2014

10.2.3 The date span of the search.

2000 to 2014 (for MHRA and FDA Maude)

10.2.4 The complete search strategies used, including all the search terms: textwords (free text), subject index headings (for example, MeSH) and the relationship between the search terms (for example, Boolean).

1. All hits obtained with the Boolean strings A, B and C used in the search strategy detailed in Appendix 1 above were scanned for mention of adverse events associated with any analogous usage of any low-friction fabric. None was found.

2. The MHRA Device Alerts and FDA Maude databases were searched for any adverse effect associated with any of the three known fabric products that are or have been marketed for relief or prevention of pressure ulcers or other fragile skin conditions. This is (intentionally) broader than the scope of this submission since the two others use different materials and they only supply sheets. The searches in both databases were by product identification (Parafricta, DermaTherapy, and Tepso) and additionally in one case (Tepso) by manufacturer (Schoeller Medical) because of uncertainty concerning the product name actually being used.

3. The MHRA database was also searched for
   ulcer OR sore OR decubitus OR fabric

In all the above searches a NIL result was delivered.

10.2.5 Details of any additional searches (for example, searches of company databases [include a description of each database]).

In compliance with the class 1 device registration of its product, the Company undertakes regular post-market surveillance, contacting all purchasers and users, the records of which are retained. No reports of adverse events have been received.

10.2.6 The inclusion and exclusion criteria.

N/A

10.2.7 The data abstraction strategy.

N/A

10.3 Appendix 3: Search strategy for economic evidence (section 8.1.1)

The following information should be provided.

10.3.1 The specific databases searched and the service provider used (for example, Dialog, DataStar, OVID, Silver Platter), including at least:

- **Medline**
- **Embase**
- **Medline (R) In-Process**
- **EconLIT**
- **NHS EED**

Free online database searches of Medline from Pub Med and the Cochrane Library from John Wiley (which includes results from NHS EED)

10.3.2 The date on which the search was conducted.

March 10 2014

10.3.3 The date span of the search.

Not limited

10.3.4 The complete search strategies used, including all the search terms: textwords (free text), subject index headings (for example, MeSH) and the relationship between the search terms (for example, Boolean).

Main strategy was a Boolean search using (friction OR shear) AND (ulcer OR sore) AND (cost OR economic OR benefit)
Follow-up strategy was (pressure) AND (ulcer OR sore) AND (cost OR economic OR benefit)
In PubMed the output was further limited by selecting only "REVIEWS"
In the Cochrane Library the output was further limited by selecting only "ECONOMIC EVALUATIONS"

10.3.5 Details of any additional searches (for example, searches of company databases [include a description of each database]).

N/A

10.4 Appendix 4: Resource identification, measurement and valuation (section 9.3.2)

The following information should be provided.

10.4.1 The specific databases searched and the service provider used (for example, Dialog, DataStar, OVID, Silver Platter), including at least:

- **Medline**
- **Embase**
- **Medline (R) In-Process**
- **NHS EED**
- **EconLIT.**

No formal search of literature was conducted since the relevant validation of the resources, measurement and valuations (e.g. the cost to the NHS of an excess bed-day) was taken from the NHS' own publically available data, principally
National Schedule of Reference Costs 2012-13
(www.gov.uk/government/publications/nhs-reference-costs-2012-to-2013)
Health and Social Care Information Centre (e.g. Hospital episode statistics, OPCS-4.6 coding, Safety Thermometer data) (www.hscic.gov.uk)

10.4.2 The date on which the search was conducted.

February 5 2014

10.4.3 The date span of the search.

N/A

10.4.4 The complete search strategies used, including all the search terms: textwords (free text), subject index headings (for example, MeSH) and the relationship between the search terms (for example, Boolean).

N/A

10.4.5 Details of any additional searches (for example, searches of company databases [include a description of each database]).

N/A

10.4.6 The inclusion and exclusion criteria.

N/A

10.4.7 The data abstraction strategy.

N/A

11 Related procedures for evidence submission

11.1 Cost models

An electronic executable version of the cost model should be submitted to NICE with the full submission.

NICE accepts executable cost models using standard software – that is, Excel, TreeAge Pro, R or WinBUGs. If you plan to submit a model in a non-standard package, NICE should be informed in advance. NICE, in association with the External Assessment Centre, will investigate whether the requested software is acceptable, and establish if you need to provide NICE and the External Assessment Centre with temporary licences for the non-standard software for the duration of the assessment. NICE reserves the right to reject cost models in non-standard software. A fully executable electronic copy of the model must be submitted to NICE with full access to the programming code. Care should be taken to ensure that the submitted versions of the model programme and the written content of the evidence submission match.

NICE may distribute the executable version of the cost model to a consultee if they request it. If a request is received, NICE will release the model as long as it does not contain information that was designated confidential by the model owner, or the confidential material can be redacted by the model owner without producing severe limitations on the functionality of the model. The consultee will be advised that the model is protected by intellectual property rights, and can be used only for the purposes of commenting on the model's reliability and informing comments on the medical technology consultation document.

Sponsors must ensure that all relevant material pertinent to the decision problem has been disclosed to NICE at the time of submission. NICE may request additional information not submitted in the original submission of evidence. Any other information will be accepted at NICE's discretion.

When making a full submission, sponsors should check that:

- an electronic copy of the submission has been given to NICE with all confidential information highlighted and underlined
- a copy of the instructions for use, regulatory documentation and quality systems certificate have been submitted
- an executable electronic copy of the cost model has been submitted
- the checklist of confidential information provided by NICE has been completed and submitted.

- A PDF version of all studies (or other appropriate format for unpublished data, for example, a structured abstract) included in the submission have been submitted

11.2 Disclosure of information

To ensure that the assessment process is as transparent as possible, NICE considers it highly desirable that evidence pivotal to the Medical Technologies Advisory Committee's decisions should be publicly available at the point of issuing the medical technology consultation document and medical technology guidance.

Under exceptional circumstances, unpublished evidence is accepted under agreement of confidentiality. Such evidence includes 'commercial in confidence' information and data that are awaiting publication ('academic in confidence').

When data are 'commercial in confidence' or 'academic in confidence', it is the sponsor's responsibility to highlight such data clearly, and to provide reasons why they are confidential and the timescale within which they will remain confidential. The checklist of confidential information should be completed: if it is not provided, NICE will assume that there is no confidential information in the submission. It is the responsibility of the manufacturer or sponsor to ensure that the confidential information checklist is kept up to date.

It is the responsibility of the sponsor to ensure that any confidential information in their evidence submission is clearly underlined and highlighted

correctly. NICE is assured that information marked ‘academic in confidence’ can be presented and discussed during the public part of the Medical Technologies Advisory Committee meeting. NICE is confident that such public presentation does not affect the subsequent publication of the information, which is the prerequisite allowing for the marking of information as ‘academic in confidence’.

Please therefore underline all confidential information, and highlight information that is submitted under ‘commercial in confidence’ in blue and information submitted under ‘academic in confidence’ in yellow.

NICE will ask sponsors to reconsider restrictions on the release of data if there appears to be no obvious reason for the restrictions, or if such restrictions would make it difficult or impossible for NICE to show the evidential basis for its guidance. Information that has been put into the public domain, anywhere in the world, cannot be marked as confidential.

Confidential information submitted will be made available for review by the External Assessment Centre and the Medical Technologies Advisory Committee. NICE will at all times seek to protect the confidentiality of the information submitted, but nothing will restrict the disclosure of information by NICE that is required by law (including in particular, but without limitation, the Freedom of Information Act 2000).

The Freedom of Information Act 2000, which came into force on 1 January 2005, enables any person to obtain information from public authorities such as NICE. The Act obliges NICE to respond to requests about the recorded information it holds, and it gives people a right of access to that information. This obligation extends to submissions made to NICE. Information that is designated as ‘commercial in confidence’ may be exempt under the Act. On receipt of a request for information, the NICE secretariat will make every effort to contact the designated company representative to confirm the status of any information previously deemed ‘commercial in confidence’ before making any decision on disclosure.

11.3 Equality

NICE is committed to promoting equality and eliminating unlawful discrimination, including paying particular attention to groups protected by equalities legislation. The scoping process is designed to identify groups who are relevant to the evaluation of the technology, and to reflect the diversity of the population. NICE consults on whether there are any issues relevant to equalities within the scope of the evaluation, or if there is information that could be included in the evidence presented to the Medical Technologies Advisory Committee to enable them to take account of equalities issues when developing guidance.

Evidence submitters are asked to consider whether the chosen decision problem could be impacted by NICE's responsibility in this respect, including when considering subgroups and access to recommendations that use a clinical or biological criterion.

For further information, please see the NICE website (www.nice.org.uk/aboutnice/howwework/NICEEqualityScheme.jsp).

12. Sponsor Submission Appendices

Appendix 5: Data from Section 7 studies

Study JWC 2010

Comparison of Cohort 1 & 2

The authors ran statistical tests to compare the Waterlow Score and Ulcer Grading between the two cohorts and can conclude while there were some observed differences between the cohorts the distributions were not significant. As mentioned previously the design of the study was observational reflecting real world patient populations and not a clinical trial where cohorts would be matched.

The results for the Waterlow score and Ulcer Grading are presented in Tables 1 and 2 with the significance test used. In addition looking at longest periods between assessments there was no significant differences (Table 3) between the two groups. The only area where there was evidence of a significant difference was the number of times assessed (average 3.44 for Cohort 1 to 4.11 for Cohort 2) P= 0.015, This indicates that the pre Parafricta cohort were assessed more often than the post Parafricta cohort which suggests that the patients once they were on the product may have required less intervention as their outcome improved. Comparing a sub set of patients from both cohorts where no Pressure Ulcer developed there was no significant difference in number of times assessed.

Table 1 Waterlow score comparison

All incidences			
	Waterlow score	Number	Percentage
Cohort 1 Pre Parafricta products	15-19 20-24 25+	103 82 21	50.00% 39.81% 10.19%
Total		206	
Cohort 2 Post Parafricta products	15-19 20-24 25+	94 52 19	56.97% 31.52% 11.52%
Total		165	
Chi Square Test result P value	0.2553898 p-value from Chi-square test (implies non-difference if > 0.05)		

Table 2 Ulcer Grading Comparison

		All incidences	
	Ulcer Grading	Number	Percentage
Cohort 1 Pre Parafricta products	Grade 1 Grade 2 Grade 3	87 39 7	65.4% 29.3% 5.3%
Total		133	
Cohort 2 Post Parafricta products	Grade 1 Grade 2 Grade 3	78 21 7	73.6% 19.8% 6.6%
Total		106	

Chi Square Test result P value 0.237233278

p-value from Chi-square test (implies non-difference if > 0.05)

Table 3 Assessment comparison

	All Incidences	
Cohort 1 Pre Parafricta products	Number of Times assessed	Longest between assessments
median	4	6
Mean	4.11	6.5
Cohort 2 Post Parafricta products		
Median	3	7
Mean	3.44	7.22

t-Test: Two-Sample Assuming Unequal Variances

P(T<=t) two-tail	0.015526139	0.105733694
t Critical two-tail	1.966484524	1.967049315

if P value > 0.05 implies non difference

Table 4: Patients Length of Stay (days)

Description	Cohort 1	Comments
No PU on admission, did not develop PU	10.0	Median value used as it is a better measure of central tendency in the data than the mean value because of outliers
No PU on admission, time to develop PU	5.5	
No PU on admission, developed PU	21.0	
PU on admission, no change	14.0	
PU on admission, deteriorated	27.0	
PU on admission, developed additional PU	21.0	

PU: Pressure ulcer

Table 5: Length of Stay Values for Different Patient Pathways

Patient's Pathways	Cohort 1		
	Median	CI at 95% (lower)	CI at 95% (higher)
	Length of Stay (days)		
No PU on admission, did not develop PU	10.0	7.0	13.0
No PU on admission, developed PU	21.0	12.0	32.0
PU on admission, no additional PU developed	14.0	11.0	16.0
PU on admission, deteriorated	27.0	20.0	37.0
PU on admission, additional PU developed	21.0	19.0	35.0
No PU on admission, time to develop PU	5.5	3.5	4.0

CI: Confidence interval
PU: Pressure ulcer

Table 6 – Prevalence Data
Prevalence data

	Aug-09		Dec-09	
	n	%	n	%
Patients Audited	70	100.00%	58	100.00%
Eligible for Parafricta	39	55.71%	37	63.79%
Admitted with Ulceration	17	43.59%	18	48.65%
Outcome not recorded	2	11.76%	6	33.33%
Remained same	10	66.67%	5	41.67%
Deteriorating	5	33.33%	3	25.00%
Improving	0	0.00%	4	33.33%
Admitted without ulceration	*22*	56.41%	*19*	51.35%
Developed Ulceration	11	50.00%	7	36.84%

Statistical Analysis of JCN2009

Statistical analysis

While figures 2,3 and 6 show a visual difference, in order to understand if there is a significant difference between the samples the data was run through two sample Kolmogorov-Smirnov statistical test (KS test). The KS test is a non-parametric test of the equality of two distributions and can be used to determine if two datasets differ significantly irrespective of the distribution of the data.

The two sample KS test compares the empirical distributions of two Samples.

The null hypothesis is that the two distributions are the same.

The output of the test is expressed as a D value which determines the extent of difference between the sample and a P value which determines the probability that the difference was down to error. A high D value and low P value suggest a large difference between the datasets with low probability of error, while a low D value and high P value suggest that the datasets are similar.

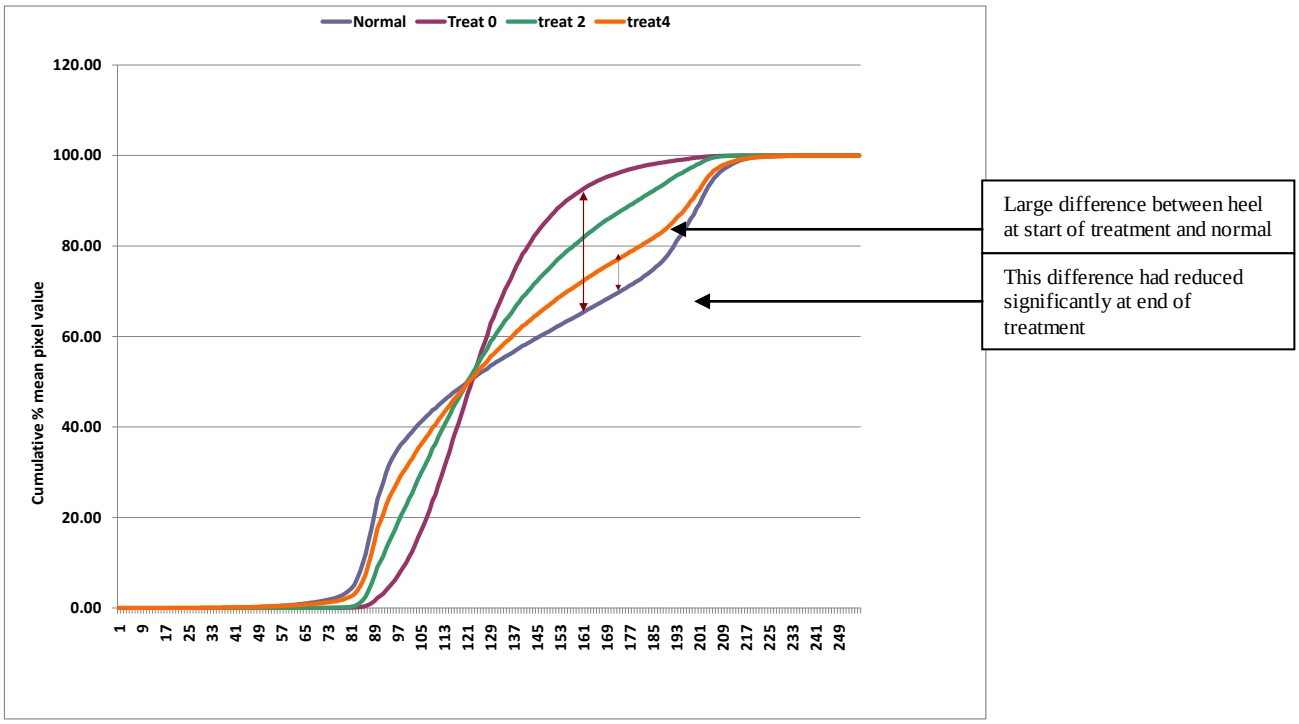
The mean pixel data across all patients for each treatment and stage was converted to a cumulative percentage before running the test to give the best visual results of the variations in the distribution of the data.

Heel study results

The statistical results are presented in table 1 while a visualization of the studies is expressed in Figures 7 and 8.

Table 1: Statistical analysis of the Heel data

	Statistic	Normal Heel	Control 0	Control 4 weeks	Treated 0	Treated 4 weeks
Normal Heel	Diff		30.4	30.9	29.7	9.4
	p value		0	0	0	0.2
Control 0	Diff	30.4		3.91	9.8	36.72
	p value	0		0.98	0.16	0
Control 4 weeks	diff	30.9	3.91		9	34.38
	p value	0	0.98		0.24	0
Treated 0	Diff	29.7	9.8	9		31.2
	p value	0	0.16	0.24		0
Treated 4 weeks	Diff	9.4	36.72	34.38	31.2	
	p value	0.2	0	0	0	



`

Probability values: Normal vs. Time 0: P = 0.00 Normal vs. Time 2: P = 0.00 Normal vs. Time 4: P = 0.2

Figure 7: Cumulative distribution plots for Heel data (Normal and treated at times 0, 2 and 4 weeks after treatment)

Analysis of the results shows that there was a significant difference between the heel at the start of treatment and the normal heel (D= 29.7 and P =0) - probability that the difference was due to error = 0 %. By the end of the treatment process that difference had reduced (D= 9.4 and P=0.2). The difference between the heel at treatment 0 and 4 weeks was significantly different, (D = 31.25 and P = 0) demonstrating the effectiveness of the Parafricta™ product in reducing oedema.

If the treated and the control heels were to be compared then it would be evident that the control heels at both timelines 0 and 4 weeks had very similar pixel distributions (D=3.91 P=0.98**)** and were significantly different from the readings for the normal curve (D=30.40 and P= 0). A significant difference between the treated and the control samples (D=34.38 and P=0).could be observed post 4 weeks of treatment of the test subjects.

From these results it could be concluded that the symptoms of the treated heel had improved significantly over time when compared to the control heel at times 0 and 4 weeks and the level of oedema as measured by ultrasound mean pixel distribution had moved significantly towards the profile for that of the normal heels.

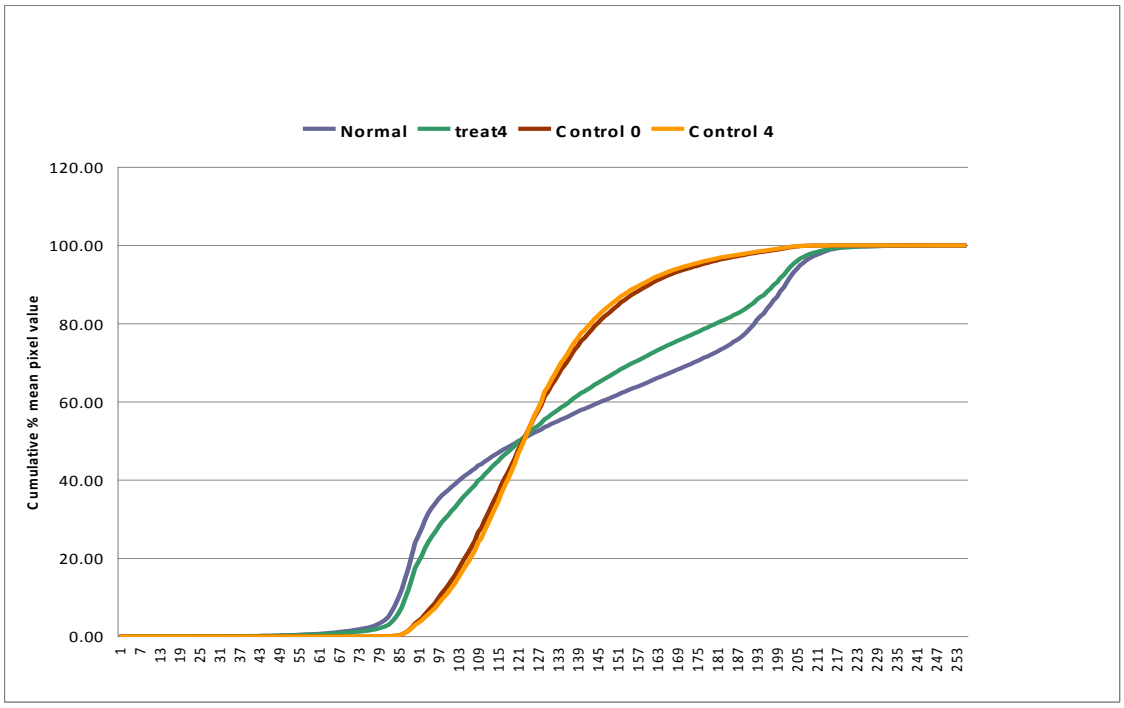


Figure 8: Heel data – comparison of Treated vs. Control Heels

Sacrum data

The results of the sacrum study are presented in Table 2 and Figure 9. Without any control in this section of the study the analysis concentrated on charting the progress of the treated sacrum over the four week study period towards a normal distribution curve.
The results show a significant improvement from start of treatment to week 4 (D= 14.84 p=0.006). This difference was also initially apparent after two weeks with the D value reducing over time. The cumulative distribution graph shows a clear movement of the curve to the normal away from Time 0.

Table 2: Statistical analysis for the sacrum study

	Statistic	Normal Sacrum	Time 0	Time 2 weeks	Time 4 weeks
Normal sacrum	Diff		19.73	14.45	10.55
	p value		0	0.008	0.109
Time 0	Diff	19.73		14.46	14.84
	p value	0		0.011	0.006
Time 2 weeks	diff	14.45	14.46		10.94
	p value	0.008	0.011		0.087
Time 4 weeks	Diff	10.55	14.84	10.94	
	p value	0.109	0.006	0.087	

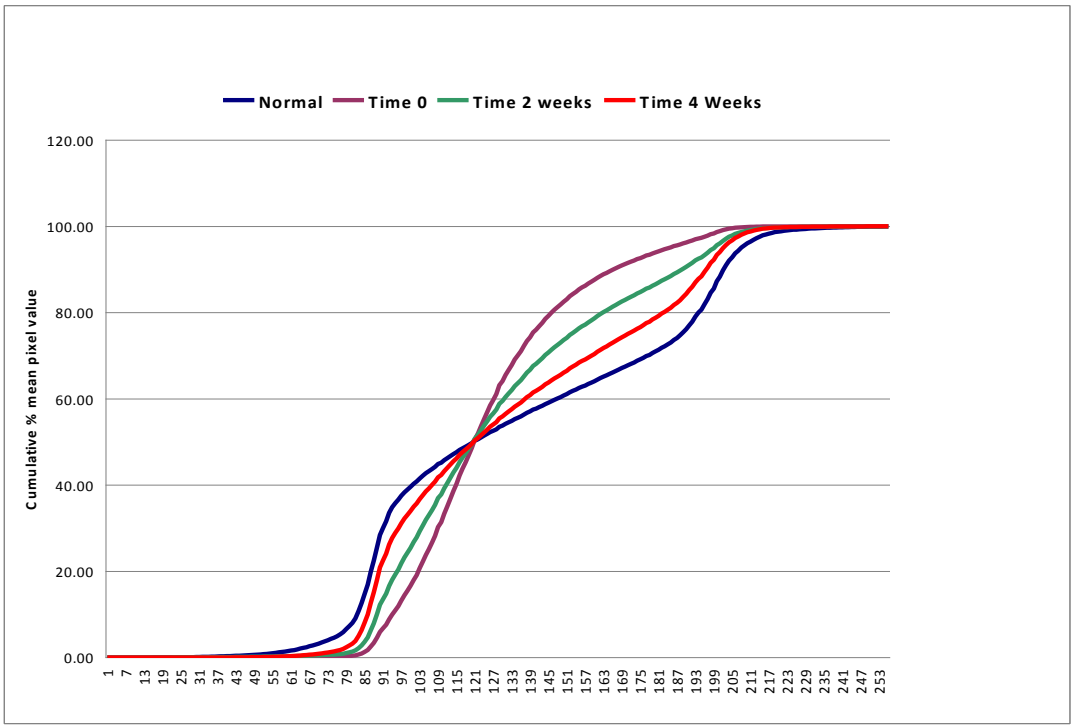
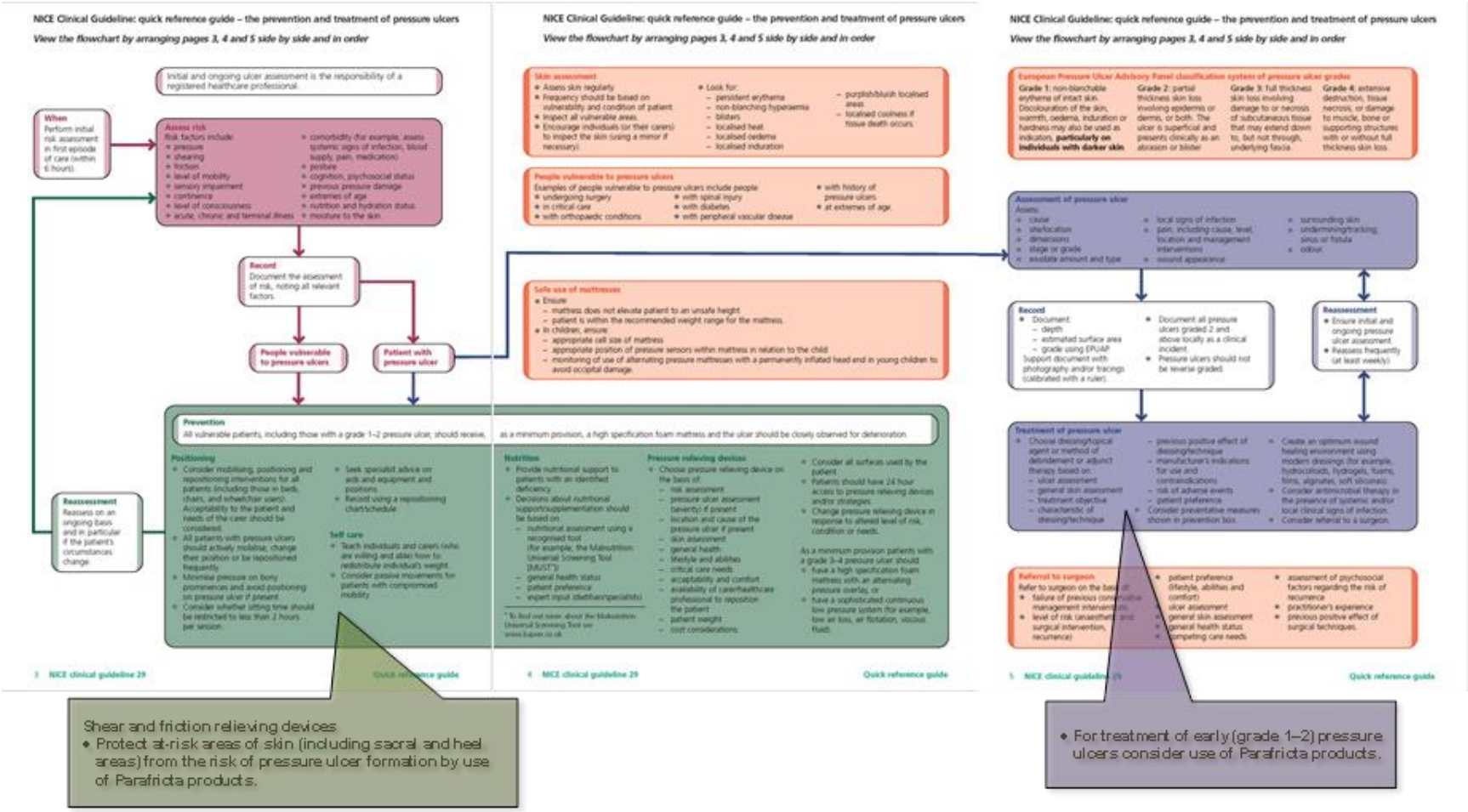
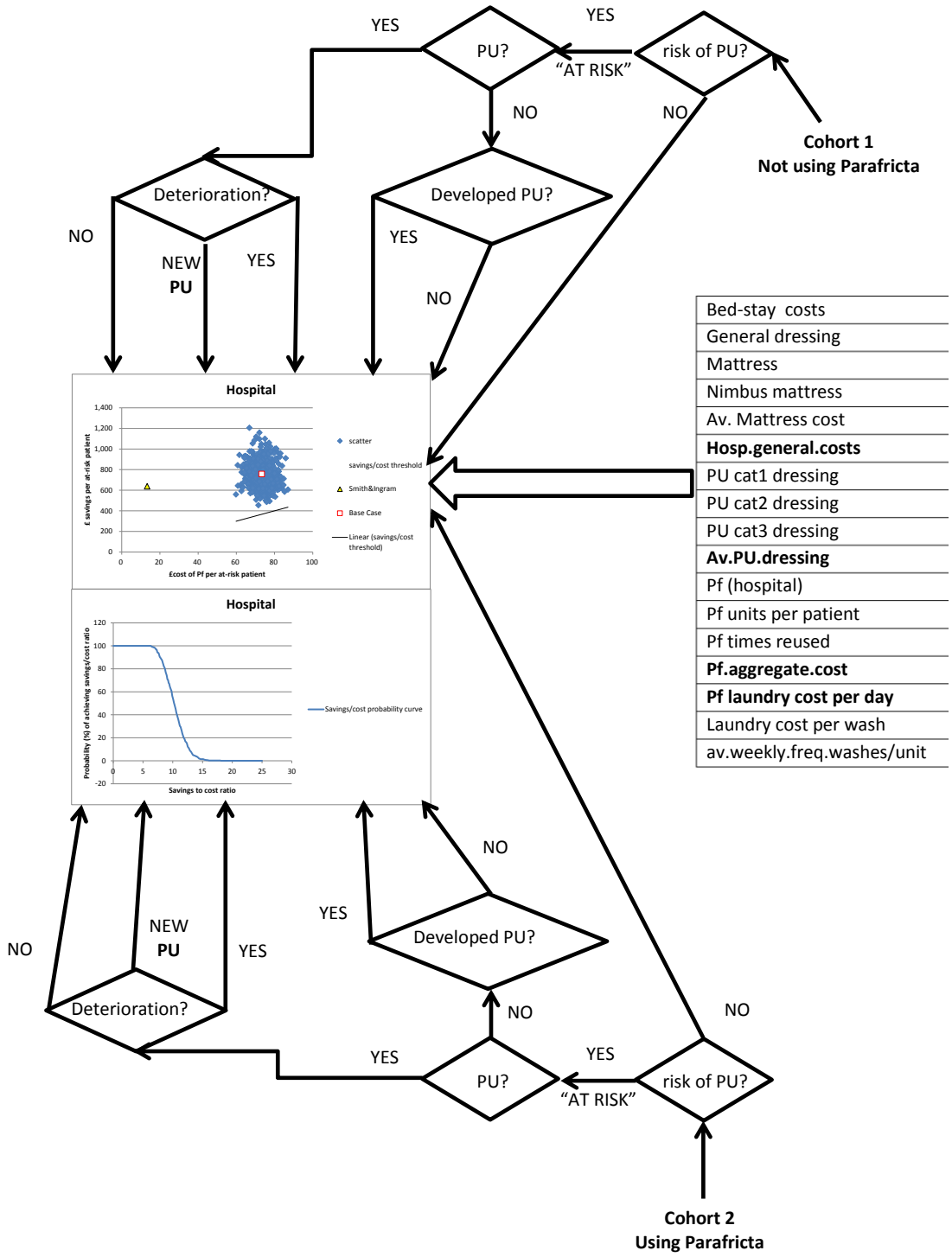
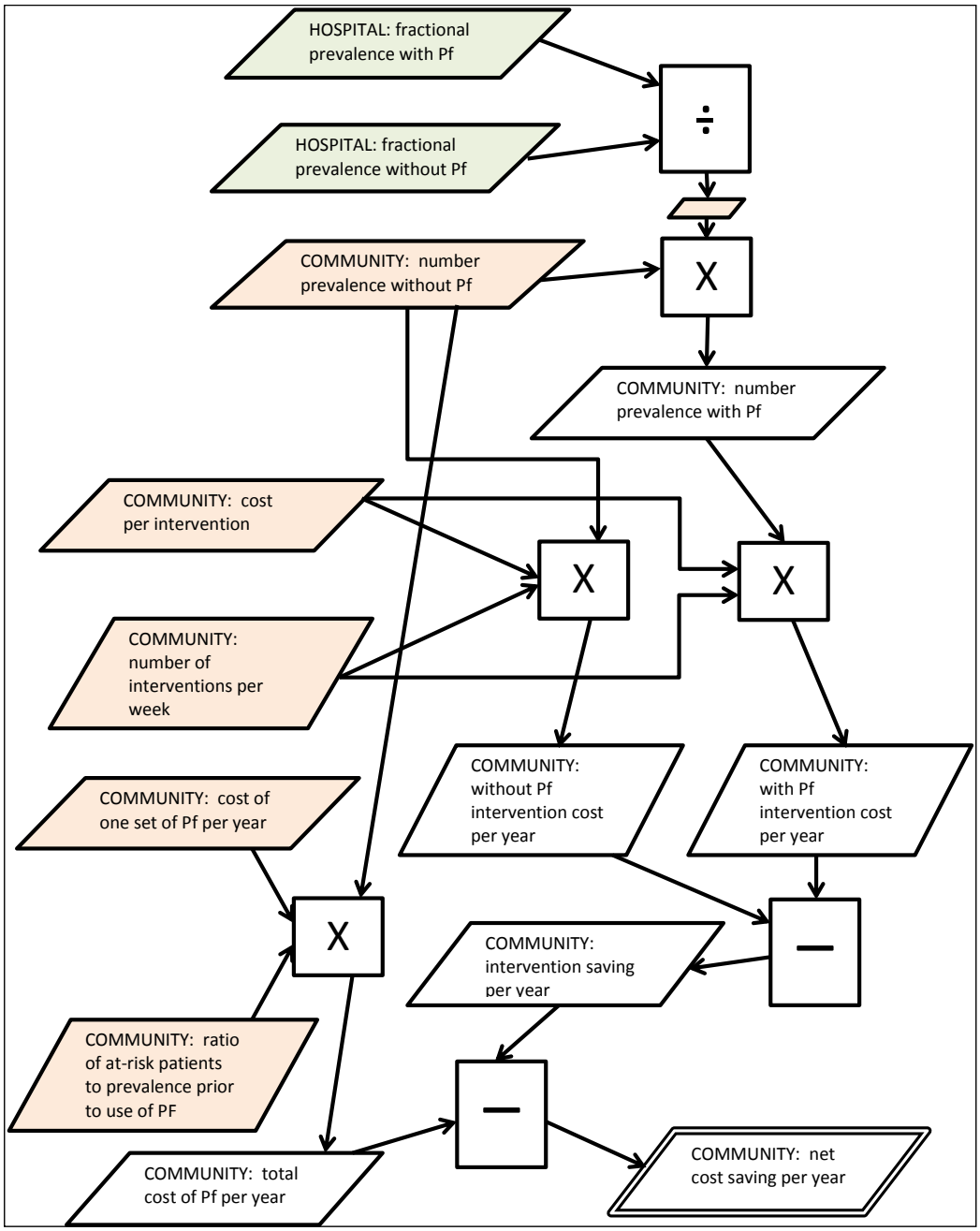


Figure 9: Sacral data, cumulative distributions

Appendix 6 – The NICE CG29 Pressure Ulcer Guidelines



Appendix 7 - Flowchart for Hospital Model



Appendix 8 - Flowchart for Community Model