NICE National Institute for Health and Care Excellence

Medical technologies advisory committee

(MTAC) 19 December 2024

GID-HTE10051 Slide sheets for repositioning or moving a person on or from a bed

This product was selected for a Late Stage assessment in 2023. Clinical and economic evidence has been submitted to NICE by the companies, and an external assessment centre report has been completed.

This pack presents the information required for the MTAC to make draft recommendations on this topic. The consultation period on these draft recommendations is scheduled to take place between 4th February 2025 and 18 February 2025.

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Papers included in pack:

1. Front sheet
2. Final Scope
3. EAG assessment report (EAR)
4. EAG assessment report overview (ARO)
5. User preference report
6. EAG assessment report & User preference report collated stakeholder comments
7. Register of interest

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HealthTech Programme

GID-HTE10051 Slide sheets for repositioning or moving a person: late-stage assessment

Final scope

1 Introduction

The topic has been identified for late-stage assessment (LSA) by NICE. LSA aims to assess technologies that are in widespread or established use in the NHS. Over time, technologies in use often undergo continuous or incremental innovation and adaptation. LSA will assess whether price variations between technologies are justified by the incremental differences and advancements, and which technologies represent value for money. It will support clinical practitioners, managers and commissioners in using NHS resources as effectively as possible and ensure that patient and system benefits are maximised.

The technologies identified for this assessment are slide sheets available for use in the NHS. The evaluation will assess the clinical and economic benefits of innovations in slide sheets used for moving or repositioning a person, as well as evaluating how product features impact outcomes and user preferences.

1.1 Background

Patient handling is an essential and necessary part of care in hospitals and community settings, as well as of supporting people in their own homes. Patient handling tasks can be broadly categorised into moving (transferring) and repositioning tasks. People may need to be moved laterally from one surface to another, for example from one hospital bed to another or from a

confined space onto a transfer board. People also need to be frequently repositioned within the same bed to prevent pressure ulcers (NICE, 2014) and other adverse events associated with not being able to move unassisted. Repositioning relieves pressure, promotes circulation, allows investigation of skin condition and allows air to reach the skin to avoid problems with the collection of moisture (Gillespie et al. 2020). Repositioning in bed is typically done once every 2 hours and so has been reported to account for almost half of all patient handling tasks (McCoskey, 2007). Repositioning is also done to increase comfort by sliding the person up a bed. A person may also need to be repositioned for sanitary and hygiene purposes, such as washing, and for changing clothes and bed linen.

Moving and repositioning tasks are done by a wide range of caregivers including, but not limited to:

- nurses, midwives, health care assistants and hospital porters
- physiotherapists and occupational therapists
- paramedics and ambulance crews
- radiographers, anaesthetists and other clinicians
- social care workers and home carers.

There is a risk that lifting or moving tasks can cause injuries to the person being moved, such as damage to the skin, bruising or cuts (NHS England, 2024). Poor moving and handling practice can also lead to discomfort and a lack of dignity for the person being moved (HSE, 2024).

Handling tasks can also put the handler at significant risk of musculoskeletal injury. Injuries to the back are most common, however, other injuries or accidents can also occur (NHS England, 2024). A review found that the lifetime prevalence of lower back and shoulder pain among nurses is 65% and 54%, respectively (Davis and Kotowski, 2015). Musculoskeletal burden has also been found to be very common among informal carers (Darragh et al. 2013). Musculoskeletal injuries result in costs to the healthcare system and productivity loss, as well as job dissatisfaction in the longer term. In the 10 years between 2009 and 2019, the NHS spent more than £57 million on claims related to manual handling (NHS Resolution, 2020).

Assistive devices decrease the lifting forces experienced by the handler (HSE, 2013). There are two types of assistive technologies: mechanical aids and small aids. Small aids are non-electrical assistive devices such as bed ladders, anti-slide mats, transfer boards, turn tables, handling belts, slings and slide sheets.

1.2 Current management

There are various pieces of legislation that outline safety requirements for moving and handling, with a focus on reducing risk through risk assessments:

- The Health and Safety at Work etc Act 1974.
- The Manual Handling Operations Regulations 1992.
- The Management of Health and Safety at Work Regulations 1999.
- Provision and Use of Work Equipment Regulations 1998.
- Lifting Operations and Lifting Equipment Regulations 1998.

A clinical review by the NHS Clinical Evaluation team (NHS, 2018) established the following best practices for the use of assistive technologies:

- Any use of an assistive device should be accompanied by a risk assessment prior to use.
- All bony prominences should be covered by a slide sheet throughout the movement or repositioning task, paying particular attention to the head and heels.
- A slide sheet must remain double layered at all times, as the forces involved greatly increase once the sheet is single layered.
- During lateral transfers a transfer board must be used to bridge the gap between the two surfaces.
- A minimum of 3-4 people are needed to carry out a lateral patient transfer, with 1-2 required for vertical movements.
- For repositioning in a chair a one way glide sheet is more appropriate to use.

Slide sheets are widely used in the NHS. The guide to The Handling of People (2011) recommends the use of slide sheets for repositioning a patient in the bed, moving a person up the bed and for lateral transfers of a person. The use

of slide sheets is not advocated in repositioning of a person in a chair, sitting to sitting transfers or rolling or turning in bed.

2 Technologies

This section is based on information provided to NICE by companies, experts and information available in the public domain.

2.1 Purpose of the technologies

Slide sheets are friction reducing devices that assist the repositioning or moving of a person on or from a hospital bed or another surface. The aim is to reduce the overall musculoskeletal burden on the person doing the handling task. Additionally, slide sheets aim to minimise adverse events and increase comfort for the care recipient, by protecting vulnerable tissues from friction, shear and 'stiction'.

Slide sheets are used for several moving and repositioning tasks:

- Moving a person laterally from one surface to another, for example from one hospital bed to another or from a confined space onto a transfer board.
- Repositioning a person within the same bed to prevent pressure ulcers and other adverse events, increase comfort or for sanitary and hygiene purposes.
- Slide sheets can also be used for inserting a sling, helping with changing clothes or for exercise and rehabilitation.

Usually, at least two handlers are needed to perform a moving or repositioning task with a slide sheet but this will depend on the risk assessment.

In a healthcare setting, manual handling advisers will advise wards on which slide sheets to procure, taking into consideration the cost, design and technology features, facilities available to the handler and training. Then, the handler will choose a slide sheet based on characteristics of the person being moved or repositioned. For example, the handler may need to match the size of the slide sheet to the care recipient's dimensions, consider the type of material, or safety features needed. Whether the user has received

appropriate training may also drive the choice of which slide sheet is used. The handler may have limited choice between available slide sheets.

Benefits of using slide sheets include reduced perceived exertion, reduced calculated spine compression and shear loading, reduced activity in some muscles and reduced peak force required (Pay et al. 2021). A study has shown that repositioning with a slide sheet takes longer than without one, but is more effective in terms of total personnel time and subjective evaluations of fatigue (Omura et al. 2019).

2.2 Technology features

Basic technology requirements

A slide sheets system consists of 2 layers of low friction material. As a person is moved, one layer stays in contact with them while the other stays in contact with the supporting surface. This allows the material to slide against itself, reducing friction (NHS Clinical Evaluation Team, 2018).

Slide sheets can be flat, tubular or hybrid (a combination of both flat and tubular). Flat slide sheets are single pieces of fabric which are typically used in pairs. They provide flexibility as they allow for 360-degree movement including up, down, turning and swivelling. Tubular slide sheets are continuous tubes of fabric, essentially a single sheet sewn into a cylinder. The open edge of a tubular slide sheet can be on any side, but is typically on the longer one. Hybrid slide sheets are flat sheets offset and stitched together to form a tube.

Slide sheets can be single-use, single patient-use or reusable. Single-use slide sheets are disposed after each use. Single patient-use sheets are disposed after multiple uses with the same person. Reusable slide sheets can be laundered for decontamination and must withstand cleaning to national infection control guidelines. Slide sheets are available in different materials, that can affect the thickness and softness of the product. The friction-reducing properties of slide sheets can be from a coating, for example silicone, or the friction-reducing material within the slide sheet. Laundering may worsen the friction reducing properties of a slide sheet if it is based on a coating.

Slide sheets are available in different shapes and sizes. NHS Supply Chain requires all products to be provided in the following sizes (width x length):

- ≤100cm x 100cm
- 100cm x 200cm
- 140cm x 200cm
- 100cm x 220cm
- 140cm x 220cm.

Experts have advised that slide sheets with a length of less that 150cm are rarely used for moving or repositioning tasks.

Slide sheets can come in packages of a single slide sheet (e.g. a tubular slide sheet), a pair (e.g. two flat slide sheets to be used together) or multiple slide sheets (e.g. a pack of 50).

Additional features, adaptions and potential innovations

Slide sheets can have additional features such as handles for gripping or straps for securing a part of the slide sheet to a mattress or bed. Single patient-use and reusable slide sheets are usually stored near the patient while they are in use. The slide sheet may have a method for indicating which patient the product belongs to, for example a storage bag which can hang on a bed or be placed in a patient's locker.

In situ slide sheets are designed to stay under the patient without needing to be removed after each use. Using an in situ slide sheet may allow for a moving or repositioning task to be done by a single carer.

Providing different colours and labelling can be used to distinguish different sizes, single-use from reusable slide sheets or different types, for example flat from tubular slide sheets. It can also be used to indicate the friction-reducing side of a slide sheet.

Transfer sheets, one-way glide sheets, air assist devices and other assistive technologies that do not consist of 2 layers of low friction material that work together to reduce friction are out of scope for this assessment.

2.3 Current NHS market for the technologies

There are a large number of slide sheets available to the NHS with a wide range of characteristics (such as size, type, material and additional features). There are at least 30 companies providing over 187 products (including different sizes and variants) to the NHS across a range of procurement routes:

- Slide sheets are listed as lot 9 in NHS Supply Chain's Pressure Area Care and Patient Handling framework.
- Purchases made directly from a supplier.
- Purchases made through a community loan store.

Around 80% of all sales in the NHS are through NHS Supply Chain. Most sales through NHS Supply Chain's framework are in acute trusts with a minority procured for community hospitals. NHS Supply Chain's spend on slide sheets between May 2023 and May 2024 was just over £7 million. The market leaders held 80% of the market.

There is price variation across the types of slide sheets available to the NHS. Individual product costs range from just over £1 each to over £180, with the majority being between £1 and £12.

3 Decision problem

Population	Any person who is temporarily or permanently unable to move unassisted and has to be repositioned or moved, and the caregivers performing the handling task
Subgroups	If the evidence allows, the following subgroups may be considered: • People who need longer-term care • People who are particularly frail or with a poor skin integrity.
Intervention	Flat, tubular, hybrid and in situ slide sheets that are available for purchase in the NHS.
Comparator(s)	Slide sheets without additional or innovative features. The comparator may differ between subgroups.
Healthcare setting	Hospital and community care settings
Outcomes	Outcome measures for consideration may include, but are not limited to: **Caregiver related outcomes** • Measures of musculoskeletal injury (e.g. rate or risk) and pain related to injury • Perceived risk and burden (e.g. using the Borg scale). **Patient related outcomes** • Adverse events, such as skin tears and pressure damage • Patient reported outcomes, including health-related quality of life and comfort. **Technology related outcomes** • Biomechanical measures of horizontal (pushing) and vertical (lifting) forces • Incidences when the technology does not function • Microclimate and breathability. **Costs and resource use** • Cost of the technology and associated lifecycle costs • Cost of treating adverse events • Number of carers needed to perform a moving or repositioning task • Time for performing the moving or repositioning task. In addition, user preference and non-clinical outcome measures will be assessed as part of a user preference assessment.
Economic analysis	An appropriate health economic model will be developed, where possible. Costs will be considered from an NHS and Personal Social Services perspective. Sensitivity and scenario analysis should be undertaken to address the relative effect of parameter or structural uncertainty on results.

	The time horizon should be long enough to reflect all important differences in costs or outcomes between the technologies being compared.

3.1 Potential equality issues or considerations

NICE is committed to promoting equality of opportunity, eliminating unlawful discrimination and fostering good relations between people with particular protected characteristics and others.

Slide sheets may not be suitable for people who are particularly frail, critically ill or who have severe skin conditions, for example burns or ulcers.

The musculoskeletal burden felt by caregivers when using slide sheets is heavily dependent on the ability of the care recipient to assist during the moving or repositioning task. Some people, for example those with limited understanding of the English language when no interpretation support is available, or people with mental health conditions or a learning disability may be unable or less able to assist their caregiver, as well as those who are particularly frail, critically ill, with a physical disability or reduced mobility.

Some of the conditions which lead to a person needing assistance to move or reposition themselves may be considered a disability. In addition, the prevalence of most conditions that lead to a person needing assistance to move or reposition themselves rises with age. Older people or people with underlying skin conditions may be more likely to have fragile skin that is prone to tearing. They may also be at a higher risk of pressure ulcers. People with overweight or obesity may be at higher risk of pressure ulcers. The proportion of people with overweight or obesity is higher in men than women.

Caregivers may be at higher risk of sustaining injury when moving and handling patients if they are shorter or taller than average.

Age, disability and gender are protected characteristics under the Equality Act 2010.

4 Stakeholders

4.1 Healthcare professional organisations

The following healthcare professional organisations have been identified as stakeholders for this evaluation:

- Chartered Society of Physiotherapy
- National Back Exchange
- Royal College of Nursing
- Royal College of Occupational Therapists
- Society of Radiographers
- Society of Tissue Viability.

4.2 Patient and carer organisations

NICE's Public Involvement Programme has identified the following organisations:

- Age UK
- British Geriatrics Society
- Carers UK
- Hospice UK
- Living Made Easy
- National Back Pain Association.

4.3 Additional non-clinical professional organisations

The following non-clinical professional organisations have been identified as stakeholders for this evaluation:

- Association of British Healthcare Industries (ABHI)
- British Healthcare Trades Association (BHTA)
- Chartered Institute for Ergonomics and Human Factors
- NHS Supply Chain.

5 Authors

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26 September 2024

Appendix A. Related Guidance

- **Related Guidelines:**

  Home care: delivering personal care and practical support to older people living in their own homes. (2015). NICE guideline 21.

  Pressure ulcers: prevention and management. (2014). Clinical guideline 179.

- **Related Quality Standards:**

  Home care for older people. (2016). NICE quality standard 123.

  Pressure ulcers. (2015). NICE quality standard 89.

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Late stage assessment guidance GID-HTE10051 Slide sheets for repositioning or moving a person External assessment report

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Contains confidential information: No

Number of attached appendices: 7

Purpose of the late stage assessment report

The late stage assessment report is part of the late stage guidance process described in the late-stage assessment interim process and methods statement. The purpose of the external assessment report is to review and synthesise the relevant evidence in order to evaluate the value of the different outcomes and features of technologies under assessment. NICE has commissioned this work and provided the template for the report. The report forms part of the papers considered by the Committee when it is making decisions about the late stage assessment.

Declared interests of the authors

Description of any declared interests with related companies, and the matter under consideration. See NICE's Policy on managing interests for board members and employees.

None

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Responsibility for report

The views expressed in this report are those of the authors and not those of NICE. Any errors are the responsibility of the authors.

Contents

Abbreviations

Term	Definition
A&E	Accident and emergency department
CI	Confidence interval
EAG	External assessment group
EPUAP	European Pressure Ulcer Advisory Panel
JBI	Joanna Briggs Institute
LSA	Late stage assessment
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NICE CG	NICE clinical guideline
NICE HTE	NICE health technology evaluation
NICE TSD	NICE technical support documents
NMB	Net monetary benefit
NPIAP	National Pressure Injury Advisory Panel
PPPIA	Pan Pacific Pressure Injury Alliance
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PSA	Probabilistic sensitivity analysis
PSSRU	Personal Social Services Research Unit
QALY	Quality adjusted life year
RCT	Randomised controlled trial
RFI	Request for information
THIN	THIN database of routine healthcare data
VAT	Value added tax

Executive summary

Background

Slide sheets are friction-reducing devices used to aid in the repositioning or moving of a person on or from a hospital bed or other surface. Further information regarding the use of slide sheets and the clinical context can be found in the published scope. The aim of this late stage assessment (LSA) is to assess whether there is any value added by incremental innovation in features of slide sheets that could justify variation in price to the NHS.

Clinical evidence

The EAG identified 7 key studies which compared at least 2 slide sheets with each other, however none of the key studies sought to compare any impacts of additional or innovative features. Overall, results from the key studies suggest there may be differences between different slide sheets. However, as the majority of these studies did not seek to compare the impact of additional or innovative features, it is difficult to draw conclusions on whether any features are associated with a difference in outcomes. An exception to this is the study by Sturman-Floyd (2011) which provided a comparison of an in situ slide sheet and a removable slide sheet. This study identified benefits of a reduction in the number of care workers required for repositioning when using in situ slide sheets.

Several themes were identified from clinical expert responses, including: the type of slide sheet used; differences in performance and issues with laundering (section 5.4). When new, the different types of slide sheets, other than disposable, were thought to have similar friction-reducing properties, however the performance of washable slide sheets may deteriorate after repeated washing. Single patient use slide sheets may deteriorate over time, however would often either not be needed as long, or be replaced before that point.

Experts commented on their experience of issues associated with laundering removable washable slide sheets, including reliance on external laundry facilities, items going missing and laundry instructions not being followed leading to damage. In situ slide sheets are often used in community settings, with informal caregivers responsible for laundry. Damage can still occur during laundering, and washing can be time consuming for informal caregivers along with other responsibilities.

One local project was shared with the EAG that involved a comparison of slide sheets and rigorous testing of washable slide sheets, in an NHS setting. They noted differences between the slide sheet performance after washing, and particular damage to one device, the design of which has since been changed.

Economic evidence

The EAG identified only one non-peer reviewed study that was relevant to the scope and included an economic component (Sturman-Floyd, 2011). This described the implementation of in situ slide sheets compared to removable flat slide sheets. The author described savings due to the reduction in the number of care workers needed for visits in a proportion of patients (section 6.2).

Regression analysis (section 7.6) of the removable slide sheet features found that 63% of the price variation was explained by the included features. Features found to be associated with significantly higher prices, were handles, and being washable. Tubular slide sheets were associated with a significantly lower price than purchasing two single flat slide sheets, and slide sheet size also had a significant association with price.

There was a lack of clinical evidence available to inform modelling reliant on differences in clinical efficacy, manual handling injury outcomes or patient experience. Therefore, the EAG focused on a cost comparison of features that meant the devices incurred different costs across their lifespan:

- reusability (disposable vs single patient use vs washable),
- removable vs in situ.

For the reusability of slide sheets the EAG considered a number of scenarios with durations ranging from a single use only, to a 6-month duration. In all of these scenarios washable slide sheets were found to be the least costly, except for the 6-month scenario, when no losses of slide sheet were included, as shown in the table below, and discussed in section 7.7.

Scenario		Incremental cost per patient of single patient use slide sheets vs washable slide sheets	
		No losses	With losses
A	Outpatients, ambulance or A&E, single use of slide sheet	£2.93	£2.89
B	Acute ward, with stay of 1 week, occasional repositioning or transfer	£2.93	£6.94
C	Hospital stay, longer term (30 days), repositioning every 4 hours	£2.04	£53.73
D	Patient home, repositioning every 4 hours, 6-month duration	-£5.97	£307.37

This finding should be considered in conjunction with expert concerns about the implementation issues associated with using washable slide sheets. These included variation in durability of washable slide sheets, damage during laundering and losses if slide sheets were not returned to wards or hospital sites.

Comparing in situ and removable slide sheets, the EAG base case was confined to considering the device costs and changes in care worker costs due to the limitations of clinical evidence. There were comments from both clinical experts and informal caregiver experts that the choice of device would impact on both patient and caregiver experience. This is an important consideration that is not captured in the economic model due to a lack of evidence.

The EAG found that in situ slide sheets were less costly than removable slide sheets if devices are assumed to be returned to equipment stores after use, and that this was robust to most parameter changes in the sensitivity analysis. However, if devices are assumed to be disposed of after use, the cost saving is much smaller, and less robust to sensitivity analysis. Results are presented in detail in section 7.8.

The inclusion of pressure ulcer data from Sturman-Floyd (2011) gives an increased cost saving due to reduced numbers of pressure ulcers as well as an increased utility. This results in the in situ slide sheets being dominant for both the base case and the scenario where slide sheets are disposed of after use.

	Incremental cost for in situ	
	Base case, no disposal	**Scenario, assuming disposal**
Device purchase, laundry and replacement	£231.73	£793.46
Care worker visits	-£1,642.50	-£1,642.50
Total costs	**-£1,410.77**	**-£849.04**
Pressure ulcer care	-£959.96	-£959.96
Total costs including pressure ulcer care	**-£2,370.73**	**-£1,809.00**
Total utilities	**0.0027**	**0.0027**

In all cases, the economic results should not be viewed without consideration of the individual setting, clinical opinion and the expert advice presented in this report. Key factors discussed were the patient and care worker experience and the successful implementation of laundering washable slide sheets.

Key points for decision makers

The EAG believes the following issues should be considered by decision makers:

- A lack of published clinical evidence comparing slide sheet features.
- A lack of published clinical evidence on patient experience of repositioning using different types of slide sheet.
- Non peer-reviewed audit data was informative for this report, and greater sharing of similar data would improve the evidence base available.
- Impact of setting, number of uses and local procedures on choice of features.
- In modelling, washable slide sheets are the least costly devices for all scenarios unless loss rates are very low (<0.3% per use), however potential issues with the implementation of washable slide sheets may limit the realisation of this in practice.
- EAG models demonstrated the potential for in situ slide sheets to be cost saving compared to removable slide sheets, due to a reduced number of care workers for visits. The evidence base for this is slim, and practical implementation issues may impact on the findings.

- The modelling did not include patient and caregiver experience or preference which are important factors to consider alongside the cost.

Summary

There is a lack of published clinical evidence that explicitly compared the features of at least two slide sheets.

Experts gave information on the choice of tubular or flat slide sheets, the durability of single patient use or washable slide sheets, issues relating to laundering washable slide sheets and the impact of removable or in situ slide sheets for caregivers and the person being moved.

Washable slide sheets were found to be less costly than single patient use slide sheets in most cases, however there are implementation considerations particularly around laundry provision. Disposable slide sheets were more costly than other options in all scenarios unless only one use per patient was required.

The EAG model found that in situ slide sheets may be less costly than removable slide sheets, due to a reduction in the number of care workers required for repositioning. Clinical and informal caregiver experts spoke about differences in experiences for both caregivers and the person being moved, however there was a lack of published evidence for this.

1 Decision problem

The decision problem is shown in Table 1, and described in the scope, published 26 September 2024.

Table 1: Decision problem

Item	Description
Population(s)	Any person who is temporarily or permanently unable to move unassisted and has to be repositioned or moved, and the caregivers performing the handling task
Subgroups	If the evidence allows, the following subgroups may be considered: • People who need longer-term care • People who are particularly frail or with a poor skin integrity.
Intervention(s)	Flat, tubular, hybrid and in situ slide sheets that are available for purchase in the NHS
Comparators	Slide sheets without additional or innovative features. The comparator may differ between subgroups.
Healthcare setting	Hospital and community care settings
Outcomes eligible for inclusion (organised by outcome type)	Outcome measures for consideration may include, but are not limited to: Caregiver related outcomes: • Measures of musculoskeletal injury (e.g. rate or risk) and pain related to injury • Perceived risk and burden (e.g. using the Borg scale). Patient related outcomes: • Adverse events, such as skin tears and pressure damage • Patient reported outcomes, including health-related quality of life and comfort. Technology related outcomes: • Biomechanical measures of horizontal (pushing) and vertical (lifting) forces • Incidences when the technology does not function • Microclimate and breathability. Costs and resource use: • Cost of the technology and associated lifecycle costs

	• Cost of treating adverse events • Number of carers needed to perform a moving or repositioning task • Time for performing the moving or repositioning task. In addition, user preference and non-clinical outcome measures will be assessed as part of a user preference assessment.
Economic analysis	An appropriate health economic model will be developed, where possible. Costs will be considered from an NHS and Personal Social Services perspective. Sensitivity and scenario analysis should be undertaken to address the relative effect of parameter or structural uncertainty on results. The time horizon should be long enough to reflect all important differences in costs or outcomes between the technologies being compared.

2 Technologies

Slide sheets are friction reducing devices that assist with the repositioning or moving of a person on or from a hospital bed or other surface. The aim of a slide sheet is to reduce the overall musculoskeletal burden on the person doing the handling task. Additionally, slide sheets aim to minimise adverse events and increase comfort for the care recipient, by protecting vulnerable tissues from friction, shear and 'stiction'. Slide sheets are generally considered to be Class I medical devices. All technologies included in the LSA process are available through NHS Supply Chain. Therefore, the EAG has assumed that all technologies in scope have the relevant regulatory certifications and has not sought confirmation of this for any individual technology.

Details of the technologies which are evaluated in this assessment can be found in the published scope. Transfer sheets, one-way glide sheets, air assist devices and other assistive technologies that do not consist of 2 layers of low friction material that work together to reduce friction are out of scope for this assessment.

At the time of this assessment, there were almost 200 technologies which are classified as slide sheets available through NHS Supply Chain. There are various different features that slide sheets may or may not have. A non-exhaustive list of features and their intended purpose or potential benefit is summarised in Table 2.

The reusability of slide sheets can be described in different ways. Throughout this report the EAG have used the following definitions:

Disposable: slide sheets that are for a single use only and then discarded (also called single use).

Single patient use: slide sheets that are used repeatedly for a single patient, and discarded when no longer needed for that patient, or if soiled or worn. They cannot be washed (also called patient specific slide sheets).

Washable: slide sheets that may be used repeatedly for a single patient, but when no longer needed for that patient, or if soiled, will be laundered. They may then be used for another patient, or by the same patient again (also called reusable).

Table 2 Summary of slide sheet features

Feature	Intended purpose or potential benefit
Straps/handles	Helps with gripping the device to reduce physical strain on the user during repositioning or transferring of a person.
Colours/labels which indicate different sizes or types of slide sheet	Enables easy identification of different varieties of slide sheet, to reduce wastage that may occur as a result of unintentionally unpackaging a slide sheet that is not fit for the intended purpose. Colours may also be used to distinguish top and bottom slide sheets to aid use.
Reusable with a specific patient (single patient use)	Reduces waste that comes from disposing of single-use slide sheets.
Washable	Reduces waste that comes from disposing of single-use slide sheets.
Ability to remain in situ	Avoids the requirement of removing and replacing slide sheets each time a person needs repositioning or transferring. This may minimise discomfort and disruption to the person being moved and save time for the users carrying out the repositioning. Some may include straps for locking in place
Tubular	Tubular slide sheets require only a single item, rather than a pair of flat sheets.
Labelling	Some slide sheets have a space to label them with the patient name, to enable them to be easily identified for re-use
Bag for a pair of slide sheets	Some slide sheets come as a pair, within a bag that can then be hung from the patient's bed for re-use.

3 Clinical context

Slide sheets are used across the NHS in various healthcare settings in primary, secondary and tertiary care. Slide sheets may also be used in domestic settings e.g. in a person's home or in a care home. A non-exhaustive list of example scenarios where slide sheets may be employed is as follows:

- In-bed repositioning or turning of a person who is temporarily or permanently unable to reposition themselves.
- Laterally transferring a person between a bed and a trolley for the purpose of transportation between locations
- Laterally transferring a person from a bed or trolley to another surface to receive a medical intervention or procedure

Users of slide sheets vary substantially depending on the setting and type of transfer or repositioning being carried out. Most clinical staff in the NHS are trained to use slide sheets as part of standard mandated manual handling training. Frequent users of slide sheets include, but are not limited to, allied health professionals, ambulance staff, carers, doctors, health care assistants, hospital porters and nurses.

Repositioning is an important strategy for prevention of pressure ulcers. NICE guidance (NICE CG179, 2014) recommends that adults who are able to change their position are encouraged to change their position frequently, and at least every 6 hours. For those at high risk of developing a pressure ulcer, this is increased to every 4 hours. Assistance should be offered if needed, with the use of appropriate equipment.

The Clinical Practice Guideline (2019) for prevention and treatment of pressure ulcers also gives guidance on repositioning individuals at risk of pressure ulcers. This guidance states the need for repositioning regardless of the type of support surface. They also discuss the need to tailor the frequency of turning to the individual requirement, and present indirect evidence that repositioning can cause pain, particularly for individuals with chronic pain, limited cognitive ability or receiving end-of-life care.

Relevant legislation and guidance for manual handling is identified in the scope.

3.1 *Equality issues*

Equality issues and considerations for this LSA are described in the equality impact assessment published alongside the scope.

No additional equality issues have been identified during the assessment at present.

4 Clinical and technological evidence selection

4.1 *Evidence search strategies and study selection*

The EAG conducted a comprehensive, systematic literature search to identify relevant clinical evidence. A search of bibliographic and clinical trial databases identified 370 records. Additionally, 4 records were identified from company websites and a further 14 records were included in company submissions to NICE as part of the company Requests for Information (RFIs). Six additional studies were identified by experts as being relevant to the scope, of which one was a systematic review. From the studies included in the systematic review, 11 additional records were identified. One further record was identified through scoping searches. In total, 406 records were identified. Full details of the EAG searches are provided in Appendix A.

The 370 records independently identified from bibliographic databases and clinical trial registries were screened at title/abstract by one reviewer, with a random 20% of excluded records checked by a second reviewer. Database records selected for screening at full-text were screened by one reviewer. A selection of 65% of records were screened independently by a second reviewer. Conflicting decisions were resolved through discussion with a third reviewer. The 36 records identified from additional search methods (i.e. company websites, company RFIs, scoping searches, experts, systematic review) were screened at full-text by one reviewer. All inclusions were agreed by a second reviewer. Records were screened considering their relevance to the published scope and in accordance with the inclusion and exclusion criteria outlined in the EAG protocol. The screening process is presented in the PRISMA flow diagram in Appendix B. Records that were identified from company RFIs and were excluded from the clinical and technological evidence review are summarised in Appendix C.

The studies included at full text were considered for their relevance to the decision problem and their ability to address the overall research question in the EAG protocol. The EAG considered studies that compared at least 2 slide sheets with or without additional features to be most relevant to the decision problem and overall research question. Therefore, these studies were prioritised as key studies for the clinical and technological evidence review.

Studies that only compared slide sheets to alternative assistive devices were not included as key studies as it was not possible to attribute outcomes to any particular features of slide sheets. These studies were considered to be indirectly relevant to the scope and are summarised in Appendix D. Studies where slide sheets were used in combination with other assistive devices as part of a "system" or where there were insufficient details of the slide sheets' features were not included as key studies, as it was not possible to attribute outcomes specifically to slide sheets. These studies are also presented in Appendix D.

4.2 *Critical appraisal of clinical studies*

Critical appraisal of key studies for the clinical and technological evidence review was conducted in accordance with the NICE health technology evaluations manual. Critical appraisal of each study was carried out using the Joanna Briggs Institute (JBI) checklist for quasi-experimental studies (Barker et al., 2024). Critical appraisal was conducted by one reviewer and checked by a second reviewer. A summary of these appraisals can be found in Section 5.1.

5 Clinical and technological evidence review

The EAG found a very limited evidence base for the features of slide sheets. The aim of the clinical evidence searches and synthesis was primarily to examine different features of slide sheets rather than to compare individual devices. Therefore, evidence on devices was included even where they are not currently available for purchase through NHS Supply Chain, or where they are not on sale in the UK.

Overall, the EAG identified 7 key studies that were directly relevant to the decision problem. These studies compared multiple slide sheets with and without additional or innovative features. These studies are discussed in Section 5.3.

The EAG also identified 15 studies that assessed slide sheets that are in scope. However, these studies compare only 1 slide sheet with alternative assistive devices. This means any differences that result from the inclusion of specific features cannot be disaggregated. The EAG also identified 1 systematic review that included studies assessing slide sheets and other assistive devices. Due to the limited information relevant for this assessment, these studies have not been selected as key studies and were considered indirectly relevant to the decision problem. A summary of these additional studies and reasons for their exclusion from the main assessment can be found in Appendix D, Table 28.

The EAG identified a further 13 studies which were considered indirectly relevant to the decision problem. In 7 of these studies, the outcomes reported could not be attributed to slide sheets specifically as the intervention under investigation was slide sheets in combination with other devices as part of a 'system'. In the remaining 6 studies, there were insufficient details or description of the slide sheets used in the study, making it difficult to attribute observed outcomes to any particular design feature or innovation of a slide sheet. These studies and reasons for their exclusion from the main assessment are summarised in Appendix D, Table 29.

Ongoing trial records identified as relevant to the topic at the title/abstract screening stage were also screened against the inclusion and exclusion criteria. The EAG identified 1 ongoing trial that was considered relevant to this LSA. The trial compares slide sheets, slide sheets combined with a transfer belt and no slide sheets. No results are available for the trial. The trial is summarised in Appendix E.

5.1 *Quality appraisal of studies*

The JBI checklist for quasi-experimental studies (Barker et al., 2024) was used to assess risk of bias and quality of key studies for the clinical and technological evidence review. This checklist includes questions pertaining to risk of bias in the following domains:

- temporal precedence
- selection and allocation
- confounding factors

- administration of intervention/exposure
- assessment, detection and measurement of outcome
- participant retention

The checklist also assesses the validity of statistical conclusions made in the studies, which relates to study quality rather than risk of bias.

Guidance on the use of JBI critical appraisal tools does not recommend prescribing overall ‘ratings’ of bias for each domain or question (Barker et al. 2024). Therefore, the results of these checklists and key concerns around risk of bias are summarised in Table 3 and discussed narratively in in Appendix F.

Table 3: Summary of JBI Critical Appraisal checklist for key clinical studies

Author (year)	Domain/question								
	Criteria related to temporal precedence	Criteria related to selection and allocation	Criteria related to confounding factors	Criteria related to administration of intervention/ exposure	Criteria related to assessment, detection and measurement of outcome			Criteria related to participant retention	Statistical conclusion validity
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Baptiste et al. (2006)	Y	N	NA	U	NA	Y	N	U	Y
Bartnik & Rice (2013)	Y	N	Y	N	NA	Y	Y	N	Y
Fray & Hignett (2009)	Y	U	U	Y/U*	U	Y/U	Y/U	U	Y/U
Fray et al. (2016)	Y	N	U	U	Y	Y	Y	U	U
Larson et al. (2018)	Y	N	U	Y	Y	Y	Y	N	Y
Lloyd & Baptiste (2006)	Y	N	Y	Y	Y	Y	Y	U	Y
Sturman-Floyd (2011)	Y	N	U	N	N/U/NA	Y/U	Y/U	Y/N/U	Y/U

Questions in checklist:
Question 1: Is it clear in the study what is the "cause" and what is the "effect" (i.e. there is no confusion about which variable comes first)?
Question 2: Was there a control group?
Question 3: Were participants included in any comparisons similar?
Question 4: Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
Question 5: Were there multiple measurements of the outcome, both pre and post the intervention/exposure?
Question 6: Were the outcomes of participants included in any comparisons measured in the same way?
Question 7: Were outcomes measured in a reliable way?
Question 8: Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analyzed?
Question 9: Was appropriate statistical analysis used?

Note: Questions 5-9 were assessed per separate outcome measured by the study. Where there were multiple outcomes and answers differed between outcomes, multiple answers are reported for that question and highlighted in orange. Where there were multiple outcomes and answers did not differ between outcomes they are reported together as a single answer.

* Two groups were assessed in this study: caregivers and participants. Therefore, multiple answers are indicated

5.2 *Additional issues relating to study quality*

During the process of critical appraisal, several additional issues were identified that related to the quality of the key clinical studies and their applicability to the decision problem.

Study aim

From the studies identified by the EAG, no studies primarily aimed to compare slide sheets with and without additional features, however, Sturman-Floyd (2011) provided a comparison of an in situ slide sheet and a removable slide sheet. Whilst some of the key clinical studies did compare slide sheets with and without additional features, this was not the primary aim of those studies. Study aims related to comparing the performance or efficacy of various slide sheets and other assistive devices, or measuring the forces needed for repositioning patients using slide sheets and other assistive devices. Therefore, none of the studies identified directly addressed the decision problem of the published scope.

Study design

There were no randomised controlled trials (RCTs) identified by the EAG that compared at least 2 slide sheets with and without additional or innovative features. The key studies included in the clinical and technological evidence review all had quasi-experimental designs. The lack of studies that used random assignment or control groups is a limitation of the evidence base for this topic as the use of random assignment and control groups can reduce bias in studies that aim to assess the effect of interventions.

The EAG also noted that 2 of the key studies included were not published in peer reviewed journals (Fray et al., 2016; Sturman-Floyd, 2011) and that 1 study was a conference paper (Fray & Hignett, 2009). One study included both a peer reviewed journal article and a conference paper (Larson 2018a, 2018b).

Setting

Five studies were conducted in a laboratory setting (Bartnik & Rice, 2013; Fray & Hignett, 2009; Fray et al., 2016; Larson et al., 2018a, 2018b; Lloyd & Baptiste, 2006). Whilst this allowed researchers to control the environment where the slide sheets were used, the controlled nature of laboratory settings limits the applicability

of these studies to real world care settings. Additionally, a mannequin was used in 1 study (Lloyd & Baptiste, 2006) and volunteers acting as patients were used in repositioning tasks in 4 studies (Bartnik & Rice, 2013; Larson et al. 2018a, 2018b; Fray & Hignett, 2009; Fray et al., 2016), which further limits the applicability to real-world settings.

There were 2 studies conducted within patient care settings (Baptiste et al., 2006; Sturman-Floyd, 2011). One study (Sturman-Floyd, 2011) was conducted within primary care and social care settings in the UK. The study by Baptiste et al. (2006) was conducted in acute care units in a hospital in the USA.

Sample size

One study did not report the total sample size for caregivers completing movements with slide sheets (Fray et al., 2016). Several of the studies had a small number of participants. In 2 studies only 1 participant performed all transfers (Bartnik & Rice, 2013; Lloyd & Baptiste, 2006), which limits the generalisability of the findings.

Description of intervention

There were differences in the way that studies described the slide sheets (see Table 5). For instance, the Arjo MaxiSlide was described in different studies as having no pull straps (Lloyd & Baptiste, 2006), extended pull straps (Baptiste et al. 2006) and ergonomic handles (Bartnik & Rice, 2013). The McAuley Medical slide sheet was described as both “disposable” and “single patient use” by Bartnik and Rice (2013). It is unclear whether either of these descriptions match the definitions set out in Section 2, or whether the slide sheet would have been discarded after one use or multiple uses with a single patient. These differences in description make it difficult to know what the features of each slide sheet were in the key studies and whether studies used the same model of slide sheet. The differences in description also make it difficult to know whether there are any similarities or differences in findings of the studies that can be attributed to the features of the slide sheets.

There were limitations in the reporting of the features of the slide sheets. For instance, whether a slide sheet was disposable, single patient use or washable was reported for 3 of the slide sheets assessed in the key studies. The presence or absence of handles or straps was reported for 4 of the slide sheets assessed in key

studies. Information on the material that slide sheets were made of was available for 4 of the slide sheets assessed in the key studies.

There were 6 studies where the slide sheets or features of slide sheets were not adequately described (Amini Pay et al., 2021; Church & Chechile, 2020; Drew et al., 2016; Robertson, 1997, 2000; Vinstrup et al., 2020), which made it difficult to attribute outcomes to any specific feature or innovation of a slide sheet. Therefore, these studies were considered indirectly relevant to the decision problem and are summarised in Appendix D, Table 29.

Outcomes

A variety of outcomes and measures were used across studies, which makes it difficult to draw conclusions from the evidence. Several studies considered the forces required to perform repositioning tasks. Hand forces were measured in 2 studies (Bartnik & Rice, 2013; Larson et al., 2018a, 2018b) and spinal forces were measured in 3 studies (Bartnik & Rice, 2013; Larson et al., 2018a, 2018b; Lloyd & Baptiste et, 2006). Fray et al. (2016) measured the force required to perform a lateral transfer. Caregiver evaluations of slide sheets were measured in 2 studies (Baptiste et al., 2006; Fray & Hignett, 2009). Additionally, one study considered the change in the number of pressure ulcers and the perceived exertion of caregivers (Sturman-Floyd, 2011).

There were inconsistencies in the evaluation of outcomes. For instance, caregiver evaluations of slide sheets were considered in 2 studies: Baptiste et al. (2006) used a survey that included the domains of comfort, ease of use, injury reduction, time efficiency and safety; Fray & Hignett (2009) used a survey to evaluate usability, force and time characteristics supplemented with details from participant discussions.

Additionally, the methods for calculating statistics were sometimes not clearly described in studies, which limits the conclusions that can be drawn from the evidence.

Types of repositioning movements

The types of repositioning movements that caregivers completed differed across studies. This means it is difficult to compare results across studies. Types of repositioning tasks assessed included sliding a patient up the bed (Bartnik & Rice,

2013; Larson et al., 2018a, 2018b), and lateral transfers (Fray & Hignett, 2009; Fray et al., 2016; Lloyd & Baptiste, 2006). In some studies, the types of repositioning movements carried out by caregivers were not detailed (Baptiste et al., 2006; Sturman-Floyd, 2011).

5.3 *Key clinical evidence studies:*

The EAG identified 7 key studies for the clinical and technological evidence review. The key studies are summarised in Table 4. The key studies identified did not primarily aim to compare the features of the slide sheets (however, Sturman-Floyd, 2011, provided a comparison of an in situ slide sheet and a removable slide sheet), and therefore, results may not be directly related to the specific features of the tested slide sheets. These studies include slide sheets with features that differed between the devices being investigated (see Table 5). However, there may be additional differences between the devices that may impact on results. Within the key studies, the following features were identified: slide sheets with handles or straps (n=4 studies); flat slide sheets (n=6 studies); tubular slide sheets (n=4 studies); quilted tubular slide sheets (n=1 study); hybrid slide sheets (n=1 study); in situ slide sheets (n=1 study).

Table 4: Key studies with clinical and technological evidence.

Author (year), study design and location	Slide sheets assessed	Participants, setting and duration of study	Relevant outcomes and key results	Relevance and limitations
Baptiste *et al.* (2006) **Study design:** Experimental design **Location:** USA	**Slide sheets assessed:** • Arjo MaxiSlide flat sheet with extended pull straps • Inventive Products Inc. The Slipp silicone-filled tubular sheet • Phil-E-Slide Flat Sheet Set with extended pull straps	**Participants:** • 77 caregivers (including nurses, nurse practitioners and nursing aids) • Patients on acute wards (number not reported (NR) **Setting:** 8 acute care units in a Veteran's Administration hospital **Follow-up:** 10 months	**Primary outcome:** • Overall caregiver perceived performance **Secondary outcomes:** • Comfort; Ease of use; Injury reduction; Time efficiency; Patient safety (all assessed by caregivers) **Key results:** • Arjo MaxiSlide was ranked as the top slide sheet by users for overall perceived performance, followed by the Slipp • Arjo MaxiSlide was rated higher than slide sheet comparators for comfort, injury reduction, and patient safety • The Slipp was rated higher than slide sheet comparators for ease of use and time efficiency	Compared 3 slide sheets relevant to decision problem. Did not specifically test the features of the devices. Underpowered to detect significant differences. Explicitly commented on a feature of one device that impacted the results.
Bartnik & Rice (2013) **Study design:** Biomechanical evaluation	**Slide sheets assessed:** • McAuley Medical disposable fabric slide sheet	**Participants:** • 1 female caregiver • 29 healthy adults acting as "patients"	**Primary outcome:** • Peak hand forces **Secondary outcomes:**	Compared 2 slide sheets relevant to decision problem. Only used one Arjo MaxiSlide, as

Author (year), study design and location	Slide sheets assessed	Participants, setting and duration of study	Relevant outcomes and key results	Relevance and limitations
Location: USA	• Arjo MaxiSlide washable slide sheet	**Setting:** Laboratory **Follow-up:** N/A	• Compressive and shear forces of the lumbar region **Key results:** • No statistically significant difference between the Arjo MaxiSlide and McAuley Medical slide sheet • McAuley Medical slide sheet consistently resulted in lower forces across the hands and the lumbar region	opposed to a pair, which is not standard practice, meaning the results have limited generalisability. Additionally the study authors detailed that the findings are likely to be different with other care givers, which limits the interpretation of the results. Did not specifically test the features of the devices.

Fray & Hignett (2009)
 	
Study design: Quasi-experimental
 	
Location: UK
	Slide sheets assessed:
	• Tube flat slide sheet
	• Pair of single flat slide sheets
	• Quilted tube slide sheet
		Participants:
		• 21 clinical staff (nurses, physiotherapists and back care advisors)
		  ○ 14 volunteering as caregivers
		  ○ 7 volunteering as “patients”
			Primary outcome:
			• Caregiver data (time taken, forces, complexity, preference)
			
			Secondary outcomes:
			• Patient data (comfort on insertion, transfer, removal and transport, security on insertion and transport, preference)
			• Time
				Compared 3 slide sheets relevant to decision problem.
				
				Involved a small sample size, meaning that statistical significance could not be identified.

Author (year), study design and location	Slide sheets assessed	Participants, setting and duration of study	Relevant outcomes and key results	Relevance and limitations
		Setting: NR **Follow-up:** N/A	• Forces **Key results:** • From the slide sheets assessed, caregivers ranked the tube flat highest, with the pair flat slide sheets second highest • From the slide sheets assessed, patients ranked the pair of flat slide sheets highest, with the tube flat slide sheet second highest • Time taken for transfers was similar across slide sheets • The flat tube slide sheet resulted in the lowest forces to transfer	Used a scoring system to measure the user and patient data, but does not include any detail on how this was implemented or the numbers used as parameters. Did not specifically test the features of the devices.
Fray *et al.* (2016) **Study design:** Biomechanical evaluation **Location:** UK	**Slide sheets assessed:** • ReDi Slide tubular slide sheet • Flat slide sheets with differing features, including handles, or no handles • Tubular slide sheets of differing sizes	**Participants:** • Caregivers (number NR) • Patient actors of three sizes (58kg, 72kg, 98kg) **Setting:** Laboratory **Follow-up:** N/A	**Primary outcome:** • Forces resulting from lateral transfers **Secondary outcomes: N/A** **Key results:** • The ReDi Slide tubular slide sheet resulted in the lowest force used for a lateral transfer	Reports comparative data for 5 slide sheets relevant to decision problem. Force data not available for all slide sheets assessed in the study. Tested 5 different surfaces with each

Author (year), study design and location	Slide sheets assessed	Participants, setting and duration of study	Relevant outcomes and key results	Relevance and limitations
				of the 5 slide sheets, but not reported how many transfers were undertaken. Did not specifically test the features of the devices.
Larson *et al.* (2018) **Study design:** Biomechanical evaluation **Study design:** **Location:** USA	**Slide sheets assessed:** • Arjo MaxiSlide reusable flat slide sheet • McAuley Medical disposable flat slide sheet	**Participants:** • 38 healthy adults as caregivers • 1 adult male acting as "patient" **Setting:** Laboratory **Follow-up:** N/A	**Primary outcome:** • Hand forces **Secondary outcomes:** • Lower back forces **Key results:** • McAuley slide sheet resulted in lower total forces in both the hands and lower back when sliding a patient up in bed	Compared 2 slide sheets relevant to decision problem. Study authors suggest a limitation that findings are not likely to be generalisable to health care settings, which limits the interpretation of the results. Did not specifically test the features of the devices.

Author (year), study design and location	Slide sheets assessed	Participants, setting and duration of study	Relevant outcomes and key results	Relevance and limitations
Lloyd & Baptiste (2006) **Study design:** Biomechanical evaluation **Location:** USA	**Slide sheets assessed:** • Phil-E-Slide Flat Sheet Set • Arjo MaxiSlide • Inventive Products Inc. The Slipp	**Participants:** • 1 male investigator completed lateral transfers • 1 mannequin represented patient **Setting:** Laboratory **Follow-up:** N/A	**Primary outcome:** • Spinal forces **Secondary outcomes:** • Applied forces • Overall rank **Key results:** • Phil-E-Slide Flat Sheet Set resulted in the lowest spinal compression, with comparators resulting in nearly double the force • Mean applied force was lowest for the Arjo MaxiSlide • Phil-E-Slide Flat Sheet Set had the highest overall rank for slide sheets	Compared 3 slide sheets relevant to decision problem. Small sample size involving just 1 person completing the lateral transfers, which inherently limits the generalising of results. Explicitly commented on a feature of one device that impacted the results. Did not specifically test the features of the devices.
Sturman-Floyd (2011) **Study design:** Before-and-after study **Location:** UK	**Slide sheets assessed:** • WendyLett in situ slide sheet	**Participants:** • 232 care workers • Clients requiring in situ slide sheets (n 110)	**Primary outcome:** • Pressure ulcer incidence **Secondary outcomes:** • Costs	Compares 2 slide sheets relevant to decision problem. Authors report that introduction of WendyLett system

Author (year), study design and location	Slide sheets assessed	Participants, setting and duration of study	Relevant outcomes and key results	Relevance and limitations
	• Cromptons flat washable slide sheets	**Setting:** • Primary care trust • Social care organisations **Follow-up:** 6 months	• Carer perceived exertion • Number of handlers for bariatric clients **Key results:** • WendyLett in situ slide sheet led to a reduction in pressure ulcer severity and incidence • Use of WendyLett in situ slide sheet led to reduction in staff costs by at least one-third for bariatric clients and 45% for non-bariatric clients	led to reduction of carer perceived exertion. However, the EAG has not identified data to support this. The study compared the use of in situ slide sheets with removable flat slide sheets in the community.

Abbreviations: N/A = not applicable; NR = not reported

Table 5: Features of the identified slide sheets within key studies.

Key Study	Slide Sheet	Features
Baptiste et al. 2006	Inventive Products Inc. The Slipp	Tubular sheet, Silicone-filled
	Phil-E-Slide Flat Sheet Set	Flat sheet set with extended pull straps
	Arjo MaxiSlide	Flat sheet set with extended pull straps
Bartnik & Rice 2013	McAuley Medical	Disposable fabric slide sheet; flat sheet designed for single patient use, made of non-woven fabric and has a low-friction coating on one side
	Arjo MaxiSlide	Flat sheet made of synthetic nylon low-friction material with ergonomic handles along each side; Washable
Fray & Hignett 2009	Slide Sheet A (Unnamed)	Tube flat slide sheet
	Slide Sheet B (Unnamed)	Pair of single flat slide sheets
	Slide Sheet C (Unnamed)	Quilted tube slide sheet
Fray *et al.* 2016	Slide Sheet 1 (Unnamed)	Pair of flat sheets, coated polyester; No handles
	Slide Sheet 2 (Unnamed)	Pair of flat sheets, green plastic
	Slide Sheet 3 (Unnamed)	Pair of flat sheets, coated paper
	Slide Sheet 4 (Unnamed)	Pair of flat sheets; Coated polyester handles
	Slide Sheet 5; ReDi Slide (now named Versal, GBUK Banana)	Novel design (described by NHS Supply Chain as being hybrid: half flat and half tubular)
Larson *et al.* 2018	Arjo MaxiSlide	Reusable
	McAuley Medical	Disposable fabric slide sheet
Lloyd & Baptiste 2006	Phil-E-Slide Flat Sheet Set	Flat sheet; two sheets used directly on top of each other with two straps
	Arjo MaxiSlide	No pull straps
	Inventive Products Inc. The Slipp	Polyurethane bonded to nylon with silicone inside
Sturman-Floyd, 2011	WendyLett	Washable in situ sheet; Made of a satin-finished woven textile
	Cromptons slide sheets	Pair of flat washable slide sheets

Baptiste *et al.* (2006) compared 8 methods for transferring patients (3 in scope of this assessment), including 2 flat slide sheets with extended pull straps (the Phil-E-Slide Flat Sheet Set; the Arjo MaxiSlide used as a flat sheet set), and 1 silicone-filled tubular slide sheet (Inventive Products Inc. The Slipp). This study was set within a Veteran's Administration hospital in the USA, involving 8 acute care units and 77 caregiver participants. Over a 10-month period, the acute care units each received a random device (of the 8 devices tested) every 2 weeks, and caregivers were instructed to complete a 5-question survey following each transfer. At the end of the 10-month period, the Phil-E-Slide had been used for 30 transfers, the Arjo MaxiSlide for 28 transfers, and the Inventive Products Inc. The Slipp for 16 transfers. The Arjo MaxiSlide was rated by the caregivers as highest for four categories: comfort (7.68/10), injury reduction (7.86/10), safety (7.89/10), and for overall performance with a score of 37.64/50. Inventive Products Inc. The Slipp was rated by the caregivers as highest for two categories: ease of use (7.56/10) and time efficiency (6.88/10); with an overall performance score of 36.38/50. The Phil-E-Slide Flat Sheet Set was rated lowest of the slide sheets by the caregivers, with an overall performance score of 32.73/50. The study details that the poor rating received by the Phil-E-Slide Flat Sheet Set may have been contributed to by the "extremely slippery" nature of the sheets which were thought to be unmanageable to keep two sheets together in practice. This study is underpowered to detect significant differences among the 3 slide sheets tested, as the power analysis required 23 transfers per device, which was not achieved for the Inventive Products Inc. The Slipp. The study did not explicitly test for the impact of the features of the slide sheets, however the presence of the extended pull straps, which minimised the reach of caregivers, was specifically cited as contributing to the performance of the Arjo MaxiSlide.

Lloyd & Baptiste (2006) compared 11 methods for transferring patients (3 in scope of this assessment), including 1 flat slide sheet with straps (the Phil-E-Slide) and 1 without straps (the Arjo MaxiSlide), with 1 silicone-filled tubular slide sheet (Inventive Products Inc. The Slipp). The study was set in a lab within the USA and involved 1 male investigator laterally transferring a mannequin 'patient', with the resulting forces used within the transfers measured. The forces identified at the L5/S1 spinal segment were comparable across slide sheets for both lateral shear and anterior-posterior shear. The Phil-E-Slide Flat Sheet Set with straps resulted in the lowest

compression at approximately 1000N, whereas the Arjo MaxiSlide without straps and the Inventive Products Inc. The Slipp tubular sheet were around 2000N each. The percentage of the population with adequate joint strength to use the devices was highest for the Phil-E-Slide Flat Sheet Set with straps for both torso and shoulder (>90%), and highest for both the Phil-E-Slide Flat Sheet Set with straps and the Inventive Products Inc. The Slipp tubular sheet for elbow joints (100%). The overall mean applied force was lowest (>200N) for the Arjo MaxiSlide without straps, and the other slide sheets resulted in a similar force (around 250N for both). The Phil-E-Slide Flat Sheet Set was reported to minimise the rotation of the torso, due to the two extended pull straps, which additionally contributed to the lower compression of the L5/S1 spinal segment over the other slide sheets, and led to a substantial improvement in the posture of the investigator conducting the transfer.

Bartnik & Rice (2013) compared 2 flat slide sheets (1 without handles, 1 with handles) for patient repositioning. The slide sheet without handles (McAuley Medical) tested was non-woven, with low-friction material on one side, and fit for single-patient use. The slide sheet with handles (Arjo MaxiSlide) tested was made from synthetic nylon low-friction material with handles on each side. The Arjo MaxiSlide is described as being washable, but there is no detail within the study of whether it was tested as a new product, or following washing. This study was based in a lab setting within the USA and involved 29 healthy adult participants, with one acting as a consistent caregiver and others taking turns to act as either a secondary caregiver, or a patient. The study used focused contrast (Cohen's *f*) in statistical analysis to identify the difference between the average compression forces experienced when using the slide sheets. Across all conditions studied, both slide sheets outperformed the traditional cotton sheet tested. However, the McAuley Medical slide sheet without handles consistently resulted in less lower back compression force than the Arjo MaxiSlide with handles: statistical testing to estimate the difference between the means found a focused contrast of 6.77 (p=0.019) at the L5-S1 spinal segment; and a focused contrast of 12.91 (p=0.002) at the L4-L5 spinal segment. A notable limitation of the study is that only a single Arjo MaxiSlide was tested, therefore the results in regards to the comparison between the slide sheets may not be valid under typical conditions (where two Arjo MaxiSlide sheets would be used). The authors detailed a limitation that the hand and lower back forces identified in the study were

tested in a lab setting and likely to be ‘dramatically’ different when care givers are performing the repositioning outside of this setting.

Larson *et al.* (2018) compared 2 flat slide sheets (the Arjo MaxiSlide sheet with handles and the McAuley Medical single-patient use fabric slide sheet without handles; as previously tested in Bartnik & Rice, 2013) for patient repositioning. The study was undertaken in a lab setting in the USA, involving 38 adult participants acting as caregivers and one male staff member from the research team acting as a patient. A repeated measures design was utilised, in which the number of sheets used were tested, with either a single slide sheet, or a pair of slide sheets, with hand forces measured in kg and lower back forces measured in Newtons. The results both confirmed and expanded upon the previous findings of Bartnik & Rice (2013), as it was found that the use of a single Arjo MaxiSlide did not result in a significant improvement over the use of a traditional cotton sheet. However, when moving patients up a bed, the use of a single McAuley sheet, a pair of McAuley sheets, or a pair of Arjo MaxiSlides resulted in less hand force used over a cotton sheet. The mean hand force for each device was as follows: pair of Arjo MaxiSlide = 25.87kg; pair of McAuley sheets = 23.91kg. The McAuley slide sheet without handles consistently outperformed the Arjo MaxiSlide with handles for hand forces, L4-L5 spinal section compression, and sagittal shear lower back forces. The study listed the limitation that the forces identified in the study were likely to be lower than what would be elicited in an acute care setting.

Fray & Hignett (2009) compared 4 devices for transferring patients, including 1 tube flat (tubular) slide sheet, 1 pair of flat slide sheets, and 1 quilted tube slide sheet. The study was conducted in the UK, involving 21 clinical staff participants split into 7 groups: 2 participants acting as caregivers, and 1 acting as a ‘patient’ in each group. The scoring system used to measure the slide sheet preference of the participants is unclear within the study, but for caregivers included the: time taken, forces, complexity, preference; and for ‘patients’ included the: comfort of insertion and transfer, time taken, security of transport, and overall preference. The caregivers scored the sheets similarly, with a preference demonstrated by ranking exercise for the flat tube slide sheet, then the pair of flat slide sheets. The ‘patients’ additionally scored the sheets similarly, with a preference for the pair of flat slide sheets, followed

by the flat tube slide sheet. The time taken for transfers was comparable for both bed to trolley movement and trolley to bed movement, while the forces resulting from transferring were lowest for the flat tube slide sheet (at 113.4N for a 55kg 'patient', and 205.1N for a 78kg 'patient') and highest for the flat slide sheets (at 184.9N for a 55kg 'patient', and 271.9N for a 78kg 'patient').

Fray *et al.* (2016) compared single layer theatre sheets and 10 slide sheets, with 5 being tested for forces used for lateral movements: 1 pair of polyester flat slide sheets with no handles, 1 pair of plastic flat slide sheet with no handles, 1 pair of paper flat slide sheets with no handles, 1 pair of flat slide sheets with polyester handles, 1 polyester sheet with no handles in a novel design (identified as the ReDi slide, now named Versal by GBUK Banana, which is described by NHS Supply Chain as being hybrid: half flat and half tubular). Set in the UK, the study involved a survey for healthcare provider staff (n=170), then laboratory testing of slide sheets using three volunteer 'patients'. The novel design slide sheet (ReDi Slide, Versal) resulted in the least force used on the bed top with no additional board (63N), while the next lowest comparators were the pair of flat slide sheets with polyester handles (105N) and the pair of flat slide sheets with polyester and no handles (109N). For all of the lateral transfers performed, the novel design (ReDi Slide, Versal) consistently resulted in the lowest force used, with only the pair of flat slide sheets with polyester handles resulting in similar force when half on the solid transfer board, and the pair of flat slide sheets with polyester and no handles when fully on the solid transfer board.

Sturman-Floyd (2011) conducted a before and after study to evaluate the implementation of WendyLett in situ slide sheets. The comparator has not been detailed within the study, however following EAG correspondence, the author confirmed that the standard of care at the time of the study was to use a pair of flat, washable slide sheets (Cromptons). The study was conducted across primary care trust and social care organisations within the UK, with 110 clients receiving an in situ WendyLett slide sheet to be used over a 6-month period. Recordings of skin integrity, involving the grading of any pre-existing pressure ulcers, were made for all clients at the beginning of the trial, then after 6 weeks, 12 weeks and 6 months following the introduction of the WendyLett slide sheets. At the end of the 6-month

study period, the prevalence of pressure ulcers decreased from 31 (n=25 Grade 1; n=3 Grade 2; n=2 Grade 3; n=1 Grade 4) at baseline, to just 3 (n=2 Grade 1; n=1 Grade 2), which demonstrates a reduction in both the incidence and the severity of pressure ulcers. The study concluded that the use of the WendyLett slide sheet does not increase the risk of pressure ulcers. The author reported that handlers perceived there to be a reduction in the exertion forces required for use, however the EAG have not identified baseline measurements to support this. Cost-related findings are covered in detail within section 6.2.

5.4 *Additional clinical evidence*

5.4.1 Evidence from expert responses

The EAG consulted with experts on various clinical and economic queries during this LSA. These experts included individuals who have experience in acute or community settings. The primary aim of this exercise was to inform the economic model, as good quality published literature from which to source inputs was sparse. The EAG has summarised some key themes that were identified in the responses from experts relating to the features of slide sheets and the use of slide sheets in real-world settings, as this was deemed relevant clinical evidence that may inform decision making. This is not an exhaustive summary of responses received; full details of the responses received from clinical experts can be found in Appendix G: Expert responsesResponses were also received from caregiver experts and these are available in the correspondence log.

Impact on users and people being moved of using disposable versus single patient use versus washable slide sheets

Overall, experts were of the opinion that there were some differences between using disposable, single patient use or washable slide sheets that may be noticed by either the caregivers or the people being moved.

Three experts commented on the use of disposable slide sheets, with one stating there was noticeable difference when using them (difference not described or quantified), one stating that disposable slide sheets do not provide as smooth a transfer in comparison to other types of slide sheets, and one stating that they require ‘considerably more’ force to move weight (with no indication of what this is in

comparison to). Another expert commented on the material that disposable slide sheets are made of, stating that the ‘paper’ material may be perceived differently by the person being moved with respect to noise and feel and that the material may be difficult for users to grip on to during transfers. One informal caregiver stated that they did not feel disposable slide sheets were fit for purpose.

With respect to washable slide sheets, two experts commented that they would not expect any noticeable difference in comparison to single patient use slide sheets when both are new. One expert commented that washable slide sheets are more likely to have handles and to be made of a thicker material, which they considered to be ‘easier’ to use. Conversely, another expert highlighted the presence of handles as a potential issue as users may be prompted to lift instead of slide the person being moved.

Differences in maintaining function/performance between single patient use versus washable slide sheets

A common theme of the clinical expert responses was that, over time, washable slide sheets lose their friction-reducing properties. Three experts stated that the laundering process or not adhering to laundering instructions is associated with a decline in function of washable slide sheets. One expert stated that this decline in function can have an impact on comfort for the person being moved and on the risk of musculoskeletal injuries for the user.

There were mixed views on the performance of single patient use slide sheets over time. One expert stated that single patient use slide sheets retain their integrity for longer. Three experts stated that they had not noticed single patient use slide sheets declining in usability, with two of these experts acknowledging that the sheets may be replaced due to other reasons such as hygiene or infection control requirements sooner than if they needed to be replaced due to a decline in function. Two experts stated that single patient use slide sheets can deteriorate over time, with the rate at which this occurs depending on factors such as patient weight, the technique used by the handlers and the material composition of the slide sheet.

Issues relating to laundering washable slide sheets and in situ slide sheets

A frequently cited issue relating to washable slide sheets was the practicalities of the laundering process. Six clinical experts commented on issues relating to the use of external laundry facilities, which can lead to incorrect items being returned to departments or items going missing and not being returned at all. This issue was cited as a reason for shifting from washable to single patient use slide sheets in one clinical expert's department. Other issues relating to laundering washable slide sheets highlighted by the clinical experts included:

- Absence of laundry service during out-of-hours periods,
- Long turnaround times for items to be laundered and returned,
- Care instructions for laundering items not being followed, leading to premature deterioration of items' functions.

One clinical expert based in a community setting stated they did not feel laundry instructions were communicated effectively to caregivers in the home, which may lead to improper laundering and a subsequent premature degradation in the function of the slide sheets. A second clinical expert stated that they are aware of in situ slide sheets that have been damaged in a person's home due to issues with the laundering process. In general, in situ slide sheets used in person's home are laundered by informal caregivers. One informal caregiver commented that being personally responsible for laundering in situ slide sheets is time consuming and difficult to balance alongside other responsibilities such as a caregiver for their relative.

Using in situ slide sheets versus other types of slide sheets

In general, experts were of the opinion that in situ slide sheets were mainly used in community settings and had the following potential benefits:

- A reduction in discomfort associated with frequent insertion and removal of removable slide sheets,
- An increased preservation of dignity of the person being moved due to a reduction in need for intrusive handling,
- Less time required overall for repositioning tasks, when considering the insertion and removal time associated with removable slide sheets are not required for in situ slide sheets,
- The feasibility of only requiring a single user for some repositioning tasks.

While experts cited the feasibility of single-user repositioning as a potential benefit of in situ slide sheets, they highlighted that some repositioning tasks would still require more than one user and that individual circumstances may affect the feasibility of single-user repositioning e.g. weight and cognitive ability of the person being moved or physical capabilities of the caregivers.

Two experts indicated that in situ slide sheets could be useful in acute settings, for example for people who are living with obesity or those who are sensitive to physical touch. However, one of these experts also stated that the use of in situ slide sheets in the acute setting was not considered practical due to concerns over safety (e.g. inadequate or inconsistent staff training) and issues with laundering.

Two informal caregivers provided information of their experience using in situ slide sheets while caring for relatives. One informal caregiver commented on the friction-reducing properties of an in situ slide sheet, stating that the ‘slippiness’ of an in situ slide sheet resulted in the person being moved slipping off the bed. It was also stated that the person being moved had hemiplegia, which they considered to be a contributing factor to this incident. The same informal caregiver commented that in situ slide sheets may be useful for moving people with frailty, but cited potential issues relating to the accumulation of sweat while in use and inadequate training of users. The second informal caregiver stated that in situ slide sheets had benefits for both the caregiver and the person being moved, as a result of a reduction in disruption during repositioning in comparison to using removable slide sheets which have to be inserted and removed after every use. The same caregiver commented that in situ slide sheets make tasks such as changing incontinence pads, in-bed repositioning to avoid pressure ulcers and transferring into hoist slings much easier for both the caregiver and the person being moved. Both informal caregivers commented on the feasibility of using in situ slide sheets as a single caregiver. One commented that it was only possible to perform lateral movements as a single caregiver, and that vertical in-bed positioning was not feasible.

Pairs of flat sheets versus a tubular slide sheet

Experts' views on flat versus tubular slide sheets from were mixed. Three experts stated that tubular slide sheets were easier to use than a pair of flat sheets, citing the continuous loop design which allows for 'smoother', multi-directional movement with reduced friction. One expert also commented on flat slide sheets being used inappropriately in practice e.g. using one sheet instead of a pair and using handles to lift rather than slide the person being moved. However, four clinical experts stated that using flat sheets was standard practice in their places of work, commenting on the versatility of flat slide sheets and flexibility in their application in comparison to tubular slide sheets.

5.4.2 Evidence from local NHS audits or projects

The majority of experts stated they were not aware of any audit data that would be relevant to this LSA.

One expert provided the EAG with information on a project conducted in their NHS Trust, where different washable slide sheets were compared to inform procurement decisions. Detailed results and the types of washable slide sheets used in this project are not presented in this report as the products used are not considered to reflect those used in current practice. However, the EAG has summarised the design of the project and the broad outcomes as these were considered relevant to this LSA.

The project was designed to test the force required to move a volunteer 'patient' using different types of washable slide sheets. 'Patient' comfort ratings were also collected during the transfers. Prior to testing, the slide sheets were washed 50 times (randomly selected to reflect the typical condition of slide sheets used in hospital) to investigate if the laundering process had any effect on functionality.

Results indicated there were differences in the forces required to move a person and in the comfort of the person being moved between the different types of washable slide sheets. Notably, slide sheets from one company did not withstand the 50 washes which prevented inclusion in the assessment of functionality.

The expert also highlighted an implementation issue that was observed during initial phase of the project, where staff assumed the washable slide sheets were disposable, due to previous experience of only using disposable slide sheets, and

disposed of them instead of sending them for laundering. Following this incident, the slide sheets that were disposed of were replaced and staff were briefed in more detail on the project to ensure washable slide sheets were sent for laundering, as intended. Following the project, a standard replacement rate of 25% was employed to account for natural wastage of products.

The results of this project directed a tendering process and informed procurement decisions within the NHS Trust. Additionally, the expert highlighted that changes were made to the slide sheets that did not withstand the 50 washes by the company, following this project.

5.5 *Summary and interpretation of the clinical evidence*

There was a lack of relevant clinical evidence, with only 7 key studies identified.

Of the 7 studies that were included in this assessment, none specifically aimed to test the impacts of the features for each of the slide sheets compared, however, Sturman-Floyd (2011) provided a comparison of an in situ slide sheet and a removable slide sheet. The studies used variable measures, with some being poorly defined, and differing outcomes of interest, meaning a useful comparison of findings is challenging. Many of the studies did not have adequate sample sizes for power calculations, meaning the interpretations of the results are limited. Few studies used actual patients or clients as participants, and many were not generalisable to an NHS setting.

6 Economic evidence searches and selection

6.1 *Evidence search strategy and study selection*

The main evidence search strategy was sufficiently broad to include any relevant economic studies. No additional searches were required to identify economic evidence that addressed the decision problem.

6.2 *Economic studies relevant to the scope*

One study included economic information that was relevant to the scope. Sturman-Floyd (2011) conducted a before and after study to evaluate the implementation of WendyLett in situ slide sheets, where the previous standard of care was a pair of flat, washable slide sheets, and is described in section 5.3. The community-based study

followed up 110 people who were appropriate for in situ slide sheets, over 6 months. The authors recorded changes in the number of care workers required for visits, and the presence of pressure ulcers at baseline, 6 weeks, 12 weeks and 6 months.

There were 6/110 clients who were living with obesity, and at baseline requiring 4 care workers for each visit. This was reduced to 2 care workers per visit for 4 of the 6 patients after the introduction of in situ slide sheets. Of the remaining 114 clients, 22 clients required only 1 care worker per visit using the in situ slide sheets, compared to 2 care workers at baseline. Of these, 12 had visits 4 times per day, and 10 had visits 3 times per day. For the remaining 82 clients, there is no description of the number of visits per day, number of care workers or any change after baseline.

The authors reported a cost per visit of £15.51 for 2 care workers, or £8.51 for a single care worker. On this basis, they calculated, for the 6 clients living with obesity, an annual reduction in care worker costs of £90,330.24 (£270,990.72 at baseline reduced to £180,660.48). For the clients where 2 care worker visits were reduced to 1 care worker per visit, costs were also calculated. For the 12 clients with 4 double visits per day at base line, they calculated an annual cost reduction of £122,304.00 (£270,990.72 at baseline reduced to £148,686.72). For the 10 clients with 3 daily visits, they calculated an annual cost reduction of £76,440.00 (£169,369.20 at baseline reduced to £92,929.20). There is an assumption that these reductions in care need were ongoing for the whole year, and that the remaining clients had no change to their care needs, however this is not explicit in the paper.

These result in a total cost reduction estimation of £289,074 in care worker costs, if the reduction remains for a whole year, and other client requirements are unchanged. There is a brief discussion of the purchase of the in situ system being £450 at typical retail costs, with an expectation of a 2-year lifespan.

At the end of the 6-month study period, the prevalence of pressure ulcers decreased from 31 (n=25 Grade 1; n=3 Grade 2; n=2 Grade 3; n=1 Grade 4) at baseline, to just 3 (n=2 Grade 1; n=1 Grade 2), The authors used the NHS Pressure Ulcer Productivity Calculator, which is based on economic studies by Bennet et al, 2004, resulting in a calculated cost reduction of £79,000 per year. As a quality improvement study, there were not clearly stated inclusion criteria and therefore it is

uncertain if the pressure ulcers observed at baseline would have been expected to heal normally over the 6-month observation period, or if any decrease can be attributed to the use of in situ slide sheets.

Although forces reported by care workers were discussed, there are no reported changes in injuries, or attempts to relate these to economic findings.

There are limitations to the information reported from this study, and it has not undergone peer review, however it is based in an NHS and social services setting and is directly relevant to the decision problem. The key limitations are that it is a before and after observational study and reporting of inclusion criteria and some outcomes such as care worker visits is incomplete. It is however the only economic evidence of relevance that was identified.

6.3 *Additional economic evidence to inform modelling*

To inform model structures and inputs additional searches were carried out, primarily by identifying modelling in relevant NICE guidelines and snowballing to identify additional references. Additional web searches were used for specific items, including for sustainability and for utility values.

From these, 4 economic studies were identified that were more broadly informative to the decision problem defined by the scope, and these are summarised in Table 6. These were largely related to prevention or treatment of pressure ulcers, rather than different methods of repositioning or transfer. Due to a lack of clinical evidence to support any association between different slide sheets and pressure ulcer occurrence, these are mainly of relevance to a scenario analysis only.

Where additional papers were identified to inform individual model inputs these are described in Section 7.3 or 7.47.4.

Table 6 Economic studies of interest to modelling

Study	Description	Key findings	Relevance to scope or economic modelling
CG179 (2014)	Economic modelling: Repositioning for the prevention of pressure ulcers	More frequent repositioning leads to increased intervention cost, but a decrease in pressure ulcers together with lower treatment cost and higher utility.	• Costs of pressure ulcers, • Utility decrement related to pressure ulcers • Staff grades and times for repositioning
Posnett et al. (2023)	Economic modelling: skin moisture measurements as part of assessment and intervention to prevent hospital acquired pressure ulcers	Decision tree model found that the additional assessment resulted in a decreased cost, reduction in hospital acquired pressure ulcers and a gain in utility.	• Distribution of pressure ulcers across categories • Utility decrement related to pressure ulcers • Cost of pressure ulcers • Duration of pressure ulcers
Guest et al. (2018)	Costs and outcomes for pressure ulcers in UK, cohort study from 209 patients.	Mean pressure ulcer treatment costs and time to healing for infected and non infected wounds of different grades. Calculated for a 12 month period using routine data (THIN database)	• Costs of pressure ulcers • Duration of pressure ulcers

7 Economic evaluation

7.1 *Assessment of clinical equivalence*

The clinical evidence base was found to be very limited, with the majority of studies looking at the reduction of effort, or injuries when using slide sheets compared to cotton draw sheets, or alternatively comparing slide sheets to a more complex assistive technology. Therefore, the EAG is unable to make broad conclusions on clinical equivalence from the published evidence.

During discussions with experts at the scoping workshop, user preference workshop and follow up questions from the EAG, comments indicated that single patient use and washable devices were sufficiently friction reducing when new, and that this was not a differentiating factor when choosing a device. Some experts felt that disposable devices were not equivalent in friction reducing properties to other types of slide sheets, and could be problematic to use.

Given the lack of evidence, the EAG have assumed clinical equivalence in order to enable economic modelling, however the economic results should be considered in conjunction with expert opinions and experience (section 5.4)

7.2 *Regression analysis*

Linear regression was used to investigate the amount of price variation that could be explained by the presence of the following innovative features:

- Disposable, single patient use or washable,
- Single flat sheet, flat sheet in pair with bag, tubular and hybrid
- With or without handles
- Size of slide sheet

These features were chosen as they were discussed by experts as important, could be applied to all removable slide sheets and were relatively clearly and consistently described in the product descriptions.

It was assumed that two single flat sheets would have to be purchased for use, and therefore the priced was doubled for the regression analysis. The aim was to consider if there was a perceived value in purchasing them as a set in a bag, or individually. Size was split into four categories, based on discussions with experts during scoping and user preference workshops. Experts explained that for use on a bed the slide sheet should be full length, and there was a preference expressed for 1m x 2m. Larger slide sheets are required for use with double beds or where the person being moved is a larger size. The categories defined by the EAG were:

- Small – no dimension greater than 180cm, and so cannot be full length
- Medium small – at least 180cm long, but less than 100cm wide
- Medium – at least 200cm by 100cm
- Large – at least 180cm by 140cm

These definitions are to enable the regression only, and are not intended to be used in any other sense in the guidance. In some cases, information on sizing was not clear, in which case the EAG have used sizes listed in the NHS Supply Chain data where available.

In situ slide sheets were not included in the regression analysis, as they are considerably more expensive than removable slide sheets, have different features, are used in a narrower range of clinical scenarios and there are fewer devices available. In addition, the features of in situ slide sheets are not consistently described.

All devices included were available on NHS supply chain, and the framework prices were used, excluding VAT. An adjustment was used to allow the necessary purchase of two single flat slide sheets for use together, in comparison with sets of flat slide sheets or tubular slide sheets where only one purchase was required. The analysis was completed using Stata (Stata Statistical Software: Release 15, StataCorp).

7.3 *Economic modelling overview*

From the evidence searching and user preference workshops, the EAG determined that two features of slide sheets had sufficient evidence, or variation in the resultant pathway to allow some form of economic modelling or comparison. These two areas were:

- Washable compared to disposable and single patient use slide sheets (Sections 7.3 and 7.6)
- Removable compared to in situ slide sheets (Sections 7.4 and 7.7)

7.4 *Economic modelling for reusability features: washable compared to disposable or single patient use slide sheets*

7.4.1 Model structure

The EAG created a simple model to compare the costs of three different categories of slide sheet, as they might be used in different scenarios within the NHS and social services. The cost comparison was created in Microsoft Excel, and considers the expected lifetime and number of uses of each device. Costs include purchase,

reprocessing and disposal. Analysis has been performed in line with the NICE reference case, using an NHS and Personal Social Services perspective. Costs are expressed in 2023 prices and where necessary inflated using the NHS Cost Inflation Index (NHSCII). Discounting was not required due to the short time horizon (< 1 year).

The EAG is aware that the number of uses of a slide sheet per patient will vary greatly between different clinical settings, in addition the availability and cost of suitable laundry facilities will vary across different organisations. Given this variation, the EAG considered that it would be more informative to use a selection of scenarios for analysis, rather than a single base case. While these do not represent every setting where a slide sheet may be used, they are intended to reflect the breadth of different uses, as described by experts during workshops and follow up questions. The assumptions used to inform the scenarios were sent to experts for comment, and adjusted following their responses (Appendix G: Expert responses, Correspondence log).

The scenarios proposed are described in Table 7.

Table 7 Economic scenarios for reusability model

Scenario		Time period considered	Uses per day	Total uses
A	Outpatients, ambulance or A&E	<1 day	1	1
B	Acute ward, with stay of 1 week, occasional repositioning or transfer	7 days	2	14
C	Hospital stay, longer term, repositioning every 4 hours	30 days	6	180
D	Patient home, repositioning every 4 hours	6 months	6	1,095

Factors that influence how well the model reflects actual care are related to how slide sheets are used and how often they are spot cleaned, washed or replaced. These factors may include:

- Ability of the person being moved to independently reposition, which may mean that slide sheets are not required as often.

- Ability of the person being moved to assist in movements, which may mean that fewer caregivers are required for repositioning or transfers.
- Frailty or risk of pressure damage of the person being moved, which may increase the need for repositioning.
- Continence of the person being moved, which may determine how often slide sheets need to be cleaned, washed or replaced.

Several experts commented that scenario B may potentially use the slide sheets more often, and this has been considered in the scenario analysis

7.4.2 Model assumptions

The following assumptions are applied across all of the scenarios modelled:

- All of the slide sheets compared are equally effective at providing a low friction surface when new (Assessment of clinical equivalence, section 7.1)
- The single patient use slide sheet does not require replacement during use with a specific patient unless it is lost or soiled (alternatives discussed in sensitivity analysis, section 7.4.5).
- The washable slide sheet can be washed for 30 uses before there is a drop in performance.
- Washable slide sheets will be washed after the end of use with a specific patient, or every 100 uses.

7.4.3 Clinical parameters

Clinical equivalence has been assumed between the devices, i.e. all devices considered would be equally effective in providing a surface with reduced friction when new. Therefore, no clinical parameters were included.

This enabled modelling in the absence of efficacy data, and most experts agreed that different types of slide sheets were equally effective in providing a low friction surface when new. However, there were comments about the ease of use, problems of user error and durability from experts, and these are summarised in section 5.4 with additional information in Appendix G: Expert responses.

7.4.4 Resource use and cost parameters

Resource use is described in Table 8. There is a paucity of published literature or audit data to inform the parameters, however, the EAG have taken expert advice and included wide ranges of sensitivity analysis to consider the uncertainty. Cost parameters are described in Table 9.

Table 8 Resource use parameters

Item	Washable	Single patient use	Disposable	Source
Number of washes in lifetime	30	0	0	Assumption, checked with experts
Weight of device (kg)	0.298	0.137	0.370	John et al. 2024, EAG measurements, Supplier description
Probability that device is lost while at patient bedside	10%	10%	0	Assumption, checked with experts, tested in sensitivity analysis
Probability that device is lost during laundering	10%	0	0	Assumption, checked with experts, tested in sensitivity analysis

Table 9 Cost parameters

Item	Washable	Single patient use	Disposable	Source
Cost of purchasing a slide sheet pair	£8.85	£4.01	£1.92	NHS Supply chain, weighted mean of all products sold in 2023-4
Cost of laundering one item	£0.445	n/a	n/a	NHS Wales, All Wales Laundry Service (correspondence log)
Disposal cost per tonne (offensive or hygiene waste)	£414.82			Inflated from £330 in 2012. NHS Scotland Waste Prevention Guide
Cost of disposal per slide sheet pair	£0.25	£0.11	£0.31	

Purchase of devices The costs of the devices are taken from those flat slide sheets currently available in NHS Supply Chain, using a weighted average by volume sold in the year 2023-24. Costs of pairs of slide sheets in a bag, or tubular slide sheets were not included in the main analysis, however their prices are within the range considered in the sensitivity analysis.

Laundering Costs of laundering one device are taken from the All Wales Laundry Service, based on correspondence with Laundry Managers (correspondence log). The base case parameter of £0.45 is a mean value for all of Wales, with sensitivity analysis reflecting the range seen across different NHS Health Boards in Wales (£0.29 to £0.69). This cost covers the entire process of collecting, laundering and delivering the items back to the clinical site.

One paper (John et al. 2024) identified an evaluation of laundering facilities in the NHS, and included slide sheets, however this was a sustainability evaluation rather than costing study. The authors did not include any costs, or any discussion of damage or loss to items during the laundering process. The authors used an estimate of 100 washes before disposal for linen items, based on an audit of a large laundry unit where reusable personal protective equipment gowns were routinely laundered more than 100 times.

An unpublished audit that was completed during a tendering process for Sheffield Teaching Hospital NHS Foundation Trust by Nicky Sharpe and Sue Harrington, washed the slide sheets 50 times before testing the force required to move a volunteer. The authors reported that after this number of washes there were differences in the effectiveness of the slide sheets tested. Correspondence with the author indicated that approximately 25% of the slide sheets were replaced every year, meaning that they typically lasted 4 years. This cannot however be used to calculate the number of washes withstood, however if 50 washes represented a lifespan, this would equate to approximately 1 wash every 4 weeks.

A white paper (DHG) describes friction testing of fabric samples from two slide sheets (WendyLett and an un-named device). Testing was as described by Standard EN 14882:2005 at a variety of temperatures and humidity levels. The test were repeated on unwashed samples and after 10 and 30 washes. The mean coefficient

of friction for WendyLett and slide sheet 2 were 0.05N vs 0.04N unwashed, 0.03 vs 0.02N at 10 washes and 0.02 vs 0.05N at 30 washes.

The EAG used an assumption of 30 washes, following feedback from experts that our initial estimation of 52 may be too high. The assumption was tested in sensitivity analysis.

Losses and damage during laundering The EAG heard from experts that washable slide sheets were often damaged or lost in the laundry system. Therefore, an additional loss was factored into the model, over and above the expected number of washes. There was no audit data or other evidence to quantify this, however some of the factors mentioned by experts were:

- quality of the washable slide sheets,
- external or inhouse laundry system,
- ownership of the slide sheets – did they need to be returned to the ward, to a particular site, or owned centrally by the laundry system or wider NHS Trust.

The model used an assumption that 10% of washes resulted in the slide sheet being damaged or permanently lost and requiring replacement. This was varied in the sensitivity analysis between 0 and 20%.

Losses of slide sheets Experts explained that removable slide sheets are typically left in a bag hanging on the patient's bed, or tucked into the bed. There were a range of responses for how often these might not be found and would have to be replaced. This also includes the need for replacement due to contamination. The EAG used 10% as a base case, however it is very uncertain, and was varied between 0 and 20% in the sensitivity analysis. It will depend on the type of setting, movement of the patient to different locations and the possibilities of soiling. Sensitivity analysis for this variable was carried out including threshold analysis.

Single patient use slide sheets that are lost or soiled are assumed to require replacement with a new device. Washable slide sheets that are lost from the bedside or soiled during use are replaced with a clean, washed slide sheet. The model

assumed that the lost or soiled slide sheet will eventually be washed and returned into the system.

Disposal The cost of disposal is based on the weight of each item and the disposal method used. John et al. 2024 identified a mean washable slide sheet weight (from a locally conducted audit in an NHS hospital) of 0.298 kg. The weight of single patient use slide sheets was measured by the EAG from those used in the local NHS Health Board, and was 0.137 kg. Disposable slide sheet weights were obtained from queries to the suppliers, and based on the paper density (gms) descriptions of 180 and 190 gms. This equated to a weight per slide sheet of 0.37kg, which was surprisingly higher than other types. The potential impact of any error or discrepancy is very small overall.

It is assumed that used slide sheets were disposed of in striped yellow and black bags (NHS Property Services) where any contamination was non-infectious. This has a lower financial and environmental cost than incineration as clinical waste. Some experts reported that slide sheets would typically be placed in orange clinical waste bags (Appendix G: Expert responses). A full range of costs were considered in the sensitivity analysis.

A number of costs were available from public sources. Zero Waste Scotland reported costs in 2012 of £420 for clinical waste and £330 for hygiene waste. The EAG have used these figures inflated to 2023-4 prices. The base case assumes all products are disposed as hygiene waste, with sensitivity range increasing up to the cost of all products being disposed of as clinical waste. NHS Greater Glasgow and Clyde also report a cost of £503 per tonne for clinical waste and £160 per tonne for non-clinical waste, however the year of the costs is unclear. The Royal College of Nursing published a report in 2018 based on freedom of information requests sent to NHS Trusts in England. The report describes the types of waste classification, its disposal and a median cost per tonne of £241 (range £130 to £3,625) for offensive waste and £337 (range £26.30 to £5,000) for infectious (orange) clinical waste. The variation in the costs indicate that there may have been some misunderstandings in completing the freedom of information requests. The cost of disposal forms a relatively small part of the overall cost (2-4%), although there is also an environmental impact for waste disposal.

7.4.5 Sensitivity analysis

The main analysis already considered 4 alternative scenarios, limiting the number of additional scenarios required. One-way sensitivity analysis was used to look at how results may differ for different clinical settings, and uncertainty around key parameters. Probabilistic sensitivity analysis was used to estimate the impact of varying all parameters simultaneously around appropriate distributions. The additional scenario analyses were:

- Assuming no losses of slide sheets from the bedside
- Replacement of single patient use slide sheets after 100 uses
- Using costs for tubular slide sheets

7.5 Economic modelling: removable compared to in situ slide sheets

7.5.1 Model structure

A cost comparison model was created using a decision tree with a 6-month time horizon using Microsoft Excel. Analysis was in line with the NICE reference case, using an NHS and Personal Social Services perspective. Costs were expressed in 2023 prices and where necessary inflated using the NHS Cost Inflation Index (NHSCII). Discounting was not required due to the short time horizon.

The model was kept simple, with the key costs being the purchase, replacement and laundering of the slide sheets. The key resource use considerations were the number of staff, and time of staff required to reposition the patient.

The model was based on the paper by Sturman-Floyd (2011), where removable, washable, flat slide sheets were replaced with in situ slide sheets for a group of 110 patients, with reporting at baseline and at 6 months (see also section 5.3 and 6.2).

Therefore, the base case compared was also a removable, washable, flat slide sheet to an in situ base and top sheet set. Experts advised that in situ sheets would need regular laundering, but a removable slide sheet may be spot cleaned and would likely not need replacement over a 6-month period.

Additional scenarios, including parameters that might reflect a hospital setting, were considered in the sensitivity analysis.

Figure 1 shows the model structure depending on the choice of removable or in situ slide sheets. There is a requirement for “X” number of caregivers in the removable arm, and “Y” number of caregivers in the in situ arm.

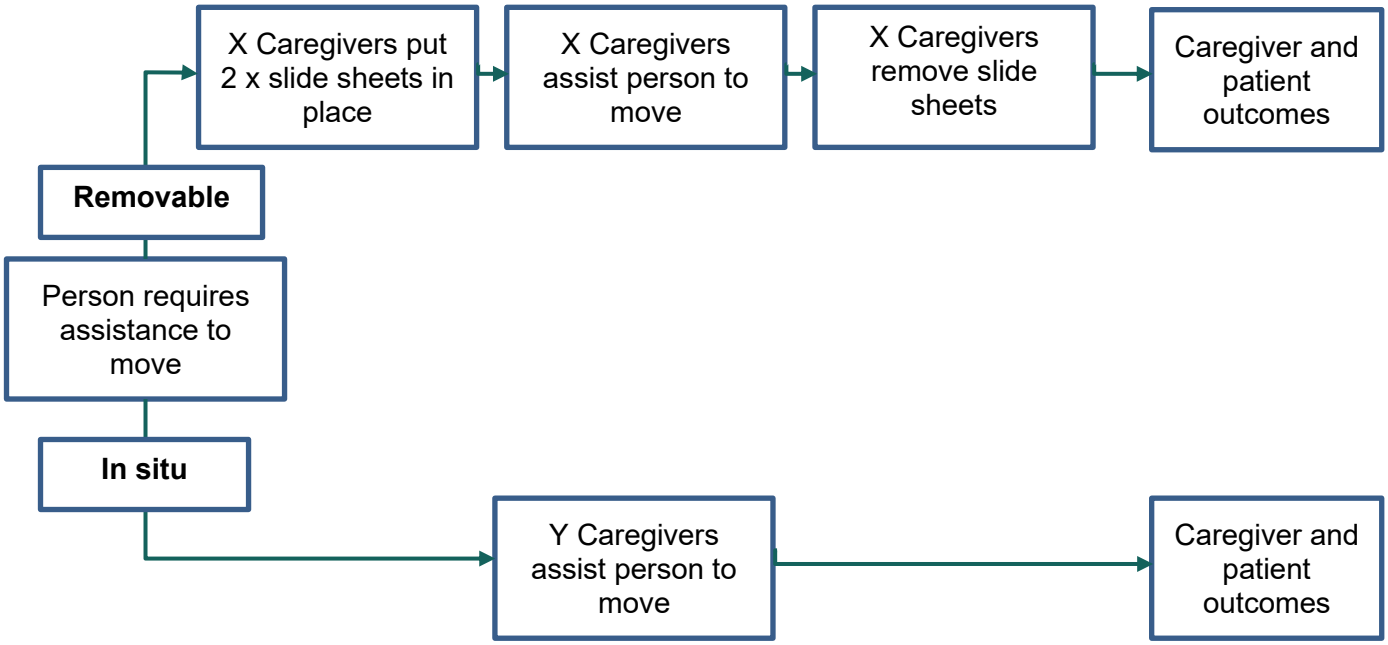

Figure 1 Model structure for removable vs in situ slide sheets

In situ slide sheets can be used across a number of settings, and for different reasons. These may include community or home use, or use in an acute setting where the person being moved cannot be rolled to allow the use of removable slide sheets. The people being moved may be able to participate in repositioning, or may not be able to assist. These factors, as well as the size and weight of the person being moved, will determine how many caregivers are required in order to carry out repositioning, and to what extent this can be reduced by changing the type of slide sheet. Experts also advised that in some cases family members may be trained to use an in situ slide sheet and have ability to reposition without the assistance of other caregivers.

7.5.2 Model assumptions

The base case makes the following assumptions:

- Repositioning is carried out by paid care workers in the person's home.
- The slide sheets are being used in the community for a 6-month period.
- The removable slide sheet can be wiped clean if needed, but will be laundered after an average of 100 uses. Two sets are required to allow laundering.
- The in situ slide sheets are washed every 3 days, and at least two sets are required to allow laundering.
- The slide sheets do not have a drop in performance during their lifespan.
- The slide sheets may be washed and used by another patient at the end of the model (although an additional scenario assumes that they are disposed of at the end of the modelled period).

7.5.3 Clinical parameters

There was an assumption that all devices considered would be equally effective in providing a surface with reduced friction when new (section 7.1). The devices do have a different mechanism of use however. In situ slide sheets require much less activity to achieve repositioning, both for the caregiver and the person being moved. A lack of evidence has led to modelling effectively assuming clinical equivalence in the base case scenario, as no clinical parameters have been included. The parameters considered by the EAG and the limitations of available evidence are discussed below.

Pressure ulcers or skin damage Due to limited data, this was not included in the base case, however it has been included as an additional scenario. Sturman-Floyd (2011) reported a lower number of pressure ulcers in participants after use of the in situ system for a 6 month period. This study reports very limited information on how participants were chosen for inclusion. The EAG cannot be certain that the baseline numbers of pressure ulcers is representative of the normal pressure ulcer prevalence for that group. Individuals with newly acquired pressure ulcers may have been added to the care worker list for that reason, or prioritised for inclusion in the study. The mean time for healing reported by Guest et al. (2018) is less than 6 months for both grade 1 and grade 2 pressure ulcers. Therefore, a high proportion of

the observed pressure ulcers may have been expected to heal within that time frame with normal care.

The EAG did not find any other evidence of reduced pressure ulcers for in situ compared to removable devices that was in scope. There were 3 papers or posters that described a reduction in pressure ulcers when using a device that combines in situ slide sheets with positioning aids compared to removable slide sheets without positioning aids (Way 2014, Way 2016, Powers 2016), as well as inconclusive results in one study (De Meyer et al. 2019). It is not possible to distinguish any impact of the in situ slide sheets in isolation from the positioning aids.

Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline (EPUAP/NPIAP/PPPIA: 2019) reported limited evidence that low friction bedding or undergarments may reduce the risk of pressure ulcers, when compared to cotton sheets or clothing. These are different devices to the low-friction in situ sheets, and may have different friction reducing properties as well as different impacts on moisture and other risk factors, and cannot inform the comparison for this report.

For these reasons the economic base case does not include the costs or dis-utilities of pressure ulcers, although a reduction is reported in Sturman-Floyd (2011). However, both are included as an additional scenario.

Caregiver injury Due the absence of relevant data, this was not included in the base case, or any scenarios. The EAG did not find any evidence for different rates of care giver injury when comparing in situ and removable slide sheets that were in scope. There were 2 papers or posters that described a reduction in caregiver injury when using a device that combines in situ slide sheets with positioning aids compared to removable slide sheets without positioning aids (Way 2014, Powers 2016). It is not possible to distinguish any impact of the in situ slide sheets in isolation from the positioning aids.

Caregiver injuries were not reported in Sturman-Floyd (2011) and no other evidence has been found to inform the model.

Pain during repositioning No evidence was found to allow comparison of pain during repositioning with removable slide sheets or in situ slide sheets, and therefore it has not been used in the base case, or scenario models. It is likely that this is an important consideration for any future work. During the scoping meeting the EAG heard from experts and a caregiver that in situ slide sheets could be less disruptive to people being moved, and that this might reduce the pain and discomfort experienced.

The Clinical Practice Guideline 2019 does not give comparative information for different slide sheets, but does summarise indirect evidence that repositioning can cause pain, especially in individuals with chronic pain, limited cognitive ability or receiving end-of-life care. This included an observational study in a hospital reporting on 1,395 patients without pressure ulcers, using a pain score, which suggested that repositioning was associated with moderate pain (Faigeles et al., 2013). An additional study reported qualitative findings of pain during movement and use of repositioning equipment in people with multiple sclerosis and pressure injuries (McGinnis et al., 2015). The guidance also stated that for some people receiving end-of-life care repositioning may not be as frequent, as they may prefer a single position for comfort (Clinical Practice Guideline 2019).

7.5.4 Resource use and cost parameters

Resource use parameters are summarised in Table 10

Frequency of repositioning and staff requirement NICE recommend frequent changes of position, and at least every 6 hours, or 4 hours for those at high risk of developing a pressure ulcer. The Clinical Practice Guideline 2019 recommends an individualised schedule, considering the individual's response to repositioning. They state that repositioning should be performed by at least two health professionals.

When considering someone in the community, experts explained that care workers would visit for a number of functions such as toileting, washing etc and repositioning would happen alongside these other activities. They also explained that informal caregivers may assist with repositioning in between care worker visits.

These findings are similar to the reported care in Sturman-Floyd 2011. In this study, people received visits from care workers either 3 or 4 times a day. The visits were initially from 2 care workers but were reduced to 1 care worker for some people after the introduction of in situ slide sheets. It was explained that in these cases an informal caregiver had been enabled to assist care workers in the repositioning tasks. The authors also mentioned that some informal caregivers found it easier to assist people to reposition with the in situ slide sheets in place at times other than a care worker's visit. The model is able to include additional slide sheet uses from informal caregivers, the base case parameter is set at zero, however it is included in sensitivity analysis.

Sturman-Floyd (2011) reported that from 110 patients, 82 had no change in the numbers of care workers visiting. For those patients living with obesity, 67% (4/6) were able to change from 4 care workers per visit to 2 care workers. A further 22 patients were able to change from 2 care workers per visit to 1 care workers, for either 3 or 4 visits per day following the introduction of in situ slide sheets.

The duration of visits has been assumed to be 20 minutes, including travel time for care workers. This will be very variable depending on the location and is varied in the sensitivity analysis. There is an assumption that if the additional care workers are not required for repositioning, then they are not required for other tasks during the visit.

Slide sheet losses during use This is assumed to be lower than in hospital use, and has been set at 2%, with this being applied at every use for removable slide sheets, and at every wash for in situ slide sheets. This is because in situ slide sheets remain on the bed between washes.

Slide sheet losses during laundry This has also been assumed to be 2%, as items are less likely to be lost during washing in a domestic setting, but may still be damaged. Both types of loss are examined in sensitivity analysis using a range of 0 to 10%, and in additional scenario analysis.

Table 10 Resource use parameters, in situ vs removable model

Item	Parameter	Source
Proportion of people being moved who are living with obesity	5.5%	Sturman-Floyd (2011) (6 / 110)
Mean number of care worker visits at baseline, for people living with obesity	16	Sturman-Floyd (2011), based on 4 visits per day, each with 4 care workers.
Reduction in number of care worker visits when using in situ, for people living with obesity	33.3%	Sturman-Floyd (2011), based on 4 out of 6 patients reducing to 2 care workers per visit.
Mean number of care worker visits at baseline for people not living with obesity	7.02	Sturman-Floyd (2011), based on 2 or 3 visits per day, each with 2 care workers.
Reduction in number of care worker visits when using in situ, for people not living with obesity	10.7%%	Sturman-Floyd (2011), based on 4 out of 6 patients reducing to 2 care workers per visit.
Staff grade	Home care worker	Sturman-Floyd (2011),
Time required for repositioning	20 min	Assumption, checked with experts and sensitivity analysis
Losses during use	2%	Assumption, applied per use for removable and per wash for in situ.
Losses during laundry	2%	Assumption, applied per wash for both types of slide sheet

Cost parameters are described in Table 11. The costs of the devices are taken from single patient use flat slide sheets available in NHS Supply Chain currently, using a weighted average by volume sold in the year 2023-24. The cost of the set of in situ base and top sheets is taken from a publicly available retail cost, to avoid disclosing confidential pricing information. A set of results using the NHS Supply Chain cost was also provided to the committee.

Costs of laundering are taken from the published costs for the All Wales Laundry Service. In community situations where care is at home, the laundering would likely be carried out by informal caregivers of the person being moved. In this case that these costs are met by families and not an NHS and personal social services cost,

then cost for in situ slide sheets would decrease by a small amount compared to removable slide sheets, as they are washed more frequently. More detail on laundry costs are given in section 7.4.4. The in situ slide sheets are assumed to be washed every 3 days following expert advice. The experts noted that this was very variable, it may be as often as daily if required, or may be much longer.

It is assumed that disposal was as offensive waste (yellow and black bags), as described in section 7.4.4. Removable slide sheets were assumed to be washed 30 times before needing disposal, as described in section 7.4.4. Experts advised that an in situ slide sheet would be expected to last without replacement for 6 months. Therefore, the EAG assumed 80 washes before replacement, allowing washing slightly more frequently than 3 times a day for a 6-month model duration.

Table 11 Key cost parameters, in situ vs removable model

Item	In situ	Removable	Source
Cost of purchasing devices (pair)	£198 [redacted]	£8.85	NHS Supply Chain for removable (two single flat sheets) Publicly listed price for in situ (Set of in situ devices), and confidential cost from NHS Supply Chain
Weight, pair (kg)	1.639	0.596	John et al. 2024 Supplier brochure
Disposal costs per item	£0.68	£0.25	Costed as described in Table 9.
Washes prior to disposal	80	30	Expert advice
Uses prior to washing	3 days	100 uses	Expert advice
Laundering costs per single item	£0.445	£0.445	NHS Wales, All Wales Laundry Service
Staff time per hour	£27	£27	PSSRU 2023 home care worker rate

7.5.5 Health state utilities

Searches for appropriate utility values used the methods described in NICE TSD 9, in particular searches of economic models used in NICE guidance and Cost-effectiveness Analysis Registry. The EAG were unable to identify any utility values that were associated with repositioning or transfers. Therefore, no utilities were

included in the base case analysis. Disutility values are available for pressure ulcers, and are described in the scenario analysis where pressure ulcer data is included in the model.

7.5.6 Sensitivity analysis

One way sensitivity analysis was used to consider the variation of parameters, given the range of possible uses described by experts. In particular threshold analysis was used to model the impact of changes in the cost of the in situ slide sheet, and two way sensitivity analysis included the impact of losses, with the in situ slide sheet cost.

Additional results were calculated that included the pressure ulcer data reported by Sturman-Floyd, 2011. For this calculation, the costs and disutilities applied are described in Table 12.

Table 12 Parameters for scenario including pressure ulcers

Pressure ulcer severity	Costs	Disutility	Source
Grade 1	£1,856.71	0.009	Costs: Guest 2018, inflated to 2023 prices Disutility: Posnett 2023, Palfreyman 2015, Bennett 2004
Grade 2	£1,1637.08	0.052	
Grade 3	£1,3048.95	0.087	
Grade 4	£1,3519.17	0.106	

Additional scenarios were:

- Assuming that new slide sheets are purchased at the start of the model, disposed of at the end, and that any damaged or lost need to be replaced with new ones.
- A hospital setting, assuming that time for repositioning is reduced to 5 minutes, and the probability of loss is 10% as in the previous model (section 7.4)

7.6 Results of regression analysis

The devices included from NHS supply chain were made up of 171 removable slide sheets and 31 in situ slide sheets. Devices were classified with the features described in Table 13):

Table 13 Features included in regression

Variable name	Feature or category
Type	removable or in situ,
Reuse	disposable, single patient use or washable,
Type2	single flat sheet, flat sheet in pair with bag, tubular, hybrid
Handle	handles, no handles
Size	Small, medium small, medium, large

All in situ slide sheets were washable. For the removable slide sheets, from those in the provided data, 5 (3%) were disposable, 93 were single patient use (56%) and 68 were washable (41%). The removable slide sheets were single flat sheets (n=95, 57%), flat sheets in pairs in a bag (n=13, 8%), hybrid (n=1, <1%), or tubular (n=57, 34%).

In terms of NHS Supply chain sales, in the data shared with the EAG, there were 50% (n=1,137,862) single flat sheets, 11% (n=246,9634) sets of flat sheets in a bag and 39% (n=897,488) tubular or hybrid. When considering the reusability there were 80% single patient use (n=1,835,535), 19% disposable (n=430,258) and only 1% (n=16,521) washable. There may be some discrepancies where the EAG were not confident of the correct classification of devices due to limited information, however this only relates to a small proportion.

Unit costs were adjusted to allow for the fact that two single flat sheet purchases are required, compared to only one purchase of a tubular, hybrid or bag with a pair of flat sheets. This was done simply by doubling the cost of the flat slide sheet, to represent a useable set. All costs were obtained from NHS Supply Chain, assuming use of price category B1, and are exclusive of VAT, in accordance with the NICE reference case.

Linear regression resulted in an R^2 value of 0.46 meaning that only 46% of the price variation was explained by these features (Table 14). The F-statistic was 14.59 (p value =0.0000) indicating that the model as a whole is statistically significant, or that the features chosen do collectively have a significant influence on the price. Three features were found to be associated with significantly higher device price. These were the presence of handles, and the device being washable, and a small size. Non-significant, lower device price was seen for pairs of flat sheets in a bag or tubular, compared to single flat sheets, with the price adjusted to compare for the number required for use, as described above. Hybrid sheets had a non-significantly higher price. The difference between 2 single flat sheets and tubular or hybrid slide sheets was small.

Table 14 Regression of adjusted unit cost, with slide sheet features

Number of observations	**166**
F(9, 156)	14.59
Prob > F	0
R-squared	0.457

	Coefficient	**Standard. Error**	**t**	**P value**	**Lower 95% CI**	**Upper 95% CI**
Type *(2 single flat sheets as comparator)*						
flat with bag	-1.13609	1.071804	-1.06	0.291	-3.253212	0.981032
hybrid	0.293754	3.450855	0.09	0.932	-6.522676	7.110185
tube	-0.25301	0.641517	-0.39	0.694	-1.520188	1.014171
Handle *(with handles as comparator)*						
No Handles	-2.80414	0.672294	-4.17	0	-4.132112	-1.47616
Reuse *(single patient use as comparator)*						
Disposable	-3.05835	1.655067	-1.85	0.067	-6.327586	0.210881
Washable	4.142457	0.571639	7.25	0	3.013305	5.271609
Size *(large as comparator)*						
Medium	-1.38444	0.739188	-1.87	0.063	-2.844551	0.075666
Medium small	-0.43861	0.91606	-0.48	0.633	-2.248089	1.370874
Small	-4.34156	0.729257	-5.95	0	-5.782054	-2.90107
_cons	9.524826	0.750952	12.68	0	8.041479	11.00817

After examining the data, it was noted that there was one outlying point that represented a device (a tubular slide sheet) that is no longer available on NHS Supply Chain. When this device was removed, the R^2 value increased to 0.63, or 63% of the price variation was explained by the included factors (Table 15).

In this analysis additional features significantly correlated to the device price ($p<0.001$). As in the previous analysis, the presence of handles, and the device being washable both increase the cost. In this analysis, tubular slide sheets were associated with a statistically significant lower device price, with the price adjusted to compare for the number required for use, as described above. All of the size categories were associated with a significant difference to the price.

Table 15 Regression of adjusted unit cost, with slide sheet features, outlier removed

Number of observations	165
F(9, 156)	29.65
Prob > F	0
R-squared	0.6326

	Coefficient	Standard. Error	t	P value	Lower 95% CI	Upper 95% CI
Type *(2 single flat sheets as comparator)*						
flat with bag	-1.39922	0.720791	-1.94	0.054	-2.823059	0.024623
hybrid	-0.20526	2.320176	-0.09	0.93	-4.788509	4.377985
tube	-0.98858	0.434556	-2.27	0.024	-1.846992	-0.13016
Handle *(with handles as comparator)*						
No Handles	-2.94341	0.452074	-6.51	0	-3.836426	-2.05038
Reuse *(single patient use as comparator)*						
Disposable	-2.01573	1.115212	-1.81	0.073	-4.218705	0.187246
Washable	3.447272	0.387586	8.89	0	2.68164	4.212905
Size *(large as comparator)*						
Medium	-1.38543	0.496931	-2.79	0.006	-2.367058	-0.40379
Medium small	-2.18275	0.628689	-3.47	0.001	-3.424653	-0.94084
Small	-4.15197	0.490448	-8.47	0	-5.120797	-3.18315
_cons	10.16409	0.506964	20.05	0	9.162643	11.16554

The largest group of removable devices were single flat slide sheets, and these were included as a separate sub analysis, with very similar results.

A visual comparison of the prices for the included removable devices available through NHS Supply Chain are shown in Figure 2, Figure 3 and Figure 4. The prices

used are adjusted as described above (with those sold as single flat sheets having their price doubled, to be used as a pair) and with the single outlier removed. The hybrid device is not included as there was only one available, and the prices are confidential. It can be seen that although there are differences between features, there is also considerable overlap between the prices of the available devices.

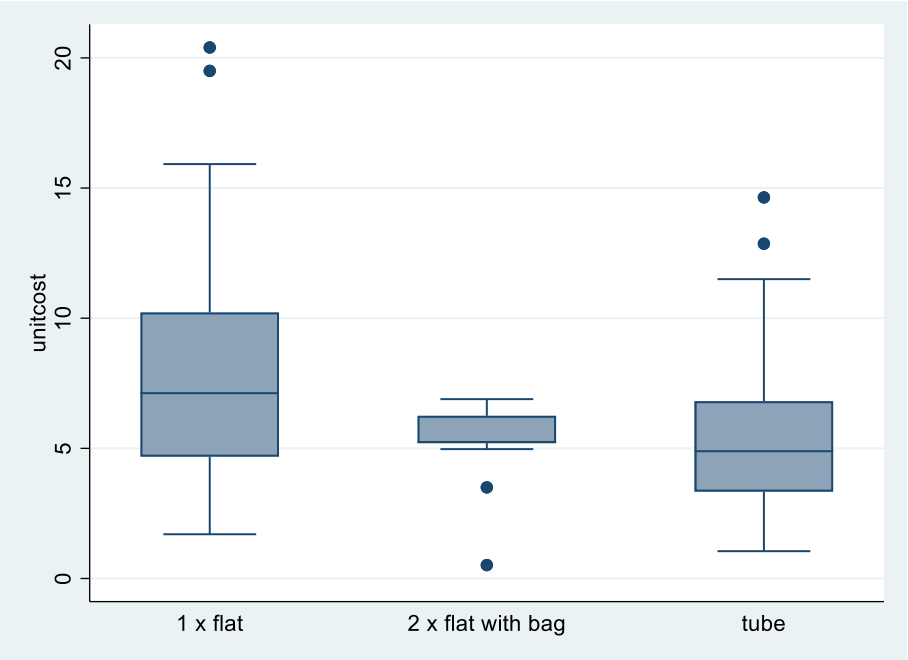

Figure 2 Adjusted unit Cost (£) for different types of removable slide sheet

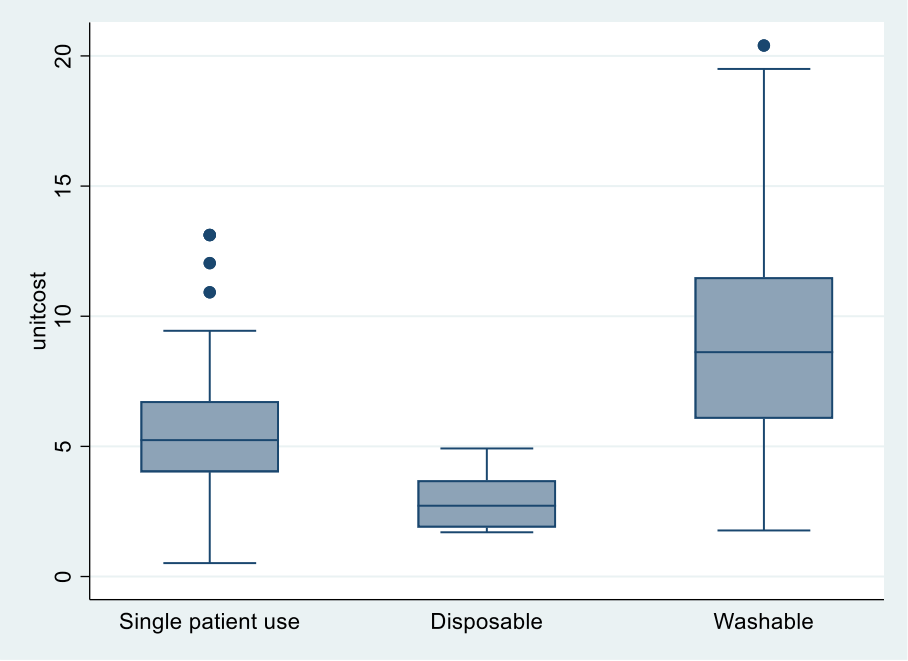

Figure 3 Adjusted unit Cost (£) for single patient use, disposable and washable slide sheets

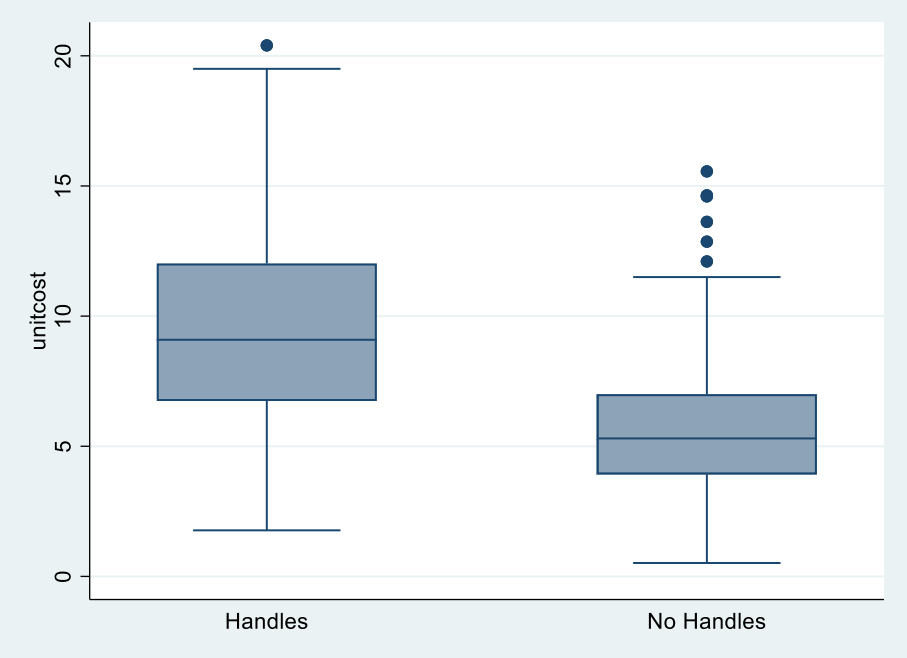

Figure 4 Adjusted unit Cost (£) for slide sheets with and without handles

7.7 Results from economic modelling: Reusability

7.7.1 Base case results

The modelling used four scenarios in the base case, which are summarised in Table 16 for convenience. The results are shown in Table 17, for each of the disposable, single patient use and washable types of device. The results include both an assumption of no losses of device occurring throughout the duration of the scenario, and an assumption that on 10% of occasions that a slide sheet is used it is either missing from the bedside or has to be replaced due to soiling. For the washable slide sheet there is an additional assumption that the slide sheet is lost or damaged on 10% of washes.

Table 16 Scenarios for economic modelling

Scenario		Time period considered	Uses per day	Total uses
A	Outpatients, ambulance or A&E	<1 day	1	1
B	Acute ward, with stay of 1 week, occasional repositioning or transfer	7 days	2	14
C	Hospital stay, longer term, repositioning every 4 hours	30 days	6	180
D	Patient home, repositioning every 4 hours	6 months	6	1,095

The modelling finds that where the slide sheets are only used once per patient (Scenario A) the disposable slide sheets cost £2.23, single patient use cost £4.26 and the washable cost £1.25, making the washable slide sheet the least costly option.

Table 17 Economic modelling results for individual devices and incremental costs

Scenarios		Results cost of slide sheets per patient				
		Disposable	Single patient use		Washable	
			No losses	With losses[a]	No losses	With losses[b]
A	1 day, 1 use only	£2.23	£4.12	£4.12	£1.19	£1.23
B	7 days, 2 uses per day	£31.20	£4.12	£9.89	£1.19	£2.94
C	30 days, 6 uses per day	£401.16	£4.12	£78.27	£2.08	£24.54
D	6 months, 6 uses per day	£2,440.40	£4.12	£455.23	£10.09	£147.85

[a] 10% of uses the device is not at bedside or is soiled during use
[b] 10% of uses the device is not at bedside or is soiled during use, 10% of washes result in the device being lost or damaged and requiring replacement.

Scenario A is the only scenario where disposable slide sheets are not the most expensive option in the model. Therefore Table 18 compares the incremental cost of single patient use compared to washable only. Where there are assumed to be no losses of devices, the washable device remains less costly than single patient use for scenarios A, B and C, however for longer term use in scenario D, the single patient use is modelled as less costly. This is because the base case assumes that the washable slide sheet is laundered after 100 uses even if it is still being used by the same patient, whereas the single patient use slide sheet is not changed.

Table 18 Incremental cost per patient of single patient use compared to washable

Scenario	Incremental cost of single patient use slide sheets compared to washable slide sheets, per patient	
	No losses	With losses
A	£2.93	£2.89
B	£2.93	£6.94
C	£2.04	£53.73
D	-£5.97	£307.37

Once the losses are included, the washable slide sheets are less costly than the single patient use slide sheets in each scenario.

The results should be interpreted in conjunction with expert advisor comments on the practicalities of using the different types of slide sheet, and the issues that have been encountered with implementing laundering systems for the washable devices. These are discussed further in sections 5.4 and 7.9.

7.7.2 Sensitivity analysis results

One-way sensitivity analysis was used in scenarios B to D to calculate the incremental cost of single patient use compared to washable devices, including losses by the bedside and in laundering. In all cases the washable devices remained cost saving compared to the single patient use device except in scenario D, where a low proportion of losses by the bedside could cause the singe patient use device to become the least costly option.

Tornado diagrams are presented in Figure 5, Figure 6 and Figure 7 for each scenario.

One-way sensitivity analysis was not presented for Scenario A as it is impacted by fewer variables. Disposable slide sheets are not included in the tornado diagrams due to the high margin by which they increase costs compared to other devices in all scenarios other than A.

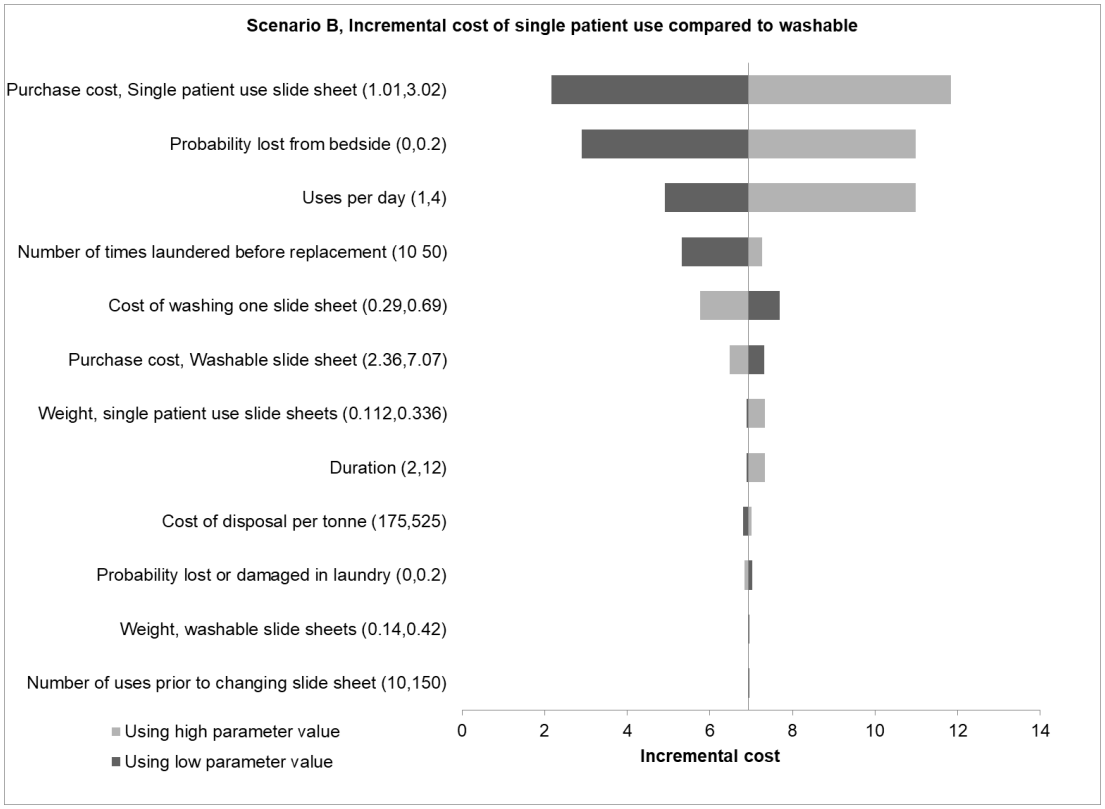

Figure 5 Tornado diagram, one-way sensitivity analysis for Scenario B

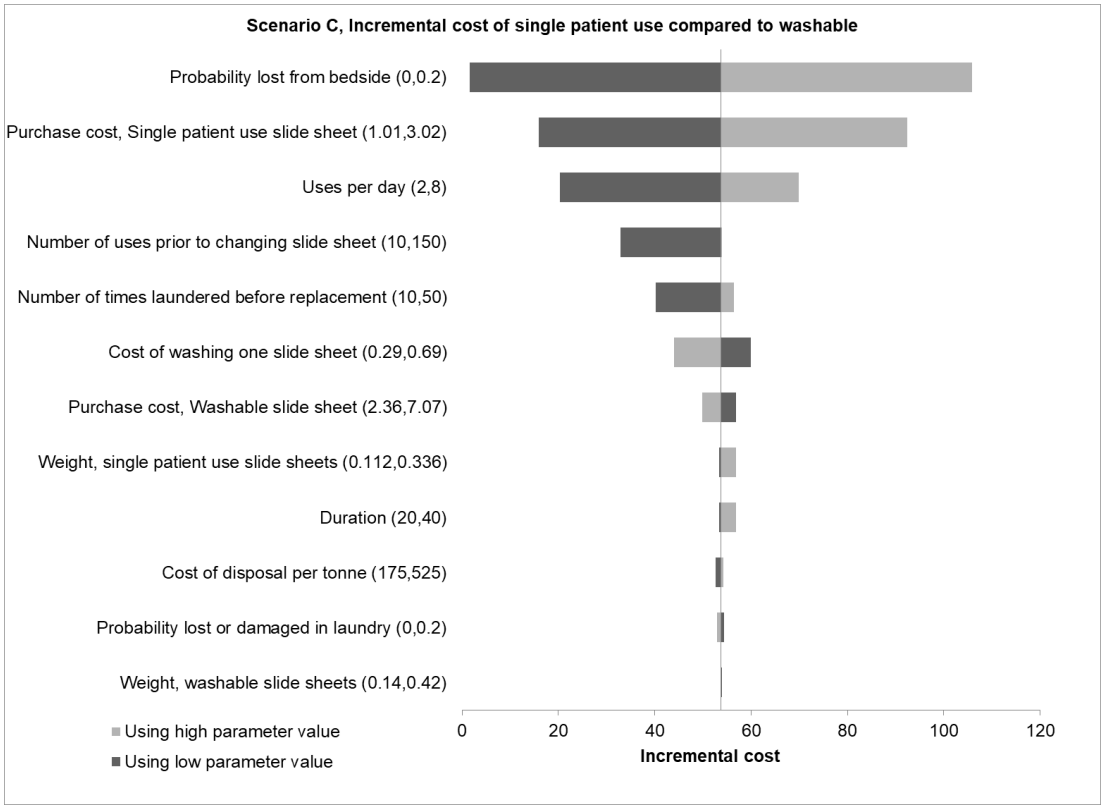

Figure 6 Tornado diagram, one way sensitivity analysis for Scenario C

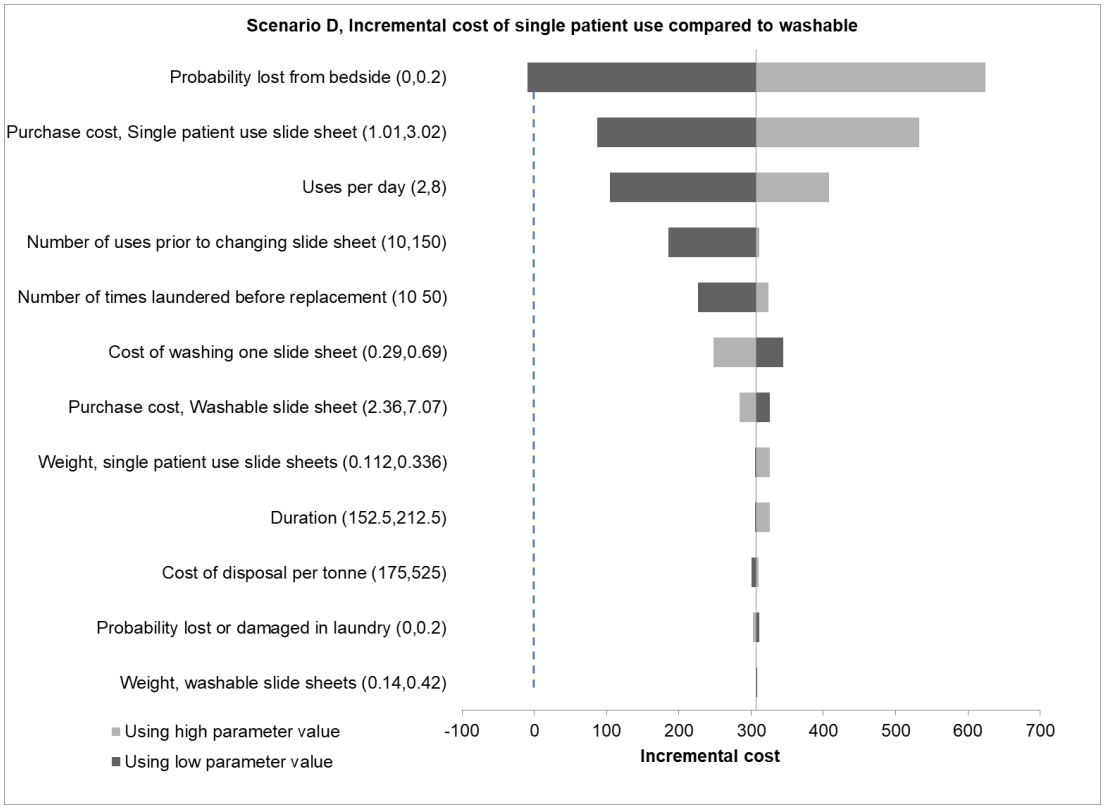

Figure 7 Tornado diagram, one way sensitivity analysis for Scenario D

Due to the clear importance of the likelihood of losing or having to replace slide sheets after use, additional analysis was carried out using a threshold diagram (Figure 8 Threshold diagramFigure 8). This illustrates the impact of this variable, and it should be seen as demonstrating the impact of different settings, and different organisational approaches, rather than attempting to find a single value that is common across the UK. It was noted that for scenario D, a 10% loss rate results in 109 replacements in a 6-month period which may be unrealistic, especially if it is likely to be in a community setting. It was seen that the loss rate has to be below 0.3% for the single patient device to become the least costly option, or less than 3 replacements being required in a 6-month period. As discussed earlier, findings should also be considered together with the implementation issues explained by experts for different slide sheet types

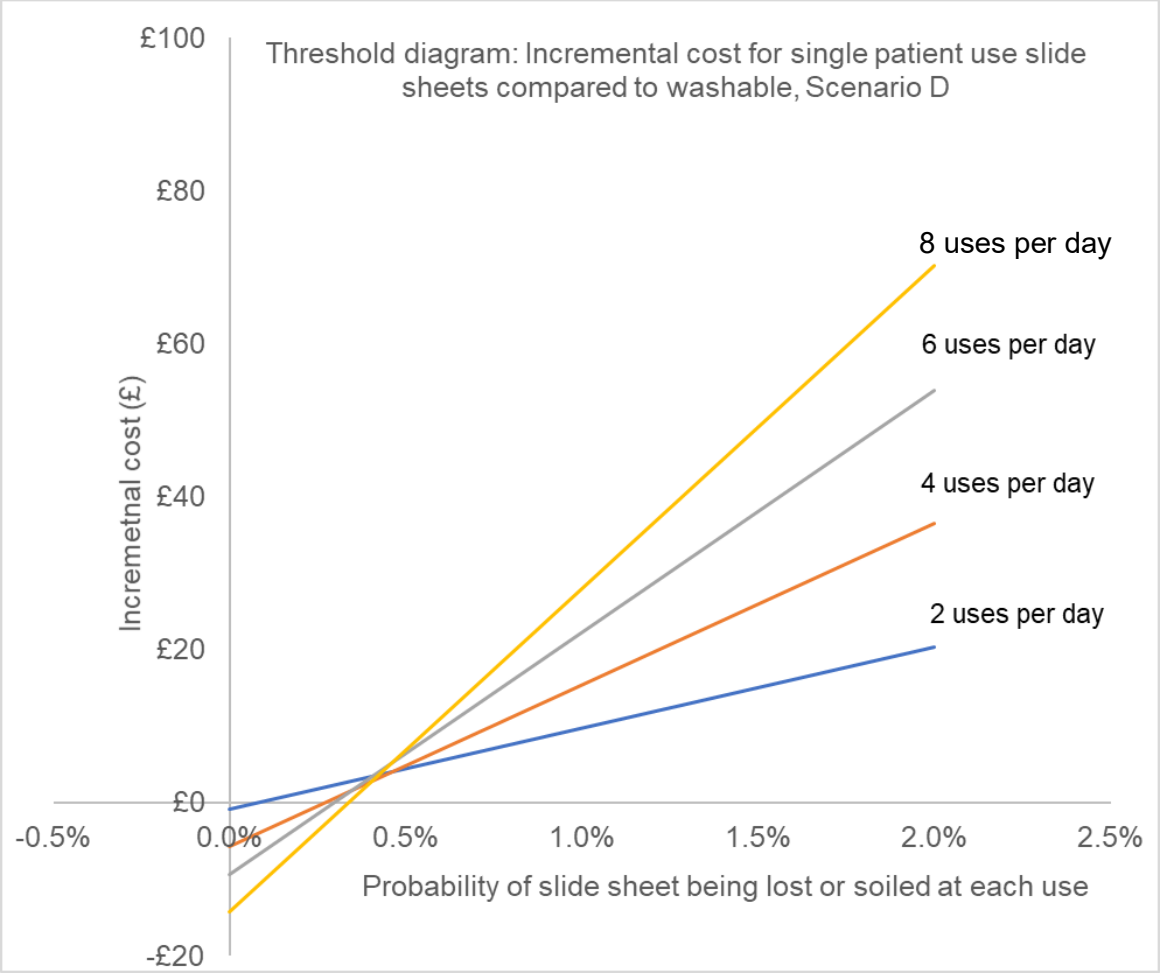

Figure 8 Threshold diagram

Probabilistic sensitivity analysis (PSA) compared all three device types, including the loss calculations. After 1000 iterations, the model found that washable devices were the least costly in all scenarios (scenario A: 93% probability, scenario B: 97% probability, scenario C: 97% probability, and scenario D: 96% probability), Table 19. As for other sensitivity analysis, the only scenario in which disposable devices came out as the least costly with any variation in parameters was scenario A, and this was only an 5% probability.

Table 19 PSA results for all scenarios

	Scenarios			
	A	**B**	**C**	**D**
Disposable	5%	0%	0%	0%
Single patient use	3%	3%	3%	4%
Washable	93%	97%	97%	96%

7.7.3 Scenario analysis results

When it is assumed that the single patient use slide sheets will need replacing after approximately 100 uses with a single patient, their cost increases relative to the washable slide sheets (where the base case assumption is that they would be washed after 100 uses). Using this assumption, the washable slide sheets are the least costly option in all of the base case scenarios (Table 20).

Table 20 Incremental cost of using single patient use compared to washable

Incremental cost of single patient use compared to washable, flat slide sheets		
Scenario	**Base case, no losses**	**Assuming single patient use replaced after 100 uses**
A	£2.93	£2.93
B	£2.93	£2.93
C	£2.04	£10.28
D	-£5.97	£39.34

When costs for tubular slide sheet were used, the findings were very similar to those of the base case analysis, which used flat slide sheets.

7.8 Results from economic modelling: Removable compared to in situ slide sheets

7.8.1 Base case results

The base case assumes a 6-month model in a community setting, where slide sheets may be used with more than one patient, provided they can be laundered adequately. The results are summarised in Table 21

Table 21 Base case summary results

	Removable	**In situ**	**Incremental cost for in situ**
Device purchase and replacement	£24.42	£256.16	£231.73
Care worker visits	£12,333.68	£10,691.18	-£1,642.50
Total	**£12,358.11**	**£10,947.34**	**-£1,410.77**

Providing the in situ device costs £231.73 more than removable slide sheets, per person, over the 6 month time horizon. During this time, the model calculates that a number of slide sheets are changed before they would normally be washed, due to soiling, or being misplaced by the bedside. An additional proportion are damaged during each wash. This is summarised in Table 22

Table 22 Slide sheet replacements during time horizon

	Removable	In situ
Number replaced due to wear	0	0
Number changed due to soiling or loss during use	12.91	1.22
Number of washes	6.45	60.8
Number replaced due to laundry damage or loss	0.13	1.22

Confidential results are provided in Table 23, using the device cost from NHS supply chain.

Table 23 Base case summary results using confidential pricing

	Removable	In situ	Incremental cost for in situ
Device purchase and replacement	[redacted]	[redacted]	[redacted]
Care worker visits	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]

7.8.2 Sensitivity analysis results

One way sensitivity analysis to examine the impact of alternative values for each of the parameters is shown in a tornado diagram, Figure 9.

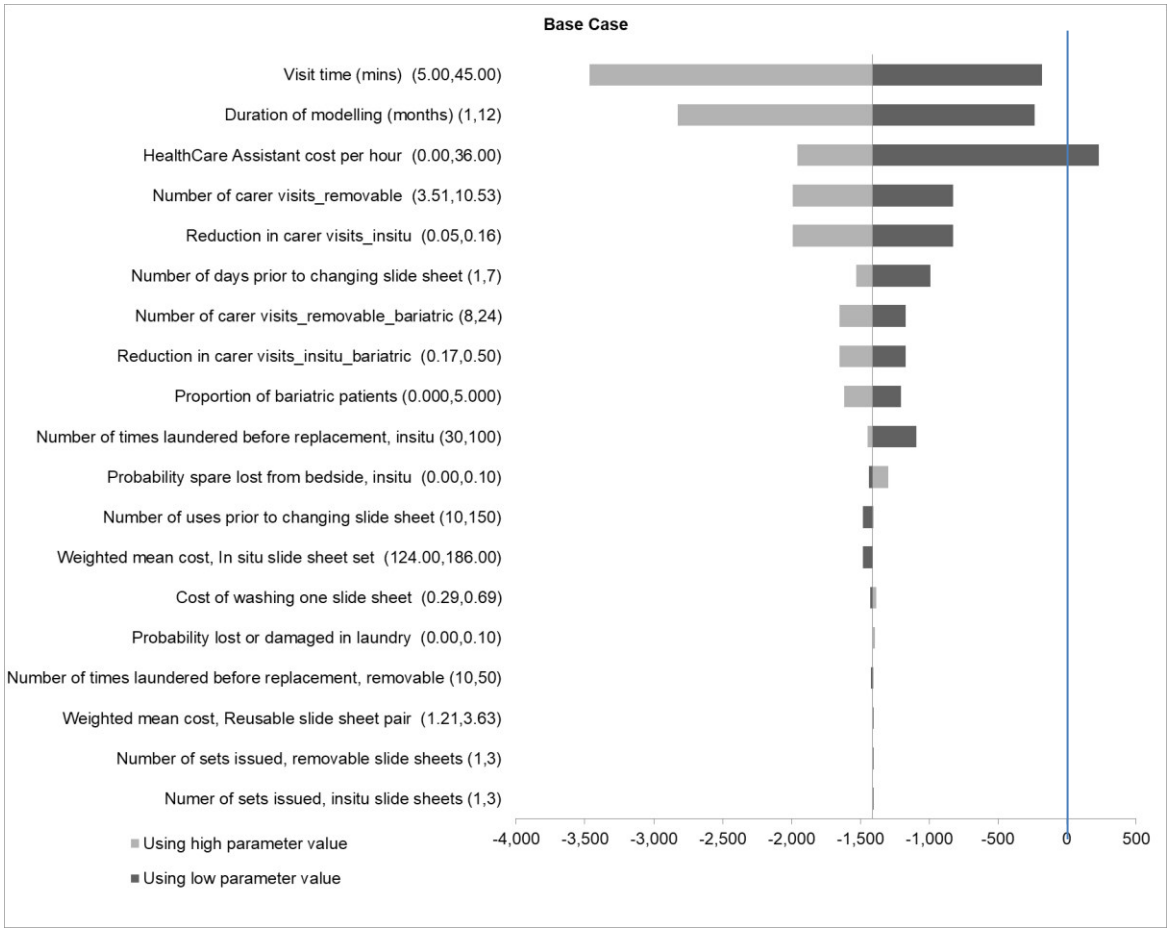

Figure 9 Tornado diagram, base case, incremental cost of in situ vs removable

In the base case, the only parameter that makes the removable device less costly than the in situ device is where the cost of the care worker is approaching zero. This would effectively be where the care is being carried out by informal caregivers only, or where there is no change in the mean number of care workers per visit.

7.8.3 Scenario analysis results

Base Case including pressure ulcers

Where the cost and utility impact of pressure ulcer reduction is included, the cost saving from using in situ slide sheets is increased. This result is included (Table 24) only as a scenario due to uncertainty about the generalisability of the study findings.

Table 24 Results for base case including cost and utilities associated with pressure ulcers

	Removable	In situ	Incremental cost for in situ

Device purchase, laundry and replacement	£24.42	£256.16	£231.73
Care worker visits	£12,333.68	£10,691.18	-£1,642.50
Pressure ulcer care	£1,099.51	£139.55	-£959.96
Total costs	**£12,481.01**	**£10,947.34**	**-£2,370.73**
Total utilities	**0.2470**	**0.2497**	**0.0027**

This makes the in situ slide sheet dominant, compared to removable slide sheets, with an incremental Net Monetary Benefit (NMB) of £2,424 at a willingness pay threshold of £20,000 per QALY.

Devices purchased for each user and disposed of after use

In the scenario where devices are purchased for each user, and disposed of at the end of use, the results are summarised in Table 25

Table 25 Results when devices purchased for each user and disposed of after use

	Removable	In situ	Incremental cost for in situ
Device purchase, laundry and replacement	£142.56	£936.02	£793.46
Care worker visits	£12,333.68	£10,691.18	-£1,642.50
Total	**£12,476.24**	**£11,627.20**	**-£849.04**

The in situ slide sheets remain cost saving, including the savings from reducing care worker time, however the difference is reduced from base case. When sensitivity analysis is used to vary the parameters, there are many more variations that become cost incurring (Figure 10). For example, a shorter visit time, short time duration of model, more frequent changing of sheets or probability of losing in situ sheets.

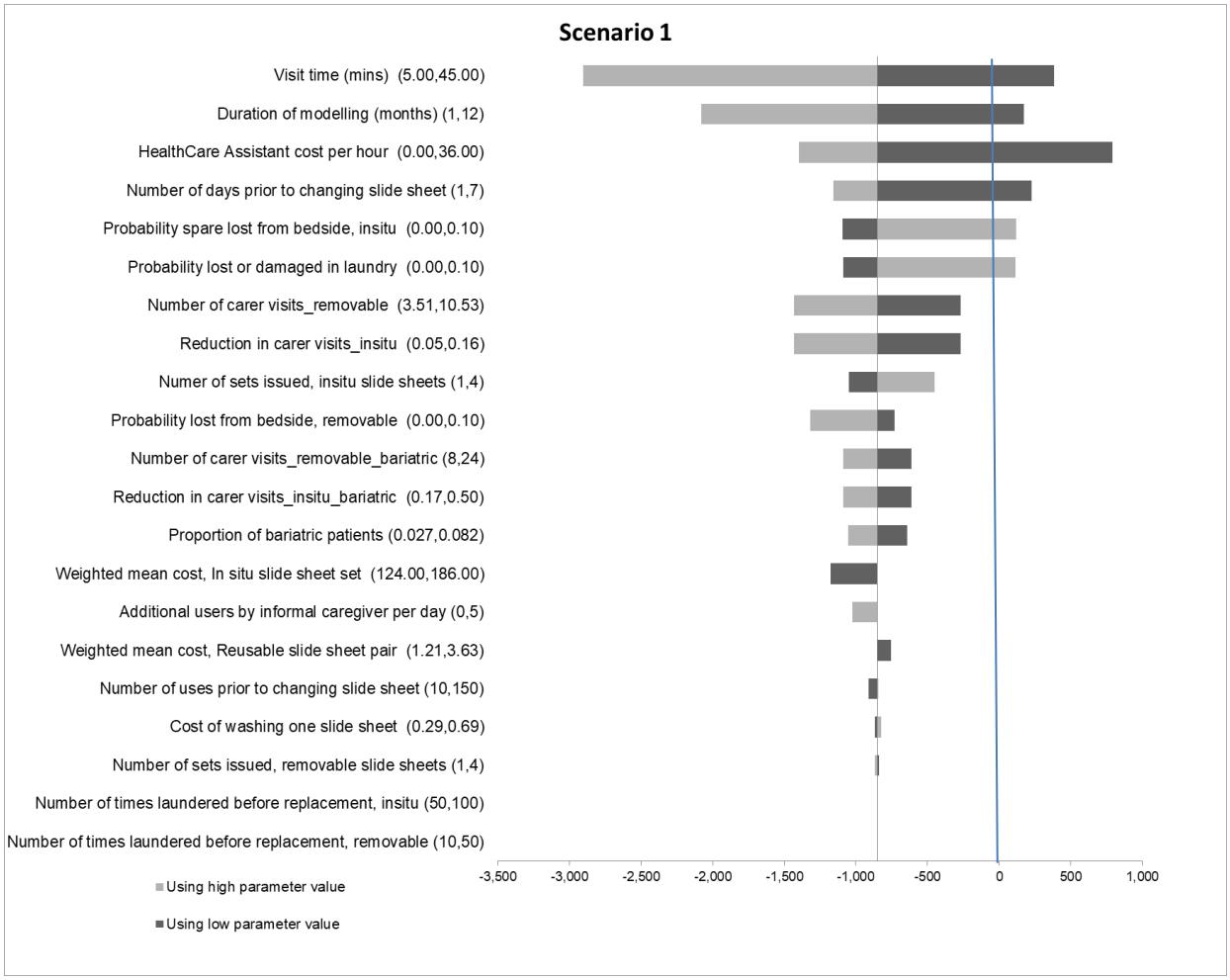

Figure 10 Tornado diagram, scenario 1, disposal of device at model end, incremental cost of in situ vs removable

Confidential results for scenario 1 are in Table 26.

Table 26 Scenario 1 summary results using confidential pricing

	Removable	In situ	Incremental cost for in situ
Device purchase, laundry and replacement	[redacted]	[redacted]	[redacted]
Care worker visits	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]

The impact of different costs for in situ slide sheets is shown in Figure 11, where both the base case and scenario 1 remain with in situ as the least costly option at a wide range of in situ slide sheet prices (assuming all other parameters are held constant).

Figure 11 Incremental cost of in situ slide sheets at different prices

Scenario using shorter staff time and higher losses

Where a care worker time of 5 minutes and higher losses of 10% were used, to approximate a possible hospital scenario, the incremental cost for in situ compared to removable is greatly reduced to -£37.35 (or a cost saving of £37.53). This assumes devices will be cleaned and reused for other patients as needed.

7.9 Summary and interpretation of the economic evidence

The EAG identified only one non-peer reviewed study that was relevant to the scope which included an economic component (Sturman-Floyd, 2011). This described the implementation of in situ slide sheets compared to removable flat slide sheets. The author described savings due to the reduction in the number of care workers needed for visits in a proportion of patients.

There was a lack of clinical evidence available to inform any modelling that relied on differences in clinical efficacy, manual handling injury outcomes or patient experience. Therefore, the EAG focused on features that meant the devices incurred different costs across their lifespan, allowing a meaningful model to be produced for these features. These were:

- disposable vs single patient use vs washable,

- removable vs in situ.

In both cases the base case scenario was a cost comparison. The EAG attempted to include factors that were described by experts such as loss of slide sheets from the bedside and damage to slide sheets during laundering. Slide sheets are used in a very wide range of scenarios, and settings and different sites will have different purchasing or laundry arrangements, which influence the way slide sheets are used in practice. This means that as well as uncertainty around the true value of a parameter, due to a lack of evidence, there is variation in the parameter due to local settings and the type of use. The EAG have included a range of scenarios to help understand this variation, as well as sensitivity analysis to demonstrate the impact of parameter changes. In all cases the economic results need to be considered in conjunction with the feedback from clinical and public experts on their experience of implementation and use of slide sheets.

Disposable slide sheets were not favourable for any scenario, and were the most costly option in all cases except scenario A where only one use was required. Experts highlighted some issues with assuming clinical equivalence for disposable slide sheets compared to other devices.

The EAG found that washable slide sheets were the least costly in almost every scenario considered. The only exception was for long durations of use, and where there were very low numbers of replacements needed due to soiling or loss. This might be the case (as an example only) where single patient use slide sheets are provided at a person's home, they are used repeatedly over a six-month period, spot cleaned if required, and are not misplaced when needed. If this is compared to a washable slide sheet that is assumed to be washed after 100 uses, and eventually replaced then the single patient use slide sheet will be less costly.

Expert advice was that implementing a change to washable slide sheets could be difficult, particularly if an external laundry service was used, or slide sheets needed to be returned to a particular site or ward. The EAG also heard that the resistance to the laundry process was variable for different slide sheets. However, some of the experts did work at sites that had successfully implemented the use of washable slide sheets.

For consistency the EAG used a 10% rate of slide sheet replacement at the bedside for all scenarios, however for the 6-month scenario (scenario D) where there are 1,095 uses, this results in the need to replace slide sheets 109.5 times with either a new single patient use device or a clean washable device. This seemed a very high replacement rate, particularly if the use was in a domestic setting. One-way sensitivity analysis in the tornado diagrams considered a range from 0 to 20% for scenarios B to D and this was further explored using a threshold analysis for Scenario D. It was seen that the loss rate has to be below 0.3% for the single patient device to become the least costly option, or greater than 3 replacements being required in a 6-month period.

Considering removable and in situ slide sheets, the EAG base case was based on data presented by Sturman-Floyd (2011) where in situ slide sheets were used for a 6-month period in a community setting. In all cases providing the in situ devices was more costly than the removable devices, however this was balanced by a reduction in the number of care workers required for repositioning. In this model a lower rate of loss was assumed due to the domestic setting, however sensitivity analysis explores the impact of this variable.

The EAG base case assumed that all devices were washable, and that they would be returned to stores for re-use at the end of the model. If replacements were required they would be clean, but not necessarily new devices. Using these assumptions, the EAG found that in situ slide sheets were cost saving compared to removable slide sheets due to a reduction in the number of care workers required. This was robust to all one-way sensitivity analysis, apart from a very low hourly cost for care workers. This would only be the case if the majority of care was by informal caregivers.

Some experts stated that at the end of community use, the slide sheets were most likely to be disposed of. Therefore, the EAG ran a further scenario that assumed that slide sheets would be disposed of at the end of use, and that any replacements required would be new devices. In this scenario the cost saving through using in situ slide sheets was much lower, and was sensitive to change in a large number of parameters. The key drivers were the visit duration, numbers of in situ slide sheet

sets issues, cost of care worker, duration of use, probability of losing slide sheets from the bedside and the frequency of washing in situ slide sheets.

8 Discussion

In this LSA, the EAG sought to identify clinical evidence to inform guidance on the use of slide sheets in the NHS. The assessment considered if there is there any value added by incremental innovation in features of slide sheets that could justify variation in price to the NHS.

There was a lack of relevant clinical evidence with only 7 key studies identified. Of the 7 key studies, none specifically aimed to compare the slide sheet features, with the exception of Sturman-Floyd (2011) which compared an in situ slide sheet to a removable slide sheet. Broadly, the variation in outcomes used, sample sizes, reporting quality and non-generalisability to normal practice in the NHS limited the value of the studies in answering the decision problem.

Sturman-Floyd (2011) found a reduction in the number of care workers required for repositioning of a small number of patients. The impact on pressure ulcers and care worker exertion were also reported, however, the EAG were unable to determine the scale of the impact that was associated with the change in slide sheet type. The study reported cost reductions in care worker time, and potential cost reductions due to reduced numbers of pressure ulcers.

Expert clinical advisors' views were sought to inform the report. In comparison with single patient use and washable slide sheets, disposable slide sheets were not preferred by expert clinical advisors. Experts' views on flat versus tubular slide sheets were mixed.

The potential for issues relating to the laundering of washable slide sheets in acute settings was frequently mentioned, with concerns surrounding the use of external laundry facilities including slide sheets going missing or being returned to the wrong departments. The implementation challenges of washable slide sheets therefore need to be considered on balance with any potential benefits.

In situ slide sheets are often laundered by informal caregivers, in a community setting. There may be damage during washing if care instructions are not communicated or followed, and washing may be time consuming. Benefits for in situ slide sheets were described by both clinical experts and a caregiver as reduced discomfort and the need for intrusive handling for the person being moved. One caregiver highlighted the possibility of slipping if not provided appropriately.

One project was shared by a clinical expert that was relevant to this LSA, involving a comparison of slide sheets for a procurement exercise. The testing involved washing of the slide sheets to test the functionality after sustained use. This identified that slide sheet functionality was variable after washing, and one device did not withstand the 50 washes (although the company has since changed the design).

The economic findings were limited to cost comparisons due to a lack of clinical evidence, and compared the following features of slide sheets:

- disposable vs single patient use vs washable,
- removable vs in situ.

For the reusability of slide sheets the EAG considered a number of scenarios with durations ranging from a single use only, to a 6-month duration. In all of these scenarios washable slide sheets were found to be the least costly, except for the 6-month scenario, if no losses of slide sheet were included. This finding should be considered in conjunction with expert concerns about the implementation issues associated with using washable slide sheets.

When considering in situ and removable slide sheets, the EAG base case was confined to considering the device costs and changes in care worker costs. There were comments from both clinical experts and informal caregiver experts that the choice of device would impact on both patient and caregiver experience. This is an important consideration that is not captured in the economic model due to a lack of evidence.

The EAG found that in situ slide sheets were less costly if devices are assumed to be returned to equipment stores after use, and that this was robust to most

parameter changes in the sensitivity analysis. However, if devices are assumed to be disposed of after use, the cost saving is smaller, and slightly less robust to sensitivity analysis.

The inclusion of pressure ulcer data from Sturman-Floyd (2011) gives an increased cost saving due to reduced numbers of pressure ulcers as well as an increased utility. This results in the in situ slide sheets being dominant for both the base case and the scenario where slide sheets are disposed of after use.

In all cases, the economic results should not be viewed without consideration of the individual setting, clinical opinion and the expert advice presented in this report. Key factors discussed were the patient and care worker experience and the successful implementation of laundering washable slide sheets.

To conclude, there is only weak clinical evidence to demonstrate any differences between additional or innovative features of slide sheets. Some features lead to different costs of use during the slide sheet lifecycle, enabling cost comparisons to be modelled. These find that for removable slide sheets, washable devices are less costly in most scenarios, however experts reported many concerns about implementation of laundry procedures. In situ slide sheets were found to be less costly than removable slide sheets based on the findings of one study, however the evidence base is weak, and this should be interpreted with caution.

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10 Appendices

Appendix A: Clinical technological and economic search strategies

The EAG conducted a search for clinical and economic evidence as directed in the published protocol. Eleven bibliographic databases were searched from inception to October 2024 using a combination of free text terms and indexed terms. The searches were comprehensive, including generic terms for slide sheets, device names, and company names. Two clinical trial registries were also searched for ongoing trials. The companies' websites were searched for additional literature and evidence provided by companies in RFIs was also considered.

Clinical and economic database searches

Date	Database name	Total number of records retrieved	Total number of records from database after de-duplication
09/10/24	Medline ALL	106	
09/10/24	Embase	117	
09/10/24	AMED	5	
09/10/24	CINAHL	61	
09/10/24	The Cochrane Library CDSR CENTRAL	 0 20	
10/10/24	CRD DARE NHS EED	1	
09/10/24	INAHTA	12	
09/10/24	Web of Science (Science citation index expanded; Conference proceedings citation index – science; Emerging sources citation index)	146	
09/10/24	Scopus	147	
10/10/24	Clinical Trials.gov	2	
10/10/24	ICTRP	0	
Database searches total		617	370

Clinical and economic company website searches

Date	Company websites	Total Number of records retrieved	Total number of records loaded into library (Duplicates not imported)	Total number of records from database after de-duplication
14/10/24	MIP UK LTD Polyglide	0	N/A	
14/10/24	GBUK HEALTHCARE	1	1	
14/10/24	SELECT HEALTHCARE (UK) LTD	0	N/A	
14/10/24	INTERWEAVE TEXTILES SUPA Slide Versal Premium Elite Slidetex	0	N/A	
14/10/24	HOSPITAL DIRECT Slideezi J Pack	0	N/A	
14/10/24	LISCLARE LTD MySling, MySling slide Emotion Superfine, insitu	0	N/A	
14/10/24	HILL-ROM UK Disposable flat, 3683906-4	0 NOT IN SCOPE	N/A	
14/10/24	DIRECT HEALTHCARE GROUP WendyLett ROMP1645	4	4	
14/10/24	SUMED INTERNATIONAL (UK) LTD. Prime Mover	0	N/A	
14/10/24	ETAC LIMITED Immedia 2 direction basesheet IM4107S	0	N/A	
14/10/24	ARJO UK LTD MaxiSlide Tube NSA0800-INT1	60	1	
Website searches total			6	4

Clinical and economic RFI searches

Date	Company Name	Total Number of records retrieved	Total number of records from database after de-duplication
10/10/24	Arjo	5	
10/10/24	Baxter	5	
10/10/24	MIP	0	
11/10/24	Stryker	4	
21/10/24	Etac	6	
21/10/24	Interweave	1	
Total		21	14

EAG Search strategies for clinical and economic evidence

Ovid MEDLINE(R) ALL <1946 to October 04, 2024>

1 ((slide or sliding or glide or gliding or "low friction") adj2 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 76

2 (("manual handl*" or "patient handl*") adj3 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 2

3 ("assistive technolog*" and reposition*).tw. 2

4 "Bedding and Linens"/ and (slide or sliding or glide or gliding or "low friction").tw. 21

5 "Moving and Lifting Patients"/ 728

6 (sheet* or bedsheet* or "bed sheet*" or bedding).tw. 96770

7 5 and 6 26

8 (or/1-4) or 7 102

9 cromptons.tw. 0

10 (polyglide or "poly glide" or ultraglide).tw. 0

11 banana slide.tw. 0

12 ("SPU PATPAQs" or "ECO tubular").tw. 0

13 GBUK.tw. 0

14 (("S.U.P.A." or SUPA) and slide).tw. 0

15 slidetex.tw. 0

16 (interweave and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 4

17 (Elite adj3 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

18 ("hospital direct" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

19 Slideezi.tw. 0

20 MySling.tw. 1

21 MySlide.tw. 0

22 Slidetex Elite.tw. 0

23 (Hillrom and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 1

24 (banana adj3 (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 3

25 WendyLett.tw. 0

26 ("prime mover" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 2

27 Immedia.tw. 0

28 MaxiTube.tw.0

29 (flexicare and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

30 (SIBA and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

31 (SIBA and "easy guide").tw. 0

32 (superfine adj3 (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding or "e motion")).tw. 0

33 Banana Versal.tw. 0

34 Versal System.tw. 0

35 or/9-34 11

36 8 or 35 113

37 exp animals/ not humans.sh. 5265712

38 36 not 37 108

39 limit 38 to english language 106

Embase <1974 to 2024 October 08>

1 ((slide or sliding or glide or gliding or "low friction") adj2 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 82

2 (("manual handl*" or "patient handl*") adj3 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 2

3 ("assistive technolog*" and reposition*).tw. 4

4 bed linen/ and (slide or sliding or glide or gliding or "low friction").tw. 1

5 patient lifting/ 604

6 (sheet* or bedsheet* or "bed sheet*" or bedding).tw. 110734

7 5 and 6 18

8 (or/1-4) or 7 93

9 cromptons.tw. 1

10 (polyglide or "poly glide" or ultraglide).tw. 0

11 banana slide.tw. 0

12 ("SPU PATPAQs" or "ECO tubular").tw. 0

13 GBUK.tw. 3

14 (("S.U.P.A." or SUPA) and slide).tw. 0

15 slidetex.tw. 0

16 (interweave and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 5

17 (Elite adj3 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

18 ("hospital direct" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 1

19 Slideezi.tw. 0

20 MySling.tw. 1

21 MySlide.tw. 0

22 Slidetex Elite.tw. 0

23 (Hillrom and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 1

24 (banana adj3 (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 2

25 WendyLett.tw. 1

26 ("prime mover" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 3

27 Immedia.tw. 8

28 MaxiTube.tw.0

29 (flexicare and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

30 (SIBA and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

31 (SIBA and "easy guide").tw. 0

32 (superfine adj3 (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding or "e motion")).tw. 0

33 Banana Versal.tw. 0

34 Versal System.tw. 0

35 or/9-34 26

36 8 or 35 119

37 limit 36 to english language 117

AMED (Allied and Complementary Medicine) <1985 to September 2024>

1 ((slide or sliding or glide or gliding or "low friction") adj2 (sheet* or bedsheet* or "bed sheet*" or bedding or "bed linen")).tw. 1

2 (("manual handl*" or "patient handl*") adj3 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 1

3 ("assistive technolog*" and reposition*).tw. 0

4 (((lift* or mov*) adj2 patient*) and (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 3

5 cromptons.tw. 0

6 (polyglide or "poly glide" or ultraglide).tw. 0

7 banana slide.tw. 0

8 ("SPU PATPAQs" or "ECO tubular").tw. 0

9 GBUK.tw. 0

10 (("S.U.P.A." or SUPA) and slide).tw. 0

11 slidetex.tw. 0

12 (interweave and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

13 (Elite adj3 (sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

14 ("hospital direct" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

15 Slideezi.tw. 0

16 MySling.tw. 0

17 MySlide.tw. 0

18 Slidetex Elite.tw. 0

19 (Hillrom and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

20 (banana adj3 (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

21 WendyLett.tw. 0

22 ("prime mover" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

23 Immedia.tw. 0

24 MaxiTube.tw.0

25 (flexicare and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

26 (SIBA and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding)).tw. 0

27 (SIBA and "easy guide").tw. 0

28 (superfine adj3 (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding or "e motion")).tw. 0

29 Banana Versal.tw. 0

30 Versal System.tw. 0

31 or/1-30 5

32 limit 31 to english 5

Cochrane

#1 ((slide or sliding or glide or gliding or "low friction") NEAR/2 (sheet* or bedsheet* or bedding or (bed NEXT sheet*))):ti,ab,kw 12

#2 (((manual* NEXT handl*) OR (patient* NEXT handl*)) NEAR/3 (sheet* or bedsheet* or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#3 ((assistive NEXT technolog*) AND reposition*):ti,ab,kw 0

#4 MeSH descriptor: [Bedding and Linens] this term only 430

#5 ((slide or sliding or glide or gliding or "low friction")):ti,ab,kw 3635

#6 #4 AND #5 4

#7 MeSH descriptor: [Moving and Lifting Patients] this term only 30

#8 (sheet* or bedsheet* or bedding or (bed NEXT sheet*)):ti,ab,kw 6970

#9 #7 AND #8 2

#10 (cromptons):ti,ab,kw 0

#11 (polyglide or "poly glide" or ultraglide):ti,ab,kw 0

#12 ("banana slide"):ti,ab,kw 0

#13 ("SPU PATPAQs" or "ECO tubular"):ti,ab,kw 0

#14 (GBUK):ti,ab,kw 0

#15 (("S.U.P.A." or SUPA) and slide):ti,ab,kw0

#16 (slidetex):ti,ab,kw 0

#17 (interweave and (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#18 (Elite NEAR/3 (sheet* or bedsheet* or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#19 ("hospital direct" and (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#20 (Slideezi):ti,ab,kw 0

#21 (MySling):ti,ab,kw 0

#22 (MySlide):ti,ab,kw 0

#23 ("Slidetex Elite"):ti,ab,kw 0

#24 (hillrom and (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#25 (banana NEAR/3 (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#26 (WendyLett):ti,ab,kw 0

#27 ("prime mover" and (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#28 (Immedia):ti,ab,kw 3

#29 (MaxiTube):ti,ab,kw 0

#30 (flexicare and (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#31 (SIBA and (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#32 (SIBA and "easy guide"):ti,ab,kw 0

#33 (superfine NEAR/3 (slide or sliding or glide or gliding or "low friction" or sheet* or "bedsheet*" or bedding or (bed NEXT sheet*))):ti,ab,kw 0

#34 ("Banana Versal"):ti,ab,kw 0

#35 ("Versal System"):ti,ab,kw 0

#36 #1 OR #2 OR #3 OR #6 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 in Cochrane Reviews 0

#37 #1 OR #2 OR #3 OR #6 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR

#25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 in Trials 20

Web of Science

1: TS=(((slide OR sliding OR glide OR gliding OR "low friction") NEAR/2 (sheet* OR bedsheet* OR "bed sheet*" OR bedding OR "bed linen")) AND Patient*) 53

2: TS=(("manual handl*" OR "patient handl*") NEAR/3 (sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 10

3: TS=("assistive technolog*" AND reposition*) 2

4: TS=(cromptons) 0

5: TS=(polyglide OR "poly glide" OR ultraglide) 0

6: TS=("banana slide") 0

7: TS=("SPU PATPAQs" OR "ECO tubular") 0

8: TS=(GBUK) 0

9: TS=(("S.U.P.A." OR SUPA) AND slide) 1

10: TS=(slidetex) 0

11: TS=(interweave NEAR/1 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 39

12: TS=(Elite NEAR/3 (sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 4

13: TS=("hospital direct" AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 1

14: TS=(Slideezi) 0

15: TS=(MySling) 1

16: TS=(MySlide) 0

17: TS=(Slidetex Elite) 0

18: TS=(Hillrom AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 1

19: TS=(banana NEAR/2 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 16

20: TS=(WendyLett) 0

21: TS=("prime mover" NEAR/3 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 1

22: TS=(Immedia) 6

23: TS=(MaxiTube) 0

24: TS=(flexicare AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 1

25: TS=(SIBA AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)) 1

26: TS=(SIBA AND "easy guide") 0

27: TS=(superfine NEAR/3 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding OR "e motion")) 10

28: TS=("Banana Versal") 0

29: TS=("Versal System") 0

30: #29 OR #28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 OR #8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 146

Scopus

(TITLE-ABS-KEY("hospital direct" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding))) OR (TITLE-ABS-KEY("Versal System")) OR (TITLE-ABS-KEY("Banana Versal")) OR (TITLE-ABS-KEY(superfine W/3 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding OR "e motion"))) OR (TITLE-ABS-KEY(SIBA AND "easy guide")) OR (TITLE-ABS-KEY(SIBA AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (TITLE-ABS-KEY((flexicare AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))) OR (TITLE-ABS-KEY(MaxiTube)) OR (TITLE-ABS-KEY(Immedia)) OR (TITLE-ABS-KEY("prime mover" W/3 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (TITLE-ABS-KEY(WendyLett)) OR (TITLE-ABS-KEY(banana W/2 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (TITLE-ABS-KEY(Hillrom AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (TITLE-ABS-KEY("Slidetex Elite")) OR (TITLE-ABS-KEY(MySlide)) OR (TITLE-ABS-KEY(MySling)) OR (TITLE-ABS-KEY(Slideezi)) OR (TITLE-ABS-KEY(Elite W/3 (sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (TITLE-ABS-KEY(interweave AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (TITLE-ABS-KEY(slidetex)) OR (TITLE-ABS-KEY(("S.U.P.A." OR SUPA) AND slide)) OR (TITLE-ABS-KEY(GBUK)) OR (TITLE-ABS-KEY("SPU PATPAQs" or "ECO tubular")) OR (TITLE-ABS-KEY("banana slide")) OR (TITLE-ABS-KEY((polyglide or "poly glide" or ultraglide))) OR (TITLE-ABS-KEY(cromptons)) OR (TITLE-ABS-KEY(("assistive technolog*" AND reposition*))) OR (TITLE-ABS-KEY(("manual handl*" OR "patient handl*") W/3 (sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (TITLE-ABS-KEY((slide OR sliding OR glide OR gliding OR "low friction") W/2 (sheet* OR bedsheet* OR "bed sheet*" OR bedding) AND patient*))

CINAHL

S36	S1 OR S2 OR S3 OR S6 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 Limiters - English Language	61
S35	AB "Versal System"	0
S34	AB "Banana Versal"	0
S33	AB ((superfine N3 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding OR "e motion")))	0
S32	AB ((SIBA AND "easy guide"))	0
S31	AB ((SIBA AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	0
S30	AB ((flexicare AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	0
S29	AB MaxiTube	0
S28	AB Immedia	0
S27	AB (("prime mover" AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	0
S26	AB WendyLett	1

S25	AB ((banana N3 (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	0
S24	AB ((Hillrom AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	1
S23	AB "Slidetex Elite"	0
S22	AB MySlide	0
S21	AB MySling	0
S20	AB Slideezi	0
S19	AB (("hospital direct" AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	0
S18	AB ((Elite N3 (sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	0
S17	AB ((interweave AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding)))	0
S16	AB slidetex	0
S15	AB ((("S.U.P.A." OR SUPA) AND slide))	0
S14	AB GBUK	0
S13	AB (("SPU PATPAQs" OR "ECO tubular"))	0
S12	AB "banana slide"	0

S11	AB ((polyglide OR "poly glide" OR ultraglide))	0
S10	AB cromptons	10
S9	S7 AND S8	12
S8	AB ((sheet* OR bedsheet* OR "bed sheet*" OR bedding))	7,545
S7	(MH "Patient Handling")	580
S6	S4 AND S5	7
S5	AB ((slide OR sliding OR glide OR gliding OR "low friction"))	8,012
S4	(MH "Bedding and Linens")	1,448
S3	AB (("assistive technolog*" AND reposition*))	2
S2	AB (("manual handl*" OR "patient handl*") N3 (sheet* OR bedsheet* OR "bed sheet*" OR bedding))	1
S1	AB ((slide OR sliding OR glide OR gliding OR "low friction") N2 (sheet* OR bedsheet* OR "bed sheet*" OR bedding))	40

CRD

1 (((slide or sliding or glide or gliding or "low friction") adj2 (sheet* or bedsheet* or "bed sheet*" or bedding))) 0

2 ((("manual handl*" or "patient handl*") adj3 (sheet* or bedsheet* or "bed sheet*" or bedding))) 0

3 ("assistive technolog*" and reposition*) 0

4 MeSH DESCRIPTOR Bedding and Linens 36

5 (slide or sliding or glide or gliding or "low friction") 106

6 #4 AND #5 0

7 MeSH DESCRIPTOR Moving and Lifting Patients 10

8 (sheet* or bedsheet* or "bed sheet*" or bedding) 262

9 #7 AND #8 1

10 (cromptons) 0

11 (polyglide or "poly glide" or ultraglide) 0

12 ("banana slide") 0

13 ("SPU PATPAQs" or "ECO tubular") 0

14 (GBUK) 0

15 (("S.U.P.A." or SUPA) and slide) 0

16 (slidetex) 0

17 (interweave) 0

18 (Elite adj3 (sheet* or bedsheet* or "bed sheet*" or bedding)) 0

19 (("hospital direct" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding))) 0

20 (Slideezi) 0

21 (MySling) 0

22 (MySlide) 0

23 ("Slidetex Elite") 0

24 (Hillrom) 0

25 ((banana adj3 (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding))) 0

26 (WendyLett) 0

27 (("prime mover" and (slide or sliding or glide or gliding or "low friction" or sheet* or bedsheet* or "bed sheet*" or bedding))) 0

28 (Immedia) 0

29 (MaxiTube) 0

30 (flexicare) 0

31 (SIBA) 1

32 (superfine) 0

33 ("Banana Versal") 0

34 ("Versal System") 0

35 #1 OR #2 OR #3 OR #6 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 2

36 (#1 OR #2 OR #3 OR #6 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34) IN DARE, NHSEED 1

INAHTA

("Versal System") OR ("Banana Versal") OR ((superfine AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding OR "e motion"))) OR ((SIBA AND "easy guide")) OR ((SIBA AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR ((flexicare AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (MaxiTube) OR (Immedia) OR (("prime mover" AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (WendyLett) OR ((banana AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR ((Hillrom AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR ("Slidetex Elite") OR (MySlide) OR (MySling) OR (Slideezi) OR (("hospital direct" AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR ((Elite AND (sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR ((interweave AND (slide OR sliding OR glide OR gliding OR "low friction" OR sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR (slidetex) OR ((("S.U.P.A." OR SUPA) AND slide)) OR (GBUK) OR (("SPU PATPAQs" OR "ECO tubular")) OR ("banana slide") OR ((polyglide OR "poly glide" OR ultraglide)) OR (cromptons) OR ("Moving and Lifting Patients"[mh]) OR ("Bedding and Linens"[mh]) OR (("assistive technolog*" AND reposition*)) OR ((("manual handl*" OR "patient handl*") AND (sheet* OR bedsheet* OR "bed sheet*" OR bedding))) OR ((slide OR sliding OR glide OR gliding OR "low friction") AND (sheet* OR bedsheet* OR "bed sheet*" OR bedding))

Clinicaltrials.gov

Search term	Results	Relevant additional results
“slide sheet”	1	1
“slide sheet*”	14	0
“glide sheet*”	2	0
“low friction sheet*”	3	1
“low friction bedding”	6	0
cromptons	0	0
Polyglide	0	0
“poly glide”	38	0
Ultraglide	0	0
“banana slide”	0	0
“SPU PATPAQs”	0	0
“ECO tubular”	0	0
GBUK	0	0
“S.U.P.A. slide”	0	0
“SUPA slide”	0	0
slidetex	0	0
interweave	1	0
Elite AND sheet	5	0
“hospital direct”	8	0
Slideezi	0	0
MySling	0	0
MySlide	0	0
“Slidetex Elite”	0	0
Hillrom	2	0
Banana AND sheet	0	0
Banana AND slide	0	0
WendyLett	0	0
“prime mover”	3	0
Immedia	3	0
MaxiTube	0	0
flexicare	7	0
SIBA	17	0
superfine	4	0
“e motion”	8	0
“Banana Versal”	0	0
“Versal System”	2	0
Total		2

ICTRP

Search term	Results	Relevant additional results
“slide sheet*”	0	0
“glide sheet*”	0	0
“low friction sheet*”	0	0
“low friction bedding”	0	0
cromptons	0	0
Polyglide	0	0
“poly glide”	0	0
Ultraglide	0	0
“banana slide”	0	0
“SPU PATPAQs”	0	0
“ECO tubular”	0	0
GBUK	0	0
“S.U.P.A. slide”	0	0
“SUPA slide”	0	0
slidetex	0	0
interweave	0	0
Elite AND sheet	0	0
“hospital direct”	0	0
Slideezi	0	0
MySling	0	0
MySlide	0	0
“Slidetex Elite”	0	0
Hillrom	0	0
Banana AND sheet	0	0
Banana AND slide	0	0
WendyLett	0	0
“prime mover”	0	0
Immedia	0	0
MaxiTube	0	0
flexicare	0	0
SIBA	0	0
superfine	0	0
“e motion”	0	0
“Banana Versal”	0	0
“Versal System”	0	0
Total		0

Appendix B: PRISMA flow diagram

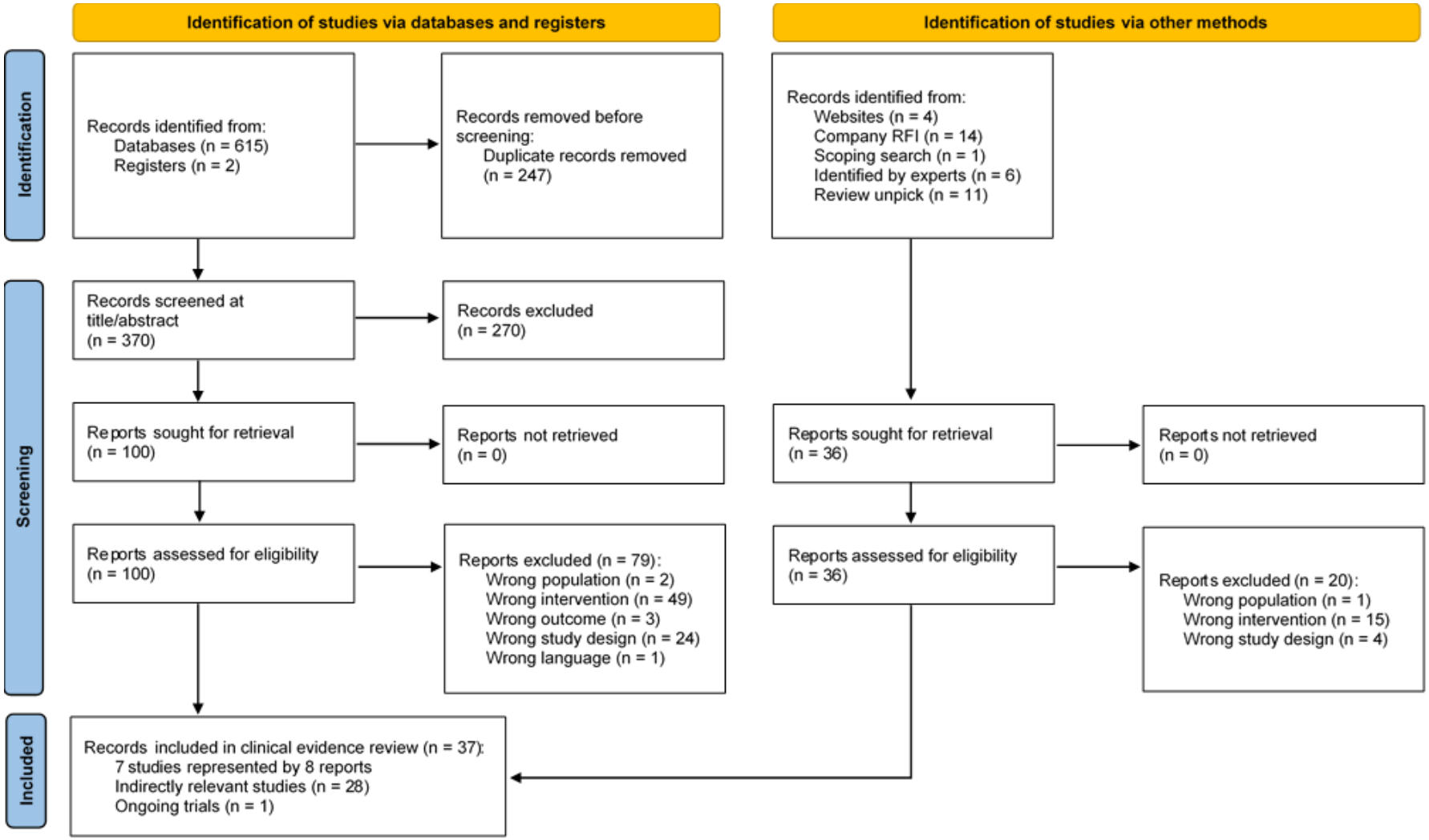


Figure 12: PRISMA flow diagram (adapted from Page et al. (2021))

Appendix C: Excluded studies

The following studies were identified in the company RFIs and were excluded from the clinical and technological evidence review during full-text screening. The reasons for exclusion are given in Table 27.

Table 27 Studies excluded from clinical and technological evidence base

Study	Publication type	Title	Comment(included / reasons for exclusion)
Asiri, 2023	Peer reviewed	Turning and Repositioning Frequency to Prevent Hospital-Acquired Pressure Injuries Among Adult Patients: Systematic Review	Wrong intervention. Examined turning and repositioning frequency.
Brem *et al.* 2010	Peer reviewed	High Cost of Stage IV Pressure Ulcers	Wrong intervention. Examined cost of stage IV pressure ulcers from US perspective.
Cohen *et al.* 2010	White paper	Patient Handling and Movement Assessments: A White Paper	Wrong study design. Narrative description and guidance without study results.
Dealey *et al.* 2012	Peer reviewed	The cost of pressure ulcers in the United Kingdom	Wrong intervention. Insufficient details of slide sheets used of features of slide sheets.
DHG, n.d.	White paper	Does Washing Slide Sheets Impact Their Level of Friction?	Wrong population, referenced in economics No person/mannequin moved or repositioned.
Clinical Practice Guideline (EPUAP) 2019	Published guideline	Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline	Wrong study design. Informed Section 3.
Fray & Hignett, 2015	Peer reviewed	Using patient handling equipment to manage immobility in and around a bed	Wrong intervention. Slide sheets not assessed as intervention. Narrative on use of slide sheets.
LeBlanc *et al.*	Peer reviewed	Best Practice Recommendations for Prevention and Management of Skin Tears in Aged Skin	Wrong intervention. Does not assess slide sheets.
National Pressure Ulcer Advisory Panel *et al.* 2014	Published guideline	Prevention and Treatment of Pressure Ulcers: Quick Reference Guide	Wrong study design. Updated guideline informed Section 3 (Clinical Practice Guideline, 2019).
Spear, 2013	Peer reviewed	Pressure Ulcers: What Are the Implications?	Wrong study design. Narrative review.

Appendix D: Indirectly relevant studies

Studies were excluded from the main assessment and considered indirectly relevant for the following reasons:

- Only 1 slide sheet was compared with other assistive device
- Slide sheets were used in combination with other devices as part of a "system"
- Insufficient details or description of the slide sheets reported

Studies that used only 1 slide sheet compared with other assistive devices are summarised in Table 28.

Studies where slide sheets were used in combination with other devices as part of a "system" or where insufficient details of the slide sheet were reported are summarised in Table 29.

Table 28: Summary of studies comparing slide sheets with other assistive devices

Reference, **Context,** **Country,**	**Study design,** **Objective**	**Identified slide sheet used** **Features specified** **Comparator**	**Measured outcomes**	**Setting, sample size**	**Relevance**
Abbott, 2017 Manual handling injuries USA	Before and after study To evaluate the implementation of slide sheets in practice	Smart Slide Sheets (MEDCO) Washable, made of durable nylon with an overlay silicone application	Incidence of musculoskeletal injuries in nursing staff	A Metropolitan Hospital – initially four units, then across the whole institution	Demonstrates reduction in musculoskeletal injuries for nursing staff compared to no slide sheet. No information on contribution of slide sheet features

Reference, **Context,** **Country,**	**Study design,** **Objective**	**Identified slide sheet used** **Features specified** **Comparator**	**Measured outcomes**	**Setting, sample size**	**Relevance**
		Compared slide sheet to traditional cotton draw sheets			
Alperovitch-Najenson *et al.* 2020 Manual handling injuries Israel	Intervention To examine the impacts of slide sheet usage on caregivers	Unnamed slide sheet Washable, tubular cylindrical sheet, made of synthetic nylon low-friction materials Single arm	Work-related musculoskeletal disorders and disability, perceived workload, burnout, and job satisfaction	Internal medicine departments of a hospital, 41 nurses and nursing assistants	Found a reduction in back and neck pain for nursing staff compared to no slide sheet. No information on contribution of slide sheet features
Clark *et al.* 2023 Pressure injuries UK	Non-randomised comparative testing To identify the effects of two transfer devices on pressure redistribution on two static and two active mattresses	WendyLett slide sheet In situ Compared in situ slide sheet to an in situ sling, and no transfer device	Contact pressures from resting upon pressure redistributing mattresses and transfer devices	Welsh Wound Innovation Centre, 10 adult volunteer participants	Identified a reduction in contact pressures from the use of the in situ slide sheet compared to the in situ sling, or no transfer device. No information on contribution of slide sheet features
Daynard *et al.* (2001)	Intervention sub study To assess and compare the	Arjo MaxiTube Tubular sheet	Time taken for transfers, spinal compression force, shear and inter-arm forces	Winnipeg's Health Sciences Centre acute tertiary hospital, 9 wards randomly assigned to three arms	Found the MaxiTube resulted in lower peak compression values than all other conditions, and less applied

Reference, **Context,** **Country,**	**Study design,** **Objective**	**Identified slide sheet used** **Features specified** **Comparator**	**Measured outcomes**	**Setting, sample size**	**Relevance**
Manual handling injuries Canada	effectiveness of injury prevention strategies in reducing injury risk	Compared tubular slide sheet to other sliding devices and a mechanical lift		of the intervention; 36 unit assistants participated in biomechanical substudy	hand force for turning and sliding a patient up in bed No information on contribution of slide sheet features
Fray & Davis (2024) Manual handling injuries Worldwide, English language journals	Systematic review An evaluation of studies investigating changes in biomechanical effects with the use of assistive devices	N/A	N/A	N/A	Identifies several studies included in this assessment (Bartnik & Rice, 2013; Hwang *et al.* 2020; Kotowski et al. 2019; Lloyd & Baptiste, 2006; Theou et al. 2011; Weiner et al. 2017; Wiggerman et al. 2021), and the other studies did not include slide sheets. No information on the contribution of slide sheet features
Grevelding & Bohannon (2001) Manual handling injuries USA	Non-randomised comparative testing To compare the push forces involved with moving subjects across a horizontal surface using	Ross Mini-Slide Tubular slide sheet Compared tubular slide sheet to a sliding board, a combination of the slide sheet and sliding board, and no transfer device	Push forces	Lab setting, 2 users and 24 participants moved	Identified reduction in mean push forces compared to the use of no device, or a sliding board. No information on the contribution of slide sheet features

Reference, Context, Country,	Study design, Objective	Identified slide sheet used Features specified Comparator	Measured outcomes	Setting, sample size	Relevance
	different assistive devices				
Higuchi *et al.* 2023 Manual handling injuries Japan	Non-randomised comparative testing To investigate of the effects of slide sheet use and bed height on muscle activity during sliding a mannequin 'patient' up in bed	TORAYEASY slide sheet Compared slide sheet to the use of no slide sheet. Bed height also used as comparator	Muscular activity, kinematics and subjective physical burden perceived by the participants	Lab setting, 33 undergraduate student participants	Identified reduction in muscle activities in the back, upper, and lower extremities (which persisted to a bed height of ≥30% of the participant's height) compared to the use of no slide sheet, No information on contribution of slide sheet features
Hwang *et al.* 2020 Manual handling injuries USA	Non-randomised comparative testing To evaluate of the effectiveness of differing assistive devices on musculoskeletal burden for patient turning tasks	TomiTurn slide sheet Flat slide sheet with handles Compared slide sheet to 3 other assistive devices: a draw sheet, an air-assisted transfer device, and an air-assisted turning device	Kinematics, muscular activity, and subjective usability of the devices perceived by the participants	Lab setting, 20 professional caregiver participants	Identified a reduction of trunk flexion by all devices tested, but the efficacy of slide sheets varied with other biochemical measures. No information on contribution of slide sheet features

Reference, **Context,** **Country,**	**Study design,** **Objective**	**Identified slide sheet used** **Features specified** **Comparator**	**Measured outcomes**	**Setting, sample size**	**Relevance**
Kotowski *et al.* 2019 Manual handling injuries USA	Non-randomised comparative testing To evaluate the effectiveness of differing assistive devices for lumbosacral spine loads during patient transferring and repositioning	Arjo MaxiSlide sheet Washable slide sheet with handles and straps Compared slide sheet to 4 other methods: a reusable air-assisted device, a disposable air-assisted device, a friction-reducing covered board, and a draw sheet	Lumbosacral compression, shear loads and participant-reported discomfort and exertion	Lab setting, 16 care givers and 2 patient participants	Minimal differences found between the slide sheet, slide board and draw sheet tested, however the slide sheet had lower perceived discomfort and exertion. No information on contribution of slide sheet features
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Nelson *et al.* 2003 Manual handling injuries USA	Intervention To identify patient handling and movement strategies reducing the incidence and severity of	Phil-E-Slide Handles/straps The slide sheet was grouped with other assistive devices and compared against the use of no devices	Biomechanical forces, joint movements, perceived comfort and posture resulting from the movements	Lab setting, 134 registered nurses, licensed practical nurses and nursing assistants (71 in control group and 63 in intervention group)	Increased nurse perceived comfort when using the slide sheet in comparison to the use of no device. The study is unclear on the internal forces resulting from the use of the slide sheet.

Reference, Context, Country,	Study design, Objective	Identified slide sheet used Features specified Comparator	Measured outcomes	Setting, sample size	Relevance
	musculoskeletal injuries				No information on contribution of slide sheet features
Omura *et al.* 2019 Manual handling injuries Japan	Non-randomised comparative testing To evaluate the effectiveness of slide sheets on the time required for patient repositioning	Rakurakkusu Mini (Amano Inc.) slide sheet Nylon Compared one caregiver using a slide sheet to the use of no slide sheet by either one or two caregivers	Caregiver burden, working time and subjective fatigue	Nursing practice room, 27 pairs of nurses and care receiver participants (n=54 participants) – each pair performed the repositioning task 3 times	Identified a reduction in fatigue for the slide sheet used compared to both the single and double caregiver without a slide sheet tested. The slide sheet took a longer amount of time but reduced fatigue. No information on contribution of slide sheet features
Pain *et al.* 1999 Medical Devices Agency (1997) Manual handling injuries UK	Non-randomised comparative testing To evaluate the features of assistive devices that impacted performance for patient moving tasks	Chattanooga Patient Roll Sheet Flat, washable slide sheet with handles. Made of nylon sailcloth with a waterproof backing. Compared slide sheet to 3 other 'slide sheets' that are not in scope of this assessment, and other assistive devices: short low friction rollers, long low friction rollers	Functioning and ease of use for care givers, features affecting performance	Within caregivers work locations (hospital, nursing home, homes), 60 carers, with 16 testing the device with a minimum of 5 uses	Found that 50% of caregivers rated the slide sheet as helpful, with only 25% envisaging frequent future use. The handles and long straps were mostly not preferred by caregivers, with the material additionally not preferred by few. Approximately 4% overall shrinkage following four washes at 71°C and the texture of the material became less smooth. The study does contain information on the slide sheet features, but does not

Reference, Context, Country,	Study design, Objective	Identified slide sheet used Features specified Comparator	Measured outcomes	Setting, sample size	Relevance
					compare at least two slide sheets that are in scope of this assessment, and therefore is not a key study.
Theou *et al.* 2011 Manual handling injuries Canada	Non-randomised comparative testing To evaluate muscle activity and exertion used while using slide sheets during patient repositioning	Slider sheet system (MIP) Consisting of a slider drawsheet (50% cotton, 50% polyester twill) and slider bottom sheet (with 20-inch centre panel of low-friction, antistatic, breathable microfibre with jersey panels on each side) Compared slide sheet to the traditional hospital bedsheet makeup of a soaker pad with jersey bottom sheet	Physiological measures of muscle activity, caregiver perceived exertion, physical resistive characteristics of the sheets	Lab setting, 5 healthcare provider participants and 1 volunteer 'patient'	Identified a reduction in perceived exertion for sliding the patient up the bed, and for turning the patient when compared to the traditional bedsheet. No information on contribution of slide sheet features
Weiner *et al.* 2017 Manual handling injuries Israel	Non-randomised comparative testing To investigate the musculoskeletal burden of using differing assistive devices for mannequin	Unnamed slide sheet Washable, tubular slide sheet made of nylon Compared slide sheet to a carrier device and traditional cotton sheets	Risk for low back disorder, caregiver perceived physical exertion	Lab setting, 48 nurse participants	Found that the slide sheet was the preferred device by caregivers, with a reduction of exertion and strain on the musculoskeletal system. No information on contribution of slide sheet features

Reference, **Context,** **Country,**	**Study design,** **Objective**	**Identified slide sheet used** **Features specified** **Comparator**	**Measured outcomes**	**Setting, sample size**	**Relevance**
	'patient' repositioning				
Wiggerman *et al.* 2021 Manual handling injuries USA	Non-randomised comparative testing To compare the physical stress while using differing assistive devices for patient repositioning	Liko HandySheets (Hillrom) Friction-reducing sheets Compared slide sheet to an air-assisted repositioning device and a glide sheet repositioning system	Hand force, spine compression	Lab setting using hospital beds, 10 nurse participants	Identified a reduction in peak spine compression and hand forces in comparison to the draw sheet and glide sheet repositioning system, but risk limits were still exceeded by the slide sheets. No information on contribution of slide sheet features

Table 29: Indirectly relevant studies: Slide sheet used as part of a system

Reference	Study design	Study objective	Reason for exclusion from main assessment
Amini Pay et al. 2021	Non-randomised comparative study.	To compare biomechanical impact on caregivers of using slide sheets in comparison to not using slide sheets.	Insufficient details of slide sheets or features of slide sheets used in study.
Church & Chechile 2020	Non-randomised comparative study.	To evaluate techniques for the prone positioning of patients using different patient-handling devices.	Insufficient details of slide sheets or features of slide sheets used in study.
De Meyer et al. 2019	Cluster RCT.	To evaluate the effectiveness of a patient positioning system with or without an algorithm for tailoring repositioning frequency.	Slide sheets used as part of a system.
Drew et al. 2016	Non-randomised comparative study.	To investigate the efficacy of a slide sheet technique on back muscle activity, pulling force, and perceived effort during lateral patient-handling tasks.	Insufficient details of slide sheets or features of slide sheets used in study.
Garg and Kapellusch 2012	Before-after study.	To evaluate long-term efficacy of an ergonomics program that included patient-handling devices.	Slide sheets used as part of a system.
Howlett (n.d.)	Case report.	To report on the use of a bed management system.	Slide sheets used as part of a system.
Kapp et al. 2023	RCT.	To determine the clinical and cost effectiveness of a system for turning and positioning ICU patients, when compared with usual care.	Slide sheets used as part of a system.
[redacted]	[redacted]	[redacted]	[redacted]
Powers 2016	Non-randomised comparative study.	To compare the impact of standard of care using pillows versus a patient positioning system on development of pressure ulcers.	Slide sheets used as part of a system.
Robertson 1997	Non-randomised comparative study.	To investigate the efficacy and safety of several methods of using transfer slide sheets.	Insufficient details of slide sheets or features of slide sheets used in study.
Robertson 2000	Non-randomised comparative study.	To compare the forces required to move patients using two different types of slide sheet.	Insufficient details of slide sheets or features of slide sheets used in study.
Vinstrup et al. 2020	Cross sectional study.	To quantify levels of muscle activity and trunk inclination during patient transfer with or without the use of assistive devices.	Insufficient details of slide sheets or features of slide sheets used in study.
Way 2016	Before-after study.	To evaluate the impact of a quality improvement intervention which included repositioning devices.	Slide sheets used as part of a system.

Appendix E: Ongoing trials

Table 30: Summary of ongoing trials

Trial record number	Status	Country	Interventions	Outcomes
JPRN-UMIN000037651	Completed 31/03/2022	Japan	• Without using slide sheets • Slide sheets inserted from patients head and patient moved with transfer belt • Slide sheet inserted from front side of side-lying patient and patient moved from the lateral side of the bed	**Primary outcome:** autonomic nervous activities **Secondary outcomes:** • Body angles • Time required for repositioning

Appendix F: Critical appraisal

Critical appraisal was conducted using the JBI checklist for quasi-experimental studies. The results are discussed narratively below.

Bias relating to temporal precedence

There was no concern over bias relating to temporal precedence in any of the 7 key studies. This domain related to the clarity of which variable was the “cause” and which variable was the “effect”.

Bias relating to selection and allocation

In 6 of the studies there was no control group and in 1 study it was not clear whether a control group was used. The lack of control group in these studies makes it difficult to attribute the outcomes to the intervention or differences in the features of the slide sheets.

Bias relating to confounding factors

In 2 studies there was no concern over bias relating to confounding factors as the participants were the same. In 4 studies it was unclear whether there was bias due to confounding factors as demographics of caregiver participants were not sufficiently reported. Participant demographics such as professional role, weight and height may have affected outcomes related to the use of slide sheets.

Bias relating to administration of intervention/exposure

This domain considered whether participants received similar treatment other than the intervention. In 2 studies there was no concern over bias relating to the administration of the intervention. In 1 study (Fray & Hignett, 2009) there were 2 groups of participants. For those participants acting in the role as patients, there was no concern over bias relating to the administration of the intervention. For those participants in the role of caregiver, it was unclear whether they received similar treatment as sufficient details were not presented. There were 2 studies where bias was identified in the administration of the intervention. This was due to the caregiver participants transferring patients of different weights, which may have impacted outcomes.

Bias relating to assessment, detection and measurement of outcome

In 3 studies multiple measurements of the outcomes were taken meaning there was no bias relating to the assessment of outcomes. In 1 study it was unclear whether multiple assessments of outcomes were recorded due to insufficient detail in the reporting. In 1 study (Sturman-Floyd, 2011) a different approach was taken for measures leading to a mixed rating. For the perceived exertion of caregivers, patient pain, and informal caregiver satisfaction, it was not clear whether multiple measures were taken; the number of caregivers for bariatric patients was only assessed once post-intervention which could introduce bias; the measurement of pressure ulcers was considered appropriate for the study design and was not assessed for this question (marked NA).

There was no concern over bias related to detection of outcomes in 5 studies as outcomes were measured in a consistent way. In 2 studies there was a mixed rating. In 1 study (Fray & Hignett, 2009) force measures, time and compliance were measured in the same way but it was unclear how evaluations were conducted for caregivers and those in the role of patients. In the study by Sturman-Floyd (2011), the perceived exertion of caregivers and pressure ulcers were measured consistently but it was unclear if the number of caregivers for bariatric patients, patient pain, and informal caregiver satisfaction were measured in a consistent way.

Whether outcomes were measured in a reliable way was also considered and in 4 studies there was no concern over bias. For 1 study, a survey was used that had not been validated. For 2 studies, there was a mixed rating. In the study by Fray and Hignett (2009), force measures, time, and compliance were measured in a reliable way but it was unclear how evaluations were conducted for caregivers and those in the role of patients. Sturman-Floyd (2011) measured the perceived exertion of caregivers and number of handlers for bariatric patients in a reliable way but it was unclear whether pressure ulcers, patient pain, and informal caregiver satisfaction were measured reliably.

Bias relating to participant retention

In 4 studies it was unclear whether data collection was complete due to insufficient reporting. There were 2 studies where bias relating to participant retention was identified because complete data could not be analysed. There was one study with a

mixed rating (Sturman-Floyd, 2011). This study had complete data available for perceived exertion of caregivers, incomplete data for the number of handlers for bariatric patients, and it was unclear whether data for pressure ulcers, patient pain and informal caregiver satisfaction was complete.

Statistical conclusion validity

There were no concerns relating to statistical validity for 4 studies. One study was unclear as information regarding statistical analysis was not sufficiently reported. There were 2 studies with a mixed rating. Fray and Hignett (2009) reported appropriate statistical analysis for force measures and time but there were insufficient details on how data for compliance and patient and caregiver evaluations were conducted. Sturman-Floyd (2011) reported appropriate descriptive statistics for the perceived exertion of caregivers, pressure ulcers and number of handlers for bariatric patients. However, it was unclear how data on patient pain and informal caregiver satisfaction were analysed.

Appendix G: Expert responses

Question	Responses from experts

• Are you aware of literature or local audit data that compares slide sheet features, or considers the following:
  • In situ vs removable, or
  • disposable vs single patient use vs washable?
	No

	No.
	NHS clinical review team, Clinical review of slide sheets published September 2018
	No
	I'm not aware of any local audit data that compares in situ v removable from a usage perspective. The issues in the acute sector are related to washing facilities, therefore in my organisation in situ slide sheets are used mainly in the community setting where the sheets can be laundered in a domestic machine. We do occasionally have patients who use in situ sheets in hospital, the washing of these needs to be managed either by the relatives or by therapy staff who have limited access to washing facilities. We undertook some internal comparisons between paper disposable v washable (patient specific slide sheets weren't in use at the time, so it was disposable or reusable) in 2014 in C&V following a RIDDOR incident where a member of staff was injured when using paper disposable slide sheets which tore during use, this also resulted in a PI claim. The comparison was in relation to the pull forces required. The recommendations following this was to increase in staffing numbers for patients above 9 stone if paper slide sheets were to be used. If more staff were not available then reusable fabric slide sheets should be used. We haven't undertaken any comparison trials between fabric patient specific and fabric washable slide sheets.
	No.
	[redacted]
	Not aware of any recent ones. However, trust has plans to review cost/benefits of washable versus single patient use standard M&H equipment. This is dependant on operational pressures within organisation.
	Clinical_Review_Report_Slide_Sheets.pdf covers some of this.
	It may be worth checking ergonomic journals, column or the International Journal of SPHM & Falls Management.
For disposable, single patient use or washable slide sheets	
• Is there any noticeable difference to the carer or person being moved between: disposable,	No
	I do not use single-use or disposable slide sheets. The NHS trust I am employed by exclusively uses washable slide sheets.
	Washable slide sheets over time lose the ability to slide between the two surfaces causing further friction to the patient, single patient use slide

single patient use or washable slide sheets (assuming they are all in new condition)	sheets offer better sliding surfaces for staff and patients, this can be tested against MSK injuries relating to slide sheets.
	Working in the community, all slide sheets are single patient use. Wipe clean is ideal for efficiency and reduces strain on carers
	Yes, assuming your definition of disposable means a paper slide sheet as stated in question 1. I don't consider there to be any noticeable difference in single use and washable slide sheets if brand new out of the packet.
	My opinion is that patients would notice the difference with disposable products (or the ones that we have used anyway) since they take considerably more force to move which could adversely affect patient comfort.
	Unsure as only ever use single patient use slide sheets in the acute setting
	Disposable slide sheets don't tend to provide as good smooth glide and reduce the friction as single patient use or washable slide sheets. Washable and single patient use slide sheets provide very similar aid for repositioning.
	Washable slide sheets are more likely to have handles on them, and also to be a slightly thicker material which can make them slightly easier to use for the carer. They are also more likely to be ordered in appropriate size – wards are likely to only have once size of disposable/ single use slide sheets – these can be very large for use with some patients.
	Some patients report being sensitive to the noise created by the material during the transfers, the cheaper ones seem to be nosier with the material heavier if that makes sense. It may also be harder to gather when trying to form a good grip of the slide sheets prior to moving the patient. Another noticeable difference is the material and how it is perceived by the patient when it, contacts the skin, especially if the patient skin is vulnerable paper slides sheets, single use)
• Does the performance change over a number of uses? How many uses would you estimate could be performed, before there was a decline in usability for:	No notice although we find we often loose sliding sheets from the wards and in laundry frequently so rarely have a 'worn out' sheet.
	The paper ones certainly deteriorate over a number of uses, how many uses it takes for this to occur is difficult to measure as there are many variables in place, weight of patient, were they used correctly, how tight the staff were holding the slide sheet etc… Disposable paper slide sheets are only slippery on one side and this slippery material comes away from the paper backing over time making moving patients more difficult. When used in pairs it is vitally important that both slippery surfaces are facing each other – this is not the case for fabric slide sheets which are slippery on both sides.
	My experience is that performance does deteriorate with continued use for both single patient use and washable slide sheets. However, I do not have any data to state how many uses are sufficient to warrant a change.

	Yes over time, certain brands of slide sheet can lose their “slippiness” or stretch, causing a lag in the translation of forces to the patient on sliding.
	the paper slide sheets are one use only, though staff reuse it over times, the more it is used there is a noticeable depreciation in its effectiveness. With the other slide sheets decision to change is user guided once they notice it’s not working as effectively as it should, i.e the effort generated to move the patient is significantly more it needs changing.
a. Single patient use slide sheets	a. N/a
	Single use slide sheets retain their integrity longer however they are single patient use only so are not used for any length of time, if they become soiled or damaged they are replaced immediately.
	The slide sheets we use are washable/ wipe clean and are only used for one patient as they are in their home. I haven’t had a slide sheet that has declined in usability
	Fabric single use slide sheets can deteriorate depending on how tightly staff are gripping them and how long the staff members nails are, along with the weight and size of the patient.
	Dependent on the brand of slide sheet, quality/thickness of the weave and weight of the patient being moved. Most will still be useable up to 6 months but dependent on usage, may need replacing as soon as 3 months.
	During one patient stay unless single patient equipment becomes dirty equipment lasts well throughout the stay.
	a) I have used single patient use slide sheets in a ward setting and seen them last for many uses. However, this may be effected by issues such as incontinence etc.
b. Washable slide sheets	
	b. I do not routinely work on the same ambulance making it difficult to track/ assess their performance over time.
	This largely down to the companies claims however we have noted that after about 6 months the integrity to slide has been compromised be regularly cleaning, however with washable slide sheets like any equipment you need to carry out further safety checks on the equipment, due to detrition of the product.
	Washable slide sheets can also deteriorate as above but the washing process also causes further deterioration to the slipperiness of the fabric.
	Not used therefore unable to comment
	Washable slide sheets are not always removed from the circulation by staff when signs of wear and tear are evident. – manufacturer estimates around 150 washing cycles.
	I have never seen any type of slide sheet had to be discarded due to decline in usability – but this may be due to the settings where I have

	worked (time limited input). Also perhaps a lack of guidance on what we might mean by decline in useability.
	Washable are supposed to last longer hover where there is failure to adhere to washing instructions, it shortens the life span of the slide sheets
• For single patient use or washable slide sheets, are they normally kept by the bedside?	Yes
	All double crewed ambulances have slide sheets within a 'moving and handling' pack. This is in the same location in all ambulance vehicles.
	Yes, kept at the bed side.
	Sometimes I will remind families to keep the slide sheet in view/ by the bedside to ensure accessible for carers visiting the home, but generally they are always in the bedroom
	They should always be kept by the bedside in the acute sector to allow staff to have easy access when needed
	We only use single patient use slide sheets. These are normally kept by the bedside.
	Yes at our Trust, they are either kept in a clear bag at the end of the bed, attached by a low ligature risk drawstring or in the patient's bedside cabinet, dependant on ward policy.
	Yes.
	Yes – in a ward either tucked into bottom of bed or in patient locker usually. At home, usually tucked into bottom of bed.
	They are kept by the bed slide. sometimes in the bed locker stuffed at the foot end of the bed or some manufacturers have bags that can be ties to the foot end of the bed. Wherever it is stored, easy accessibility is key.
a) How often would they not be located when needed and an additional set of slide sheets be used?	One in every 10 patients in my experience
	It is unlikely that slide sheets would not be present or need to be replaced, as a 'vehicle preparation operative' (VPO) is responsible for cleaning, restocking, and checking the ambulances after each use. Any missing items would typically be identified and replaced before the ambulance is deployed.
	Always located to the individuals and wards
	If a patient in the community requires a slide sheet and they don't have one, I will order as an urgent piece of equipment. Usually a patient that needs one, has one, unless I see someone who has declined and I am the first to visit
	Unsure on this number as I am not a regular end user.
	Dependent on the ward environment and how familiar they are with slide sheets. In areas of high use, they are at the end of the beds in approximately ¾ of patients but in areas where they are used less often (i.e. more mobile patients) you would need to locate a set of slide sheets when required as not readily available.

	As there is no specific place where M&H equipment for patient is stored – additional sets are taken to use fairly regularly. Unfortunately no data to back up.
	This can happen on ward. Sometimes it feels like every patient issued one whether required or not. At other times may not be able t locate and have to ask for a new one.
	This is quite common, it can easily get caught under the mattress, wrapped up in patients' clothes or sometimes discarded accidently with dirty bed lined
	For washable slide sheets only
• What laundry facilities are available at the location at which you use slide sheets, and who are they run by (in house, or external contractor)?	External contractor I believe
	This is managed by the VPOs.
	External contractor, this brings it own issues i.e. kit and equipment not being returned to the right location, ward, department.
	Community setting – patients house
	We have no formal laundry facilities on any of our sites, all slide sheets are sent to external companies for washing
	We do not currently use washable slide sheets. We do not have any on-site laundry facilities, all laundering is undertaken by a soft Facilities contractor, sub-contracted to an off-site laundry contractor.
	Current laundering arrangements are with an external contractor. We do not have an onsite laundry hence only using single patient use slide sheets due to the difficulties in laundering with an external contractor.
	In house internal laundry.
	Hospital use – I have never had access to laundry facilities. A new slide sheet would be given if needed. Home use – can vary depending on patient.
	We use sunlight services, but that's only for linen, uniforms etc .We use patient specific slide sheets, however two departments , the rehab unit and the hospice have washing facilities on site so they use a mixture of washables and patient specifics slide sheets
• Can you comment on any issues with laundering slide sheets in your experience?	No issues
	N/a
	I can confirm as stated aove the loss of kit and equipment not being returned to the right ward/department, the slide sheets themselves loss integrity over time colour fades material becomes frayed and worn especially around any stitching.
	No
	We have had major issues in the past with laundering slide sheets, the time taken for slide sheets to return can be up to 7 days, if they do get returned to our sites they are unable to be sorted by department by our on-site laundry teams, meaning in effect they become a 'disposable' item to the ward that purchased them.

	In the past we have had issues with: long turnaround times for laundered items; items not being returned; deterioration in performance following laundering; concerns that the care instruction for laundering were not being followed by the contractor.
	Washable equipment (slings/slidesheets etc) would frequently go missing and/or not be returned in a timely manner if sent to external contractors, hence why our Trust has moved to a single use model. Plus the initial outlay and replacement costs are much more for washable slide sheets.
	Laundry is not open 24/7 and not covering slide sheet washing during weekends and bank holidays. That's when they have limited service. Wards and departments report that laundry doesn't get returned and slide sheets are going missing.
	I'm not sure we're very good at informing families about laundry instructions.
	I can't comment on experience, but one this I can say for sure is sending out to external laundry services you run the risk of not getting them back or receiving back a different item
• After how many uses (with a specific patient) would washable, removable slide sheets typically be washed?	Unsure
	After every use.
	This depends on patient needs requirements.
	If soiled the family would wash, but being wipe clean is the the usual method at home
	Washable slide sheets that have been used with a specific patient should be washed when: • Patient is discharged • They are soiled
	I don't have any data to give a number of uses. Typically, slide sheets would stay in use with the patient until soiled, the handling needs change, or the patient is discharged.
	Not used so unable to comment
	Difficult to state specific numbers.
	Probably varies – lack of guidance around this. Probably not enough.
	It may depend on the patients' needs /condition. On average maybe once a week, more if patient sweats a lot or is leaking bodily fluid, in continent etc Also, we recommend one to wash and one to wear, meaning on average two slide sheets per person if you are using washable. This can be a at a considerable cost to the unit depending on the number of hospital beds.
For removable or in situ slide sheets	
• In what situations would you consider	Never in our clinical practice on trauma and orthopaedics
	The NHS trust I am employed by does not use insitu slide sheets.

the use of an in situ slide sheet?	In cases where the patient cannot be rolled due to condition.
	In Situ slide sheets (wendy lets) are becoming more known in the community. When families are trained to assist with slides, we recommend these as reduces the rolling required for placement/ change o position change on removing slide sheet
	In situ slide sheets are great for plus size patients, palliative patients, patients who are sensitive to touch and patients in the community who maybe required to be moved by relatives between care calls, this list is not exhaustive. They are also sometimes appropriate for single handed care packages.
	We do not use an in-situ slide sheet in our acute setting. We might consider their use as part of the discharge planning process, since they are used in the community. Hypothetically, in-situ slide sheets would be a benefit to many acute inpatients. However, to date, the concerns about safety (ensuring that they are used correctly across wide numbers of staff, shifts, agency staff etc.), and issues with laundering, has rendered this impractical.
	For community use, where a patient was requiring frequent repositioning or was difficult to insert/remove slide sheets from under.
	IPC risks
	I have never had access to insitu-slide sheets so have not used or been able to consider as an option. Would imagine in longer term care settings – ie in home/ care home settings – rather than in acute hospitals.
	In situ slide sheets are designed to remain under the patient, which can reduce discomfort from repositioning multiple times during the day. This could potentially lead to better patient outcomes, although it may be difficult to directly quantify this benefit in terms of cost.
• If an in situ slide sheet was not used in this situation, what would be the alternative?	Standard slide sheet placed when needed
	The alternative is a standard washable slide sheet.
	Air flow sheet
	A wipe clean general slide sheet
	Two flat slide sheets could, theoretically, be used to assess the type of repositioning/transfers that an in-situ slide sheet would be used for in the community.
	The alternative would be 2 x flat slide sheets
	Removable slide sheets inserted using a technique called panelling or consider hoisting for repositioning.
	Possibly standard reusable slide sheet
	Would imagine disposable/ single use slide sheets would be alternative
	A slide sheet with a turning system – mattress
• What is the impact of this	Not aware
	N/a

decision on the quality of life for the person being repositioned, or the carer. Are you aware of any publications, audit data or case studies on this?	NHS clinical review team, Clinical review of slide sheets published September 2018 https://www.nice.org.uk/guidance/indevelopment/gid-hte10051
	Unaware of any publications Big difference for families, less strain and time required. However being insitu, more chance of being soiled and requiring washing, therefore 2 sets is preferred.
	The impact for both patients and care givers by using the in-bed system is a reduction in manual handling by not needing to roll the patient every time slide sheets are inserted.
	My opinion is that using in-situ slide sheets increases patient comfort (no disruption or discomfort caused by the process of inserting/removing the slide sheets) and safety – much less likely that staff use an inappropriate method for repositioning such as a drag lift or pulling on bed sheets. I am not aware of data or studiers to support this.
	Unaware of any literature relating to this subject. Within insitu slide sheets a patient would require less hand on contact therefore may not experience as much pain or discomfort and may feel more dignity in care. May be able to utilise less carers with insitu slide sheets as the need to roll, insert and remove is voided.
	Not aware of any audit data.
	N/A - See above
	It may be worth checking ergonomic journals, column or the International Journal of SPHM & Falls Management. Any TVN journals may have some in formation as reposition is one way of maintaining immobile patients skin integrity
• Are you aware of any issues in laundering in situ slide sheets?	Not aware
	N/a
	No issues logged
	No
	In my organisation they are not sent to an external laundry so they are usually washed by relatives/carers at home. The only laundering issues I am aware of is that fabric softener should not be used, this needs to be reminded to relatives who may be washing them.
	In the acute sector, the issues are as per answer number 6
	Unsure as not routinely used in acute setting
	Drying – no drip dry facilities. Equipment getting lost.

	Would imagine similar challenges to above – lack of clarity about who has responsibility and frequency of laundering.
	May be using the wrong detergent , temperature fabric softener , in the community some patient's iron them which damaged the fabric
• If they are used in a person's home, who is responsible for laundering?	I only work in a hospital
	N/a
	N/A
	The persons family
	The relatives/carers would be responsible for this.
	n/a to my area of service
	Unsure as not routinely used in acute setting
	At home family is responsible for laundering.
	Likely to depend on patient – family may cover all laundry needs, or carer may attend.
	The patient family, once the equipment is handed over to the family and they are trained in its use , the care of the item lies with the patients and their family
• Would there normally be more than 1 set of in situ slide sheets available for a specific patient? If yes, how many?	One set by the bed side…often a store of 5 or 6 in the wards store
	N/a
	25 in a box
	Yes, 2 sets preferred to enable washing. Usually order 1 to begin with to check it is suitable
	Yes there would usually be a minimum of 2 sets available, however continence issues may dictate more are required (If they are needing to be washed more frequently)
	n/a
	Unsure as not routinely used in acute setting
	Usually at patients home there is 2 sets provided, one in use – one being washed, dried and ready to be used.
	N/A - See above
	Patient may have 2 normally but we may give up to 4 on some occasions. If they must wash them more often and there is a concern that drying may be delayed impacting patient care.
• Are in situ slide sheets used for multiple patients, after laundering?	Do not use
	N/a
	Not used in this trust
	No, not in a community at home setting
	Yes they can be washed and reissued to another patient, so long as the washing process meets appropriate infection control standards.

	Unsure as not routinely used in acute setting
	Majority our in situ slide sheets are disposable, on occasion wendy lets used and ideally used for another patient after laundering.
	N/A - See above
	Yes, there is normally a stock of insitu slide sheets which is shared amongst the patients
For questions 15 and 16, are you able to quantify your response, either as an estimate from personal experience, or are you aware of publications, audit data or case studies?	Personal experience
	NHS clinical review team, Clinical review of slide sheets published September 2018 https://www.nice.org.uk/guidance/indevelopment/gid-hte10051
	Again, these answers are my professional opinion/experience, I am not aware of any data to support this.
• Does the use of an in situ slide sheet make a difference to the number of carers required to safely reposition a person who is being moved.	Yes but only for someone with a BMI of 35 and above which additional 1 or 2 people may be required depending on how dependent the patient was.
	N/a
	Not used in this trust
	Still use 2 to slide, but if it just to slightly reposition/ realign rather than moving up the bed, sometimes 1 carer will be able to complete safely
	In my opinion it can make a difference to staff/carers but there are many variables to this, such as: • Weight/size of patient • Patients ability to co operate • Physical capability of the staff (pre-existing injuries/pregnancies) • Cognitive ability of patient to follow instructions • Environmental constraints If the in-bed system with handles and a ceiling track/mobile hoist is used this will have more of an impact on the reduction in numbers of care givers required.
	My opinion is that there are some techniques (often badged as part of “single handed care”) which are possible with a single carer where, traditionally, two carers would have been used which are facilitated by in-situ slide sheets (e.g. turning into side-lying, boosting up the bed). In theory, the same techniques could be performed with 2 flat slide sheets but there would be the additional burden of inserting/removing the sheets. Whilst technically possible, it is difficult with a single carer.
	Unsure as not routinely used in acute setting but if rolling and inserting/removing were problematic for the carers, this aspect of the move

	is no longer necessary when using insitu slide sheets so may reduce the number of carers needed.
	yes
	I don't know that this would change the number of carers required compared to disposable/ single use slide sheets. But slide sheets in general may impact on number of carers required.
	The ease of using in situ slide sheets can reduce the number of staff needed to complete patient handling tasks, potentially lowering labor costs associated with these tasks.
• Does the use of an in situ slide sheet make a difference to the time required to safely move someone?	Do not use in-situ sheets
	N/a
	Not used in this trust
	Quicker, less rolling. However additional time if soiled
	In my opinion it can impact on the time needed as the slide sheets do not need to be inserted and removed each time the patient needs to be repositioned. However, the actual time to physically move someone does not change as the techniques are the same.
	Yes. Less time is required to move a person since the slide sheets do not have to be inserted/removed.
	Yes, as not need to roll/insert/remove slide sheets and this is often the part that takes the longest. Would reduce the time take by approximately half.
	yes
	See above answer
	In situ slide sheets can potentially save time for staff when moving patients, especially if left under the patient for use throughout the day, reducing the need to reposition and retrieve separate sheets.
• Would the use of an in situ slide sheet require a specific mattress?	Do not use in-situ sheets
	N/a
	Not used in this trust
	No
	The sheets wouldn't dictate the mattress, but the mattress would dictate the specific type of in-situ base sheet needed. For dynamic mattresses a base sheet with elastic corners needs to be used to enable to mattress to perform effectively. If the mattress is a foam then the type of base sheet doesn't matter.
	Each product would have to be used in line with the manufacturer's instructions. I am not aware of any contraindications, other than they may not fit larger mattress sizes.
	Unsure as not routinely used in acute setting

	no
	N/A - See above
	With the in-situ slide sheet, it important that the base sheet, some are draw string design others elasticated mattress design doesn't interfere with the ability of the dynamic mattress to inflate to full capacity.
• Are there any other costs or resource use considerations?	Not to my mind.
	N/a
	N/A
	Single patient use slide sheet/ wipe clean – generally provide 1. In situ, provide 2 Wash an in situ much more regularly
	The in-situ slide sheets are more expensive than reusable slide sheets.
	Unsure as not routinely used in acute setting
	unsure
	N/A – See above
	Type and Quality: Higher-quality slide sheets that are durable and washable might cost more initially but could lead to long-term savings through reuse. Reusable vs. Disposable: Disposable slide sheets may have lower upfront costs but could become more expensive over time due to frequent replacement. Reusable slide sheets may require higher upfront investment but have lower ongoing costs. Proper Use: Staff need training on the correct and safe use of in situ slide sheets to prevent injury, which can incur costs in terms of time and resources for training programs.
• How often would washable in situ sheets typically be washed?	Do not use in-situ sheets
	N/a
	N/A
	Dependent on patients continence, can vary to daily, to every few days
	As they are generally used in the community setting within my organisation they would be washed: • When soiled • As regularly as the remaining bed linen is washed (quilt cover etc) this varies by patient.
	Unsure as not routinely used in acute setting
	Depending on patient – daily bed changes or more if needed.
	Suspect lack of guidance on this.

	In general, washable in-situ slide sheets might be washed daily or after each patient discharge, or at least every 2-3 days if the patient is long-term and there is no visible contamination.
• How many washes, or how many years of use, would you expect them to last typically?	Do not use in-situ sheets
	N/a
	N/A
	In my line of work, I have seen in use for up to 6 months, but I work in palliative care and so the reason stopped is due to end of life rather than failure of slide sheet
	This will depend upon how many times they ae used to reposition a patient and how often they are washed and how they are washed, E.g. washing temperature and if fabric softener is used.
	Unsure as not routinely used in acute setting
	Unable to say
	Suspect lack of guidance on this.
	The manufacturer of the in-situ slide sheets typically provides specific instructions regarding washing frequency, usually based on the material's durability and intended use. Following these instructions helps maintain the sheet's functionality and lifespan.
Additional questions	
• When would you use a tubular slide sheet rather than a pair of flat slide sheets?	We now use tubular more than flat slide sheets as purchased by the trust rather than clinical decision making.
	Tubular slide sheets are used most often, typically when moving a patient from a chair or bed onto the ambulance stretcher. Tubular slide sheets provide smoother movement, which is particularly useful for these types of transfers. Pairs of flat slide sheets are available in several different sizes but are used less frequently as they are more difficult to use, take longer to move the patient, and are often uncomfortable.
	Moving up the bed, bed to bed transfers using pat slide, falls recovery assisting patient out of confined space
	Always use a tubular slide sheet unless requirement for a in situ flat sheets indicated
	There would be no instance where a tubular slide sheet would be preferred for any handling activities that would usually require 2 x flat slide sheets.
	I would always use 2 flat slide sheets
	If the move required is only ever uni-directional and there is no clinical need for slide sheets to be used in any other way. Otherwise, 2 flat slide sheets would be used.
	We are advocating to use a pair of flat slide sheets due to how versatile their use is.

	Tubular slide sheets are easier so if similar manoeuvre being repeated that this was easier for would recommend that. But a pair of flat slide sheets might offer more flexibility in use.
	With tubular slide sheets, the continuous loop design allows for smoother, multi-directional movement, which can make repositioning easier and reduce friction. Tubular slide sheets are excellent for turning patients from side to side. The looped structure allows caregivers to slide the patient gently without the need to lift, helping to reduce strain on the caregiver and discomfort for the patient. Flat sheets allow for inserting a sling without the need to turn the patient, can be done with a tubular slide sheet if staff are skilled. The danger of using flat slide sheets - staff use one rather than 2 , the handles give the impression of the need to lift rather than slide the patient up the bed
• How are slide sheets disposed of at the end of their life cycle (for all types)? E.g yellow and black bag, orange bag – or something else?	Orange bag as disposed after last patient use.
	Slide sheets are disposed of as clinical waste designated for incineration in cases where they are contaminated. VPOs manage non-contaminated slide sheets.
	Clinical waste orange bag
	Within home, our supplier red cross don't take back with other equipment and therefore disposed in the patients bin
	All types of slide sheets once they have reached the end of their use in the acute sector are placed in clinical waste bags. In the community sector they can be returned to community stores for laundering and reissued, but I am unsure if this happens in practice.
	In an orange (clinical waste) bin, unless contaminated or infected, in which case in a tiger or yellow bin.
	Disposed of in yellow and black waste bags unless soiled, when they would go in orange clinical waste bags.
	Depends on the state of the sheets – IPC rules.
	Usually binned as far as I am aware
	They go into the clinical waste or infectious waste as appropriate bin, recyclable slide sheets will be great for the environment.

Follow up questions to experts

Assumption used in the model	Is this assumption reasonable?
• All of the slide sheets compared are equally	Yes, on the whole, they are very similar when new
	Don't agree.

good at reducing friction when new	Even though Poly Glide slide sheets are better than nothing they don't seem to provide as good reduction in friction as other washable/single patient use slide sheets.
	Yes
	Yes
	Yes – I would imagine there are differences (reflected in staff preferences) but suspect that these are sufficiently small as to make this a reasonable baseline.
	Depending upon the material, not all slide sheets are equally good at reducing friction, paper cannot be compared with fabric. Washable/in situ shouldn't be compared to single patient use.
	I suspect there may be varying quality
For single patient use slide sheets	
• The single patient use slide sheet does not require replacement during use with a specific patient	Yes, I have never known a slide sheet to need replacing during use with a patient.
	Within acute hospitals patients can use the same sheets throughout their stay unless it becomes dirty or lost and must be replaced.
	Not applicable to my role.
	Yes, in my clinical practice (acute hospital care) but may not be the case when used in the community for longer-term use.
	Unsure – in acute settings probably yes. For patient at home, this could be for years and might need replacement.
	If the side sheet is soiled or damaged they would need replacing, also it depends how many times per day they are being used and how long the patient is in hospital etc
	It may do -due to scenarios below or if lost.
We also considered the following scenarios:	
• 10% are lost or soiled on every use	No, in my experience, the number of slide sheets lost to soiling would be less than 10%
	Unable to comment. Don't have data to back.
	Not applicable to my role.
	Yes
	Seems reasonable
	How would this be measured? Unable to quantify

	Certainly, a proportion would be lost of soiled. Would depend on clinical area but 10% may be a reasonable overall figure. I would say certainly not less than 10%
• All single patient use slide sheets would need replacing after 100 uses	Yes, or after 6 months, whichever is first
	Unable to comment. Don't have data to back.
	Not applicable to my role.
	Reasonable (we never get to that stage in my clinical practice but sounds reasonable).
	Seems reasonable
	How would this be measured? Unable to quantify
	Would suggest following manufacturers guidance. May be a reasonable assumption but I would think a proportion may not last as many uses for reasons above/ damage etc. Not aware of anyone monitoring number of uses.
For washable, removable slide sheets	
• They can be washed for 30 uses before there is a drop in performance.	Do not use, so unable to comment
	Manufacturers state that the slide sheets can be washed at least 100 times. Ours tend to get lost before that number of washing cycles are completed.
	Yes
	Reasonable assumption
	Seems reasonable (assuming appropriate laundry guidelines followed)
	On average, depending upon how they are washed, if fabric softener used, temperature of wash.
	Would suggest following manufacturers guidance. I don't know as haven't used any as long term as this.
• They will be washed after the end of use with a specific patient, or every 100 uses.	Do not use, so unable to comment
	Correct. Agree with the statement. Also washed if visible dirty/soiled.
	Yes
	Reasonable assumption
	Seems reasonable

	They must be washed after the end of use with a specific patient, 100 uses cannot be measured.
	May be a reasonable assumption. But suspect if washable, may be washed more frequently than this. Not aware of anyone monitoring number of uses.
For In Situ slide sheets	
• In situ slide sheets will be washed every 7 days	Do not use, so unable to comment
	Depending on patient – bed sheets are changed daily or more frequently. Weekly bed sheet change is not frequent enough within inpatient hospital.
	Not applicable to my role.
	Reasonable assumption
	I am not sure about this. However, I expect this would be the maximum average washing frequency (more from personal observation of a very small sample!).
	The frequency of washing varies, based on whether they have been soiled etc. The frequency of washing is more often determined by how often the patients washes the rest of the bedding (quilt covers etc)
	I do not have experience of in situ slide sheets
• In situ slide sheets would last for at least 6 months without loss of function	Do not use, so unable to comment
	Agree with the statement. If correct washing and drying is done.
	Not applicable to my role.
	Not sure as we don't necessarily use them that much
	Seems reasonable (this would be less than 30 washes)
	This would depend on a variety of factors, how often they are being used, how often they are being washed, how they are being washed, temperature of water, if fabric softener has been used and how many sets have been issued
	As above
• After 6 months use in a patient's home they would be disposed of	Do not use, so unable to comment
	My experience from community that equipment is disposed when signs of wear and tear – this can be longer than 6 months. Not aware that there is any specific time recommendation.

	Not applicable to my role.
	Sounds reasonable but as I work in an acute hospital, I am not 100%sure
	Unsure (I'm not aware of any data that says otherwise)
	Not necessarily, again they may have been in the patients home for 6 months but barely used, if they are not needed they could be returned to Joint equipment stores, washed and reissued if they were still performing well
	As above
• In other settings they may be re-used after washing and would last for at least 52 washes before replacement (1 year of constant use)	Do not use, so unable to comment
	Unable to comment as no data/experience to back.
	Not applicable to my role.
	not sure as we don't necessarily use them that much
	Seems reasonable assuming appropriate laundry guidelines followed.
	Unable to quantify usage or washing cycles.
	As above

Comparison of disposable, single patient use and washable slide sheets

We are aware that the number of uses of a slide sheet per patient will vary greatly between different clinical settings. Therefore, we have proposed a selection of scenarios for analysis. While these do not represent every setting where a slide sheet may be used, they are intended to reflect the breadth of different uses

Scenario		Time period considered	Uses per day	Total uses
A	Outpatients, ambulance or A&E	<1 day	1	1
B	Acute ward, with stay of 1 week, occasional repositioning or transfer	7 days	2	14
C	Hospital stay, longer term, repositioning every 4 hours	30 days	6	180
D	Patient home, repositioning every 4 hours	6 months	6	1,095

While these do not represent every setting where a slide sheet may be used, they are intended to reflect the breadth of different uses

• Do you think this is a plausible range of scenarios? If not, then please explain why	Yes
	Scenario B feels a bit low number of uses per day – realistically if patient needs assistance with repositioning this is more frequent than 2 uses per day.
	Yes
	Yes plausible but would suggest Scenario B may be more like 3 for those who need a sliding sheet.
	Yes – while there might be other reasonable scenarios to consider, I think they would have sufficient similarity to those described as to be equivalent.
	Scenario B may not be reflective of an acute ward, if someone was acutely unwell in ITU they would be moved more frequently than twice a day
	Scenario A – slide sheets should not be transferred between patents for infection control. Would need to be disposable/ single patient use/ washable. Scenarios B&C – could be used many more times than this - eg repostioning but also toileting/ therapy. This may mean up to 10 manoeuvres in a day.
• Is it realistic to have a scenario with a home visit 4 times a day?	Yes
	Yes
	Yes
	On the upper end but not impossible. 2 to 3 times a day more realistic. As an acute hospital worker, I would seek clarification from community members.
	Absolutely (if you are considering a combination of professional and family/informal caregivers)
	Yes, but the patient may be moved in between this by relatives
	Yes. May be additional manoeuvres depending on family carers etc
• If people were using dynamic air mattresses, would this impact on how often repositioning	Potentially would impact on the amount of physical repositioning needed but unlikely to affect care visits as these are usually completed for personal care and activities of daily living, with repositioning only forming part of that care. Rarely do carers call purely for repositioning purposes alone

was required? Would this change the number of visits a person had to their home?	No – in some scenarios patients on dynamic air mattress may require more frequent than 4 hourly repositioning.
	Not applicable to my role.
	On the upper end but not impossible. 2 to 3 times a day more realistic. As an acute hospital worker, I would seek clarification from community members.
	I am less comfortable answering this question (I am an academic, and therefore my expertise is largely theoretical). A dynamic air mattress should reduce pressure and therefore potentially reduce turning frequency. However, my experience from working with patient handlers and from the literature suggests that they are often driven by what they see as 'gold standard' frequency of turning (eg 2 hourly).
	A dynamic mattress does not reposition patients, a turning mattress or sleep platform can assist with turning and rolling but it would not necessarily limit the number of calls as the staff may be calling to check pressure wounds or other reasons.
	Slightly – but we probably don't reposition enough.

Comparison of removable vs in situ slide sheets

The EAG model will be based on a paper by Sturman-Floyd (2011), which reports the introduction of in situ slide sheets to 110 patient homes. They reported that the number of carers required on visits was reduced for 26 of those patients, often because informal caregivers were now able to work alongside formal carers. The author also reported a reduction of pressure ulcers, which will be included in some modelling. However, there was very little information about which patients were included, and the duration of pressure ulcers prior to the study, making it hard to draw firm conclusions.

Please can you comment on:

• What would a typical time for a home visit be (including travel)?	30-45 mins for a care call, 15-20 mins for a toileting call
	This depends on whether rural or city area – rural travel can take anything up to an hour depending on where patient lives. Time for a visit can depend from 20mins to an hour depending on if it is for pad change/repositioning or for wash/dress/etc
	Not applicable to my role.
	I work in the acute setting so unable to answer this.
	This it outwith my experience

	Unable to quantify this depends on geographical location and reason for care visit
	Varies greatly – probably in home for anywhere between 15-60 mins depending on purpose of the visit. But if visiting someone with level of need that using slide sheets would hope visit would be at least 30 mins. Travel could vary greatly depending on urban / rural etc. But could maybe take an average of 30 mins travel time between visits.
• Would this typically be carried out by a home care assistant?	Yes
	Yes most likely
	Not applicable to my role.
	I work in the acute setting so unable to answer this.
	As above
	Not always
	Probably – home care assistants/ carers – different job titles in different areas!
• Any other comments about the described approach, or source of information	n/a
	Recently there is an increase with single handed care model where equipment is used to reduce the number of carers required.
	Not applicable to my role.
	I work in the acute setting so unable to answer this.
	N/A
	Unreliable data
	-

Late-stage assessment

GID-HTE10051 Slide sheets for moving or repositioning a person

Assessment report overview

This overview summarises key information from the assessment and sets out points for discussion in the committee meeting. It should be read together with the final scope, the external assessment report and the user preference report. A list of abbreviations used in this overview is in Appendix A.

The technology

Slide sheets are friction reducing devices that assist the repositioning or moving of a person on or from a hospital bed or another surface. A slide sheets system consists of 2 layers of low friction material. As a person is moved, one layer stays in contact with them while the other stays in contact with the supporting surface. This allows the material to slide against itself, reducing friction (NHS Clinical Evaluation Team, 2018). Slide sheets can be flat, tubular or hybrid (a combination of both flat and tubular) and can be single-use, single patient-use or reusable (washable). Single-use slide sheets are disposed after each use. Single patient-use sheets are disposed after multiple uses with the same person. Reusable slide sheets can be laundered for decontamination and must withstand cleaning to national infection control guidelines. Slide sheets are available in different materials, which can affect the thickness and softness of the product. The friction-reducing properties of slide sheets can be from a coating, for example silicone, or an interweaved friction-reducing material. Slide sheets are available in different sizes and come in different packages.

Slide sheets can have additional features such as handles for gripping or straps for securing a part of the slide sheet to a mattress or bed. Single patient-use and reusable slide sheets are usually stored near the patient while

they are in use. Some slide sheets have a space to label them with the patient's name, to enable them to be easily identified for re-use. Some slide sheets come within a bag that can be hung from the patient's bed for re-use. In situ slide sheets are designed to stay under the patient without needing to be removed after each use. Some slide sheets use different colours to distinguish different sizes or to indicate the friction-reducing side of a slide sheet.

Further details, including descriptions of the technology features, comparator, care pathway and outcomes, are in the final scope.

Clinical effectiveness

The EAG gathered evidence for the clinical effectiveness of slide sheets from:

- a systematic literature search of bibliographic and clinical trial databases
- a scoping literature search
- company website searches
- a review of company submissions to NICE
- expert feedback
- a review of the references of any systematic reviews identified.

The EAG considered studies that compared at least 2 slide sheets with or without additional features to be the most relevant to the decision problem and research question. These studies were prioritised as key studies. Critical appraisal was carried out using the Joanna Briggs Institute (JBI) checklist. The search and selection methods are detailed in section 4.1 and Appendix A of the external assessment report (EAR).

Overview of key studies

The EAG found a very limited evidence base for the features of slide sheets. It identified 7 key studies that compared multiple slide sheets with and without additional or innovative features. Within the key studies, the following features were identified: slide sheets with handles or straps (n=4 studies); flat slide sheets (n=6 studies); tubular slide sheets (n=4 studies); washable slide sheet

(n=3); quilted tubular slide sheets (n=1 study); hybrid slide sheets (n=1 study) and in situ slide sheets (n=1 study) (see Table 5 in the EAR).

The 7 key studies are summarised in Table 1. For additional details see Table 4 and section 5.3 in the EAR.

Table 1. Summary of the key evidence identified by the EAG

Study	Technologies	Key results	Relevance and limitations
Baptiste *et al.* 2006	Tubular, silicone-filled sheet vs 2 different pairs of flat slide sheets with straps	One flat slide sheet (Arjo MaxiSlide) ranked as the top slide sheet by users for overall perceived performance and for comfort, injury reduction and patient safety. The presence of extended pull-straps, which minimised caregiver reach, was cited as contributing to the performance. The tubular slide sheet (Slipp) rated higher than comparators for ease of use and time efficiency. The alternative flat slide sheet (Phil-E-Slide) was rated lowest for overall performance and authors notes this may have been due to the 'extremely slippery' nature of the sheets.	Experimental study in an acute care setting; 77 caregivers, number of patients not reported. Did not specifically test the features of the devices. Both the best and worst performing devices were flat slide sheets with straps. Underpowered to detect significant differences.
Lloyd & Baptiste, 2006	Tubular, silicone-filled sheet vs Pair of flat slide sheets with straps vs Pair of flat slide sheets without straps	The flat slide sheet with straps (Phil-E-Slide) resulted in the lowest spinal compression and had the highest overall rank for slide sheets. It was reported to minimise the rotation of the torso, due to the two extended pull straps, which contributed to the lower compression of the L5/S1 spinal segment over the other slide sheets, and led to a substantial improvement	Laboratory study; 1 mannequin representing a patient used. Small sample size involving just 1 person completing the lateral transfers, which limits the generalisability of results. Did not specifically test the features of the devices.

Study	Technologies	Key results	Relevance and limitations
		in the posture of the investigator conducting the transfer. Mean applied force was lowest for the flat slide sheet without straps (Arjo MaxiSlide).	
Bartnik & Rice, 2013	Single patient-use, fabric slide sheet without handles vs Washable, nylon flat slide sheet with handles	No statistically significant difference in the average compression forces between the two devices. However, the single patient-use, fabric slide sheet without handles (McAuley Medical) resulted in lower forces.	Laboratory setting; volunteers acting as patients. Only used one Arjo MaxiSlide, as opposed to a pair, which is not standard practice, meaning the results have limited generalisability. The authors detailed that the findings are likely to be different with other care givers, which limits the interpretation of the results. The study did not specifically test the features of the devices.
Fray *et al.* 2016	Hybrid slide sheet vs Flat slide sheets with differing features, including handles, or no handles	The hybrid slide sheet (ReDi Slide) resulted in the lowest force used for a lateral transfer. The second lowest forces were experienced when the pair of flat slide sheets with polyester handles were used.	Laboratory study; volunteers acting as patients. Force data not available for all slide sheets assessed in the study. The study did not specifically test the features of the devices.
Fray & Hignett, 2009	Tube flat slide sheet vs Pair of single flat slide sheets vs Quilted tube slide sheet	Caregivers ranked the tube flat highest, with the pair flat slide sheets second highest. Patients ranked the pair of flat slide sheets highest, with the tube flat slide sheet second highest. Time taken for transfers was similar across slide sheets.	Setting not reported; volunteers acting as patients. Involved a small sample size, meaning that statistical significance could not be identified. Used a scoring system to measure the user and patient data, but does not include any detail on how this was implemented or the

Study	Technologies	Key results	Relevance and limitations
		The flat tube slide sheet resulted in the lowest forces to transfer.	numbers used as parameters. The study did not specifically test the features of the devices.
Larson *et al.* 2018	Washable flat slide sheet with handles vs Single-patient use fabric slide sheet without handles	The single-patient use fabric slide sheet without handles (McAuley) resulted in lower total forces in both the hands and lower back when sliding a patient up in bed.	Laboratory study; 1 volunteer acting as a patient. Study authors suggest the findings are not likely to be generalisable to health care settings. The study did not specifically test the features of the devices.
Sturman-Floyd, 2011	In situ slide sheet vs Washable flat slide sheets	The in situ slide sheet (WendyLett) led to a reduction in pressure ulcer severity and incidence. Handlers perceived there to be a reduction in exertion forces with the in situ slide sheet but there are no measurements to support this.	Before and after implementation study; 110 people requiring an in situ slide sheet within a primary care trust and social care organisations. The study compared the use of in situ slide sheets with removable flat slide sheets in the community.

Of the 7 key studies, none specifically aimed to compare the slide sheet features, with the exception of Sturman-Floyd (2011) which compared an in situ slide sheet to a removable slide sheet. Sturman-Floyd (2011) found a reduction in the number of care workers required for repositioning of a small number of patients after in situ slide sheets were introduced for use. The study reported cost reductions in care worker time, and potential cost reductions due to reduced numbers of pressure ulcers.

As a whole, the key studies used variable outcome measures, so a useful comparison of findings was challenging. Most of the studies did not have adequate sample sizes for power calculations and the study designs and type of repositioning task varied which further limited comparability. Few studies

used actual patients. For those reasons, most of the evidence is not generalisable to the NHS setting.

Evidence from expert responses

The EAG summarised evidence related to the clinical effectiveness and value of specific features of slide sheets from its consultation with experts (see section 5.4.1 in the EAR). These experts had experience in both the acute and community settings. A summary of this evidence is presented in Table 2.

Table 2. Summary of the evidence from expert responses

Feature	Expert feedback
Disposable, single patient use or washable slide sheets	Disposable slide sheets can be less effective and usable and this may have a negative impact on the person being moved. Over time, washable slide sheets lose their friction-reducing properties. Single patient use slide sheets usually maintain performance during the period of their use, but may occasionally deteriorate or may need to be replaced for other reasons, e.g. hygiene. There are concerns related to the practicalities of the laundering process for washable slide sheets.
In situ or removable slide sheets	Benefits of using in situ slide sheets in community care setting include: • A reduction in discomfort associated with frequent insertion and removal of removable slide sheets. • An increased preservation of dignity of the person being moved. • Less time required overall for repositioning tasks. • The feasibility of only requiring a single user for some repositioning tasks. There might be benefit of using in situ slide sheets in other settings, e.g. acute care, but there may be issues with laundering and safety. Laundering is often the responsibility of informal caregivers which can be time consuming and also can lead to damage of the device if not done correctly.
Pairs of flat sheets versus a tubular slide sheet	Tubular slide sheets may have benefits in terms of ease or reducing inappropriate use, but flat slide sheets in a pair allow more versatility and flexibility.
Slide sheets with or without handles	Slide sheets with handles may be easier to use, but the presence of handles may prompt the handler to lift instead of sliding the person being moved, leading to injury.

Economic evaluation

Published economic evidence

The EAG's evidence review identified one study that included economic information that was relevant to the scope.

Sturman-Floyd (2011) conducted a before and after study to evaluate the implementation of the WendyLett in situ slide sheet for 110 people in community care, where the previous standard of care was a pair of flat, washable slide sheets. The study recorded changes in the number of care workers required for visits and the presence of pressure ulcers at baseline, 6 weeks, 12 weeks and 6 months. The results indicated a cost reduction of £289,074 in care worker costs and a reduction in the prevalence of pressure ulcers from 31 at baseline, to 3 at 6 months. The authors used the NHS Pressure Ulcer Productivity Calculator to estimate a reduction in pressure ulcers-related costs of £79,000 per year. See section 6.2 in the EAR for additional details.

Regression modelling

Methods

The EAG fitted a linear regression model to spend data from NHS Supply Chain to investigate the amount of price variation that could be explained by the presence of the following features:

- Disposable, single patient use or washable
- Single flat sheet, flat sheet in pair with bag, tubular and hybrid
- With or without handles
- Size of slide sheet.

This subset of features was chosen as the features could be applied to all removable slide sheets and were relatively clearly and consistently described in the dataset. The EAG made the following assumptions:

- Two single flat sheets would have to be purchased for use in a pair.
- In situ slide sheets were not included in the regression analysis, as they are considerably more expensive than removable slide sheets, have

different features, are used in a narrower range of clinical scenarios and there are fewer devices available.

NHS Supply Chain framework prices excluding VAT were used.

The NHS Supply Chain data contained sales of 1,137,862 (50%) single flat sheets, 246,9634 (11%) sets of flat sheets in a bag and 897,488 (39%) tubular or hybrid slide sheets. When considering the reusability, 80% were single patient use (n=1,835,535), 19% disposable (n=430,258) and 1% (n=16,521) washable.

Results

The linear regression resulted in an R^2 value of 0.63, that is 63% of the price variation was explained by these features. This was after removing an identified outlier which represented a device no longer available on the UK market.

Four device features significantly correlated with the device price:

- The presence of handles was associated with a significantly higher device price.
- The device being washable was associated with a significantly higher device price.
- Tubular slide sheets were associated with a significantly lower device price, with the price adjusted to compare for the number required for use, as described above.
- All of the size categories were associated with a significant difference to the price (with smaller sizes being cheaper).

See Table 15 in the EAR for additional details.

The EAG did a visual comparison of the prices for the included removable devices available through NHS Supply Chain (Figures 1-3). The graphs indicate that despite differences between features, there is also considerable overlap between the prices of the available devices.

Figure 1. Adjusted unit Cost (£) for different types of removable slide sheet

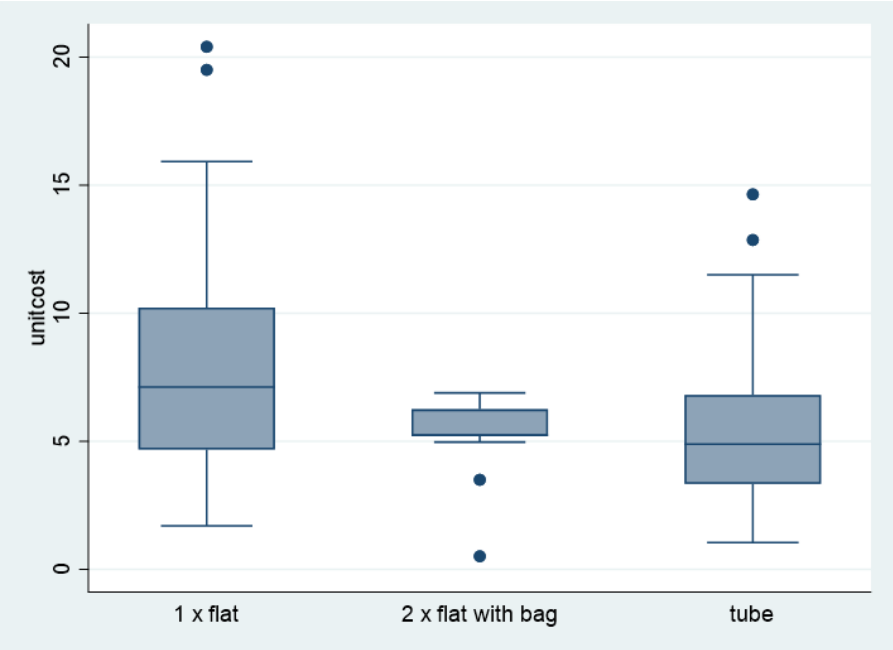


Figure 2. Adjusted unit Cost (£) for single patient use, disposable and washable slide sheets

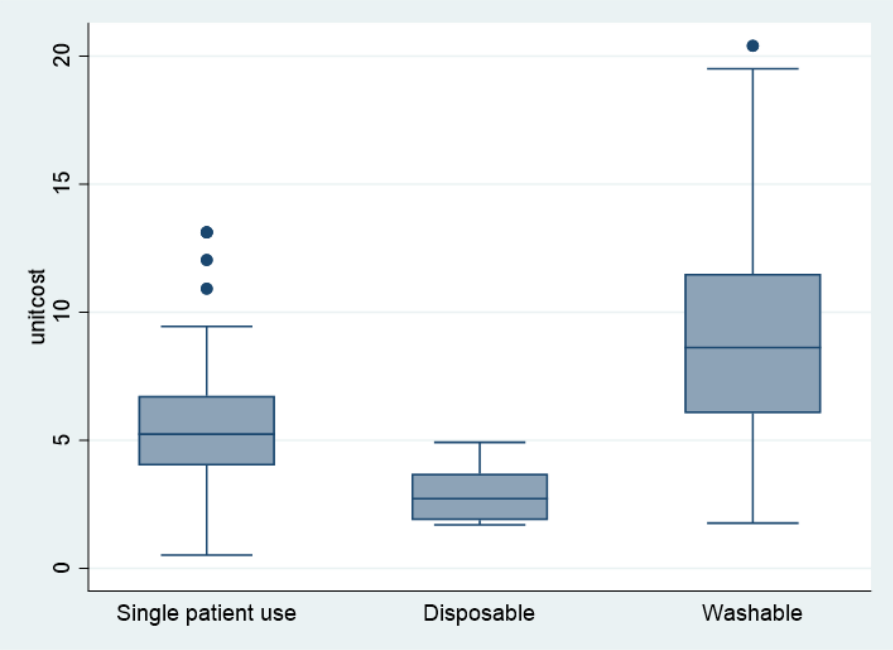
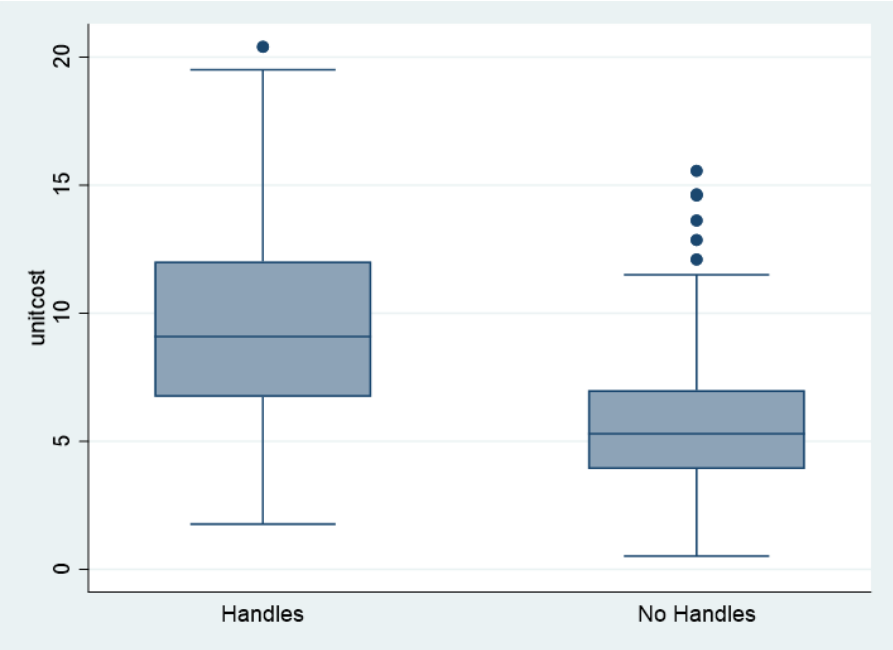


Figure 3. Adjusted unit Cost (£) for slide sheets with and without handles



Health economic models

The EAG developed two cost comparison models to investigate:

- washable compared to disposable or single patient use slide sheets
- removable compared to in situ slide sheets.

Model 1. Washable compared to disposable or single patient use slide sheets

Methods

The EAG modelled the total cost of washable compared to disposable or single patient use slide sheets in 4 clinical scenarios given the expected lifetime and number of uses of each device. The scenarios are described in Table 3.

Table 3. Economic scenarios for reusability model

Scenario		Time period considered	Uses per day	Total uses
A	Outpatients, ambulance or A&E	<1 day	1	1
B	Acute ward, with stay of 1 week, occasional repositioning or transfer	7 days	2	14

C	Hospital stay, longer term, repositioning every 4 hours	30 days	6	180
D	Patient home, repositioning every 4 hours	6 months	6	1,095

The EAG assumed clinical equivalence between slide sheets for the purpose of this model. It also assumed that the single patient use slide sheet does not require replacement during use with a specific patient unless it is lost (at bedside or during laundering) or soiled. Washable slide sheets will be washed after the end of use with a specific patient, or every 100 uses and they can be washed 30 times before requiring replacement. The model included costs related to purchase, reprocessing and disposal. Technology costs were based on NHS Supply Chain framework prices excluding VAT. Resource use and cost parameters are described in Table 4. See section 7.4.4 in the EAR for additional details on the methodology.

Table 4. Resource use and cost parameters in the reusability model

Item	Washable	Single patient use	Disposable	Source
Number of washes in lifetime	30	0	0	Assumption, checked with experts
Weight of device (kg)	0.298	0.137	0.370	John et al. 2024, EAG measurements, Supplier description
Probability that device is lost while at patient bedside	10%	10%	0	Assumption, checked with experts. Results are presented with and without losses.
Probability that device is lost during laundering	10%	0	0	Assumption, checked with experts. Results are presented with and without losses.
Cost of purchasing a slide sheet pair	£8.85	£4.01	£1.92	NHS Supply chain, weighted mean of all products sold in 2023-4

Cost of laundering one item	£0.445	n/a	n/a	NHS Wales, All Wales Laundry Service (correspondence log)
Disposal cost per tonne (offensive or hygiene waste)	£414.82			Inflated from £330 in 2012. NHS Scotland Waste Prevention Guide
Cost of disposal per slide sheet pair	£0.25	£0.11	£0.31	Calculated; see section 7.4.4 in the EAR

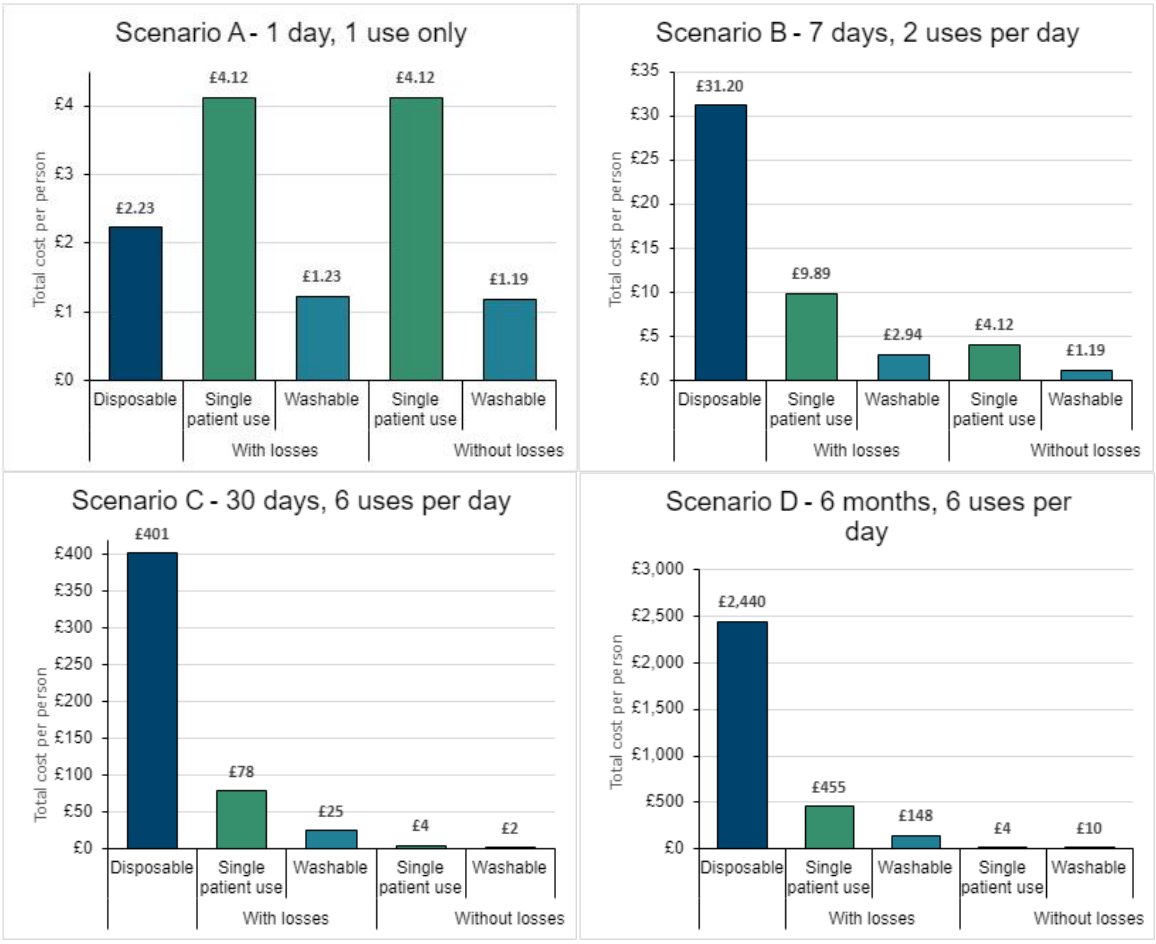
Results

The results are presented in Figure 4. Washable slide sheets were the lowest cost option in all scenarios if it was assumed that some losses from patient bedside or from laundering (around 0.3%) occurred. The only exception was where they were used for long periods of time with a very low number of replacements needed (due to soiling or loss). In these cases, single patient use slide sheets may be less costly. Probabilistic sensitivity analysis also found washable slide sheets to be the least costly in all scenarios (scenario A: 93% probability, scenario B: 97% probability, scenario C: 97% probability, and scenario D: 96% probability). Disposable slide sheets had the highest total cost in all scenarios except for scenario A (where only one use was required).

The EAG noted that this model did not account for the implementation of laundering systems for the washable slide sheets.

Beyond the rate of losses, the results were sensitive to the cost of the single patient-use slide sheet, the number of uses per day and to a lesser extent, to the number of times a slide sheet can be laundered before replacement, the cost of washing and for scenario D – the number of uses prior to washing a washable slide sheet. The results were not sensitive to the cost of the washable slide sheet within the range modelled. See Tables 17 and 18 and sections 7.7.1 and 7.7.2 in the EAR for additional detail.

Figure 4. Total cost per person for each type of slide sheet across scenarios A to D

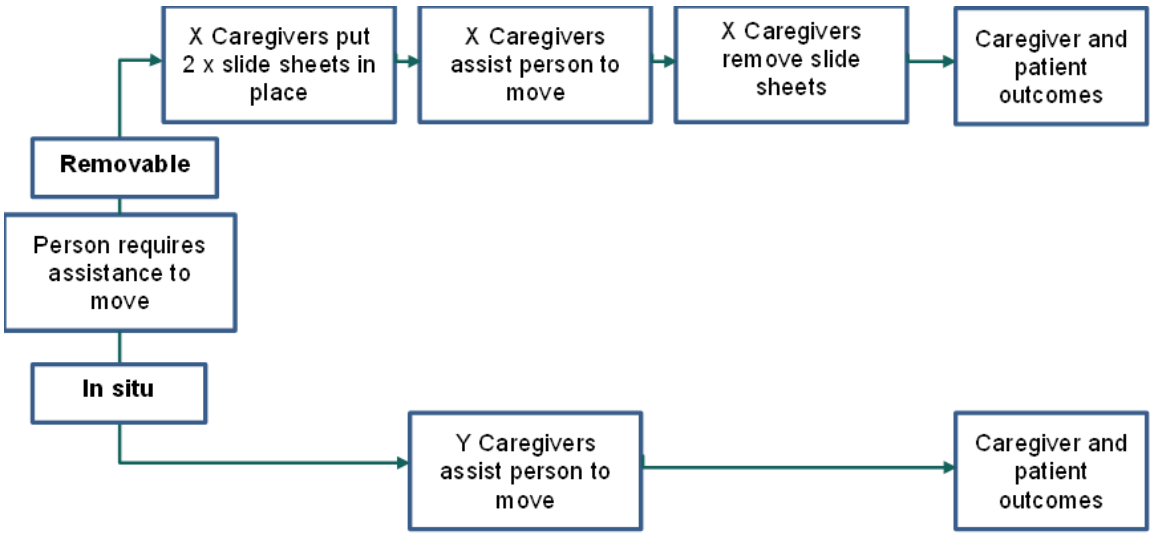


Model 2. Removable compared to in situ slide sheets

Methods

The EAG modelled the total cost of removable compared to in situ slide sheets in community care over a 6-month time horizon. The model structure is shown in Figure 5.

Figure 5. Structure of the economic model



The EAG made the following assumptions:

- Repositioning is carried out by paid care workers in the person's home.
- The removable slide sheet can be wiped clean if needed, but will be laundered after an average of 100 uses. Two sets are required to allow laundering.
- The in situ slide sheets are washed every 3 days, and at least two sets are required to allow laundering.
- The slide sheets do not have a drop in performance during their lifespan.
- The slide sheets may be washed and used by another patient at the end of the model (although an additional scenario assumes that they are disposed of at the end of the modelled period).
- The rate of caregiver injury or pain during repositioning is not different whether in situ or removable slide sheets are used.
- The slide sheets are clinically equivalent.

Cost parameters included the purchase, replacement and laundering of slide sheets and resource use considerations included the number of staff and time of staff required to reposition the patient. Technology costs in the comparator arm were based on NHS Supply Chain framework prices excluding VAT. The cost of the set of in situ base and top sheets was taken from a publicly available retail cost, but a scenario used the confidential cost of one device on

the NHS Supply Chain framework. Resource use and cost parameters are described in Tables 5 and 6, respectively. See section 7.5.4 in the EAR for additional details.

Table 5. Resource use parameters in the in situ vs removable slide sheets model

Item	Parameter	Source
Proportion of people being moved who are living with obesity	5.5%	Sturman-Floyd (2011) (6 / 110)
Mean number of care worker visits at baseline, for people living with obesity	16	Sturman-Floyd (2011), based on 4 visits per day, each with 4 care workers.
Reduction in number of care worker visits when using in situ, for people living with obesity	33.3%	Sturman-Floyd (2011), based on 4 out of 6 patients reducing to 2 care workers per visit.
Mean number of care worker visits at baseline for people not living with obesity	7.02	Sturman-Floyd (2011), based on 2 or 3 visits per day, each with 2 care workers.
Reduction in number of care worker visits when using in situ, for people not living with obesity	10.7%%	Sturman-Floyd (2011), based on 4 out of 6 patients reducing to 2 care workers per visit.
Staff grade	Home care worker	Sturman-Floyd (2011)
Time required for repositioning	20 min	Assumption, checked with experts and sensitivity analysis
Losses during use	2%	Assumption, applied per use for removable and per wash for in situ.
Losses during laundry	2%	Assumption, applied per wash for both types of slide sheet

Table 6. Cost parameters in the in situ vs removable slide sheets model

Item	In situ	Removable	Source
Cost of purchasing devices (pair)	£198	£8.85	Publicly listed price for in situ (Set of in situ devices), and confidential cost from NHS Supply Chain NHS Supply Chain for removable (two single flat sheets)

Weight, pair (kg)	1.639	0.596	John et al. 2024 Supplier brochure
Disposal costs per item	£0.68	£0.25	Costed as described in Table 9 in the EAR.
Washes prior to disposal	80	30	Expert advice
Uses prior to washing	3 days	100 uses	Expert advice
Laundering costs per single item	£0.445	£0.445	NHS Wales, All Wales Laundry Service
Staff time per hour	£27	£27	Personal Social Services Research Unit 2023, home care worker rate

Results

The EAG's base case showed that using an in situ slide sheet results in an additional cost of £232 per person, but that this was offset by a cost saving of £1,643 due to fewer care worker visits. So, the total estimated benefit of using in situ slide sheets was a saving of £1,411 per person (see Table 21 in the EAR). The results were similar when the confidential NHS Supply Chain framework price for an in situ slide sheet is used, with the total estimated saving being marginally higher (see Table 23 in the EAR).

The results were sensitive to the duration of the carer visit, the time horizon, the hourly cost for healthcare assistants and to a lesser extent the number of carer visits (removable slide sheets arm) and the reduction in care visits (in situ slide sheets arm). However, the EAG noted that the only parameter that makes the in situ slide sheets more costly than removable slide sheets is where the cost of the care worker is approaching zero. This would happen if all care was done by informal caregivers only or if there was no change in the mean number of care workers per visit. This means that in all other cases despite the variation of the parameters, the in situ slide sheet remains a cost-saving option for long term use in the community.

When the cost and utility impact of pressure ulcer reduction from using in situ slide sheets was included, the cost savings increased to £2,371 per person (with a utility gain of 0.0027; see Table 24 in the EAR). This makes the in situ

slide sheet dominant, compared to removable slide sheets, with an incremental net monetary benefit of £2,424 at a willingness pay threshold of £20,000 per QALY, but the EAG cautioned of the uncertainty of those results due to a lack of data.

If devices are purchased for each user and disposed of at the end of use the savings are reduced to £849 per person (see Table 25 in the EAR). If this assumption is retained the model is more sensitive to changes in individual parameters and using in situ slide sheets can emerge as cost-incurring when carer visit time is reduced, when the duration of the model is shorter, when more frequent changing of slide sheets is assumed or when the probability of losing in situ sheets is higher (see Figure 10 in the EAR).

The EAG also investigated the potential use of in situ slide sheets in a hospital setting by modelling a scenario with a care worker time of 5 minutes and higher losses of 10%. They assumed devices would be cleaned and reused for other patients. The incremental cost for in situ compared to removable slide sheets was greatly reduced but nonetheless resulted in a cost saving of £38.

User preferences

A group of 9 manual handling advisers participated in NICE's user preference assessment to explore the most important criteria when selecting which slide sheet should be used by handlers. They identified a set of 9 criteria that reflected user preferences. They then ranked the criteria in order of importance and assigned weights to reflect how much more important they judged one criterion to be compared with the one below. The list of ranked criteria with weights is in Table 7. The weight of each criterion reflects its relative importance compared to the other criteria.

Table 7. List of user preference criteria after ranking and weighting

Rank	Criterion	Weight
1	Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and not stretchable)	33%

2	Material (the slide sheet is not made of paper)	20%
3	Different colours to indicate normal (general) versus plus size slide sheet	14%
4	The slide sheet is single use or single-patient use i.e. not washable	10%
5	The slide sheet does not have Velcro for joining two of them in a pair	7%
6	The slide sheet does not have straps, handles or a top clip loop	6%
7	Different colours to indicate the top and bottom in a pair of flat slide sheets	4%
8	The slide sheet comes with a high-quality bedside storage bag	3%
9	The slide sheet comes in recyclable packaging	3%

Six further criteria were also identified but were judged to only be relevant in specific patient subgroups or clinical scenarios and so were excluded from the main set of user preference criteria (see Table 2 in the user preference report). These included the type and size of the slide sheet, whether waterproof or a particularly durable material was used, presence of an absorbent/cotton layer and whether it comes in a large pack.

The top 2 general criteria were both related to the material of the slide sheet and had a combined weight of 53%. Eight of the 9 general criteria were binary, so meeting the criterion is directly related to a slide sheet having a particular feature or characteristic. A performance rule for Criterion 1 was not established. However, one manual handling adviser suggested that the quality of the slide sheet can be related to its sliding properties, specifically if it provides a sufficient amount of glide to reduce the strain for handler. Therefore, this criterion could be related to clinical outcomes, for example the forces exerted by the handler.

Clinical and economic evidence related to the user preference criteria

The EAG identified 7 papers in their clinical review that included slide sheets with some of the features identified by the user preference work (higher quality material, single use or single patient use and no straps/handles). But

they were not able to draw any conclusions about the impact of any specific feature on outcomes for patients or users. Some of the user preference criteria were included in the EAG's regression model (single use or single patient use and no straps/handles) as well as the type and size of the slide sheet. The presence of handles and the device being washable were factors associated with a higher price which is in contrast to the user preferences in that both of these features were deemed undesirable. Size and type of the slide sheet were deemed a clinical criterion in the user preference work but manual handlers did specify that they would only recommend 2 sizes, one for general use and one for bariatric patients. One user preference criterion was included in the EAG's modelling (analysis of washable compared to disposable or single patient use slide sheets). The results were in contrast to the preference of the users as they indicated that washable slide sheets are generally the least costly option across most scenarios. However, the analysis did not factor in any implementation issues (for example, with laundering), whereas most users noted that such issues are the reason why they would prefer single use or single patient use slide sheets.

Details on the identified user preferences are on pages 7 to 12 of the user preference report.

Equality considerations

The final scope and the scoping equality impact assessment describe equality considerations for this assessment. The EAG did not identify any additional equality issues during the assessment. Relevant subgroups where there might be potential equality considerations include:

- People who are particularly frail, critically ill or who have severe skin conditions, for example burns or ulcers.
- People with a limited understanding of the English language when no interpretation support is available, people with mental health conditions or a learning disability, people who are particularly frail, critically ill, with a physical disability or reduced mobility, or any other person who may

be unable or less able to assist their caregiver during a repositioning task.

- Older people or any other person whose condition leads to the need for assistance to move or reposition themselves when the condition may be considered a disability.
- People with overweight or obesity or any other person who may be at higher risk of pressure ulcers.
- Caregivers who are shorter or taller than average.

The key studies in this assessment did not report subgroup data or study participant information on any of the relevant subgroups.

Limitations and key issues

Clinical effectiveness

Limitations

- Only 7 studies that were directly relevant to the decision problem were identified. Six of those did not aim to compare slide sheets with and without additional features. Only 1 study provided a comparison of an in situ slide sheet and a removable slide sheet.
- All key studies had quasi-experimental designs; no studies used random assignment or control groups. Two of the key studies were not published in peer reviewed journals and 1 study was a conference paper.
- The EAG expressed concerns about the generalisability of the evidence to the NHS context because:
  - Five studies were conducted in a laboratory setting (not representative of the real world).
  - Several of the studies had a small number of participants and in 2 studies only 1 participant performed all transfers; most studies did not have adequate sample sizes for power calculations.
  - A variety of outcomes and measures were used with limited comparability.
  - The types of repositioning tasks differed across studies.

- Only 3 studies were conducted in the UK.

- The EAG expressed concerns about the validity and reliability of the evidence because there were differences in the way that studies described the slide sheets used, including which features the slide sheets used had.
- The EAG was unable to establish or reject clinical equivalence between different slide sheets.

Key issues:

- Do the clinical studies provide evidence for the value of any feature of a slide sheet?
- To what extent is the evidence generalisable to the NHS context?
- Can clinical equivalence between some slide sheets with or without a particular feature or features be established?

Economic evaluation

Limitations:

- The EAG identified only one non-peer reviewed study that was relevant to the scope which included an economic component.
- There was a lack of clinical evidence available to inform any modelling that relied on differences in clinical efficacy, manual handling injury outcomes or patient/carer experience. Both of the EAG's models were cost-comparisons.
- Some uncertainty arose from the clinical parameters, which were obtained from one non-peer reviewed study or through expert elicitation.
- There was additional uncertainty in the results due to differing purchasing or implementation (for example, laundry) arrangements between and within trusts. This limits the reliability of the results.
- The features included in the regression analysis only explained up to 63% of the price variation and not all features could be included.
- There was a lack of evidence available to inform any modelling of the following features of slide sheets identified through the user preference assessment – the material, Velcro for joining in a pair, handles or a top clip loop, different colours, bedside storage bag or recyclable packaging.

Key issues:

- Are the structure, assumptions and clinical and cost parameters of the economic models appropriate? In particular, is it reasonable to assume:
  - Clinical equivalence between slide sheets?
  - That neither washable, nor in situ slide sheets have a drop in performance during their lifespan or that washable slide sheets will require replacement after 30 washes and in situ will require replacement after 80 washes?
  - That using an in situ slide sheet reduces the number of carers needed to perform the moving or repositioning tasks?
  - Handling tasks in the community will be done during 3 to 4 visits a day by a paid carer?
  - In situ slide sheets would be washed and reused with different patients in the community?
- Are the results of the economic model valid within the particular clinical settings modelled? Are the results generalisable to other clinical settings?
- What conclusions be drawn about the value of any features from the economic models?
- Which features of slide sheets contribute to the price variation between technologies?

User preferences

Limitations:

- A performance rule for Criterion 1 (slide sheet being made of a higher quality material) was not established.
- The user preference assessment was associated with some uncertainty because users were represented by manual handling advisers.

Key issues:

- What conclusions can be drawn from the user preference assessment?
- How can the quality of the slide sheet be further defined?

Appendix A. Abbreviations

EAG	External assessment group
EAR	External assessment report
JBI	Joana Briggs Institute
RFI	Requests for Information
VAT	Value added tax

NICE National Institute for Health and Care Excellence

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Late-stage assessment

GID-HTE10051 Slide sheets for moving or repositioning a person

User preference report

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Table of Contents

1. Introduction

Alongside the assessment of a technology's value based on costs and effectiveness, the late-stage assessment on slide sheets for moving or repositioning a person includes an assessment of user preferences that influence decision making when selecting which technology to use (see NICE's interim methods and process statement for late-stage assessment). This report presents the key findings from the user preference assessment that was done to understand:

- which factors (criteria) are important when choosing a slide sheet,
- how important those factors are, and
- how the criteria can be measured.

This report should be read alongside the external assessment group (EAG)'s external assessment report (EAR).

2. Background

Slide sheets are friction reducing devices that assist the repositioning or moving of a person on or from a hospital bed or another surface with the aim to reduce the overall musculoskeletal burden on the handler. Additionally, slide sheets aim to minimise adverse events and increase comfort for the person being moved, by protecting vulnerable tissues from friction, shear and 'stiction'.

A slide sheets system consists of 2 layers of low friction material. Slide sheets can be flat, tubular or hybrid (a combination of both flat and tubular). Flat slide sheets need to be used in pairs. Slide sheets can be single use, single patient-use or reusable (washable) and are available in different materials. They come in different sizes and packages and can have additional features that may benefit the patient or the handler. Most slide sheets need to be put under the patient and removed after each use. In situ slide sheets are designed to stay under the patient.

3. Methods

This user preference assessment was done in line with NICE's interim methods and process statement for late-stage assessment. The aim of capturing user preferences is to transparently collect and present information to the committee on the criteria that users consider important when deciding which technology to choose. Users are defined as those who will use the technology and are directly involved in the decision to choose one technology over another.

Participants

Manual handling advisers were identified as the main decision makers, because they recommend to wards and healthcare professionals which slide sheets should be procured and used. So, they have the knowledge and experience to know what the users' needs are. Many healthcare professionals, including nurses, midwives, health care assistants, hospital porters, physiotherapists, occupational therapists, paramedics, ambulance crews, radiographers, anaesthetists, social care workers and home carers use slide sheets to move or reposition people.

Manual handling advisers were recruited according to standard expert recruitment processes (see Chapter 1. Involvement and participation in NICE's health technology evaluation manual). All participants were registered and submitted declarations for confidentiality agreement and conflicts of interest. The register of declared interests can be accessed along with other project documents on the topic's page on the NICE website.

Assessment stages

The user preference assessment has been designed with Multicriteria Decision Analysis (MCDA) principles (ISPOR Task Force Report, 2016). Data on user preference was collated through participation in 1 online workshop and 2 email tasks. The process followed 3 stages:

- Stage 1: identifying and defining criteria for selecting slide sheets (workshop)

- Stage 2: ranking criteria in order of importance (email task 1)
- Stage 3: weighting of criteria and performance rules where relevant (email task 2).

Stage 1: identifying and defining criteria

Users were asked to identify key factors that are important when recommending which slide sheets should be selected. A preliminary set of criteria identified during scoping, based on expert advice and published literature, was used as a starting point at the workshop. This set of criteria was refined and extended following a structured discussion during an online workshop. Following the workshop the wording of the criteria was refined and the criteria were split into those for ranking (see next stage) and clinical criteria relevant to specific patient sub-groups or clinical scenarios only. The clinical criteria were not excluded from the overall assessment and their relevance and impact is investigated elsewhere. During the workshop, users also suggested consulting tissue viability experts for their opinions on the list of criteria and the outcomes from the subsequent tasks.

Stage 2: ranking criteria in order of importance

Users were asked to rank the criteria in order of importance to them via email. Ranked lists from all respondents were collated, averaged and ordered from most important to least important, creating a final ranked list of criteria and definitions (using the SMART ranking technique; see Appendix C for a detailed definition). The final ranks were taken as the average of the ranks of all responders. Standard deviation (SD) was used to measure the level of agreement between responders.

Stage 3: weighting criteria

Users were asked to weight the criteria to show how much more important 1 criterion was compared with the criterion ranked below (using the swing weighted technique, see Appendix C for a detailed definition) via email. To weight the criteria, users were asked to give each criterion a score from 0 to 100%. For example, a score of 0% meant that there was no difference in importance between a criterion and the criterion ranked below, and a score of

100% meant that it was considered twice as important. Weighted lists for all respondents were collated, averaged and weights were calculated. SD was used to measure the level of agreement between responders. At this stage users were also given the opportunity to identify performance rules for any criteria where this was relevant.

The final list of criteria and their weights were consulted separately with tissue viability experts in order to quality assure the results from the ranking and weighting tasks. Tissue viability experts were also given the opportunity to contribute to the development of any performance rules.

4. Results

A total of 9 manual handling advisers took part in the user preference assessment (see Appendix D for the list of participants). Six users participated in the identification task (stage 1), 9 in the ranking task (stage 2) and 7 in the weighting task (stage 3). Three manual handling advisers identified performance rules in stage 3.

The cost of the slide sheet was recognised as an important consideration, but was not included in the set of criteria, because it was considered by the EAG (see sections 6 and 7 of the EAR). The criteria were split into 2 groups – those relevant to the general population and appropriate for ranking (n=9) and those relevant to specific patient sub-groups or clinical scenarios only, which were not included in further tasks (n=6). The former group (including a brief rationale for the criterion) is presented in Table 1. The latter group (including the rationale for exclusion) is presented in Table 2. Eight of the 9 general criteria were formulated as binary criteria to reflect the presence or absence of a specific feature of the slide sheet.

Following ranking and weighting of the 9 general criteria, a final list in order of importance with associated weights was created (Table 3). The raw data from the ranking and weighting exercises is presented in Appendix B.

Table 1. General criteria with rationale for inclusion

Criterion	Reason for inclusion
Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and not stretchable)	Using a slide sheet that is made of a higher quality material, i.e. densely weaved making it durable and not stretchable would benefit the handler by reducing the effort needed to move the patient.
Material (the slide sheet is not made of paper)	Manual handling advisers explained that slide sheets made of paper may be particularly prone to failure, that they may cause trauma to the patient's skin more easily and may be noisier when used.
Different colours to indicate normal (general) versus plus size slide sheet	Being able to easily distinguish between normal and plus-size slide sheets can be beneficial for users such as nurses, especially in busy acute care settings. It can reduce waste which arises from throwing away a slide sheet mistakenly selected in the wrong size.
The slide sheet is single use or single-patient use i.e. not washable	Manual handling advisers noted the significant implementation issues associated with using washable slide sheets. They explained that many trusts in the UK work with external laundering services and that slide sheets are usually procured at the ward level, but that returning each ward's slide sheets without mistakes and mix-ups after laundering is very hard to achieve. They noted the higher cost of those technologies and that slide sheets not being correctly returned after laundering can result in a ward being left with no slide sheets.
The slide sheet does not have Velcro for joining two of them in a pair	Manual handling advisers noted that features such as Velcro to join a pair are not desirable from an infection control and prevention point of view. A tissue viability expert explained that these features may also cause trauma to a patient's skin.
The slide sheet does not have straps, handles or a top clip loop	Manual handling advisers noted that features such as straps, handles and top clip loops often cause more confusion among users. They also explained that the presence of handles may prompt users to lift the patient which can cause significant harm to the handler. A tissue viability expert explained that these features may also cause trauma to a patient's skin.
Different colours to indicate the top and bottom in a pair of flat slide sheets	Being able to easily distinguish between the top and bottom sheet from a pair of slide sheets can be beneficial for users such as nurses, but this would only be relevant in the cases when the top and bottom sheet are different materials.
The slide sheet comes with a high-quality bedside storage bag	Being able to store reusable slide sheets by each patient's bedside can be beneficial for users such as nurses, especially in busy acute care settings. It can

	reduce waste by promoting the use of reusable slide sheets and by ensuring that a patient's slide sheet stays with them if they change wards.
The slide sheet comes in recyclable packaging	Manual handling advisers explained that the packaging of slide sheets is not clinical waste, so it can be recycled.

Table 2. Clinical criteria with the reason for exclusion from further tasks

Criterion	Reason for exclusion
Type of slide sheet	The handler would usually consider a specific type to address a clinical reason. For example, tubular slide sheets would be used for smaller handling tasks, whereas in situ slide sheets would be used for people who need longer-term care. Those are usually in acute wards, for example neurosurgery, or in the community. In situ slide sheets are also considered specifically for bariatric patients.
Size of the slide sheet	Manual handling advisers would recommend 2 sizes only, one for general use and one for bariatric patients. The user will select the size based on clinical need.
Material (the slide sheets is made of a waterproof material)	Manual handling advisers would recommend slide sheets made of a waterproof material in specific clinical cases only.
Material (the slide sheet's sliding properties are particularly durable)	Manual handling advisers would consider the durability of the slide sheet's sliding coating if the device will be used in specific clinical cases where it will be needed for longer.
Presence of a non-slip side, absorbent or a cotton layer	These features are specific to in situ slide sheets and are chosen for specific clinical cases based on patient needs.
The slide sheet comes in a large pack	Manual handling advisers may recommend large packs of slide sheets for specific wards, for example where patients may be staying for a very short time.

Table 3. List of criteria after ranking and weighting

Rank	Criterion	Weight
1	Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and not stretchable)	33%
2	Material (the slide sheet is not made of paper)	20%

3	Different colours to indicate normal (general) versus plus size slide sheet	14%
4	The slide sheet is single use or single-patient use i.e. not washable	10%
5	The slide sheet does not have Velcro for joining two of them in a pair	7%
6	The slide sheet does not have straps, handles or a top clip loop	6%
7	Different colours to indicate the top and bottom in a pair of flat slide sheets	4%
8	The slide sheet comes with a high-quality bedside storage bag	3%
9	The slide sheet comes in recyclable packaging	3%

Identifying, ranking and weighting criteria

The criteria ranged in terms of importance, from 33% for C*riterion 1. Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and not stretchable)* to 3% for *Criteria 8. The slide sheet comes with a high-quality bedside storage bag* and *9. The slide sheet comes in recyclable packaging*. Criteria 1 and 2 accounted for more than half of the combined weight when making a decision. The criteria were closely related, as both were concerned with the material of the slide sheet. *Criterion 9. The slide sheet comes in recyclable packaging* was ranked lowest. Only one user gave it the last rank, but all other users consistently ranked it low. However, during the workshop users noted the importance of reducing product waste and the carbon footprint of slide sheets. This was also relevant to *Criterion 4. The slide sheet is single use or single-patient use i.e. not washable*. Users recognised the sustainability benefits of washable slide sheets, but noted that there is an important trade-off against the much more complex implementation issues stemming from involving a laundering service.

Users stated that the clinical factors associated with specific clinical scenarios or presentations are important in the choice of slide sheet. At the first workshop users identified 6 criteria related to clinical presentation (Table 2). These criteria are presented separately to the other criteria and were not

included in the ranking and weighting stages, and no performance measures were created. This is because what may be important for one person with a specific clinical presentation may not be important for someone else, so ranking them in order of importance is not appropriate.

The user preference assessment methods allow for the list of criteria to be truncated by removing the criteria whose relative weight is lower than 5%. However, this was judged inappropriate after observing the data (see Appendix B) and following feedback from some users provided along with the weights. Specifically, 2 users indicated that the criteria should essentially be split into 2 groups – "more important" and "less important" criteria. A further 2 users indicated that some of the criteria with lower ranks should be weighted equally, essentially representing a "less important criteria" group.

Creating performance rules

Given that 8 of the 9 criteria were binary, a performance rule was only relevant to one criterion – *Criterion 1. Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and not stretchable)*. Three users identified potential performance rules with some overlap between them. One user suggested that the quality of the material can be judged by the failure rate, specifying that if a slide sheet failed after one or 2 uses, it would be considered insufficiently durable. Another user suggested that the quality of the slide sheet can be expressed in terms of its sliding properties, specifically if it provides a sufficient amount of glide to reduce the strain for handler. They also proposed that the thinness of the material can be used as a proxy, whereby a thinner slide sheet would be of a lesser quality. In a similar argument, the third user explained that the quality of the slide sheet depends on the weave and the density of the warp and weft of the slide sheet. They added that companies have data for those characteristics of their products. However, they noted that the density also depends on whether the sheet is reusable or disposable, so the two types may not be comparable. One of the users suggested that for washable slide sheets the number of washes during which the sliding properties are sustained can be used to rank those products. A tissue viability expert

suggested that a high-quality slide sheet could be one which can be removed without causing damage, such as shearing, to the patient's skin. The expert described a performance rule relevant to in situ slide sheets, whereby a lower quality one would be a slide sheet that causes additional pressure damage, for example from raised seams.

5. Criteria captured by the EAG's clinical review and economic modelling

Criteria covered in the EAG's clinical review

The EAG identified 7 key studies which compared at least 2 slide sheets with some of the features identified. However, none of the key studies sought to compare any impacts of additional or innovative features and so were of limited use. The features that the slide sheets in the key studies had included single use, single-patient use and washable slide sheets made from different materials and slide sheets with and without straps. So, the EAG identified evidence related to the following criteria:

- Criterion 1. Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and not stretchable)
- Criterion 4. The slide sheet is single use or single-patient use i.e. not washable
- Criterion 6. The slide sheet does not have straps, handles or a top clip loop.

The EAG noted that the results from the key studies suggest there may be differences between different slide sheets but was unable to draw any conclusions about features (see section 5 of the EAR).

Criteria covered in the EAG's economic modelling

Full details of the EAGs economic modelling can be found in section 7 of the EAR.

Regression model

The EAG developed a regression model to investigate the amount of price variation that could be explained by the presence of features. Only 2 of the 9 general criteria were captured in the regression model. These were whether the slide sheet is single use, single-patient use or washable *(Criterion 4. The slide sheet is single use or single-patient use i.e. not washable)* and whether the slide sheet has handles *(Criterion 6. The slide sheet does not have straps, handles or a top clip loop)*. The EAG also considered one of the clinical criteria in its regression model (Table 2), whether a slide sheet is flat, flat in pair with bag, tubular or hybrid. Two features were found to be associated with significantly higher device price. These were the presence of handles, and the device being washable. In an extension to this analysis, tubular slide sheets were found to be associated with a statistically significant lower device price (noting that only 1 is used rather than a pair).

Economic model

The EAG modelled the impact of using washable compared to disposable or single patient use slide sheets in a cost comparison model *(Criterion 4. The slide sheet is single use or single-patient use i.e. not washable)*. The results indicated that washable slide sheets are generally the least costly option across most scenarios. But they emphasised the need to take into account the challenges associated with implementing washable sheets such as laundering and that the extent of the benefits may depend partly on the clinical setting.

The EAG also considered one of the clinical criteria in its economic assessment (Table 2). It modelled the impact of using removable compared with in situ slide sheets. The results of the model suggested that in situ slide sheets can result in cost savings when used instead of removable slide sheets in the community due to a reduction in the number of carers required for repositioning tasks.

6. Sources of uncertainty

A source of uncertainty is the sample size of users (10 in total). However, the assessment benefitted from high levels of engagement throughout all stages. The response rate was high for stages 1 and 2 (see Appendix A for additional detail). It was lowest for the task of establishing a performance rule for criterion 1 at stage 3 (see Appendix A). A similar trend was observed in terms of consensus, whereby there was very broad agreement at stages 1 and 2. However, the agreement was slightly lower for the weighting task (see Appendix A). There was minimal consensus on the performance rule for criterion one. In addition, only 3 (more if they comments received) users participated in the development of this rule, which represents a source of uncertainty. A specialist committee member highlighted that all participants and experts represented clinical staff, who may be better trained and more skilled than informal carers.

The criterion with the worst agreement was the same for both the ranking and weighting exercises. This was *Criterion 2. Material (the slide sheet is not made of paper)*. This can be explained by the fact that one user had a particular preference for this feature, which was not widely-agreed by the rest of the users. However, this user justified it with a clinical scenario, which may not be relevant to all users.

Some uncertainty stems from the decision to only include manual handling advisers in all stages. It was assumed that manual handling advisers would be well poised to answer all tasks on behalf of patient handlers as they are the people who communicate, train and advise handlers on slide sheets. This assumption was agreed on by the manual handling advisers during the workshop. However, to increase the validity of the results, they were consulted with tissue viability experts. Two tissue viability experts commented on the on the final list of user preference criteria and on ways to measure the performance for Criterion 1. Both of them stated that both the assumption and the final list of criteria are reasonable and appropriate. One of the experts highlighted the importance of including both a clinical and ergonomist perspective when judging the quality of a slide sheet.

A further limitation of the user preference assessment is volunteer bias. Users volunteered to take part in this assessment, and it is likely that the sample of users is not fully representative of the wider population. However, users came from a range of NHS trusts in England and Wales and included experienced manual handling advisers working across both the acute and community settings.

A major source of uncertainty is the lack of published evidence, which can demonstrate the impact of the features reflected in the criteria on patient and handler outcomes. The EAG did not identify any studies that looked specifically at the features of slide sheets and was not able to draw any conclusions about the impact of features on any outcomes from studies comparing one slide sheet to another. It investigated the impact of some of the features on price variation through a regression model and conducted cost comparison analyses of washable versus non-washable slide sheets and in-situ versus removable slide sheets. The results from both the regression and the economic models were uncertain.

7. Conclusion

Nine manual handling advisers took part in a user preference assessment to determine the most important criteria when selecting which slide sheet should be used by patient handlers. Nine criteria independent of clinical presentation were identified, ranked and weighted. Six criteria were identified but excluded from further tasks, because they were relevant to specific patient sub-groups or clinical scenarios only. Following ranking and weighting of the general criteria, the top 2 had a combined weight of 53%. Both criteria were related to the material of the slide sheet – *Criterion 1. Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and not stretchable)* and *Criterion 2. Material (the slide sheet is not made of paper)*.

While consensus on defining and ranking was good, there was some variation in the weighting of the criteria. Eight of the 9 criteria were binary, accounting for the presence or absence of a particular feature, so no performance rules were created. A performance rule for *Criterion 1. Material (the slide sheet is*

made of a higher quality material, i.e. densely weaved making it durable and not stretchable) was not established. It should be further established how the quality of a slide sheet can be measured, especially if this is used as a factor during procurement considerations.

Only 2 preference criteria were partially captured in the EAG's EAR (*Criterion 4. The slide sheet is single use or single-patient use, i.e. not washable* and *Criterion 6. The slide sheet does not have straps, handles or a top clip loop*). Their combined weight was 16%. The EAG did not identify any evidence to attribute an improvement in outcomes to those features. Economic modelling suggested that washable slide sheets could be the cheapest option in most clinical scenarios provided they could be successfully implemented.

Appendix A. Uncertainty in the user preference exercise

Identifying and defining criteria

There was notable agreement and a large degree of consensus at the identification stage. However, some users noted that they had not used slide sheets with all of the identified features. They also highlighted that clinical considerations may be relevant even for the general criteria. In addition, users noted that the relevance and importance of some criteria may depend on the trust, for example in relation to how laundering services are organised.

Ranking stage

Nine users contributed to the ranking exercise. There were 9 criteria ranked, therefore responses could have ranged from 1-9 meaning the maximum SD was approximately 4.5. The SD ranged from 1.32 for Criterion 9 to 2.98 for Criterion 2.

Weighting stage

Seven users contributed to the weighting exercise. Responses could range from 0-100 meaning the maximum SD was approximately 50. The SD of the weighting responses ranged from 24.39 for criterion 9 to 53.45 for criterion 4. The agreement was visibly lower for the higher-ranking criteria and higher for the lower-ranking criteria. Users explained this qualitatively, noting that the lower-ranking criteria can essentially be seen as a broad group of less important, but equal criteria. However, there was disagreement as to which criteria should fall within this broad group.

Appendix B. Data from ranking and weighting stages

Table 4. Raw data from ranking exercise

Criterion	User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9	Mean	SD	Final rank
Different colours to indicate normal (general) versus plus size slide sheet	7	3	3	2	5	3	3	1	9	4.00	2.55	3
Different colours to indicate the top and bottom in a pair of flat slide sheets	7	2	9	3	6	9	8	7	3	6.00	2.69	7
Material (the slide sheet is not made of paper)	1	9	2	4	1	1	2	1	7	3.11	2.98	2
Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and NOT stretchable)	3	4	1	1	2	1	1	5	1	2.11	1.54	1
The slide sheet is single use or single-patient use (i.e. not washable)	1	8	5	6	8	3	5	1	2	4.33	2.74	4
The slide sheet comes in recyclable packaging	7	6	8	8	9	5	6	6	8	7.00	1.32	9
The slide sheet does not have straps, handles or a top clip loop	3	5	7	5	4	7	8	7	5	5.67	1.66	6
The slide sheet comes with a high-quality bedside storage bag	5	7	6	7	7	8	4	7	4	6.11	1.45	8
The slide sheet does not have Velcro for joining two of them in a pair	5	1	4	8	3	6	7	1	6	4.56	2.51	5

Table 5. Raw data from weighting exercise

Rank	Criterion	User 1	User 2	User 3	User 4	User 5	User 6	User 7	mean	SD	Overall weight*
1	Material (the slide sheet is made of a higher quality material, i.e. densely weaved making it durable and NOT stretchable)	75	100	100	100	100	0	0	67.86	47.25	33%
2	Material (the slide sheet is not made of paper)	100	0	100	0	100	0	0	42.86	53.45	20%
3	Different colours to indicate normal (general) versus plus size slide sheet	50	0	90	0	100	0	0	34.29	45.41	14%
4	The slide sheet is single use or single-patient use (i.e. not washable)	0	95	100	100	0	0	0	42.14	52.59	10%
5	The slide sheet does not have Velcro for joining two of them in a pair	75	25	100	0	0	0	0	28.57	41.90	7%
6	The slide sheet does not have straps, handles or a top clip loop	75	0	70	0	0	**	100	40.83	45.87	6%
7	Different colours to indicate the top and bottom in a pair of flat slide sheets	0	95	50	50	0	0	0	27.86	37.84	4%
8	The slide sheet comes with a high-quality bedside storage bag	0	0.1	50	50	0	0	0	14.30	24.39	3%
9	The slide sheet comes in recyclable packaging	-	-	-	-	-	-	-	-	-	3%

*points are attributed to the criterion based on the mean importance relative to the criterion below. These are used to calculate the final weight

**missing values

Appendix C. Glossary

Term	Definition
SMART ranking technique	Simple Multi-Attribute Rating Technique is a process mainly used in Multi Criteria Decision Analysis. It allows a group of alternatives to be ordered by importance. Individual responses from each member of the sample are collated and then meaned ensuring equal say among the group (Von Winterfeldt D, Edwards W. (1993) Decision analysis and behavioral research. Cambridge: Cambridge University Press).
Swing weighting technique	Swing weighting is also a process often used in Multi Criteria Decision Analysis. It is a method used for calculating and reporting the relative importance (weight) of each of the alternatives from a ranked group. Each member of the provides individual answers to questions asking them to decide (on a scale of 0-100%) how important each criterion is over the criterion below it. All of the responses from each member of the sample are then collated and meaned. After this, weights are calculated (Von Winterfeldt D, Edwards W. (1993) Decision analysis and behavioral research. Cambridge: Cambridge University Press).
Performance rule	A rule which describes how the users measure performance of the technology in question against the criteria.
Performance matrix	A list of the most important criteria to users, and the performance rules associated with these criteria.

Appendix D. Participants

Darren Gill

Manual handling adviser, Cwm Taf Morgannwg University Health Board

Drayton O'Connor

Manual handling adviser, Manchester University NHS Foundation Trust

Evelyn Otunbade

Moving and handling adviser, London North West Healthcare NHS Trust

Hanna Wilkinson

Falls and moving and handling lead, University Hospitals Dorset NHS Foundation Trust

Kerry Kemp

Moving and handling lead, Walsall Healthcare NHS Trust; vice chair of National Back Exchange

Samantha Skelton

Manual handling adviser, Cardiff and Vale University Health Board

Sarah Thornton

Moving and handling team manager, Kirklees Council; chair of National Back Exchange

Shaun Farrell

Moving and handling specialist advisor, Lincolnshire Community Health Services NHS Trust

Vincent Smith

Manual handling manager, University Hospitals Leicester NHS Trust

NICE National Institute for Health and Care Excellence

HealthTech Programme

GID-HTE10050 Bed frames for adults in acute settings: Late-stage assessment

External Assessment Report (EAR)

Collated comments table

Section A: redacted External Assessment Report – Collated comments table:

Any confidential sections of the information provided should be underlined and highlighted. Please underline all confidential information, and separately highlight information that is 'commercial in confidence' in blue and all that is 'academic in confidence' in yellow

Comment no.	Stakeholder	Page no.	Section no.	Comment	EAG Response
1	Company 1	6	Clinical Evidence	We would question the inclusion of the Sturman-Floyd 2011 report. Should it be included as evidence and evaluated in the same level as the other articles We understand it is published/available exclusively through the DHG website. We believe it's somewhat misleading to classify it as an article or study when it's only a report. Page 20, mentions that the study design poses an issue (stating that the study wasn't published in a peer-reviewed journal). It is the only "study" comparing two different slide sheets and it is mentioned that it's difficult to find usable data in the study.	We understand the concern, and have highlighted that it is not peer reviewed, and also discussed other limitations to the conclusions that can be drawn from the evidence. However, there is a very limited evidence base for this topic. We have not made any changes to the assessment report, however we would encourage the limitations of clinical evidence to be included in the committee discussion.

Section B: redacted User Preference Report – Collated comments table:

Any confidential sections of the information provided should be underlined and highlighted. Please underline all confidential information, and separately highlight information that is 'commercial in confidence' in blue and all that is 'academic in confidence' in yellow

Comment no.	Stakeholder	Page no.	Section no.	Comment	NICE Response
1	Company 1	9	Table 3	The users' described as those using slide sheets and therefore influencing which ones are purchased) preferences are outlined in a clear list, highlighting what they value most. When comparing these preferences to the EAR, which is evidence-based, the focus seems to be on slide sheet features that can justify differences in price. They assess washable vs. SU/SPU, concluding that washable is more economical to purchase. However, there are significant challenges: washable slide sheets lose their glide after repeated washes (if coated), wear out, and are difficult to redistribute to the correct departments. Additionally, some slide sheets are handled by caregivers and may be damaged due to improper washing. They also compare removable vs. in situ sheets, with a preference for in situ, primarily due to reduced costs associated with less staffing needs. We noticed a final preference for "recyclable packaging," but there's no mention of material choices for the product itself. As we discussed internal yesterday, isn't this one of the main reasons for price increases? Selecting not only durable materials but also ones with disposal, sustainability, and potentially environmental impact in mind? All of this is likely something manufacturers must address, which reflects in the price, but it's not something they've considered in their reports.	The user preference report and the external assessment report are meant to be read alongside each other. They are complementary pieces of evidence which utilise different methodologies. Both will be used to inform committee discussions. Criteria related to the material of the slide sheet were identified by users in the user preference assessment. They were ranked highly and more than half of the weight of the decision which slide sheet to use is given to considerations related to the material. This includes considerations related to quality and durability. During the user preference workshop users noted that whether a slide sheet is recyclable (not the packaging) could be a criterion, but that usually slide sheets have to be disposed of as clinical waste as so cannot be recycled. Therefore, this was not included as a criterion. Users did not reach consensus as to what a high quality material for a slide sheet is. All of the evidence will be presented to the committee and recommendations will be

Comment no.	Stakeholder	Page no.	Section no.	Comment	NICE Response
				There are no specific preferences/requirements for what the different slide sheets should offer in terms of "additional/innovative features. In our Immedia range, for example, there are various (perhaps innovative) features (2-way glide, 4-way glide, handles for attaching to hoists to minimise caregiver strain, etc.). So, what innovative features do they prioritize—and how can we meet them?	drafted based on their discussions regarding features of slide sheets.

NICE National Institute for Health and Care Excellence

Medical Technologies Advisory Committee Interests Register

Topic: Slide sheets for repositioning or moving a person on or from a bed: Late Stage Assessment

NICE's declaration of interest policy can be accessed here

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
Mr Drayton O'Connor	Specialist Committee member	N/A	NIL	N/A	29.10.2024	N/A	No further action
Dr Helen Vosper	Specialist Committee member	N/A	NIL	N/A	29.10.2024	N/A	No further action
Professor Toby Smith	Specialist Committee member	Financial	Paid employment - University of Warwick	2022	29.10.2024	Ongoing	No further action
Professor Toby Smith	Specialist Committee member	Financial	Paid employment - University of East Anglia	2019	29.10.2024	Ongoing	No further action
Professor Toby Smith	Specialist Committee member	Financial	Paid employment - Norfolk and Norwich University Hospital	2004	29.10.2024	Ongoing	No further action
Professor Toby Smith	Specialist Committee member	Indirect	Committee member - NICE Health Technological Appraisal Committee B	2020	29.10.2024	Ongoing	No further action

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
Mrs Laura Neil	Specialist Committee member	Non-financial professional and personal interests	Board member / Director of Renfrew Development Trust	08.2024	29.10.2024	Ongoing	No further action
Mr Ryan Buxton	Specialist Committee member	N/A	NIL	N/A	29.10.2024	N/A	No further action
Mrs Sally Morrow	Specialist Committee member	N/A	NIL	N/A	29.10.2024	N/A	No further action
Tom Clutton-Brock	MTAC LSA Chair (scoping workshop)	Non-financial professional and personal interests	Director NIHR HRC in Devices, Digital and Robotics. No personal income	April 2024	July 2024	Ongoing	No further action
		Non-financial professional and personal interests	Director Medical Devices Testing and Evaluation Centre. No personal income	January 2015	July 2024	Ongoing	No further action
Jacob Brown	MTAC Chair		NIL	n/a			
Neil Hawkins	Committee member	Non-Financial Professional & Personal Interests	I am a director of a consultancy providing HTA services to pharmaceutical and biotech companies. No services have been provided to the named stakeholders for these	n/a	Nov 2024	Ongoing	Declare and participate

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
			assessments or with respect to technologies being considered.				
Stacey Chang-Douglass	Committee member	**Financial interests**	I am a part-time employee of Evidera, a health economic and outcome research consultancy, since January 2023. Evidera is part of PPD, which is a business entity of Thermo Fisher Scientific. However, research and consulting activities conducted by Evidera are independent of its parent organisations and other entities within the business. My company provides research and consulting support to pharmaceutical companies at various stages of their product development, including NICE submissions. However, I am not involved in any work 9 January 2023 31 July 2024 Interests form (advisory committees) October 2022 3 of 5 associated with medical or diagnostic devices or medical technologies. This COI arose since my employment with Evidera in January 2023. My	n/a	July 2024	n/a	No further Action

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
			employment with Evidera is ending on 31 July 2024.				
		Non-financial professional and personal interests	NIL	n/a	July 2024	n/a	No further action
		Indirect interests	NIL	n/a	July 2024	n/a	No further action
Mike Fray	Professional Expert	**Financial interests**	Grant (awarded): Arjo abTitle: Evenda - Low Bed Project – value of £40k	2020 (PI)	August 2024	n/a	Declare and participate
			Grant (awarded): ARJO Title: Biomechanical evaluation of ultra-low beds (LUEL 8744) – value of £28k				Declare and participate
			Grant application: Hill-Rom Title: Low beds project with SHi. (In creation) – value of £30k				Declare and participate
			Grant application: Arjo Title: Low bed – value of £45k				Declare and participate

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
			Publications: Fray, M., & Davis, K. G. (2024). Effectiveness of safe patient handling equipment and techniques: A review of biomechanical studies. Human Factors, 66(10), 2283-2322. * * * Fray, M., & Hignett, S. (2009). The evaluation of a prototype handling device to assist with horizontal lateral transfers [Paper presentation]. Proceedings of the 17th Triennial Congress of the International Ergonomics Association, Beijing. * * * Fray, M., & Hignett, S. (2015). Using patient handling equipment to manage immobility in and around a bed. British Journal of Nursing, 24(6), S10-S14. * * *	n/a	August 2024	n/a	No further action

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
			Fray, M., David, D., Hindson, D., Pattison, L., & Metcalfe, D. (2016). Does the use of friction reducing devices actually reduce the exposure to high force lateral transfers? The Column, 29.2, 6-10. * * * Holgate G., and Fray M., (2018) Does carer position around a bed change the force applied when moving a person up a bed. Column 30.2, NBE UK. (Online, ISBN 978-1-9160188-4-6) * * * Fray M. and Hignett S. (2015). Using patient handling equipment to manage mobility in and around a bed. British Journal of Nursing, Vol 24, Issue 6, 10-14, 6th April 2015 DOI * * * Fray, M. and Holgate G., (2018). A comparative force assessment				

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
			of 4 methods to move a patient up a bed. Proceedings of the 20th Triennial Congress of the International Ergonomics Association, Florence, Italy August 2018 * * * Fray M., Hignett S., Jun T. (2014). Drifting between patient falls and nurses MSD's: Exploring resilience in bedside care. Proceedings of IEHF Healthcare Conference, Nov 2014, London * * * Proceedings of ODAM 2011, 10th International Symposium on Human Factors in Organisational Design and Management, 4-6 April 2011, Grahamstown, South Africa				
			Principal investigator on paper funded by Arjo - project title: ENT 8744 Biomechanical Evaluation of	n/a	October 2024	March 2025	Declare and participate

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
			Low Bed Use. There were two papers published from the study: IJSPHM published a literature review Arjo published a white paper which was supported by an international webinar session. The 2nd Journal paper is still in production/review.				
			Contract with London Ambulance for expert evaluation and user trial for access and egress with patients, (LAS NHS Trust, Contract ENT10538, £50K + VAT). The provider in one vehicle was Stryker (powered trolley and stairclimbing wheelchair). I have presented some findings back to Styker in an internal staff facing event. Project ongoing, no bed frames involved only ambulance products.	2022	Nov 2024	March 2025	Declare and participate
Mike Fray	Professional Expert	Non-financial professional	NIL	n/a			No further action

Name	Role with NICE	Type of interest	Description of interest	Interest arose	Interest declared	Interest ceased	Comments
		and personal interests					
Mike Fray	Professional Expert	Indirect interests	NIL	n/a			No further action
Hannah Wilkinson	Professional Expert		NIL	n/a			No further action
Darren Gill	Professional Expert		NIL	n/a			No further action