Cochrane Wounds Group Reviews and Review Updates

EDITOR:

Gill Rizzello, Managing editor Cochrane Wounds, School of Nursing, Midwifery and Social Work, University of Manchester

Correspondence: gill.rizzello@manchester.ac.uk · More information: www.wounds.cochrane.org

Conflicts of Interest: None

Publication in The Cochrane Library Issue 5, 2021

Alternating pressure (active) air surfaces for preventing pressure ulcers

Chunhu Shi, Jo C Dumville, Nicky Cullum, Sarah Rhodes, Asmara Jammali-Blasi, Elizabeth McInnes

Citation: Shi C, Dumville JC, Cullum N, Rhodes S, Jammali-Blasi A, McInnes E.
Alternating pressure (active) air surfaces for preventing pressure ulcers.
Cochrane Database of Systematic Reviews 2021, Issue 5. Art. No.: CD013620.
DOI: 10.1002/14651858.CD013620.pub2.

ABSTRACT

Background

Pressure ulcers (also known as pressure injuries, pressure sores, decubitus ulcers and bed sores) are localised injuries to the skin or underlying soft tissue, or both, caused by unrelieved pressure, shear or friction. Alternating pressure (active) air surfaces are widely used with the aim of preventing pressure ulcers.

Objectives

To assess the effects of alternating pressure (active) air surfaces (beds, mattresses or overlays) compared with any support surface on the incidence of pressure ulcers in any population in any setting.

Search methods

In November 2019, we searched the Cochrane Wounds Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Ovid MEDLINE (including In – Process & Other Non – Indexed Citations); Ovid Embase and EBSCO CINAHL Plus. We also searched clinical trials registries for ongoing and unpublished studies, and scanned reference lists of relevant included studies as well as reviews, meta – analyses and health technology reports to identify additional studies. There were no restrictions with respect to language, date of publication or study setting.

Selection criteria

We included randomised controlled trials that allocated participants of any age to alternating pressure (active) air beds, overlays or mattresses. Comparators were any beds, overlays or mattresses.

Data collection and analysis

At least two review authors independently assessed studies using predetermined inclusion criteria. We carried out data extraction, 'Risk of bias' assessment using the Cochrane 'Risk of bias' tool, and the certainty of the evidence assessment according to Grading of Recommendations, Assessment, Development and Evaluations methodology.

Main results

We included 32 studies (9058 participants) in the review. Most studies were small (median study sample size: 83 participants). The average age of participants ranged from 37.2 to 87.0 years (median: 69.1 years). Participants were largely from acute care settings (including accident and emergency departments). We synthesised data for six comparisons in the review: alternating pressure (active) air surfaces versus: foam surfaces, reactive air surfaces, reactive water surfaces, reactive fibre surfaces, reactive gel surfaces used in the operating room followed by foam surfaces used on the ward bed, and another type of alternating pressure air surface. Of the 32 included studies, 25 (78.1%) presented findings which were considered at high overall risk of bias.

Primary outcome, pressure ulcer incidence

Alternating pressure (active) air surfaces may reduce the proportion of participants developing a new pressure ulcer compared with foam surfaces (risk ratio (RR) 0.63, 95% confidence interval (CI) 0.34 to 1.17; I2 = 63%; 4 studies, 2247 participants; low – certainty evidence). Alternating pressure (active) air surfaces applied on both operating tables and hospital beds may reduce the pro-

portion of people developing a new pressure ulcer compared with reactive gel surfaces used on operating tables followed by foam surfaces applied on hospital beds (RR 0.22, 95% CI 0.06 to 0.76; I2 = 0%; 2 studies, 415 participants; low-certainty evidence).

It is uncertain whether there is a difference in the proportion of people developing new pressure ulcers between alternating pressure (active) air surfaces and the following surfaces, as all these comparisons have very low-certainty evidence: (1) reactive water surfaces; (2) reactive fibre surfaces; and (3) reactive air surfaces.

The comparisons between different types of alternating pressure air surfaces are presented narratively. Overall, all comparisons suggest little to no difference between these surfaces in pressure ulcer incidence (7 studies, 2833 participants; low-certainty evidence).

Included studies have data on time to pressure ulcer incidence for three comparisons. When time to pressure ulcer development is considered using a hazard ratio (HR), it is uncertain whether there is a difference in the risk of developing new pressure ulcers, over 90 days' follow-up, between alternating pressure (active) air surfaces and foam surfaces (HR 0.41, 95% CI 0.10 to 1.64; I2 = 86%; 2 studies, 2105 participants; very low-certainty evidence). For the comparison with reactive air surfaces, there is low-certainty evidence that people treated with alternating pressure (active) air surfaces may have a higher risk of developing an incident pressure ulcer than those treated with reactive air surfaces over 14 days' follow-up (HR 2.25, 95% CI 1.05 to 4.83; 1 study, 308 participants). Neither of the two studies with time to ulcer incidence data suggested a difference in the risk of developing an incident pressure ulcer over 60 days' follow-up between different types of alternating pressure air surfaces.

Secondary outcomes

The included studies have data on (1) support-surface-associated patient comfort for comparisons involving foam surfaces, reactive air surfaces, reactive fibre surfaces and alternating pressure (active) air surfaces; (2) adverse events for comparisons involving foam surfaces, reactive gel surfaces and alternating pressure (active) air surfaces; and (3) health-related quality of life outcomes for the comparison involving foam surfaces. However, all these outcomes and comparisons have low or very low – certainty evidence and it is uncertain whether there are any differences in these outcomes.

Included studies have data on cost effectiveness for two comparisons. Moderate-certainty evidence suggests that alternating pressure (active) air surfaces are probably more cost – effective than foam surfaces (1 study, 2029 participants) and that alternating pressure (active) air mattresses are probably more cost – effective than overlay versions of this technology for people in acute care settings (1 study, 1971 participants).

Authors' conclusions

Current evidence is uncertain about the difference in pressure ulcer incidence between using alternating pressure (active) air surfaces and other surfaces (reactive water surfaces, reactive fibre surfaces and reactive air surfaces). Alternating pressure (active) air surfaces may reduce pressure ulcer risk compared with foam surfaces and reactive gel surfaces used on operating tables followed by foam surfaces applied on hospital beds. People using alternating pressure (active) air surfaces may be more likely to develop new pressure ulcers over 14 days' follow–up than those treated with reactive air surfaces in the nursing home setting; but as the result is sensitive to the choice of outcome measure it should be interpreted cautiously. Alternating pressure (active) air surfaces are probably more cost–effective than reactive foam surfaces in preventing new pressure ulcers.

Future studies should include time-to – event outcomes and assessment of adverse events and trial – level cost – effectiveness. Further review using network meta – analysis will add to the findings reported here.

Plain language summary

Do beds, mattresses and mattress toppers with air – filled surfaces that regularly redistribute pressure under the body prevent pressure ulcers?

Key messages

Beds, mattresses and mattress toppers that regularly redistribute pressure under the body may reduce the chance of pressure ulcers developing when compared with surfaces that:

- apply a constant pressure to the skin; and
- are made of foam or gel.

However, they may increase the risk of pressure ulcers developing among nursing home residents when compared with air surfaces that apply constant pressure. More research is needed to strengthen the evidence that compares air – filled and other surfaces. Future studies should focus on effects that are important to decision – makers, including:

- whether and when pressure ulcers develop;
- unwanted effects; and costs.

What are pressure ulcers?

Pressure ulcers are also known as pressure sores or bed sores. They are wounds to the skin and underlying tissue caused by prolonged pressure or rubbing. They often occur on bony parts of the body, such as heels, elbows, hips and the bottom of the spine. People who have mobility problems or who lie in bed for long periods are at risk of developing pressure ulcers.

What did we want to find out?

There are beds, mattresses and mattress toppers specifically designed for people at risk of pressure ulcers. These can be made of a range of materials (such as foam, air cells or water bags) and are divided into two groups:

- reactive (static) surfaces that apply a constant pressure to the skin, unless a person moves or is repositioned;

and

- active (alternating pressure) surfaces that regularly redistribute the pressure under the body.

We wanted to find out if active, air – filled surfaces:

- prevent pressure ulcers;
- are comfortable and improve people's quality of life;
- have health benefits that outweigh their costs (cost – effectiveness);

and

- have any unwanted effects.

What did we do?

We searched the medical literature for studies that evaluated the effects of beds, mattresses and mattress toppers with an active, air – filled surface. We compared and summarised their results, and rated our confidence in the evidence, based on factors such as study methods and sizes.

What did we find?

We found 32 studies (9058 people, average age: 69 years) that lasted between three and 180 days (average: 14 days). The studies compared active, air – filled surfaces with:

- foam, fibre, water – filled or gel surfaces; and
- other air – filled surfaces.

Pressure ulcer prevention

The evidence suggests that active, air – filled surfaces may reduce the risk of pressure ulcers developing when compared with:

- foam surfaces;
- gel surfaces used on operating tables followed by foam surfaces used on hospitals beds, for people who undergo surgery.

However, active, air – filled surfaces may increase the risk of pressure ulcers developing when compared with reactive air surfaces (1 study, 308 nursing home residents, duration: 14 days).

It is unclear if active air – filled surfaces prevent pressure ulcers compared with surfaces other than reactive foam, gel or air – filled surfaces.

The type of active, air – filled surface used may make little to no difference for preventing pressure ulcers.

Other effects

Active, air – filled surfaces are probably more cost – effective than foam. Mattresses with an active, air – filled surface are probably more cost – effective than mattress toppers with the same surface.

We did not find sufficiently robust and clear evidence to determine how active, air – filled surfaces affect comfort, quality of life and unwanted effects.

What limited our confidence in the evidence?

Most studies were small (83 people on average) and more than two – thirds of them (25) used methods likely to introduce errors in their results.

How up – to – date is this review?

The evidence in this Cochrane Review is current to November 2019.

Publication in The Cochrane Library Issue 5, 2021

Foam surfaces for preventing pressure ulcers

Chunhu Shi, Jo C Dumville, Nicky Cullum, Sarah Rhodes, Elizabeth McInnes

Citation: Shi C, Dumville JC, Cullum N, Rhodes S, McInnes E.
Foam surfaces for preventing pressure ulcers.
Cochrane Database of Systematic Reviews 2021, Issue 5. Art. No.: CD013621.
DOI: 10.1002/14651858.CD013621.pub2.

ABSTRACT

Background

Pressure ulcers (also known as pressure injuries) are localised injuries to the skin or underlying soft tissue, or both, caused by unrelieved pressure, shear or friction. Foam surfaces (beds, mattresses or overlays) are widely used with the aim of preventing pressure ulcers.

Objectives

To assess the effects of foam beds, mattresses or overlays compared with any support surface on the incidence of pressure ulcers in any population in any setting.

Search methods

In November 2019, we searched the Cochrane Wounds Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Ovid MEDLINE (including In – Process & Other Non – Indexed Citations); Ovid Embase and EBSCO CINAHL Plus. We also searched clinical trials registries for ongoing and unpublished studies, and scanned reference lists of relevant included studies as well as reviews, meta – analyses and health technology reports to identify additional studies. There were no restrictions with respect to language, date of publication or study setting.

Selection criteria

We included randomised controlled trials that allocated participants of any age to foam beds, mattresses or overlays. Comparators were any beds, mattresses or overlays.

Data collection and analysis

At least two review authors independently assessed studies using predetermined inclusion criteria. We carried out data extraction, 'Risk of bias' assessment using the Cochrane 'Risk of bias' tool, and the certainty of the evidence assessment according to Grading of Recommendations, Assessment, Development and Evaluations methodology. If a foam surface was compared with surfaces that were not clearly specified, then the included study was recorded and described but not considered further in any data analyses.

Main results

We included 29 studies (9566 participants) in the review. Most studies were small (median study sample size: 101 participants). The average age of participants ranged from 47.0 to 85.3 years (median: 76.0 years). Participants were mainly from acute care settings. We analysed data for seven comparisons in the review: foam surfaces compared with: (1) alternating pressure air surfaces, (2) reactive air surfaces, (3) reactive fibre surfaces, (4) reactive gel surfaces, (5) reactive foam and gel surfaces, (6) reactive water surfaces, and (7) another type of foam surface. Of the 29 included studies, 17 (58.6%) presented findings which were considered at high overall risk of bias.

Primary outcome: pressure ulcer incidence

Low – certainty evidence suggests that foam surfaces may increase the risk of developing new pressure ulcers compared with (1) alternating pressure (active) air surfaces (risk ratio (RR) 1.59, 95% confidence interval (CI) 0.86 to 2.95; I2 = 63%; 4 studies, 2247 participants), and (2) reactive air surfaces (RR 2.40, 95% CI 1.04 to 5.54; I2 = 25%; 4 studies, 229 participants).

We are uncertain regarding the difference in pressure ulcer incidence in people treated with foam surfaces and the following surfaces: (1) reactive fibre surfaces (1 study, 68 participants); (2) reactive gel surfaces (1 study, 135 participants); (3) reactive gel and foam surfaces (1 study, 91 participants); and (4) another type of foam surface (6 studies, 733 participants). These had very low – certainty evidence.

Included studies have data on time to pressure ulcer development for two comparisons. When time to ulcer development is considered using hazard ratios, the difference in the risk of having new pressure ulcers, over 90 days' follow – up, between foam surfaces and alternating pressure air surfaces is uncertain (2 studies, 2105 participants; very low – certainty evidence). Two further studies comparing different types of foam surfaces also reported time – to – event data, suggesting that viscoelastic foam surfaces with a density of 40 to 60 kg/m3 may decrease the risk of having new pressure ulcers over 11.5 days' follow – up compared with foam surfaces with a density of 33 kg/m3 (1 study, 62 participants); and solid foam surfaces may decrease the risk of having new pressure ulcers over one month's follow – up compared with convoluted foam surfaces (1 study, 84 participants). Both had low – certainty evidence.

There was no analysable data for the comparison of foam surfaces with reactive water surfaces (one study with 117 participants).

Secondary outcomes

Support – surface – associated patient comfort: the review contains data for three comparisons for this outcome. It is uncertain if there is a difference in patient comfort measure between foam surfaces and alternating pressure air surfaces (1 study, 76 participants; very low – certainty evidence); foam surfaces and reactive air surfaces (1 study, 72 participants; very low – certainty evidence); and different types of foam surfaces (4 studies, 669 participants; very low – certainty evidence).

All reported adverse events: the review contains data for two comparisons for this outcome. We are uncertain about differences in adverse effects between foam surfaces and alternating pressure (active) air surfaces (3 studies, 2181 participants; very low – certainty evidence), and between foam surfaces and reactive air surfaces (1 study, 72 participants; very low – certainty evidence).

Health – related quality of life: only one study reported data on this outcome. It is uncertain if there is a difference (low – certainty evidence) between foam surfaces and alternating pressure (active) air surfaces in health – related quality of life measured with two different questionnaires, the EQ – 5D – 5L (267 participants) and the PU – QoL – UI (233 participants).

Cost – effectiveness: one study reported trial – based cost – effectiveness evaluations. Alternating pressure (active) air surfaces are probably more cost – effective than foam surfaces in preventing pressure ulcer incidence (2029 participants; moderate – certainty evidence).

Authors' conclusions

Current evidence suggests uncertainty about the differences in pressure ulcer incidence, patient comfort, adverse events and health – related quality of life between using foam surfaces and other surfaces (reactive fibre surfaces, reactive gel surfaces, reactive foam and gel surfaces, or reactive water surfaces). Foam surfaces may increase pressure ulcer incidence compared with alternating pressure (active) air surfaces and reactive air surfaces. Alternating pressure (active) air surfaces are probably more cost – effective than foam surfaces in preventing new pressure ulcers.

Future research in this area should consider evaluation of the most important support surfaces from the perspective of decision – makers. Time – to – event outcomes, careful assessment of adverse events and trial – level cost – effectiveness evaluation should be considered in future studies. Trials should be designed to minimise the risk of detection bias; for example, by using digital photography and by blinding adjudicators of the photographs to group allocation. Further review using network meta – analysis will add to the findings reported here.

Plain language summary

Do mattresses and mattress toppers made of foam prevent pressure ulcers?

Key messages

Mattresses and mattress toppers made of foam:

- may increase the risk of developing pressure ulcers when compared with air – filled surfaces;
- are probably less cost – effective than air – filled surfaces that regularly redistribute pressure under the body.

It is unclear if foam has an effect on pressure ulcers compared with surfaces made of fibre, gel or water cells.

Future studies should focus on options and effects that are important to decision – makers, such as:

- gel surfaces that apply constant skin pressure, compared with foam surfaces; and
- whether and when pressure ulcers develop, unwanted effects and costs.

What are pressure ulcers?

Pressure ulcers are also known as pressure sores or bed sores. They are wounds to the skin and underlying tissue caused by prolonged pressure or rubbing. They often occur on bony parts of the body, such as heels, elbows, hips and the bottom of the spine. People who have mobility problems or who lie in bed for long periods are at risk of developing pressure ulcers.

What did we want to find out?

There are beds, mattresses and mattress toppers specifically designed for people at risk of pressure ulcers. These can be made of a range of materials (such as foam, fibre, air cells or water bags) and are divided into two groups:

- reactive (static) surfaces that apply a constant pressure to the skin, unless a person moves or is repositioned; and
- active (alternating pressure) surfaces that regularly redistribute the pressure under the body.

We wanted to find out if mattresses and mattress toppers made of foam (a reactive surface):

- prevent pressure ulcers;
- are comfortable and improve people's quality of life;
- have health benefits that outweigh their costs (cost – effectiveness); and
- have any unwanted effects.

What did we do?

We searched the medical literature for studies that evaluated the effects of mattresses and mattress toppers made of foam. We compared and summarised their results, and rated our confidence in the evidence, based on factors such as study methods and sizes.

What did we find?

We found 29 studies (9566 people, average age: 76 years) that lasted between five days and one year (average: 15 days). The studies compared foam with active and reactive surfaces made of gel, air cells, water bags and other foam types.

Pressure ulcer prevention

The evidence suggests that:

- foam surfaces may increase the risk of developing pressure ulcers when compared with active or reactive air-filled surfaces (8 studies);
- denser memory foam (foam that adapts to a person's body shape) may be better than lighter memory foam for preventing pressure ulcers if the data on the time it takes to develop a new ulcer is looked at (1 study, duration: 11.5 days);
- flat foam surfaces may be better than ridged foam surfaces for preventing pressure ulcers if the data on the time it takes to develop a new ulcer is looked at (1 study, duration: 1 month).

It is unclear if foam has an effect on pressure ulcers compared to water or gel surfaces.

Other effects

Evidence from one study suggests that foam is probably less cost – effective than active, air – filled surfaces.

We did not find sufficiently robust and clear evidence to determine how foam affects comfort, quality of life and unwanted effects.

What limited our confidence in the evidence?

Most studies were small (101 people on average) and more than half (17 studies) used methods likely to introduce errors in their results.

How up – to – date is this review?

The evidence in this Cochrane Review is current to November 2019.

Publication in The Cochrane Library Issue 5, 2021

Reactive air surfaces for preventing pressure ulcers

Chunhu Shi, Jo C Dumville, Nicky Cullum, Sarah Rhodes, Vannessa Leung, Elizabeth McInnes

Citation: Shi C, Dumville JC, Cullum N, Rhodes S, Leung V, McInnes E.
Reactive air surfaces for preventing pressure ulcers.
Cochrane Database of Systematic Reviews 2021, Issue 5. Art. No.: CD013622.
DOI: 10.1002/14651858.CD013622.pub2.

ABSTRACT

Background

Pressure ulcers (also known as pressure injuries, pressure sores, decubitus ulcers and bed sores) are localised injuries to the skin or underlying soft tissue, or both, caused by unrelieved pressure, shear or friction. Reactive air surfaces (beds, mattresses or overlays) can be used for preventing pressure ulcers.

Objectives

To assess the effects of reactive air beds, mattresses or overlays compared with any support surface on the incidence of pressure ulcers in any population in any setting.

Search methods

In November 2019, we searched the Cochrane Wounds Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Ovid MEDLINE (including In – Process & Other Non – Indexed Citations); Ovid Embase and EBSCO CINAHL Plus. We also searched clinical trials registries for ongoing and unpublished studies, and scanned reference lists of relevant included studies as well as reviews, meta – analyses and health technology reports to identify additional studies. There were no restrictions with respect to language, date of publication or study setting.

Selection criteria

We included randomised controlled trials that allocated participants of any age to reactive air beds, overlays or mattresses. Comparators were any beds, overlays or mattresses that were applied for preventing pressure ulcers.

Data collection and analysis

At least two review authors independently assessed studies using predetermined inclusion criteria. We carried out data extraction, 'Risk of bias' assessment using the Cochrane 'Risk of bias' tool, and the certainty of the evidence assessment according to Grading of Recommendations, Assessment, Development and Evaluations methodology. If a reactive air surface was compared with surfaces that were not clearly specified, then we recorded and described the concerned study but did not included it in further data analyses.

Main results

We included 17 studies (2604 participants) in this review. Most studies were small (median study sample size: 83 participants). The average participant age ranged from 56 to 87 years (median: 72 years). Participants were recruited from a wide range of care settings with the majority being acute care settings. Almost all studies were conducted in the regions of Europe and America. Of the 17 included studies, two (223 participants) compared reactive air surfaces with surfaces that were not well described and therefore could not be classified. We analysed data for five comparisons: reactive air surfaces compared with (1) alternating pressure (active) air surfaces (seven studies with 1728 participants), (2) foam surfaces (four studies with 229 participants), (3) reactive water surfaces (one study with 37 participants), (4) reactive gel surfaces (one study with 66 participants), and (5) another type of reactive air surface (two studies with 223 participants). Of the 17 studies, seven (41.2%) presented findings which were considered at high overall risk of bias.

Primary outcome: Pressure ulcer incidence

Reactive air surfaces may reduce the proportion of participants developing a new pressure ulcer compared with foam surfaces (risk ratio (RR) 0.42; 95% confidence interval (CI) 0.18 to 0.96; I2 = 25%; 4 studies, 229 participants; low – certainty evidence). It is uncertain if there is a difference in the proportions of participants developing a new pressure ulcer on reactive air surfaces compared with: alternating pressure (active) air surfaces (6 studies, 1648 participants); reactive water surfaces (1 study, 37 participants); reactive gel surfaces (1 study, 66 participants), or another type of reactive air surface (2 studies, 223 participants). Evidence for all these comparisons is of very low certainty.

Included studies have data on time to pressure ulcer incidence for two comparisons. When time to pressure ulcer incidence is considered using a hazard ratio (HR), low – certainty evidence suggests that in the nursing home setting, people on reactive air surfaces may be less likely to develop a new pressure ulcer over 14 days' of follow – up than people on alternating pressure (active) air surfaces (HR 0.44; 95% CI 0.21 to 0.96; 1 study, 308 participants). It is uncertain if there is a difference in the hazard of developing new pressure ulcers between two types of reactive air surfaces (1 study, 123 participants; very low – certainty evidence).

Secondary outcomes

Support – surface – associated patient comfort: the included studies have data on this outcome for three comparisons. We could not pool any data as comfort outcome measures differed between included studies;

therefore a narrative summary is provided. It is uncertain if there is a difference in patient comfort responses between reactive air surfaces and foam surfaces over the top of an alternating pressure (active) air surfaces (1 study, 72 participants), and between those using reactive air surfaces and those using alternating pressure (active) air surfaces (4 studies, 1364 participants). Evidence for these two comparisons is of very low certainty. It is also uncertain if there is a difference in patient comfort responses between two types of reactive air surfaces (1 study, 84 participants; low – certainty evidence).

All reported adverse events: there were data on this outcome for one comparison: it is uncertain if there is a difference in adverse events between reactive air surfaces and foam surfaces (1 study, 72 participants; very low – certainty evidence).

The included studies have no data for health – related quality of life and cost – effectiveness for all five comparisons.

Authors' conclusions

Current evidence is uncertain regarding any differences in the relative effects of reactive air surfaces on ulcer incidence and patient comfort, when compared with reactive water surfaces, reactive gel surfaces, or another type of reactive air surface. Using reactive air surfaces may reduce the risk of developing new pressure ulcers compared with using foam surfaces. Also, using reactive air surfaces may reduce the risk of developing new pressure ulcers within 14 days compared with alternating pressure (active) air surfaces in people in a nursing home setting.

Future research in this area should consider evaluation of the most important support surfaces from the perspective of decision – makers. Time – to – event outcomes, careful assessment of adverse events and trial – level cost – effectiveness evaluation should be considered in future studies. Trials should be designed to minimise the risk of detection bias; for example, by using digital photography and adjudicators of the photographs being blinded to group allocation. Further review using network meta – analysis will add to the findings reported here.

Plain language summary

Do beds, mattresses and mattress toppers with air – filled surfaces that apply constant pressure to the skin prevent pressure ulcers?

Key messages

Reactive, air – filled surfaces that apply constant pressure to the skin may reduce people's chances of developing pressure ulcers compared with foam surfaces.

They may also be better at preventing pressure ulcers among people in nursing homes than air – filled surfaces that regularly redistribute pressure under the body.

More research is needed to strengthen the evidence. Future studies should focus on options and effects that are important to decision – makers, such as:

- Reactive, air – filled surfaces that apply constant skin pressure, compared with air – filled surfaces that regularly redistribute pressure; and
- whether and when pressure ulcers develop, unwanted effects and costs.

What are pressure ulcers?

Pressure ulcers are also known as pressure sores or bed sores. They are wounds to the skin and underlying tissue caused by prolonged pressure or rubbing. They often occur on bony parts of the body, such as heels, elbows, hips and the bottom of the spine. People who have mobility problems or who lie in bed for long periods are at risk of developing pressure ulcers.

What did we want to find out?

There are beds, mattresses and mattress toppers specifically designed for people at risk of pressure ulcers. These can be made of a range of materials (such as foam, air cells or water bags) and are divided into two groups:

- reactive (static) surfaces that apply a constant pressure to the skin, unless a person moves or is repositioned; and
- active (alternating pressure) surfaces that regularly redistribute the pressure under the body.

We wanted to find out if reactive, air – filled surfaces:

- prevent pressure ulcers;
- are comfortable and improve people's quality of life;
- have health benefits that outweigh their costs; and
- have any unwanted effects.

What did we do?

We searched the medical literature for studies that evaluated the effects of beds, mattresses and mattress toppers with a reactive, air – filled surface. We compared and summarised their results, and rated our confidence in the evidence, based on factors such as study methods and sizes.

What did we find?

We found 17 studies (2604 people, average age: 72 years) that lasted between five days and six months (average: 14 days). The studies compared reactive, air – filled surfaces with:

- foam surfaces;
- active, air – filled surfaces;

and

- reactive surfaces filled with water, gel or other materials.

Pressure ulcer prevention

The evidence suggests that fewer people may develop pressure ulcers when lying on a reactive, air – filled surface compared with:

- foam surfaces (four studies, 229 people);

and

- an active, air – filled surface (one study, 308 people in a nursing home, followed for 14 days).

It is unclear whether reactive, air – filled surfaces prevent ulcers more than other types of reactive surfaces.

Other effects

The studies did not provide sufficiently robust and clear evidence for us to determine how reactive, air – filled surfaces affect comfort and unwanted effects. No studies reported information about quality of life and cost.

What limited our confidence in the evidence?

Most studies were small (83 people on average). Seven studies used methods likely to introduce errors in their results. It was unclear whether the other 10 studies used robust methods.

How up – to – date is this review?

The evidence in this Cochrane Review is current to November 2019.

Publication in The Cochrane Library Issue 5, 2021

Alternative reactive support surfaces (non – foam and non – air – filled) for preventing pressure ulcers

Chunhu Shi, Jo C Dumville, Nicky Cullum, Sarah Rhodes, Elizabeth McInnes

Citation: Shi C, Dumville JC, Cullum N, Rhodes S, McInnes E.
Alternative reactive support surfaces (non-foam and nonair-filled) for preventing pressure ulcers.
Cochrane Database of Systematic Reviews 2021, Issue 5. Art. No.: CD013623.
DOI: 10.1002/14651858.CD013623.pub2.

ABSTRACT

Background

Pressure ulcers (also known as injuries, pressure sores, decubitus ulcers and bed sores) are localised injuries to the skin or underlying soft tissue, or both, caused by unrelieved pressure, shear or friction. Reactive surfaces that are not made of foam or air cells can be used for preventing pressure ulcers.

Objectives

To assess the effects of non – foam and non – air – filled reactive beds, mattresses or overlays compared with any other support surface on the incidence of pressure ulcers in any population in any setting.

Search methods

In November 2019, we searched the Cochrane Wounds Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Ovid MEDLINE (including In – Process & Other Non – Indexed Citations); Ovid Embase and EBSCO CINAHL Plus. We also searched clinical trials registries for ongoing and unpublished studies, and scanned reference lists of relevant included studies as well as reviews, meta – analyses and health technology reports to identify additional studies. There were no restrictions with respect to language, date of publication or study setting.

Selection criteria

We included randomised controlled trials that allocated participants of any age to non – foam or non – air – filled reactive beds, overlays or mattresses. Comparators were any beds, overlays or mattresses used.

Data collection and analysis

At least two review authors independently assessed studies using predetermined inclusion criteria. We carried out data extraction, 'Risk of bias' assessment using the Cochrane 'Risk of bias' tool, and the certainty of the evidence assessment according to Grading of Recommendations, Assessment, Development and Evaluations methodology. If a non – foam or non – air – filled surface was compared with surfaces that were not clearly specified, then the included study was recorded and described but not considered further in any data analyses.

Main results

We included 20 studies (4653 participants) in this review. Most studies were small (median study sample size: 198 participants). The average participant age ranged from 37.2 to 85.4 years (median: 72.5 years). Participants were recruited from a wide range of care settings but were mainly from acute care settings. Almost all studies were conducted in Europe and America. Of the 20 studies, 11 (2826 participants) included surfaces that were not well described and therefore could not be fully classified. We synthesised data for the following 12 comparisons: (1) reactive water surfaces versus alternating pressure (active) air surfaces (three studies with 414 participants), (2) reactive water surfaces versus foam surfaces (one study with 117 participants), (3) reactive water surfaces versus reactive air surfaces (one study with 37 participants), (4) reactive water surfaces versus reactive fibre surfaces (one study with 87 participants), (5) reactive fibre surfaces versus alternating pressure (active) air surfaces (four studies with 384 participants), (6) reactive fibre surfaces versus foam surfaces (two studies with 228 participants), (7) reactive gel surfaces on operating tables followed by foam surfaces on ward beds versus alternating pressure (active) air surfaces on operating tables and subsequently on ward beds (two studies with 415 participants), (8) reactive gel surfaces versus reactive air surfaces (one study with 74 participants), (9) reactive gel surfaces versus foam surfaces (one study with 135

participants), (10) reactive gel surfaces versus reactive gel surfaces (one study with 113 participants), (11) reactive foam and gel surfaces versus reactive gel surfaces (one study with 166 participants) and (12) reactive foam and gel surfaces versus foam surfaces (one study with 91 participants). Of the 20 studies, 16 (80%) presented findings which were considered to be at high overall risk of bias.

Primary outcome: Pressure ulcer incidence

We did not find analysable data for two comparisons: reactive water surfaces versus foam surfaces, and reactive water surfaces versus reactive fibre surfaces. Reactive gel surfaces used on operating tables followed by foam surfaces applied on hospital beds (14/205 (6.8%)) may increase the proportion of people developing a new pressure ulcer compared with alternating pressure (active) air surfaces applied on both operating tables and hospital beds (3/210 (1.4%) (risk ratio 4.53, 95% confidence interval 1.31 to 15.65; 2 studies, 415 participants; I2 = 0%; low – certainty evidence). For all other comparisons, it is uncertain whether there is a difference in the proportion of participants developing new pressure ulcers as all data were of very low certainty.

Included studies did not report time to pressure ulcer incidence for any comparison in this review.

Secondary outcomes

Support – surface – associated patient comfort: the included studies provide data on this outcome for one comparison. It is uncertain if there is a difference in patient comfort between alternating pressure (active) air surfaces and reactive fibre surfaces (one study with 187 participants; very low – certainty evidence).

All reported adverse events: there is evidence on this outcome for one comparison. It is uncertain if there is a difference in adverse events between reactive gel surfaces followed by foam surfaces and alternating pressure (active) air surfaces applied on both operating tables and hospital beds (one study with 198 participants; very low – certainty evidence).

We did not find any health – related quality of life or cost – effectiveness evidence for any comparison in this review.

Authors' conclusions

Current evidence is generally uncertain about the differences between non – foam and non – air – filled reactive surfaces and other surfaces in terms of pressure ulcer incidence, patient comfort, adverse effects, health – related quality of life and cost – effectiveness. Reactive gel surfaces used on operating tables followed by foam surfaces applied on hospital beds may increase the risk of having new pressure ulcers compared with alternating pressure (active) air surfaces applied on both operating tables and hospital beds.

Future research in this area should consider evaluation of the most important support surfaces from the perspective of decision – makers. Time – to – event outcomes, careful assessment of adverse events and trial – level cost – effectiveness evaluation should be considered in future studies. Trials should be designed to minimise the risk of detection bias; for example, by using digital photography and adjudicators of the photographs being blinded to group allocation. Further review using network meta – analysis will add to the findings reported here.

Plain language summary

Do beds, mattresses and mattress toppers that apply constant pressure to the skin and are not air – filled or made of foam prevent pressure ulcers?

Key messages

Due to a lack of robust evidence, it is unclear whether most types of surface that apply constant pressure to the skin and are not air – filled or made of foam prevent pressure ulcers.

Lying surgery patients on an operating table with a gel surface that applies constant pressure to the skin and then a hospital bed with a foam surface, rather than using air – filled surfaces, may increase the risk of developing pressure ulcers.

Future studies should focus on options and effects that are important to decision – makers, such as:

- gel surfaces that apply constant pressure to the skin, compared to air – filled or foam surfaces; and
- whether and when pressure ulcers develop, unwanted effects and costs.

What are pressure ulcers?

Pressure ulcers are also known as pressure sores or bed sores. They are wounds to the skin and underlying tissue caused by prolonged pressure or rubbing. They often occur on bony parts of the body, such as heels, elbows, hips and the bottom of the spine. People who have mobility problems or who lie in bed for long periods are at risk of developing pressure ulcers.

What did we want to find out?

There are beds, mattresses and mattress toppers specifically designed for people at risk of pressure ulcers. These can be made of a range of materials (such as foam, air cells or water bags) and are divided into two groups:

- reactive (static) surfaces that apply a constant pressure to the skin, unless a person moves or is repositioned; and
- active (alternating pressure) surfaces that regularly redistribute the pressure under the body.

We wanted to find out if reactive surfaces that are not air filled or made of foam:

- prevent pressure ulcers;
- are comfortable and improve people's quality of life;

- have health benefits that outweigh their costs; and
- have any unwanted effects.

What did we do?

We searched the medical literature for studies that evaluated the effects of beds, mattresses and mattress toppers with a reactive surface that was not air – filled or made of foam. We compared and summarised the results of these studies, and rated our confidence in the evidence, based on factors such as study methods and sizes.

What did we find?

We found 20 studies (4653 people, average age: 73 years) that lasted between seven days and six months (average: four weeks). The studies compared reactive surfaces filled with water or gel, or made of fibre, against other active or reactive surfaces.

In general, the studies did not provide sufficiently robust evidence for us to determine if reactive surfaces that are not air – filled or made of foam prevent pressure ulcers.

Evidence from two studies suggests that people who undergo surgery may be more likely to develop pressure ulcers when they lie on an operating table with a reactive gel surface and then a hospital bed with a foam surface, rather than on active air – filled surfaces.

The other benefits and risks of gel and other reactive surfaces are unclear. No studies reported information about quality of life and cost.

What limited our confidence in the evidence?

Most studies were small (198 people on average) and used methods likely to introduce errors in their results.

How up – to – date is this review?

The evidence in this Cochrane Review is current to November 2019.

Publication in The Cochrane Library Issue 5, 2021

Beds, overlays and mattresses for treating pressure ulcers

Chunhu Shi, Jo C Dumville, Nicky Cullum, Sarah Rhodes, Asmara Jammali-Blasi, Victoria Ramsden, Elizabeth McInnes

Citation: Shi C, Dumville JC, Cullum N, Rhodes S, Jammali-Blasi A, Ramsden V, McInnes E.
Beds, overlays and mattresses for treating pressure ulcers.
Cochrane Database of Systematic Reviews 2021, Issue 5. Art. No.: CD013624.
DOI: 10.1002/14651858.CD013624.pub2.

ABSTRACT

Background

Pressure ulcers (also known as pressure injuries, pressure sores, decubitus ulcers and bed sores) are localised injuries to the skin or underlying soft tissue, or both, caused by unrelieved pressure, shear or friction. Beds, overlays or mattresses are widely used with the aim of treating pressure ulcers.

Objectives

To assess the effects of beds, overlays and mattresses on pressure ulcer healing in people with pressure ulcers of any stage, in any setting.

Search methods

In November 2019, we searched the Cochrane Wounds Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Ovid MEDLINE (including In – Process & Other Non – Indexed Citations); Ovid Embase and EBSCO CINAHL Plus. We also searched clinical trials registries for ongoing and unpublished studies, and scanned reference lists of relevant included studies as well as reviews, meta – analyses and health technology reports to identify additional studies. There were no restrictions with respect to language, date of publication or study setting.

Selection criteria

We included randomised controlled trials that allocated participants of any age to pressure – redistributing beds, overlays or mattresses. Comparators were any beds, overlays or mattresses that were applied for treating pressure ulcers.

Data collection and analysis

At least two review authors independently assessed studies using predetermined inclusion criteria. We carried out data extraction, 'Risk of bias' assessment using the Cochrane 'Risk of bias' tool, and the certainty of the evidence assessment according to Grading of Recommendations, Assessment, Development and Evaluations methodology.

Main results

We included 13 studies (972 participants) in the review. Most studies were small (median study sample size: 72 participants). The average age of participants ranged from 64.0 to 86.5 years (median: 82.7 years) and all studies recruited people with existing pressure ulcers (the baseline ulcer area size ranging from 4.2 to 18.6 cm2,median 6.6 cm2). Participants were recruited from acute care settings (six studies) and community and long – term care settings (seven studies). Of the 13 studies, three (224 participants) involved surfaces that were not well described and therefore could not be classified. Additionally, six (46.2%) of the 13 studies presented findings which were considered at high overall risk of bias. We synthesised data for four comparisons in the review: alternating pressure (active) air surfaces versus

foam surfaces; reactive air surfaces versus foam surfaces; reactive water surfaces versus foam surfaces, and a comparison between two types of alternating pressure (active) air surfaces. We summarise key findings for these four comparisons below.

(1) Alternating pressure (active) air surfaces versus foam surfaces: we are uncertain if there is a difference between alternating pressure (active) air surfaces and foam surfaces in the proportion of participants whose pressure ulcers completely healed (two studies with 132 participants; the reported risk ratio (RR) in one study was 0.97, 95% confidence interval (CI) 0.26 to 3.58). There is also uncertainty for the outcomes of patient comfort (one study with 83 participants) and adverse events (one study with 49 participants). These outcomes have very low – certainty evidence. Included studies did not report time to complete ulcer healing, health – related quality of life, or cost effectiveness.

(2) Reactive air surfaces versus foam surfaces: it is uncertain if there is a difference in the proportion of participants with completely healed pressure ulcers between reactive air surfaces and foam surfaces (RR 1.32, 95% CI 0.96 to 1.80; I2 = 0%; 2 studies, 156 participants; low – certainty evidence). When time to complete pressure ulcer healing is considered using a hazard ratio, data from one small study (84 participants) suggests a greater hazard for complete ulcer healing on reactive air surfaces (hazard ratio 2.66, 95% CI 1.34 to 5.17; low – certainty evidence). These results are sensitive to the choice of outcome measure so should be interpreted as uncertain. We are also uncertain whether there is any difference between these surfaces in patient comfort responses (1 study, 72 participants; very low – certainty evidence) and in adverse events (2 studies, 156 participants; low – certainty evidence). There is low – certainty evidence that reactive air surfaces may cost an extra 26 US dollars for every ulcer – free day in the first year of use (1 study, 87 participants). Included studies did not report health – related quality of life.

(3) Reactive water surfaces versus foam surfaces: it is uncertain if there is a difference between reactive water surfaces and foam surfaces in the proportion of participants with healed pressure ulcers (RR 1.07, 95% CI 0.70 to 1.63; 1 study, 101 participants) and in adverse events (1 study, 120 participants). All these have very low – certainty evidence. Included studies did not report time to complete ulcer healing, patient comfort, health – related quality of life, or cost effectiveness.

(4) Comparison between two types of alternating pressure (active) air surfaces: it is uncertain if there is a difference between Nimbus and Pegasus alternating pressure (active) air surfaces in the proportion of participants with healed pressure ulcers, in patient comfort responses and in adverse events: each of these outcomes had four studies (256 participants) but very low – certainty evidence. Included studies did not report time to complete ulcer healing, health – related quality of life, or cost effectiveness.

Authors' conclusions

We are uncertain about the relative effects of most different pressure – redistributing surfaces for pressure ulcer healing (types directly compared are alternating pressure air surfaces versus foam surfaces, reactive air surfaces versus foam surfaces, reactive water surfaces versus foam surfaces, and Nimbus versus Pegasus alternating pressure (active) air surfaces). There is also uncertainty regarding the effects of these different surfaces on the outcomes of comfort and adverse events. However, people using reactive air surfaces may be more likely to have pressure ulcers completely healed than those using foam surfaces over 37.5 days' follow – up, and reactive air surfaces may cost more for each ulcer – free day than foam surfaces.

Future research in this area could consider the evaluation of alternating pressure air surfaces versus foam surfaces as a high priority. Time – to – event outcomes, careful assessment of adverse events and trial – level cost – effectiveness evaluation should be considered in future studies. Further review using network meta – analysis will add to the findings reported here.

Plain language summary

What are the benefits and risks of different types of beds, mattresses and mattress toppers for treating pressure ulcers?

Key messages

Due to a lack of robust evidence, the benefits and risks of most types of beds, mattresses and mattress toppers for treating pressure ulcers are unclear.

Beds with an air – filled surface that apply constant pressure to the skin may be better than mattresses and toppers made of foam for ulcer healing if the evidence on the time needed to completely heal an ulcer is looked at, but may cost more.

Future research in this area should focus on options and effects that are important to decision – makers, such as:

- foam or air – filled surfaces that redistribute pressure under the body; and
- unwanted effects and costs.

What are pressure ulcers?

Pressure ulcers are also known as pressure sores or bed sores. They are wounds to the skin and underlying tissue caused by prolonged pressure or rubbing. They often occur on bony parts of the body, such as heels, elbows, hips and the bottom of the spine. People who have mobility problems or who lie in bed for long periods are at risk of developing pressure ulcers.

What did we want to find out?

There are beds, mattresses and mattress toppers specifically designed for people with pressure ulcers. These can be made from a range of materials (such as foam, air cells or water bags) and are divided into two groups:

- reactive (static) surfaces that apply a constant pressure to the skin, unless a person moves or is repositioned; and
- active (alternating pressure) surfaces that regularly redistribute the pressure under the body.

We wanted to find out if reactive and active surfaces:

- help ulcers to heal;
- are comfortable and improve people's quality of life;
- have health benefits that outweigh their costs; and
- have any unwanted effects.

What did we do?

We searched the medical literature for studies that evaluated the effects of beds, mattresses and mattress toppers. We compared and summarised their results, and rated our confidence in the evidence, based on factors such as study methods and sizes.

What did we find?

We found 13 studies (972 people, average age: 83 years) that lasted between seven days and 18 months (average: 37.5 days).

In general, the studies did not provide sufficiently robust evidence for us to determine the effects of active and reactive surfaces.

Evidence from two studies suggests that, when compared with mattresses and mattress toppers made of foam, beds with a reactive air – filled surface may:

- improve chances of pressure ulcers healing if the data on the time needed to completely heal an ulcer is looked at (1 study, 84 people);
- cost an extra 26 US dollars per person for every ulcer
- free day in the first year of use (1 study, 87 people).

The other benefits and risks of these and other surfaces are unclear.

What limited our confidence in the evidence?

Most studies were small (72 people on average) and nearly half of them (six studies) used methods likely to introduce errors in their results.

How up – to – date is this review?

The evidence in this Cochrane Review is current to November 2019.