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## Preventing pressure ulcers in nursing homes: developing a care bundle using the Behaviour Change Wheel

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-026639
Article Type:	Research
Date Submitted by the Author:	12-Sep-2018
Complete List of Authors:	Lavallée, Jacqueline; University of Manchester, Gray, Trish; University of Manchester, Division of Nursing, Midwifery and Social Work, School of Health Sciences, Faculty of Biology, Medicine and Health Dumville, Jo C.; Univ Manchester, Cullum, Nicky; The University of Manchester, School of Nursing, Midwifery & Social Work
Keywords:	Pressure ulcer prevention, nursing homes, care bundle, nominal group technique, behaviour change wheel, intervention development

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3 **Preventing pressure ulcers in nursing homes: developing a care**  
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6 **bundle using the Behaviour Change Wheel**  
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11 Jacqueline F. Lavallée,<sup>1,2</sup> Trish A. Gray,<sup>1,2</sup> Jo Dumville,<sup>1,2</sup> and Nicky Cullum<sup>1,2,3</sup>  
12

13  
14 <sup>1</sup>Division of Nursing, Midwifery and Social Work, University of Manchester,  
15  
16 Manchester Academic Health Science Centre, UK; <sup>2</sup>Collaboration for Leadership in  
17  
18 Applied Health Research and Care (CLAHRC) Greater Manchester, UK; <sup>3</sup> Research  
19  
20 and Innovation Division, Manchester University NHS Foundation Trust, Manchester  
21  
22 Academic Health Science Centre, UK.  
23  
24  
25

26  
27  
28  
29 jacqueline.lavallee@manchester.ac.uk;  
30 jo.dumville@manchester.ac.uk;  
31 trish.gray@manchester.ac.uk;  
32 nicky.cullum@manchester.ac.uk  
33  
34

35  
36 Corresponding author:

37 Jacqueline Lavallée, Division of Nursing, Midwifery & Social Work, The University  
38 of Manchester, Jean McFarlane Building room 5.305, Oxford Road, Manchester, M13  
39 9PL.  
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43 Word count: 3786  
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## Abstract

**Objective:** To develop, with nurse specialists and nursing home care staff, a theory and evidence-informed pressure ulcer prevention care bundle for use in nursing home settings.

**Design:** A complex intervention development study.

**Methods:** We undertook a detailed, multi-staged and theoretically-driven development process. Firstly we identified evidence-informed pressure ulcer prevention practices: these formed an initial set of possible target behaviours to be considered for inclusion in the bundle. During a four-hour workshop and supplemental email consultation with a total of 13 healthcare workers, we agreed the key target behaviours for the care bundle. We explored with staff the barriers and facilitators to prevention activity and defined intervention functions and behaviour change practices using the Behaviour Change Wheel.

**Setting:** North West England.

**Results:** The target behaviours consisted of three elements: support surfaces, skin inspection, repositioning. We identified capability, opportunity and reflective motivation as influencing the pressure ulcer prevention behaviours of nursing home care staff. The intervention functions (education, training, modelling) and behaviour change techniques (information about social, environmental and health consequences; feedback on behaviour and the outcome of behaviour; prompts/cues; instruction on how to perform the behaviour; demonstration of behaviour) were incorporated into the care bundle.

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2  
3 **Conclusions:** This is the first description of a pressure ulcer prevention care bundle  
4  
5 for nursing homes developed using the Behaviour Change Wheel. Key stakeholders  
6  
7 identified and prioritised the appropriate target behaviours to aid pressure ulcer  
8  
9 prevention in a nursing home setting.  
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### 15 **Keywords**

16  
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18 Pressure ulcer prevention; nursing homes; care bundle; nominal group technique;  
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20 behaviour change wheel; intervention development; complex intervention.  
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## Article summary

### Strengths and limitations of this study

- This study will inform the development of a novel intervention to support nursing home care staff to prevent pressure ulcers in residents.
- Integrating theory, research evidence and expert opinion into the care bundle should maximise the intervention's acceptability, feasibility and potential effectiveness.
- The pressure ulcer prevention care bundle is described in detail along with the intervention's potential mechanisms of action and the specific behaviour change techniques enhancing applicability and reproducibility.
- A number of experienced staff participated in the Nominal Group technique, but there was a limited number of tissue viability nurses who participated face-to-face.

## Background

Pressure ulcers are areas of localised damage to the skin and underlying tissue [1].

They are caused by prolonged, or short but intense, periods of pressure or pressure and shear. Pressure ulcers can lead to severe pain and distress, poor health-related quality of life and serious complications such as gangrene and mortality [2-4].

Reducing and eliminating pressure ulcers across all healthcare settings in the UK is a priority [5]. People at high risk of pressure ulceration include those who are seriously ill, the elderly and those with impaired mobility [6, 7]. Thus many people living in nursing homes are likely to be at an increased risk of pressure ulcers.

Pressure ulcer prevention processes are shaped by national and international guidelines based on a synthesis of research findings and expert opinion [1, 8].

Current guidelines recommend a range of clinical interventions including: *risk assessment, skin assessment, repositioning, maintaining hydration and nourishment*, the use of *pressure redistributing devices and barrier creams, training for care staff and accurate monitoring and documentation*. However the implementation of such prevention activities remains challenging, particularly in nursing homes where understaffing, high staff turnover and a lack of monitoring can result in limited staff knowledge and inconsistent clinical care [9, 10].

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2  
3 Care bundles were first introduced by the Institute for Healthcare Improvement to  
4  
5 improve the quality and consistency of care [11]. Care bundles comprise three to  
6  
7 five evidence-informed clinical interventions (referred to as “elements”), which  
8  
9 have the potential to improve patient outcomes when performed collectively and  
10  
11 reliably. The Institute for Healthcare Improvement suggests that every eligible  
12  
13 patient should receive all of the bundle elements unless medically contraindicated  
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18 [11].  
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23 Care bundles aim to change the behaviour of healthcare workers, therefore the use  
24  
25 of behaviour change theory is key [12]. Whilst several care bundles have been  
26  
27 developed it is not always clear how they were developed or whether they were  
28  
29 underpinned by theory [13]. There are multiple theories and frameworks for  
30  
31 behaviour change, many with overlapping constructs [14, 15]. The Behaviour  
32  
33 Change Wheel [14, 16] was developed to facilitate the integration of target  
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35 behaviours, behaviour change theory and intervention development through a  
36  
37 series of three key stages that can be subdivided into eight steps (Appendix 1).  
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46 The COM-B model [16] forms the centre of the Behaviour Change Wheel [14, 16]  
47  
48 and assists with understanding the behaviour in context (Stage 1 of intervention  
49  
50 development). The COM-B model hypothesises that capability (C), opportunity (O)  
51  
52 and motivation (M) all interact and can explain behaviour (B) and can become the  
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54 focus for the behaviour change intervention.  
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5 Once the targets for change (e.g., physical opportunity) have been identified using  
6  
7 the COM-B model, the second and third stages of the Behaviour Change Wheel focus  
8  
9 on how intervention developers might facilitate change in these areas using  
10  
11 intervention functions, policy categories, behaviour change techniques and modes of  
12  
13 delivery. It is recommended that developers consider their intervention design using  
14  
15 the APEASE criteria [14].  
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23 Currently, there are no published pressure ulcer prevention care bundles designed  
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25 for, and implemented in, nursing home settings. Most of the published pressure  
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27 ulcer prevention care bundles focus on acute hospital settings such as intensive care  
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29 units and critical care units [17-22]. This paper describes the development of the first  
30  
31 reported nursing home-specific pressure ulcer prevention care bundle. We aimed,  
32  
33 with key stakeholders from nursing homes and the National Health Service (NHS),  
34  
35 to co-produce a pressure ulcer prevention care bundle that is relevant to the nursing  
36  
37 home context. We describe how the Behaviour Change Wheel was used to support  
38  
39 the theory-driven processes in the design of the implementation plan for the care  
40  
41 bundle. Figure 1 presents a logic model illustrating our knowledge and  
42  
43 understanding at the start of this work and the outcomes we were aiming for. At the  
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45 end of the work we aimed to design the components of the intervention (the  
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47 “solution” in Figure 1).  
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## Methods

### *Study design*

We describe a two part care bundle development process. Part 1 used the Nominal Group technique [23] to gain consensus about the elements to include in the care bundle. Part 2 followed the steps outlined in the Behaviour Change Wheel to facilitate the development of the implementation plan for the care bundle.

### *Participants*

The study took place in the North West of England. Purposive sampling was used to recruit participants with relevant clinical and management experience and expertise. Participants were eligible to participate if they were a nursing home-based registered nurse (referred to from now on as a nurse), manager or healthcare assistant or a community-based tissue viability nurse. Written consent was gained from all participants.

### *Materials and procedures*

Figure 2 presents a diagrammatical outline of the processes involved in developing the care bundle and how we applied the Behaviour Change Wheel processes here.

#### **Stage1: Understanding the behaviours**

*Behaviour Change Wheel Step 1. Define the problem in behavioural terms (pre-workshop)*

1  
2  
3 We reviewed the pressure ulcer prevention literature to gain an understanding of  
4  
5 the main barriers to pressure ulcer prevention in nursing homes. We conducted a  
6  
7 systematic review that identified and explored existing care bundles and any  
8  
9 evidence for particular design features and behaviour change approaches that might  
10  
11 be associated with positive clinical outcomes [anonymised for review].  
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18 *Behaviour Change Wheel Steps 2 and 3. Select and specify the target behaviours (care bundle*  
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20 *development workshop)*  
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23 These two steps involved the identification of care bundle elements (i.e. the specific  
24  
25 pressure ulcer prevention clinical interventions) and consideration of who, what,  
26  
27 when, where and how often the care bundle elements should be delivered. We held  
28  
29 a four hour interactive workshop with key stakeholders to identify the clinical  
30  
31 interventions to assist with pressure ulcer prevention in nursing homes. There are  
32  
33 several possible methods that can be drawn on for developing a care bundle. We  
34  
35 used the Nominal Group technique to gain consensus about the most important  
36  
37 pressure ulcer prevention elements to be included in the care bundle. This approach  
38  
39 is highly structured; consisting of multiple rounds where items or questions are  
40  
41 rated, discussed and re-rated by the expert panellists (e.g., nurses). This method  
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43 minimises the effects of any dominant participants as all group members are  
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45 provided with equal opportunities for voting.  
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3 We presented participants with an overview of the research-based international and  
4 national pressure ulcer prevention guidelines [1, 8]. We then discussed the guideline  
5 recommendations, focusing in particular on their applicability in a nursing home  
6 setting. All participants had the opportunity to add any clinical interventions they  
7 thought were missing from the guidelines before they began voting.  
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18 The Nominal Group process was explained and participants were split into two  
19 groups for voting purposes (i.e. healthcare assistants or registered nurses). Each  
20 participant within these groups was given five votes in the form of coloured stickers  
21 which they used to vote individually for their top three to five pressure ulcer  
22 prevention clinical interventions. The colour of the sticker indicated whether the  
23 voter was a nurse or healthcare assistant. We counted the votes in real time and  
24 presented the results to the participants to facilitate discussion prior to the second  
25 round of voting. In the case of a tie, we offered the participants one extra vote for  
26 one of the two tied clinical interventions. We invited participants to express their  
27 opinions on the clinical interventions and whether they believed clarification was  
28 required. Again, colour-coded stickers were used to cast votes in the second round.  
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46 This round was used to finalise the agreement between participants [23]. The care  
47 bundle elements were agreed after a final discussion of the clinical interventions that  
48 received the highest numbers of votes.  
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3 We then asked the workshop participants to specify the detail for each bundle  
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5 element; the frequency with which they should be delivered, where and by whom  
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7 and we asked participants to score the components of each element out of 10 (0 = not  
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9 important, 10 = extremely important). Following the workshop, the care bundle  
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11 elements and specific components were reviewed in line with existing research  
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13 evidence and cross-checked for validity by experts in the field such as tissue viability  
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15 nurses.  
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23 *Behaviour Change Wheel Step 4. Identifying what needs to change to enable the reliable*  
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25 *delivery of pressure ulcer prevention clinical interventions*  
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28 We collected data from 25 participants using semi-structured interviews where we  
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30 explored the barriers and facilitators to pressure ulcer prevention using the  
31  
32 Theoretical Domains Framework [anonymised for review]. We identified the  
33  
34 behavioural and psychological influences on pressure ulcer prevention by mapping  
35  
36 the salient barriers and facilitators identified using the Theoretical Domains  
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38 Framework onto the COM-B model, using the guidance provided by the Behaviour  
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40 Change Wheel [14].  
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### 48 **Stages 2 and 3: Identifying the intervention content and implementation options**

49 *Behaviour Change Wheel Steps 5-8. Identifying the intervention functions, policy categories,*  
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51 *behaviour change techniques and modes of delivery*  
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3 We mapped the components of the COM-B model identified as being relevant to  
4 pressure ulcer prevention in nursing homes (Step 4) onto the matrices provided in  
5 the Behaviour Change Wheel, and this informed our plan for implementing the care  
6 bundle. We applied the APEASE criteria [14] for designing and evaluating  
7 interventions to each of the relevant implementation aspects to guide our  
8 judgements in selecting the most appropriate intervention functions, policy  
9 categories, behaviour change techniques and modes of delivery likely to support the  
10 successful implementation of the care bundle.  
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26 To ensure the implementation plan was suitable, we held discussions individually  
27 with the nursing home care staff, tissue viability nurses and academic researchers  
28 before we finalised the care bundle. These discussions were based on the 'modelling'  
29 guidance provided by the UK Medical Research Council's guidance for developing  
30 and evaluating complex interventions [12] which includes: who should receive the  
31 intervention; how changes to practice are usually introduced; what the barriers to  
32 change might be and how delivery can be documented.  
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## 46 **Patient and public involvement**

47 Patients were not involved in this study.  
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## 53 **Results**

### 54 *Behaviour Change Wheel Stage 1: Understanding the behaviours* 55 56 57

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3 *Behaviour Change Wheel Step 1. Define the problem in behavioural terms (pre-workshop)*

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5 We found that the barriers to pressure ulcer prevention commonly reported within  
6  
7 the literature included understaffing, high staff turnover and limited staff  
8  
9 knowledge [9, 10]; whereas communication and positive attitudes towards pressure  
10  
11 ulcer prevention were often described as facilitators [24-26]. Our findings suggested  
12  
13 that central to the prevention of pressure ulcers is the belief that the actions of  
14  
15 healthcare workers (e.g., repositioning) directly influence the development of  
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17 pressure ulcers [27]. Consequently, care bundles may be an effective tool to improve  
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19 the implementation of guidelines and evidence-informed practices [13].  
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28 Within our systematic review we were not able to conduct a meta-regression of  
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30 study features or explore the magnitude of effects as there were insufficient  
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32 comparisons involving patient outcomes. Consequently, we conducted subgroup  
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34 analyses. We found that all care bundles (regardless of the number of elements)  
35  
36 reduced the risk of the negative patient outcomes and the apparent effect of care  
37  
38 bundles appeared to reduce as the number of elements increased. The lowest risk for  
39  
40 the negative patient outcomes was in the subgroup with 'eight behaviour change  
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42 techniques'. However, we considered these data to be of very low quality. Our  
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44 findings from the systematic review are reported in detail elsewhere [13].  
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53 *Behaviour Change Wheel Steps 2 and 3. Select and specify the target behaviours (care bundle*  
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55 *development workshop)*

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3 A total of 10 participants attended the workshop, including one tissue viability nurse  
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5 and staff from one nursing home (four healthcare assistants and five registered  
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7 nurses). A further three tissue viability nurses were unable to attend the workshop  
8  
9 but participated in email (n = 2) or face-to-face (n = 1) consultations, which followed  
10  
11 the processes outlined in the methods section as closely as possible. The participants'  
12  
13 ages ranged from 26 to 55 years, one participant was male and one had previously  
14  
15 attended wound care training. The median years of experience in working with  
16  
17 people at risk of developing pressure ulcers was 11 years (interquartile range: 1.4  
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19 years to 13 years).  
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28 During the discussion prior to round one, it was agreed that '*pain management*'  
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30 should be added as a clinical intervention, and *nutrition and hydration* should be  
31  
32 separated into two. The clinical interventions voted for in round one by each group  
33  
34 differed (Table 1). For example the healthcare assistants did not vote for *skin*  
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36 *assessment*, whereas 80% of the nurses (4/5) and 75% of the tissue viability nurses  
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38 (3/4) did. Similarly, 75% of the healthcare assistants (3/4) and 50% of the tissue  
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40 viability nurses (2/4) voted for *support surfaces* to be included but the nurses did not.  
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46 During the discussion the nurses explained that they did not select *support surfaces* as  
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48 a key clinical intervention as they felt that pressure redistributing devices covered  
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50 this (although this only received one vote from the nurses' group). Further  
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52 discussion resulted in reuniting *nutrition and hydration* as all nursing home  
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54 participants explained that they offer these together. Consequently, six clinical  
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3 interventions went through to the second round of voting (*skin care, continence care,*  
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5 *skin assessment, repositioning, nutrition and hydration and support surfaces*).

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10 *Repositioning, skin assessment, skin care, continence care and nutrition and hydration* were  
11  
12 voted into the top five in round two (Table 1). Every tissue viability nurse voted for  
13  
14 *support surfaces*; whereas the healthcare assistants considered support surfaces to be  
15  
16 important but embedded within *repositioning*, and this was reflected in their voting.  
17  
18 Through discussion the participants agreed that including *support surfaces* as an  
19  
20 element separate to *repositioning* was important and *support surfaces* should  
21  
22 incorporate *pressure redistributing devices* too. Whilst the participants deemed  
23  
24 *nutrition and hydration* and *continence care* to be important, they decided that  
25  
26 providing and monitoring such clinical interventions are part of basic care and  
27  
28 should not be included in a specific pressure ulcer prevention care bundle. The *skin*  
29  
30 *care* and *skin assessment* clinical interventions were merged. Consequently, three  
31  
32 elements made up the care bundle: *support surfaces, skin inspection* and *repositioning*.  
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43 Participants ranked, in order of perceived importance, the components required to  
44  
45 ensure the accurate and consistent completion of each of the care bundle elements.

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47 All participants agreed that residents should receive a monthly pressure ulcer risk  
48  
49 assessment to trigger the activation of the care bundle for those at risk of developing  
50  
51 a pressure ulcer. However, more frequent assessments may be warranted for some  
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53 residents at high risk of pressure ulcer development or if there is a change in a  
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3 resident's clinical status. The frequency with which the elements of care are to be  
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5 delivered will be informed by the risk assessment, although the risk assessment was  
6  
7 separate from the care bundle. It was agreed that the nursing home care staff should  
8  
9 complete and document every element of the care bundle for all residents deemed to  
10  
11 be at risk of developing a pressure ulcer, and where an element cannot be completed  
12  
13 a reason must be provided (e.g., where a resident has refused to be repositioned).  
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20 *Behaviour Change Wheel Step 4. Identifying what needs to change to enable the reliable*  
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22 *delivery of pressure ulcer prevention clinical interventions*  
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25 The semi-structured interview data (reported elsewhere [anonymised for review]),  
26  
27 when mapped on to the COM-B model, suggested the following factors as influences  
28  
29 on the prevention of pressure ulcers in nursing home settings: *psychological and*  
30  
31 *physical capability; physical and social opportunity; and reflective motivation*. We found  
32  
33 that improvements in pressure ulcer prevention knowledge and skills are required.  
34  
35  
36 In particular, the tissue viability nurses could provide information about, and  
37  
38 training on, pressure ulcers and how to prevent them within a nursing home  
39  
40 context; but the nursing home care staff need to be permitted to attend this training.  
41  
42  
43 In addition there appears to be scope to increase the use and documentation of  
44  
45 evidence-informed pressure ulcer prevention clinical interventions. Pressure ulcer  
46  
47 prevention clinical interventions need to be conducted in line with the resident's risk  
48  
49 of developing a pressure ulcer. If it is not possible to complete an aspect of care, this  
50  
51 must be documented.  
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5 *Behaviour Change Wheel Stage 2: Identifying the intervention content and*  
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7  
8 *implementation options*  
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10 We used the Behaviour Change Wheel to define the key intervention functions and  
11  
12 policy categories that could be used to improve pressure ulcer prevention in nursing  
13  
14 homes using the relevant COM-B components identified in Step 4.  
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21 *Step 5: Intervention functions*  
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23 The three most suitable intervention functions were *education, training and modelling*  
24  
25 (i.e. providing a role model such as a skin champion). Increasing the knowledge of  
26  
27 the nursing home care staff and improving their skills through education and  
28  
29 training is a crucial aspect to facilitating the prevention of pressure ulcers in nursing  
30  
31 home residents. The inclusion of skin champions should assist with accessing  
32  
33 training and education as these can be delivered in-house by the skin champion.  
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41 *Step 6: Policy categories*  
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43 The policy categories most suitable for achieving the behaviour change included  
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45 *communication/marketing (e.g., posters), guidelines, regulation and service provision.*  
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51 *Step 7: Behaviour change techniques*  
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53 Using the Behaviour Change Technique Taxonomy Version 1 [28] and the findings  
54  
55 from our systematic review we selected the seven techniques we believed were most  
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3 suitable to facilitate behaviour change and support prevention practices (*information*  
4 *about social and environmental consequences; information on health consequences; feedback*  
5 *on behaviour; feedback on the outcome of the behaviour; prompts/cues; instruction on how to*  
6 *perform the behaviour; demonstration of behaviour*).

#### 15 *Step 8: Mode of delivery*

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18 We then formulated a plan regarding how and by whom the care bundle would be  
19  
20 implemented in practice and this was based on the discussions held with key  
21  
22 stakeholders. The delivery of the care bundle will differ at specific stages and the key  
23  
24 modes of delivery are specified in Table 2 (e.g., the tissue viability nurses will deliver  
25  
26 the face-to-face group training to address the *capability* of nursing home care staff as  
27  
28 identified through the COM-B model in Stage 1).  
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## 36 **Discussion**

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38 This is the first explicit, behaviour change theory-driven, pressure ulcer prevention  
39  
40 care bundle that we have been able to identify. We identified the important elements  
41  
42 of the care bundle in collaboration with key stakeholders. Using the COM-B model  
43  
44 and with the steps outlined in the Behaviour Change Wheel we developed a  
45  
46 pressure ulcer prevention care bundle that focused on the three identified target  
47  
48 behaviours (*the checking of support surfaces, skin inspection and repositioning*). The  
49  
50 broad functions of the intervention (*education, training, modelling*) aim to be achieved  
51  
52 using seven theoretically-based behaviour change techniques delivered using a  
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3 variety of methods, including face-to-face and written materials. This information  
4  
5 can be used to populate the solutions box in Figure 1 in the introduction (Figure 3).  
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9  
10 Three main aspects of pressure ulcer prevention that consistently feature in care  
11  
12 bundles were included within our nursing home care bundle, albeit operationalised  
13  
14 differently: repositioning, skin assessment and the use of support surfaces [17-19,  
15  
16 29]. However, our care home-focused intervention differs from those delivered in  
17  
18 hospital settings as we did not incorporate continence care or nutrition and  
19  
20 hydration; mainly because they were deemed core aspects of nursing care that  
21  
22 should be prioritised irrespective of any tenuous link with pressure ulcer prevention.  
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27  
28 Whilst our care bundle elements reflect those included in hospital-focused bundles,  
29  
30 the process of deciding how to promote the behaviour changes around these target  
31  
32 behaviours has not been clear in previous work. We supported this work using a  
33  
34 strong theoretical framework for intervention design. Through the transparent  
35  
36 reporting of the mechanisms of action, modes of delivery and the theoretical  
37  
38 constructs, future evaluations of the effectiveness of this care bundle will be possible.  
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### 46 *Strengths and limitations*

47  
48 The theoretical basis and systematic presentation of the development of the care  
49  
50 bundle is a strength of our study. The empirical work revealed the target behaviours  
51  
52 required (i.e. checking of support surfaces, skin inspection, repositioning) and the  
53  
54 Behaviour Change Wheel identified the implementation interventions suitable for  
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2  
3 the care bundle. Previous studies detailing pressure ulcer prevention care bundles  
4  
5 [17, 19] have not provided such explicit and transparent methods, which may limit  
6  
7 the understanding of the mechanisms of action and causal relationships within the  
8  
9 interventions [30]. Thus the present study addresses these concerns, facilitating  
10  
11 subsequent evaluations and future replications.  
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17  
18 The use of Nominal Group technique to develop the care bundle was beneficial for  
19  
20 many reasons. The participation of the nursing home care staff and the NHS tissue  
21  
22 viability nurses was vital to ensure the integration of specialist knowledge alongside  
23  
24 context specific expertise. The Nominal Group technique enabled each participant to  
25  
26 express their view (via individual votes) which minimised the effects of any  
27  
28 potentially dominant participants. Using the Nominal Group technique during the  
29  
30 workshop was advantageous as it yielded extensive and rich data in a relatively  
31  
32 short period of time.  
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41 A limitation of the current study was the inclusion of only one nursing home and the  
42  
43 relatively small number of tissue viability nurse workshop participants. Expert  
44  
45 opinion is a fundamental aspect of the Nominal Group technique, and whilst the  
46  
47 majority of the participants who did attend had a range of expertise in caring for  
48  
49 individuals residing in nursing homes, specialist nurse input was crucial. Initially all  
50  
51 of the local tissue viability nurses agreed to attend however, due to unforeseen  
52  
53 circumstances, some could not. Consequently, the process was repeated with the  
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3 tissue viability nurses via face-to-face meetings or online consultations to ensure  
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5 their specialist knowledge of the prevention of pressure ulcers could be combined  
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7 with the results. We believe that taking such a systematic and structured approach to  
8  
9 designing the care bundle will result in a more efficacious intervention and will aid  
10  
11 subsequent evaluations and improvements.  
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### 16 17 18 *Future research*

19  
20 The next phase of this research is to test the feasibility of implementing the care  
21  
22 bundle in a nursing home context. If the care bundle intervention is feasible and  
23  
24 acceptable to nursing home care staff, further evaluation will be necessary to assess  
25  
26 the clinical and cost-effectiveness. The explicit theoretical links provided through the  
27  
28 use of the Behaviour Change Wheel [14, 16] and Behaviour Change Technique  
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30 Taxonomy Version 1 [28] will facilitate future replications and data synthesis.  
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### 38 39 *Conclusion*

40  
41 Care bundles have received much attention within inpatient settings over the past  
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43 decade due to the potentially synergistic effect of incorporating several clinical  
44  
45 interventions within one package. The structure of care bundles can be used to  
46  
47 facilitate reliable and sustainable changes in the work habits of staff. However, few  
48  
49 theory-informed care bundles are reported within the literature. This paper  
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51 describes how a pressure ulcer prevention care bundle was developed for use in UK  
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53 nursing homes and how the Behaviour Change Wheel guided the development of  
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3 the intervention. Key stakeholders contributed to the design of the care bundle,  
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5 forging the first step towards standardising pressure ulcer prevention practices  
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7 within nursing home settings. Whilst preventing pressure ulcers in nursing home  
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9 residents is complex and multifaceted, this structured and transparent approach has  
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11 facilitated a thorough process for the development of the intervention. The next step  
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13 is to assess the feasibility of implementing this care bundle within the nursing home  
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15 environment to ensure that it is acceptable before wider evaluation ensues.  
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### 23 **Abbreviations**

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25 **PU:** pressure ulcer

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28 **TVN:** tissue viability nurse

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31 **BCW:** Behaviour Change Wheel

### 32 33 34 35 **Figure legends**

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38 Figure 1; Logic model for the pressure ulcer prevention care bundle; an outline of the  
39  
40 consequences of pressure ulcers in nursing homes, the potential behavioural causes  
41  
42 of pressure ulcers and the pathway to benefit through preventing pressure ulcers.  
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46 Figure 2; The Behaviour Change Wheel stages; data collection and analysis processes  
47  
48 used to develop the care bundle using the steps and stages outlined in the Behaviour  
49  
50 Change Wheel.  
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52  
53 Figure 3; Solutions box for Figure 1; the content of the pressure ulcer prevention care  
54  
55 bundle and the steps required to implement the care bundle in nursing homes.  
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## **Additional files**

Appendix 1; Behaviour Change Wheel stages and steps [11]; an overview of the Behaviour Change Wheel.

Appendix 2; Pressure ulcer prevention care bundle.

Appendix 3. Care bundle poster (.txt 464KB)

## **Declarations**

### **Ethics approval and consent to participate**

This study was given approval by [anonymised for review] (ref: 15451), together with approval from the Research and Development department at the participating NHS site (ref: 100321).

### **Consent for publication**

Not applicable.

### **Availability of data and material**

All data generated or analysed during this study are included in this published manuscript.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

This project was funded by the [anonymised for review].

### **Author contributions**

All of the authors conceived the study and contributed to its design. [anonymised for review] co-ordinated the study, developed the standard operating procedures for the workshop, held the email/face-to-face consultations with the tissue viability nurses and analysed the data. [anonymised for review] facilitated the workshop. All of the authors contributed to the interpretation of the data, assisted with drafting and revising the manuscript and approved the final version before submission.

### **Acknowledgements**

We are grateful to the [anonymised for review] for supporting this work. The [anonymised for review] is a partnership between providers and commissioners from the NHS, industry and the third sector, as well as clinical and research staff from the [anonymised for review]. The views expressed in this article are those of the authors and not necessarily those of the [anonymised for review].

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Table 1

*Votes from rounds one and two from each healthcare staff group*

	Healthcare		Tissue	Overall
	assistants	Nurses	viability	percentage of
Clinical intervention	(n = 4)	(n = 5)	nurses (n = 4)	votes
<b><u>Voting round 1</u></b>				
Nutrition	1	4	4	69%
Hydration	2	4	0	31%
Skin care	2	1	1	38%
Support surfaces	3	0	2	46%
Repositioning	3	5	4	92%
Continence care	4	5	4	100%
Pressure redistributing devices	1	1	2	31%
Skin assessment	0	4	3	54%
Pain	0	0	0	0%
Barrier cream	0	0	0	0%
<b><u>Voting round 2</u></b>				
Skin care	2	4	1	45%
Continence care	4	4	4	92%
Skin assessment	0	3	3	46%
Repositioning	4	5	4	100%
Nutrition and hydration	4	5	4	100%
Support surfaces	0	0	4	31%

Table 2. *Implementation plan for pressure ulcer prevention care bundle*

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<p><b>Training and education:</b></p> <ul style="list-style-type: none"> <li>- on risk factors, pressure ulcer prevention, equipment, outcomes, protocols.</li> </ul>	<p>Access to training was identified as a barrier to pressure ulcer prevention in nursing homes. To improve pressure ulcer prevention knowledge and skills in nursing home care staff (registered and unregistered). We identified the following two BCTs as important components of the intervention: 'information about social and environmental consequences' and 'information on health consequences'.</p>	<p>Provided by a tissue viability nurse to nursing home care staff (registered and unregistered).</p>	<p>Training will be provided one week prior to the implementation of the care bundle and will be a one-off face-to-face, three hour interactive group session. Presentation using PowerPoint and printed materials will be provided to the staff who attend and also to the nursing home for staff who are unable to attend. Additional training sessions will be offered to the nursing home care staff to maximise attendance.</p>	<p>Due to practical reasons, training will be held off-site. Written training materials will be available in the nursing home.</p>
<ul style="list-style-type: none"> <li>- on the care bundle and each individual element (support surfaces, skin inspection, repositioning), and how to use the care bundle in practice.</li> </ul>	<p>To increase the uptake of the care bundle, to familiarise staff with the processes involved.</p>	<p>Provided to nursing home care staff (registered and unregistered) by a researcher with expertise in behaviour change.</p>	<p>Face-to-face one hour interactive group session. PowerPoint and printed materials will be provided to staff who attend and also to the nursing home for staff who are unable to attend.</p>	

Table 3

(Cont.)

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Modelling and demonstration of behaviour:</b> - skin champions	The skin champions will deliver the care bundle as intended and will be available during a shift. Staff can speak with the skin champions if they have any concerns or queries. Skin champions are also able to demonstrate pressure ulcer prevention techniques and provide examples of good record keeping (i.e. documentation).	Nursing home care staff (likely to be a registered nurse).	This is available face-to-face and is likely to be delivered on an individual basis and will be available as required. The researcher will meet with the skin champions at least bi-weekly to discuss any issues or concerns.	Nursing home.
<b>Implementation of the care bundle:</b> - risk assessment	To identify any risk factors for the development of a pressure ulcer and indicate the frequency with which the care bundle needs to be delivered.	Registered nurse and/or nursing home manager.	Using a validated risk assessment tool, the risk assessment will be completed at least monthly. If there is a change to a resident's clinical status, the risk assessment should be conducted again.	Nursing home.

Table 3

(Cont.)

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Implementation of the care bundle:</b>				
- complete care bundle for each eligible resident (support surfaces, skin inspection, repositioning).	To improve the reliability of care and to prevent pressure ulcers using elements identified locally as being important within a nursing home context. To improve the documentation of pressure ulcer prevention practices.	Nursing home care staff (registered and unregistered).	Nursing home care staff will complete each element of care included within the care bundle. If it is not possible to conduct all of the elements ( <i>support surfaces, skin inspection, repositioning</i> ) within the care bundle, this must be documented on the overleaf section of the care bundle documentation sheet. The frequency with which this needs to be conducted will depend on each individual resident. The frequency should be amended in line with a resident's needs and risk. For example, for those at risk of developing a pressure ulcer it should be at least every 6 hours, at least every 4 hours for those at a high risk, and at least every 2 hours for those at a very high risk. Staff are required to ensure the appropriate pressure relieving equipment is being used and is functioning.	Nursing home.



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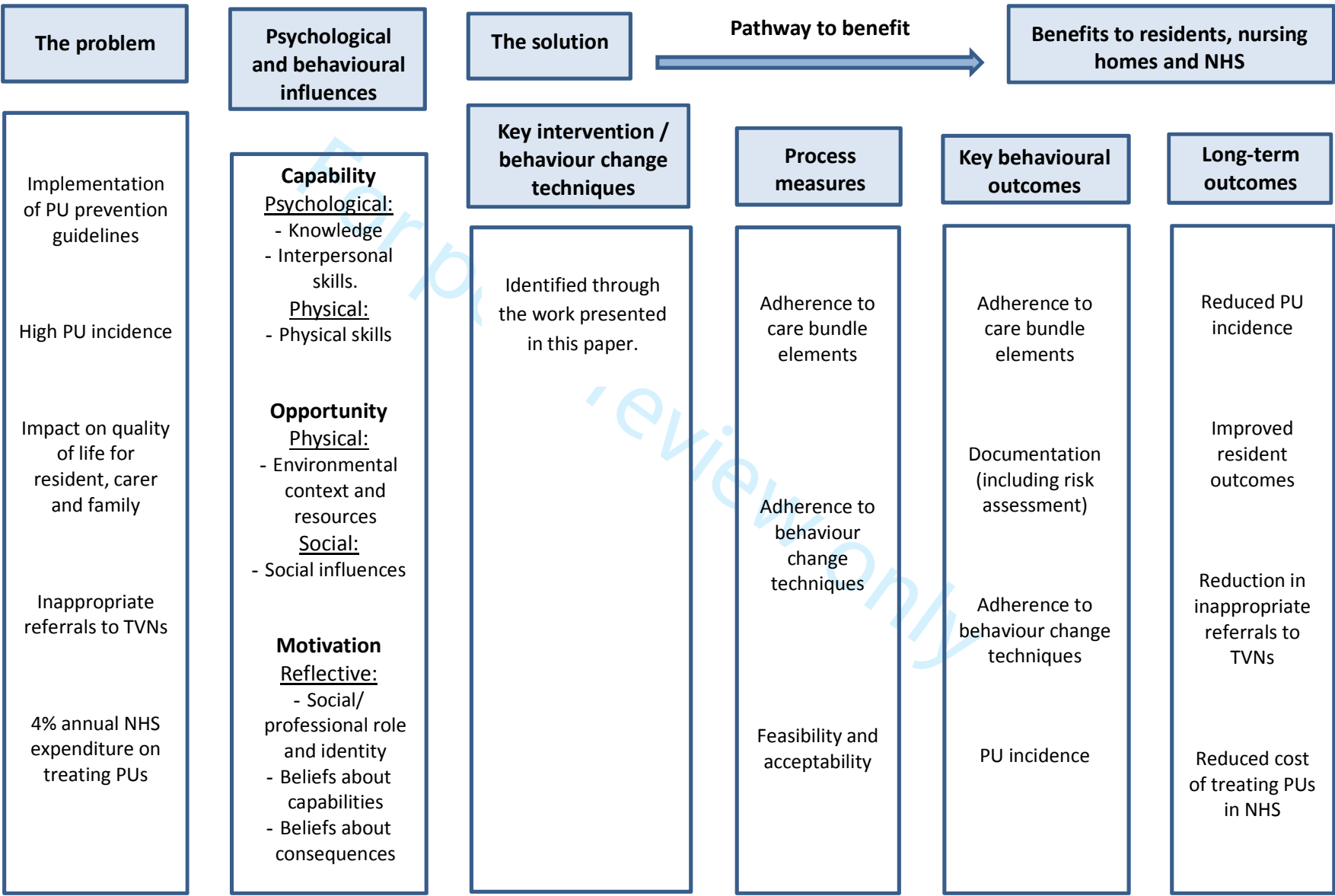
<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Prompts and cues</b>	An aide memoire was reported as a facilitator of pressure ulcer prevention in nursing homes. Thus, posters will be placed in staff communal areas (e.g., nursing office) to remind staff of the steps involved within the care bundle. The care bundle itself also acts as a checklist as staff are required to document the provision of care on the care bundle sheets.	The research team will provide posters and care bundle documentation.	The unit manager will decide the positioning of the posters on the unit (see Appendix 3). The nursing home staff are responsible for the completion of the care bundle and associated documents. These will be available daily throughout the study period.	Nursing home (including nursing office, residents' bedrooms, residents' files).

Table 3

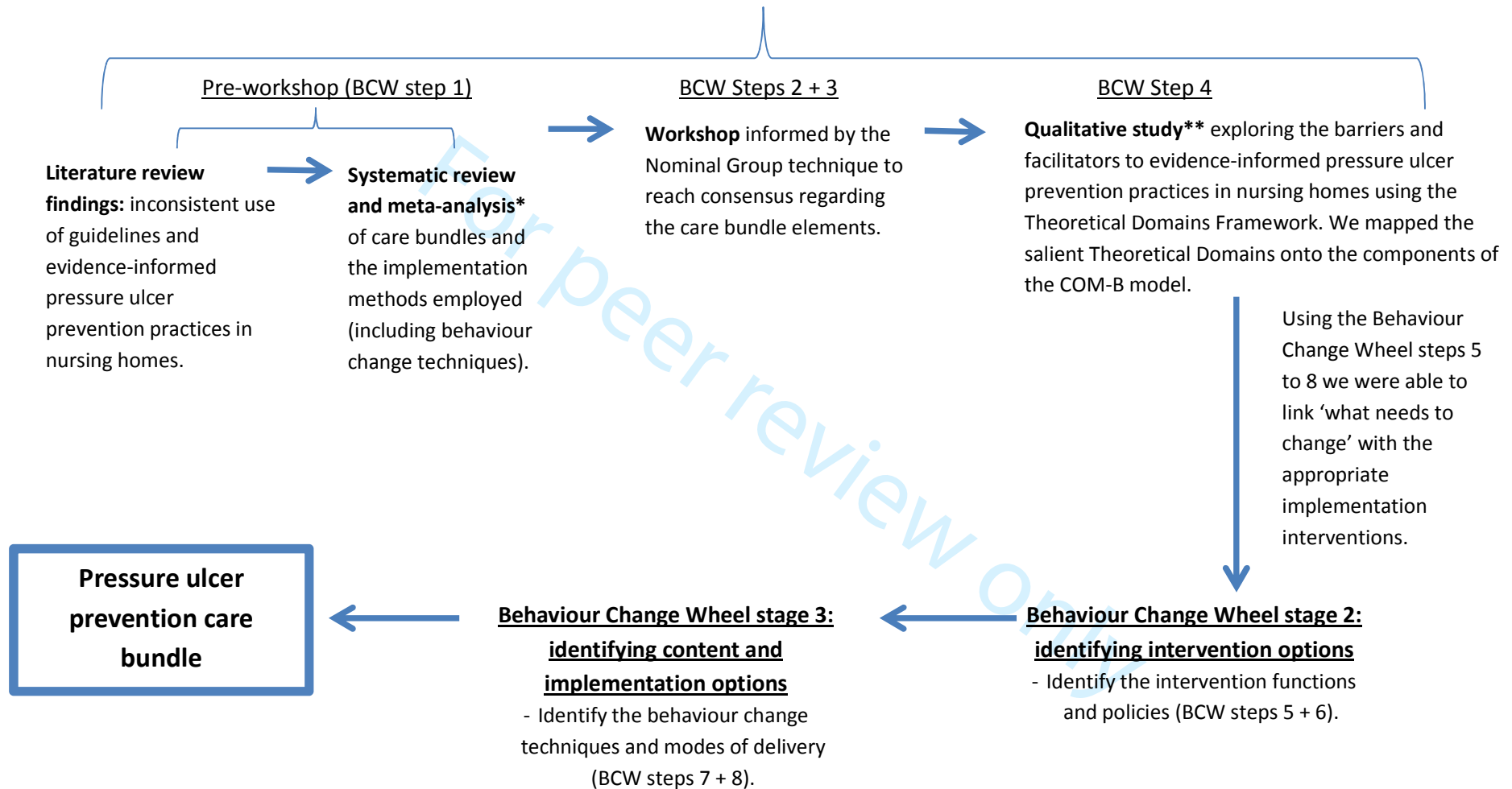
(Cont.)

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Feedback:</b>	To maintain motivation and engagement with the care bundle.			
- on behaviours and outcomes.	To highlight areas of pressure ulcer prevention where staff are maintaining high levels of care and the areas that could be improved.	Researcher	The research team will provide verbal feedback to the unit manager on a monthly basis during the study period. This will include the number of pressure ulcers acquired and adherence to the care bundle. Feedback will be provided in the form of percentages on the following: <ul style="list-style-type: none"> <li>- All-or-none compliance (when all aspects of the care bundle were delivered, including times when it was not possible to complete the care bundle but reasons were documented);</li> <li>- Overall adherence with each individual element: support surfaces, skin inspection, repositioning.</li> </ul> Following the completion of the study, the above information will be collated and the findings from the whole study period will be presented verbally to the unit manager and nursing home care staff.	Nursing home.

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### Behaviour Change Wheel stage 1: understand the behaviour



\*Methods and findings reported in [anonymised for review]; \*\*methods and findings reported in [anonymised for review].

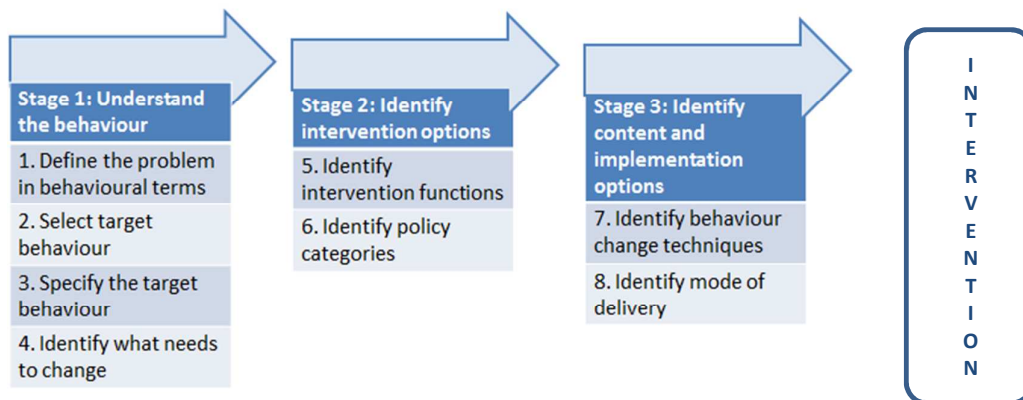
**Care bundle elements:**

- Support surfaces
- Skin inspection
- Repositioning

**Behaviour change techniques:**

- Information about social and environmental consequences
- Information on health consequences
- Feedback on behaviour
- Feedback on the outcome of the behaviour
- Prompts/cues
- Instruction on how to perform the behaviour
- Demonstration of behaviour

review only



For peer review only

## Table 2

*The care bundle elements and the specific components*

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**Support surfaces:**

Checked for creases, tubing and personal items.

Is all of the equipment working?

**Skin inspection:**

All pressure areas checked?

Any redness or changes to the skin? (If yes, please document)

Is the resident experiencing wound pain?

**Repositioning:**

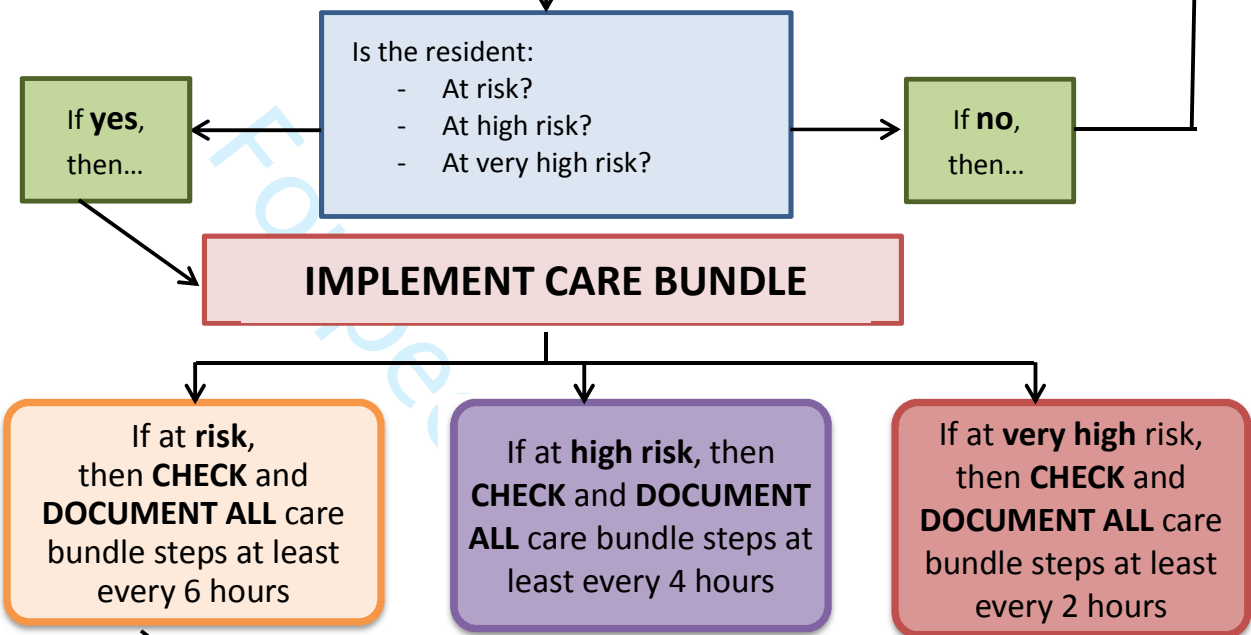
Document whether the resident has turned/stood/walked/been hoisted to another position.

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Additional file 2. Care bundle poster

**Pressure Ulcer Prevention Care Bundle**

**Conduct pressure ulcer risk assessment every month, or sooner if there is a change to resident's health status.  
Document findings and due date of next assessment and alert all concerned.**



Time – use 24 hour clock 00.00 – 24.00			
<b>Support surfaces</b>			
Surface checked for creases, tubing, personal items etc.?			
Equipment checked?			
<b>Skin inspection</b>			
All pressure areas checked?			
Redness/changes to skin? Yes (Y) No (N)? (If Y, document overleaf)			
Is the resident experiencing wound pain?			
<b>Repositioning</b>			
In bed: rotated onto right (R), left (L) side or hoisted (H)			
Sitting: stood (S) walked (W)			
Other (document overleaf)			
Initials			

Write the frequency here

You will need a new form each day

Initial here

**All Care Staff PLEASE READ and ensure all residents 'at risk' have forms in their room. Please ask the nurse in charge to explain if unsure**





Template for Intervention Description and Replication

The TIDieR (Template for Intervention Description and Replication) Checklist\*:

Information to include when describing an intervention and the location of the information

Item number	Item	Where located **	
		Primary paper (page or appendix number)	Other † (details)
1.	<b>BRIEF NAME</b> Provide the name or a phrase that describes the intervention.	_____	_____
2.	<b>WHY</b> Describe any rationale, theory, or goal of the elements essential to the intervention.	Abstract, page 2	_____
3.	<b>WHAT</b> Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (e.g. online appendix, URL).	Page 7 Pages 9-11	_____
4.	<b>WHO PROVIDED</b> Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.	Pages 9-11	_____
5.	<b>HOW</b> For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.	Page 8	_____
6.	<b>WHERE</b> Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.	Page 18, table 2	_____
7.	Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.	_____	_____

TIDieR checklist

	<b>WHEN and HOW MUCH</b>	Abstract, page 13	
8.	Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose.	_____	_____
	<b>TAILORING</b>	Page 15, table 2	
9.	If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how.	_____	_____
	<b>MODIFICATIONS</b>	Page 15	
10.†	If the intervention was modified during the course of the study, describe the changes (what, why, when, and how).	_____	_____
	<b>HOW WELL</b>	N/A	
11.	Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.	_____	_____
12.‡	Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.	N/A _____ N/A __	_____

\*\* **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use ‘?’ if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).

‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

\* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.

\* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see [www.consort-statement.org](http://www.consort-statement.org)) as an extension of **Item 5 of the CONSORT 2010 Statement**. When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see [www.spirit-statement.org](http://www.spirit-statement.org)). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see [www.equator-network.org](http://www.equator-network.org)).

TIDieR checklist

# BMJ Open

## Preventing pressure injury in nursing homes: developing a care bundle using the Behaviour Change Wheel

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-026639.R1
Article Type:	Research
Date Submitted by the Author:	28-Jan-2019
Complete List of Authors:	Lavallée, Jacqueline; University of Manchester, Gray, Trish; University of Manchester, Division of Nursing, Midwifery and Social Work, School of Health Sciences, Faculty of Biology, Medicine and Health Dumville, Jo C.; Univ Manchester, Cullum, Nicky; The University of Manchester, School of Nursing, Midwifery & Social Work
<b>Primary Subject Heading</b>:	Nursing
Secondary Subject Heading:	Evidence based practice
Keywords:	nursing homes, care bundle, nominal group technique, behaviour change wheel, intervention development, Pressure injury prevention

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Manuscripts

# Preventing pressure injury in nursing homes: developing a care bundle using the Behaviour Change Wheel

Jacqueline F. Lavallée,<sup>1,2</sup> Trish A. Gray,<sup>1,2</sup> Jo Dumville,<sup>1,2</sup> and Nicky Cullum<sup>1,2,3</sup>

<sup>1</sup>Division of Nursing, Midwifery and Social Work, University of Manchester, Manchester Academic Health Science Centre, UK; <sup>2</sup>Collaboration for Leadership in Applied Health Research and Care (CLAHRC) Greater Manchester, UK; <sup>3</sup> Research and Innovation Division, Manchester University NHS Foundation Trust, Manchester Academic Health Science Centre, UK.

jacqueline.lavallee@manchester.ac.uk;  
jo.dumville@manchester.ac.uk;  
trish.gray@manchester.ac.uk;  
nicky.cullum@manchester.ac.uk

Corresponding author:

Jacqueline Lavallée, Division of Nursing, Midwifery & Social Work, The University of Manchester, Jean McFarlane Building room 5.305, Oxford Road, Manchester, M13 9PL.

Word count: 4275

1  
2  
3 **1 Abstract**  
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5  
6 **2 Objective:** To develop, with nurse specialists and nursing home care staff, a theory  
7  
8  
9 and evidence-informed **pressure injury prevention** care bundle for use in nursing  
10  
11 home settings.  
12

13  
14 **3 Design:** The development of a care bundle.  
15

16  
17 **4 Methods:** We undertook a detailed, multi-staged and theoretically-driven  
18  
19 development process. Firstly we identified evidence-informed pressure injury  
20  
21 prevention practices: these formed an initial set of possible target behaviours to be  
22  
23 considered for inclusion in the bundle. During a four-hour workshop and  
24  
25 supplemental email consultation with a total of 13 healthcare workers, we agreed the  
26  
27 key target behaviours for the care bundle. We explored with staff the barriers and  
28  
29 facilitators to prevention activity and defined intervention functions and behaviour  
30  
31 change practices using the Behaviour Change Wheel.  
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38  
39 **5 Setting:** North West England.  
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41  
42 **6 Results:** The target behaviours consisted of three elements: support surfaces, skin  
43  
44 inspection, repositioning. We identified capability, opportunity and reflective  
45  
46 motivation as influencing the pressure injury prevention behaviours of nursing  
47  
48 home care staff. The intervention functions (education, training, modelling) and  
49  
50 behaviour change techniques (information about social and environmental  
51  
52 consequences; information on health consequences; feedback on behaviour; feedback  
53  
54 on the outcome of behaviour; prompts/cues; instruction on how to perform the  
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56 behaviour; demonstration of behaviour) were incorporated into the care bundle.  
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3 23 **Conclusions:** This is the first description of a pressure injury prevention care bundle  
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5  
6 24 for nursing homes developed using the Behaviour Change Wheel. Key stakeholders  
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8  
9 25 identified and prioritised the appropriate target behaviours to aid pressure injury  
10  
11 26 prevention in a nursing home setting.  
12  
13

14 27  
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16 28 **Keywords**

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19 29 Pressure injury prevention; nursing homes; care bundle; nominal group technique;  
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22 30 behaviour change wheel; intervention development; complex intervention.  
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3 31 **Article summary**  
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6 32 **Strengths and limitations of this study**  
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- 8  
9 33 • This study will inform the development of a novel intervention to support  
10  
11 34 nursing home care staff to prevent pressure injury in residents.  
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13  
14 35 • Integrating theory, research evidence and expert opinion into the care bundle  
15  
16 36 should maximise the intervention's acceptability, feasibility and potential  
17  
18 37 effectiveness.  
19  
20 38 • The pressure injury prevention care bundle is described in detail along with the  
21  
22 39 intervention's potential mechanisms of action and the specific behaviour change  
23  
24 40 techniques enhancing applicability and reproducibility.  
25  
26 41 • A number of experienced staff participated in the Nominal Group technique, but  
27  
28 42 there was a limited number of tissue viability nurses who participated face-to-  
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30 43 face.  
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## 44 **Background**

45 Pressure injuries are areas of localised damage to the skin and underlying tissue [1].

46 They are caused by prolonged, or short but intense, periods of pressure or pressure  
47 and shear. Pressure injury can lead to severe pain and distress, poor health-related  
48 quality of life and serious complications such as gangrene and mortality [2-4].

49  
50 Reducing and eliminating pressure injuries across all healthcare settings in the UK is  
51 a priority [5]. People at high risk of pressure injury include those who are seriously  
52 ill, the elderly and those with impaired mobility [6, 7]. Thus many people living in  
53 nursing homes are likely to be at an increased risk of pressure injury. Moreover, a  
54 point prevalence survey of complex wounds (e.g., pressure ulcers, leg ulcers)  
55 conducted in a northern UK city found 26% of individuals with a pressure ulcer (an  
56 open wound caused by pressure) lived in residential or nursing homes [8].

57  
58 Pressure injury prevention processes are shaped by national and international  
59 guidelines based on a synthesis of research findings and expert opinion [1, 9].

60 Current guidelines recommend a range of clinical interventions including: *risk*  
61 *assessment, skin assessment, repositioning, correction of compromised hydration and*  
62 *nourishment, the use of pressure redistributing devices and barrier creams, training for*  
63 *care staff and accurate monitoring and documentation.* However the implementation of  
64 pressure injury prevention activities remains challenging, particularly in nursing



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3 65 homes where understaffing, high staff turnover and a lack of monitoring can result  
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6 66 in limited staff knowledge and inconsistent clinical care [10, 11].  
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10  
11 68 Care bundles were first introduced by the Institute for Healthcare Improvement to  
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13  
14 69 improve the quality and consistency of care [12]. Care bundles comprise three to  
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16  
17 70 five evidence-informed clinical interventions (referred to as “elements”), which  
18  
19  
20 71 have the potential to improve patient outcomes when performed collectively and  
21  
22 72 reliably. The Institute for Healthcare Improvement suggests that every eligible  
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24  
25 73 patient should receive all of the bundle elements unless medically contraindicated  
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27  
28 74 [12].  
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30 75

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33 76 Care bundles aim to change the behaviour of healthcare workers, therefore the use of  
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35  
36 77 behaviour change theory is key [13]. Whilst several care bundles have been  
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38  
39 78 developed it is not always clear how they were developed or whether they were  
40  
41  
42 79 underpinned by theory [14]. There are multiple theories and frameworks for  
43  
44  
45 80 behaviour change, many with overlapping constructs [15, 16]. The Behaviour  
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47  
48 81 Change Wheel [15, 17] is a framework for designing behaviour change interventions  
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50  
51 82 and was developed to facilitate the integration of target behaviours, behaviour  
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53  
54 83 change theory and intervention development through a series of three key stages  
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57 84 that can be subdivided into eight steps (Appendix 1). Thus, the Behaviour Change  
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60 85 Wheel outlines a systematic and transparent approach to identify the appropriate

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3 86 theory-based intervention content which may bring about change in the people who  
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5  
6 87 are its target (in this case, nursing home staff).  
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10  
11 89 The COM-B model [17] forms the centre of the Behaviour Change Wheel [15, 17]  
12  
13  
14 90 and assists with understanding the behaviour in context (Stage 1 of intervention  
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16  
17 91 development). The COM-B model hypothesises that capability (C), opportunity (O)  
18  
19  
20 92 and motivation (M) all interact and can explain behaviour (B) and can become the  
21  
22  
23 93 focus for the behaviour change intervention. Within the COM-B model *capability*  
24  
25 94 refers to the person's psychological and physical capacity to engage in the target  
26  
27  
28 95 behaviour. *Opportunity* refers to the factors that are external to the individual and  
29  
30  
31 96 influence the potential success of the behaviour (i.e. the physical environment or the  
32  
33  
34 97 social environment). *Motivation* involves the psychological processes that can trigger  
35  
36 98 and direct behaviour, including reflective and automatic motivation.  
37

38 99

40  
41 100 Once the targets for change (e.g., physical opportunity) have been identified using  
42  
43  
44 101 the COM-B model, the second and third stages of the Behaviour Change Wheel focus  
45  
46  
47 102 on how intervention developers might facilitate change in these areas using  
48  
49  
50 103 intervention functions, policy categories, behaviour change techniques and modes of  
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53 104 delivery. It is recommended that developers consider their intervention design using  
54  
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56 105 the APEASE criteria [15]. The APEASE criteria are used to guide the decisions on  
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58  
59 106 the intervention content and how to implement the intervention within a particular  
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3 107 setting [15, 17]. These criteria involve an assessment of: affordability; practicability;  
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6 108 effectiveness and cost-effectiveness; acceptability; side-effects/safety; equity.  
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9 109  
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11 110 We were unable to identify any pre-existing pressure injury prevention care bundles  
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14 111 designed for, and implemented in, nursing home settings. All of the published  
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17 112 pressure injury prevention care bundles focus on acute hospital settings such as  
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20 113 intensive care units and critical care units [18-23]. This paper describes the  
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23 114 development of the first reported nursing home-specific pressure injury prevention  
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26 115 care bundle. We aimed, with key stakeholders from nursing homes and the National  
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29 116 Health Service (NHS), to co-produce a pressure injury prevention care bundle that is  
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32 117 relevant to the nursing home context. We describe how the Behaviour Change Wheel  
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35 118 was used to support the theory-driven processes in the design of the implementation  
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37  
38 119 plan for the care bundle. Figure 1 presents a logic model illustrating our knowledge  
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40  
41 120 and understanding at the start of this work and the outcomes we were aiming for. At  
42  
43  
44 121 the end of the work we aimed to design the components of the intervention (the  
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46  
47 122 “solution” in Figure 1).

## 124 **Methods**

### 125 *Study design*

126 We describe a two part care bundle development process. Part 1 used the Nominal  
127 Group technique [24] to gain consensus about the elements to include in the care

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2  
3 128 bundle. Part 2 followed the steps outlined in the Behaviour Change Wheel to  
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6 129 facilitate the development of the implementation plan for the care bundle.  
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### 11 131 *Participants*

13 14 132 The study took place in the North West of England. Purposive sampling was used  
15  
16 17 133 to recruit participants with relevant clinical and management experience and  
18  
19 20 134 expertise. Participants were eligible to participate if they were a nursing home-  
21  
22 23 135 based registered nurse (referred to from now on as a nurse), manager or healthcare  
24  
25 26 136 assistant or a community-based tissue viability nurse. Written consent was gained  
27  
28 29 137 from all participants.

30 138

### 33 139 *Materials and procedures*

35 36 140 Figure 2 presents a diagrammatical outline of the processes involved in developing  
37  
38 39 141 the care bundle and how we applied the Behaviour Change Wheel processes here.  
40

41 142

#### 44 143 **Stage1: Understanding the behaviours**

46 47 144 *Behaviour Change Wheel Step 1. Defining the problem in behavioural terms (pre-workshop)*

49 50 145 We reviewed the pressure injury prevention literature to gain an understanding of  
51  
52 53 146 the main barriers to pressure injury prevention in nursing homes. We conducted a  
54  
55 56 147 systematic review that identified and explored existing care bundles and any  
57  
58 59 148 evidence for particular design features and behaviour change approaches that might  
60 149 be associated with positive clinical outcomes [14].

150

151 *Behaviour Change Wheel Steps 2 and 3. Selecting and specifying the target behaviours (care*  
152 *bundle development workshop)*

153 These two steps involved the identification of care bundle elements (i.e. the specific  
154 pressure injury prevention clinical interventions) and consideration of who, what,  
155 when, where and how often the care bundle elements should be delivered. We held  
156 a four hour interactive workshop with key stakeholders to identify the clinical  
157 interventions to assist with pressure injury prevention in nursing homes. There are  
158 several possible methods that can be drawn on for developing a care bundle. The  
159 Nominal Group technique was developed to facilitate the decision making of groups  
160 [24]. In essence we used the Nominal Group technique to gain consensus about the  
161 most important pressure injury prevention elements to be included in the care  
162 bundle. This approach is highly structured, usually delivered face-to-face; consisting  
163 of multiple rounds where items or questions are rated, discussed and re-rated by the  
164 expert panellists (e.g., nurses). This method minimises the effects of any dominant  
165 participants as all group members are provided with equal opportunities for voting.

166

167 We presented participants with an overview of the research-based international and  
168 national pressure injury prevention guidelines [1, 9]. We then discussed the  
169 guideline recommendations, focusing in particular on their applicability in a nursing  
170 home setting. All participants had the opportunity to add any clinical interventions  
171 they thought were missing from the guidelines before they began voting.

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6 173 The Nominal Group process was explained and participants were split into two  
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8  
9 174 groups for voting purposes (i.e. healthcare assistants or registered nurses). Each  
10  
11 175 participant within these groups was given five votes in the form of coloured stickers  
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14 176 which they used to vote individually for their top three to five pressure injury  
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16  
17 177 prevention clinical interventions. The colour of the sticker indicated whether the  
18  
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20 178 voter was a nurse or healthcare assistant. We counted the votes in real time and  
21  
22 179 presented the results to the participants to facilitate discussion prior to the second  
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24  
25 180 round of voting. In the case of a tie, we offered the participants one extra vote for  
26  
27  
28 181 one of the two tied clinical interventions. We invited participants to express their  
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31 182 opinions on the clinical interventions and whether they believed clarification was  
32  
33 183 required. Again, colour-coded stickers were used to cast votes in the second round.  
34  
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36 184 This round was used to finalise the agreement between participants [24]. The care  
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39 185 bundle elements were agreed after a final discussion of the clinical interventions that  
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41 186 received the highest numbers of votes.  
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45  
46 188 We then asked the workshop participants to specify the detail for each bundle  
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48  
49 189 element; the frequency with which they should be delivered, where and by whom  
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52 190 and we asked participants to score the components of each element out of 10 (0 = not  
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55 191 important, 10 = extremely important). Following the workshop, the care bundle  
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58 192 elements and specific components were reviewed in line with existing research  
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3 193 evidence and cross-checked for validity by experts in the field such as tissue viability  
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6 194 nurses.

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11 196 *Behaviour Change Wheel Step 4. Identifying what needs to change to enable the reliable*  
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14 197 *delivery of pressure injury prevention clinical interventions*

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17 198 We purposively recruited individuals who provide care for those at risk of  
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20 199 developing pressure injuries in nursing homes and collected data from 25  
21  
22 200 participants (healthcare assistants (n = 7), registered nurses (n = 11), nurse managers  
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25 201 (n = 3) and community-based tissue viability nurses (n = 4)). Using semi-structured  
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27  
28 202 interviews we explored the barriers and facilitators to pressure injury prevention  
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31 203 [25] using the Theoretical Domains Framework [26]. The Theoretical Domains  
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33 204 Framework comprises 14 domains that can be used to explore the determinants of  
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36 205 professional behaviour change and inform intervention design (e.g., knowledge,  
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38  
39 206 social influences, beliefs about consequences) [26]. Each of the 14 Theoretical  
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41  
42 207 Domains Framework domains can be mapped onto the COM-B model [15, 17] to  
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45 208 facilitate understanding of healthcare workers' behaviours within a particular  
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48 209 context. We analysed the data deductively, using the Theoretical Domains  
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51 210 Framework and identified the behavioural and psychological influences on pressure  
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54 211 injury prevention by mapping the salient barriers and facilitators identified onto the  
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57 212 COM-B model, using the guidance provided by the Behaviour Change Wheel [15].

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214 **Stages 2 and 3: Identifying the intervention content and implementation options**

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3 215 *Behaviour Change Wheel Steps 5-8. Identifying the intervention functions, policy categories,*  
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6 216 *behaviour change techniques and modes of delivery*  
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9 217 We mapped those components of the COM-B model identified as being relevant to  
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11 218 pressure injury prevention in nursing homes (Step 4) onto the matrices provided in  
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14 219 the Behaviour Change Wheel, and this informed our plan for implementing the care  
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17 220 bundle. In addition, the Behaviour Change Technique Taxonomy Version 1 [27]  
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19 221 informed our choice of behaviour change techniques (step 7). The Behaviour Change  
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22 222 Technique Taxonomy Version 1 [27] comprises 93 behaviour change techniques and  
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25 223 can be used to identify intervention components, enabling the standardisation of  
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28 224 terms as well as the comparison of behaviour change techniques across studies. We  
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30 225 applied the APEASE criteria [15] for designing and evaluating interventions to each  
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33 226 of the relevant implementation aspects to guide our judgements in selecting the most  
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36 227 appropriate intervention functions, policy categories, behaviour change techniques  
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39 228 and modes of delivery likely to support the successful implementation of the care  
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41 229 bundle.  
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45  
46 231 To ensure the implementation plan was suitable, we held discussions individually  
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49 232 with the nursing home care staff, tissue viability nurses and academic researchers  
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52 233 before we finalised the care bundle. These discussions were based on the 'modelling'  
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55 234 guidance provided by the UK Medical Research Council's guidance for developing  
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57 235 and evaluating complex interventions [13] which includes: who should receive the  
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3 236 intervention; how changes to practice are usually introduced; what the barriers to  
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6 237 change might be and how delivery can be documented.  
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## 10 11 239 **Patient and public involvement**

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14 240 Nursing home residents and the public were not involved in the development of the  
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17 241 care bundle.  
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19 242

## 20 21 22 243 **Results**

### 23 24 244 *Behaviour Change Wheel Stage 1: Understanding the behaviours*

#### 25 26 245 *Behaviour Change Wheel Step 1. Defining the problem in behavioural terms (pre-workshop)*

27  
28 246 Our review of the literature identified that understaffing, high turnover and limited  
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31  
32  
33 247 staff knowledge are commonly reported as barriers to pressure injury prevention

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35  
36 248 [10, 11] and that good communication and positive attitudes to pressure injury

37  
38 249 prevention are described as facilitators [28-30]. In addition, central to the prevention

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40  
41 250 of pressure injuries is the belief that the actions of healthcare workers (e.g.,

42  
43  
44 251 repositioning) directly influence the development of pressure injuries [31].

45  
46 252 Consequently, care bundles may be an effective tool to improve the implementation

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49 253 of guidelines and evidence-informed practices [14].  
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54 255 Within our systematic review we were not able to conduct a meta-regression of

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57 256 study features or explore the magnitude of effects as there were insufficient

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60 257 comparisons involving patient outcomes. Consequently, we conducted subgroup

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3 258 analyses. We found that all care bundles (regardless of the number of elements)  
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6 259 reduced the risk of the negative patient outcomes and the apparent effect of care  
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9 260 bundles appeared to reduce as the number of elements increased. The lowest risk for  
10  
11 261 the negative patient outcomes was in the subgroup with 'eight behaviour change  
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13  
14 262 techniques'. However, we considered these data to be of very low quality. Our  
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17 263 findings from the systematic review are reported in detail elsewhere [14].  
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19 264  
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22 265 *Behaviour Change Wheel Steps 2 and 3. Selecting and specifying the target behaviours (care*  
23  
24  
25 266 *bundle development workshop)*

26  
27 267 Ten participants attended the workshop, including one tissue viability nurse and  
28  
29  
30 268 staff from one nursing home (four healthcare assistants and five registered nurses).  
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32  
33 269 A further three tissue viability nurses were unable to attend the workshop but  
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36 270 participated in email (n = 2) or face-to-face (n = 1) consultations, which followed the  
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38  
39 271 processes outlined in the methods section as closely as possible. The participants'  
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41  
42 272 ages ranged from 26 to 55 years, one participant was male and one had previously  
43  
44  
45 273 attended wound care training. The median years of experience in working with  
46  
47  
48 274 people at risk of developing pressure injuries was 11 years (interquartile range: 1.4  
49  
50  
51 275 years to 13 years).

52 276  
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54  
55 277 During the discussion prior to round one, it was agreed that '*pain management*'  
56  
57  
58 278 should be added as a clinical intervention, and *nutrition and hydration* should be  
59  
60 279 separated into two. The clinical interventions voted for in round one by each group

1  
2  
3 280 differed (Table 1). For example the healthcare assistants did not vote for *skin*  
4  
5  
6 281 *assessment*, whereas 80% of the nurses (4/5) and 75% of the tissue viability nurses  
7  
8  
9 282 (3/4) did. Similarly, 75% of the healthcare assistants (3/4) and 50% of the tissue  
10  
11 283 viability nurses (2/4) voted for *support surfaces* to be included but the nurses did not.  
12  
13  
14 284 During the discussion the nurses explained that they did not select *support surfaces* as  
15  
16  
17 285 a key clinical intervention as they felt that pressure redistributing devices covered  
18  
19  
20 286 this (although this only received one vote from the nurses' group). Further  
21  
22 287 discussion resulted in reuniting *nutrition and hydration* as all nursing home  
23  
24  
25 288 participants explained that they offer these together. Consequently, six clinical  
26  
27  
28 289 interventions went through to the second round of voting (*skin care, continence care,*  
29  
30 290 *skin assessment, repositioning, nutrition and hydration and support surfaces*).  
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## 291 Table 1

292 *Votes from rounds one and two from each healthcare staff group*

	Healthcare assistants (n = 4)	Nurses (n = 5)	Tissue viability nurses (n = 4)	Overall percentage of votes
<b><u>Voting round 1</u></b>				
Nutrition	1	4	4	69%
Hydration	2	4	0	31%
Skin care	2	1	1	38%
Support surfaces	3	0	2	46%
Repositioning	3	5	4	92%
Continence care	4	5	4	100%
Pressure redistributing devices	1	1	2	31%
Skin assessment	0	4	3	54%
Pain	0	0	0	0%
Barrier cream	0	0	0	0%
<b><u>Voting round 2</u></b>				
Skin care	2	4	1	45%
Continence care	4	4	4	92%
Skin assessment	0	3	3	46%
Repositioning	4	5	4	100%
Nutrition and hydration	4	5	4	100%
Support surfaces	0	0	4	31%

293

294

295 *Repositioning, skin assessment, skin care, continence care and nutrition and hydration were*296 *voted into the top five in round two (Table 1). Every tissue viability nurse voted for*

1  
2  
3 297 *support surfaces*; whereas the healthcare assistants considered support surfaces to be  
4  
5  
6 298 important but embedded within *repositioning*, and this was reflected in their voting.  
7  
8  
9 299 Through discussion the participants agreed that including *support surfaces* as an  
10  
11 300 element separate from *repositioning* was important and *support surfaces* should also  
12  
13 301 incorporate *pressure redistributing devices*. Whilst the participants deemed *nutrition*  
14  
15 302 *and hydration* and *continence care* important, they agreed that only those residents  
16  
17 303 with inadequate nutrition and hydration require additional nutrition and fluid [9];  
18  
19 304 therefore, this element would be redundant for some individuals (making the care  
20  
21 305 bundle more of a checklist). Participants believed that continence care was a  
22  
23 306 separate, complex issue; requiring a number of detailed steps to prevent damage to  
24  
25 307 skin integrity and likely to require its own care bundle [32]. Consequently  
26  
27 308 participants decided that providing and monitoring such clinical interventions are  
28  
29 309 part of basic care and should not be included in a specific pressure injury prevention  
30  
31 310 bundle. The *skin care* and *skin assessment* clinical interventions were merged and  
32  
33 311 three elements made up the care bundle: *support surfaces*, *skin inspection* and  
34  
35 312 *repositioning*.  
36  
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38 313  
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40  
41 314 Participants ranked, in order of perceived importance, the components required to  
42  
43 315 ensure the accurate and consistent completion of each of the care bundle elements.  
44  
45  
46 316 All participants agreed that residents should receive a monthly pressure injury risk  
47  
48 317 assessment to trigger the activation of the care bundle for those at risk of developing  
49  
50 318 a pressure injury. However, more frequent assessments may be warranted for some  
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3 319 residents at high risk of pressure injury development or if there is a change in a  
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6 320 resident's clinical status. The frequency with which the elements of care are to be  
7  
8  
9 321 delivered will be informed by the risk assessment, although the risk assessment was  
10  
11 322 separate from the care bundle. It was agreed that the nursing home care staff should  
12  
13  
14 323 complete and document every element of the care bundle for all residents deemed to  
15  
16  
17 324 be at risk of developing a pressure injury, and where an element cannot be  
18  
19 325 completed a reason must be provided (e.g., where a resident has refused to be  
20  
21  
22 326 repositioned).  
23  
24

25 327

27 328 *Behaviour Change Wheel Step 4. Identifying what needs to change to enable the reliable*  
28  
29  
30 329 *delivery of pressure injury prevention clinical interventions*  
31

32  
33 330 The semi-structured interview data (reported elsewhere [25]), when mapped on to  
34  
35  
36 331 the COM-B model, suggested the following factors as influences on the prevention of  
37  
38  
39 332 pressure injury in nursing home settings: *psychological and physical capability; physical*  
40  
41 333 *and social opportunity; and reflective motivation*. We found that improvements in  
42  
43  
44 334 pressure injury prevention knowledge and skills are required. In particular, the  
45  
46  
47 335 tissue viability nurses could provide information about, and training on, pressure  
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49 336 injuries and how to prevent them within a nursing home context; but the nursing  
50  
51  
52 337 home care staff need to be permitted to attend this training. In addition there  
53  
54  
55 338 appears to be scope to increase the use and documentation of evidence-informed  
56  
57 339 pressure injury prevention interventions. Pressure injury prevention interventions  
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340 need to be conducted in line with the resident's risk of developing a pressure injury.

341 If it is not possible to complete an aspect of care, this must be documented.

342

343 *Behaviour Change Wheel Stage 2: Identifying the intervention content and*  
344 *implementation options*

345 We used the Behaviour Change Wheel to define the key intervention functions and  
346 policy categories that could be used to improve pressure injury prevention in  
347 nursing homes using the relevant COM-B components identified in Step 4.

348

349 *Step 5: Intervention functions*

350 The three most suitable intervention functions were *education, training* and *modelling*  
351 (i.e. providing a role model such as a skin champion). Increasing the knowledge of  
352 the nursing home care staff and improving their skills through education and  
353 training is a crucial aspect to facilitating the prevention of pressure injury in nursing  
354 home residents. The inclusion of skin champions should assist with accessing  
355 training and education as these can be delivered in-house by the skin champion.

356

357 *Step 6: Policy categories*

358 The policy categories most suitable for achieving the behaviour change included  
359 *communication/marketing* (e.g., posters), *guidelines, regulation* and *service provision*.

360

361 *Step 7: Behaviour change techniques*

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3 362 Using the Behaviour Change Technique Taxonomy Version 1 [27] (which is a  
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6 363 taxonomy of 93 behaviour change techniques) together with the findings from our  
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9 364 systematic review, we selected the seven techniques we believed were most suitable  
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11 365 to facilitate behaviour change and support prevention practices (*information about*  
12  
13  
14 366 *social and environmental consequences; information on health consequences; feedback on*  
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17 367 *behaviour; feedback on the outcome of the behaviour; prompts/cues; instruction on how to*  
18  
19 368 *perform the behaviour; demonstration of behaviour*).

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25 370 *Step 8: Mode of delivery*

26  
27 371 We then formulated a plan regarding how and by whom the care bundle would be  
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30 372 implemented in practice and this was based on the discussions held with key  
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33 373 stakeholders. The delivery of the care bundle will differ at specific stages and the key  
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36 374 modes of delivery are specified in Table 2 (e.g., the tissue viability nurses will deliver  
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38 375 the face-to-face group training to address the *capability* of nursing home care staff as  
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41 376 identified through the COM-B model in Stage 1).

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378 Table 2. *Implementation plan for pressure injury prevention care bundle*

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<p><b>Training and education:</b></p> <ul style="list-style-type: none"> <li>- on risk factors, pressure injury prevention, equipment, outcomes, protocols.</li> </ul>	<p>Access to training was identified as a barrier to pressure injury prevention in nursing homes. To improve pressure injury prevention knowledge and skills in nursing home care staff (registered and unregistered). We identified the following two BCTs as important components of the intervention: information about social and environmental consequences' and 'information on health consequences'.</p>	<p>Provided by a tissue viability nurse to nursing home care staff (registered and unregistered).</p>	<p>Training will be provided one week prior to the implementation of the care bundle and will be a one-off face-to-face, three hour interactive group session. Presentation using PowerPoint and printed materials will be provided to the staff who attend and also to the nursing home for staff who are unable to attend. Additional training sessions will be offered to the nursing home care staff to maximise attendance.</p>	<p>Due to practical reasons, training will be held off-site. Written training materials will be available in the nursing home.</p>
<ul style="list-style-type: none"> <li>- on the care bundle and each individual element (support surfaces, skin inspection, repositioning), and how to use the care bundle in practice.</li> </ul>	<p>To increase the uptake of the care bundle, to familiarise staff with the processes involved.</p>	<p>Provided to nursing home care staff (registered and unregistered) by a researcher with expertise in behaviour change.</p>	<p>Face-to-face one hour interactive group session. PowerPoint and printed materials will be provided to staff who attend and also to the nursing home for staff who are unable to attend.</p>	

379

380

381 Table 2

382 (Cont.)

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Modelling and demonstration of behaviour:</b> - skin champions	The skin champions will deliver the care bundle as intended and will be available during a shift. Staff can speak with the skin champions if they have any concerns or queries. Skin champions are also able to demonstrate pressure injury prevention techniques and provide examples of good record keeping (i.e. documentation).	Nursing home care staff (likely to be a registered nurse).	This is available face-to-face and is likely to be delivered on an individual basis and will be available as required. The researcher will meet with the skin champions at least bi-weekly to discuss any issues or concerns.	Nursing home.
<b>Implementation of the care bundle:</b> - risk assessment	To identify any risk factors for the development of a pressure injury and indicate the frequency with which the care bundle needs to be delivered.	Registered nurse and/or nursing home manager.	Using a validated risk assessment tool, the risk assessment will be completed at least monthly. If there is a change to a resident's clinical status, the risk assessment should be conducted again.	Nursing home.

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23

384 Table 2

385 (Cont.)

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Implementation of the care bundle:</b>				
- complete care bundle for each eligible resident (support surfaces, skin inspection, repositioning).	To improve the reliability of care and to prevent pressure injuries using elements identified locally as being important within a nursing home context. To improve the documentation of pressure injury prevention practices.	Nursing home care staff (registered and unregistered).	Nursing home care staff will complete each element of care included within the care bundle. If it is not possible to conduct all of the elements ( <i>support surfaces, skin inspection, repositioning</i> ) within the care bundle, this must be documented on the overleaf section of the care bundle documentation sheet. The frequency with which this needs to be conducted will depend on each individual resident. The frequency should be amended in line with a resident's needs and risk. For example, for those at risk of developing a pressure injury it should be at least every 6 hours, at least every 4 hours for those at a high risk, and at least every 2 hours for those at a very high risk. Staff are required to ensure the appropriate pressure relieving equipment is being used and is functioning.	Nursing home.

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388 Table 2

389 (Cont.)

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Prompts and cues</b>	An aide memoire was reported as a facilitator of pressure injury prevention in nursing homes. Thus, posters will be placed in staff communal areas (e.g., nursing office) to remind staff of the steps involved within the care bundle. The care bundle itself also acts as a checklist as staff are required to document the provision of care on the care bundle sheets.	The research team will provide posters and care bundle documentation.	The unit manager will decide the positioning of the posters on the unit (see Appendix 2). The nursing home staff are responsible for the completion of the care bundle and associated documents. These will be available daily throughout the study period.	Nursing home (including nursing office, residents' bedrooms, residents' files).

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395 Table 2

396 (Cont.)

<i>What</i>	<i>Why</i>	<i>Who</i>	<i>How/frequency</i>	<i>Where</i>
<b>Feedback:</b>	To maintain motivation and engagement with the care bundle.			
- on behaviours and outcomes.	To highlight areas of pressure injury prevention where staff are maintaining high levels of care and the areas that could be improved.	Researcher	The research team will provide verbal feedback to the unit manager on a monthly basis during the study period. This will include the number of pressure injuries acquired and adherence to the care bundle. Feedback will be provided in the form of percentages on the following: <ul style="list-style-type: none"> <li>- All-or-none compliance (when all aspects of the care bundle were delivered, including times when it was not possible to complete the care bundle but reasons were documented);</li> <li>- Overall adherence with each individual element: support surfaces, skin inspection, repositioning.</li> </ul> Following the completion of the study, the above information will be collated and the findings from the whole study period will be presented verbally to the unit manager and nursing home care staff.	Nursing home.

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## 398 Discussion

399 This is the first explicit, behaviour change theory-driven, pressure injury prevention  
400 care bundle that we have been able to identify. We identified the important elements  
401 of the care bundle in collaboration with key stakeholders. Using the COM-B model  
402 and with the steps outlined in the Behaviour Change Wheel we developed a  
403 pressure injury prevention care bundle that focused on the three identified target  
404 behaviours (*the checking of support surfaces, skin inspection and repositioning*). The  
405 broad functions of the intervention (*education, training, modelling*) aim to be achieved  
406 using seven theoretically-based behaviour change techniques delivered using a  
407 variety of methods, including face-to-face and written materials. This information  
408 can be used to populate the solutions box in Figure 1 in the introduction (Figure 3).

409  
410 Three main aspects of pressure injury prevention that consistently feature in care  
411 bundles were included within our nursing home care bundle, albeit operationalised  
412 differently: repositioning, skin assessment and the use of support surfaces [18-20,33].

413 However, our care home-focused intervention differs from those delivered in  
414 hospital settings as we did not incorporate continence care or nutrition and  
415 hydration; mainly because they were deemed core aspects of nursing care that  
416 should be prioritised irrespective of any tenuous link with pressure injury  
417 prevention. Whilst our care bundle elements reflect those included in hospital-  
418 focused bundles, the process of deciding how to promote the behaviour changes  
419 around these target behaviours has not been clear in previous work. We supported

1  
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3 420 this work using a strong theoretical framework for intervention design. Through the  
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6 421 transparent reporting of the mechanisms of action, modes of delivery and the  
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9 422 theoretical constructs, future evaluations of the effectiveness of this care bundle will  
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11 423 be possible.  
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### 15 16 17 425 *Strengths and limitations*

18  
19 426 The theoretical basis and systematic presentation of the development of the care  
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22 427 bundle is a strength of our study. The empirical work revealed the target behaviours  
23  
24  
25 428 required (i.e. checking of support surfaces, skin inspection, repositioning) and the  
26  
27  
28 429 Behaviour Change Wheel identified the implementation interventions suitable for  
29  
30  
31 430 the care bundle. Previous studies detailing pressure injury prevention care bundles  
32  
33 431 [18,20] have not provided such explicit and transparent methods, which may limit  
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36 432 the understanding of the mechanisms of action and causal relationships within the  
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39 433 interventions [34]. Thus the present study addresses these concerns, facilitating  
40  
41 434 subsequent evaluations and future replications.  
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46 436 The use of the Nominal Group technique to develop the care bundle was beneficial  
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48  
49 437 for many reasons. The participation of the nursing home care staff and the NHS  
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52 438 tissue viability nurses was vital to ensure the integration of specialist knowledge  
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55 439 alongside context specific expertise. The Nominal Group technique enabled each  
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58 440 participant to express their view (via individual votes) which minimised the effects  
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60 441 of any potentially dominant participants. Using the Nominal Group technique

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3 442 during the workshop was advantageous as it yielded extensive and rich data in a  
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6 443 relatively short period of time.  
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11 445 A limitation was the exclusion of residents and their families, as well as the wider  
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14 446 multidisciplinary team (e.g., podiatrists, dieticians); and the inclusion of only one  
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17 447 nursing home and the relatively small number of tissue viability nurse workshop  
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20 448 participants. Expert opinion is a fundamental aspect of the Nominal Group  
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23 449 technique, and whilst the majority of the participants who did attend had a range of  
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25  
26 450 expertise in caring for individuals residing in nursing homes, specialist nurse input  
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28  
29 451 was crucial. Initially all of the local tissue viability nurses agreed to attend however,  
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31  
32 452 due to unforeseen circumstances, some could not. Consequently, the process was  
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35 453 repeated with the tissue viability nurses via face-to-face meetings or online  
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38 454 consultations to ensure their specialist knowledge of the prevention of pressure  
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41 455 injuries could be combined with the results. We believe that taking such a systematic  
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43  
44 456 and structured approach to designing the care bundle will result in a more effective  
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46  
47 457 intervention and will aid subsequent evaluations and improvements.  
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49

#### 49 *Future research*

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51  
52 460 The next phase of this research is to test the feasibility of implementing the care  
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54  
55 461 bundle in a nursing home context. If the care bundle intervention is feasible and  
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58 462 acceptable to nursing home care staff, further evaluation will be necessary to assess  
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60 463 the clinical and cost-effectiveness. The explicit theoretical links provided through the



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3 464 use of the Behaviour Change Wheel [15, 17] and Behaviour Change Technique  
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6 465 Taxonomy Version 1 [27] will facilitate future replications and data synthesis. In  
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8  
9 466 addition, exploring the views of residents, their families and the wider  
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12 467 multidisciplinary team will be vital to ensure that a holistic approach is taken to the  
13  
14 468 prevention of pressure injuries in nursing home residents.  
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17 469

### 19 470 *Conclusion*

21  
22 471 Care bundles have received much attention within inpatient settings over the past  
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24  
25 472 decade due to the potentially synergistic effect of incorporating several clinical  
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28 473 interventions within one package. The structure of care bundles can be used to  
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30  
31 474 facilitate reliable and sustainable changes in the work habits of staff. However, few  
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34 475 theory-informed care bundles are reported within the literature. This paper  
35  
36 476 describes how a pressure injury prevention care bundle was developed for use in  
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38  
39 477 UK nursing homes and how the Behaviour Change Wheel guided the development  
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41  
42 478 of the intervention. Key stakeholders contributed to the design of the care bundle,  
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44  
45 479 forging the first step towards standardising pressure injury prevention practices  
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47  
48 480 within nursing home settings. Whilst preventing pressure injuries in nursing home  
49  
50  
51 481 residents is complex and multifaceted, this structured and transparent approach has  
52  
53  
54 482 facilitated a thorough process for the development of the intervention. The next step  
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56  
57 483 is to assess the feasibility of implementing this care bundle within the nursing home  
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59  
60 484 environment to ensure that it is acceptable before wider evaluation ensues.  
485

1  
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3 486 **Abbreviations**  
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6 487 **PI:** pressure injury  
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9 488 **TVN:** tissue viability nurse  
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11 489 **BCW:** Behaviour Change Wheel  
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17 491 **Figure legends**  
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19 492 Figure 1; Logic model for the pressure injury prevention care bundle outlining the  
20  
21  
22 493 consequences of pressure injury in nursing homes, the potential behavioural causes  
23  
24  
25 494 of pressure injury and the pathway to benefit through preventing pressure injury.  
26

27 495 Figure 2; Data collection and analysis processes used to develop the care bundle  
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29  
30 496 using the steps and stages outlined in the Behaviour Change Wheel.  
31

32  
33 497 Figure 3; Solutions box for Figure 1 detailing the content of the pressure injury  
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36 498 prevention care bundle and the steps required to implement the care bundle in  
37  
38  
39 499 nursing homes.  
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41 500  
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43  
44 501 **Additional files**  
45

46 502 Appendix 1; Behaviour Change Wheel stages and steps [11]; an overview of the  
47  
48  
49 503 Behaviour Change Wheel.  
50

51 504 Appendix 2; Care bundle poster (.txt 464KB)  
52  
53

54 505  
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56  
57 506  
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59  
60 507 **Ethics approval and consent to participate**

1  
2  
3 508 This study was given approval by The University of Manchester (ref: 15451),  
4  
5  
6 509 together with approval from the Research and Development department at the  
7  
8  
9 510 participating NHS site (ref: 100321).

10  
11 511

### 12 512 **Consent for publication**

13 513 Not applicable.

14 514

### 15 515 **Availability of data and material**

16 516 All data relevant to the study are included in the article or uploaded as  
17 517 supplementary information.

18 518

### 19 519 **Competing interests**

20 520 The authors declare that they have no competing interests.

21 521

### 22 522 **Funding**

23 523 This project was funded by the by the National Institute for Health Research  
24 524 Collaboration for Leadership in Applied Health Research and Care (NIHR  
25 525 CLAHRC) Greater Manchester.

26 526

### 27 527 **Author contributions**

28 528 NC had the original research idea. JL, TG, JD, NC conceived the idea and design for  
29 529 the overall project. JL developed the standard operating procedures for the  
30 530 workshop and held the email/face-to-face consultations with the tissue viability  
31 531 nurses. TG facilitated the workshop. All authors contributed to the interpretation of

1  
2  
3 532 study findings, critical revision of the manuscript for important intellectual content  
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6 533 and approval of the final manuscript.  
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10  
11 535 **Acknowledgements**  
12

13  
14 536 We are grateful to the NIHR CLAHRC Greater Manchester for supporting this work.  
15

16  
17 537 The NIHR CLAHRC Greater Manchester is a partnership between providers and  
18

19 538 commissioners from the NHS, industry and the third sector, as well as clinical and  
20

21  
22 539 research staff from The University of Manchester. The views expressed in this article  
23

24  
25 540 are those of the authors and not necessarily those of the NHS, NIHR or the  
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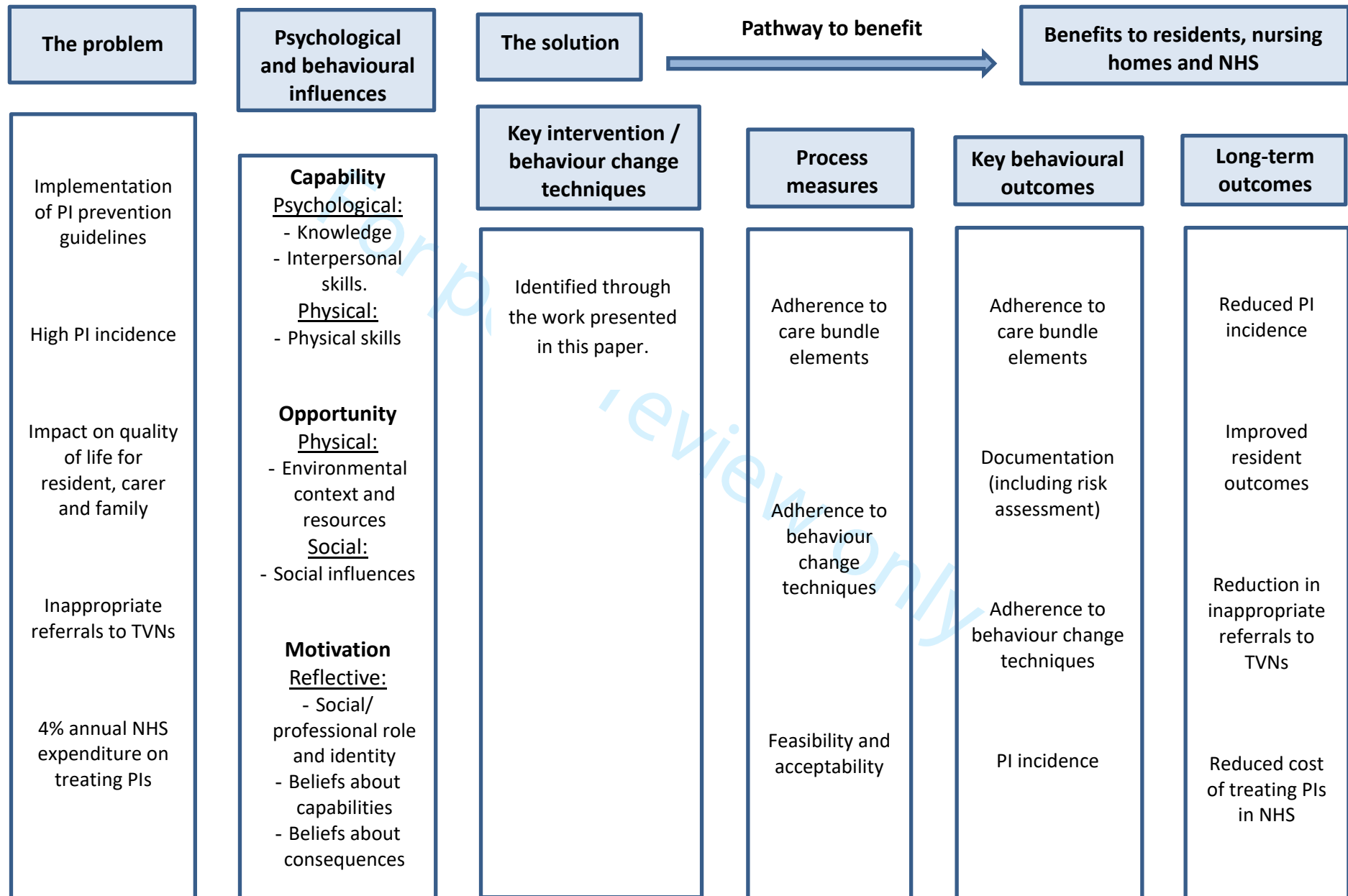
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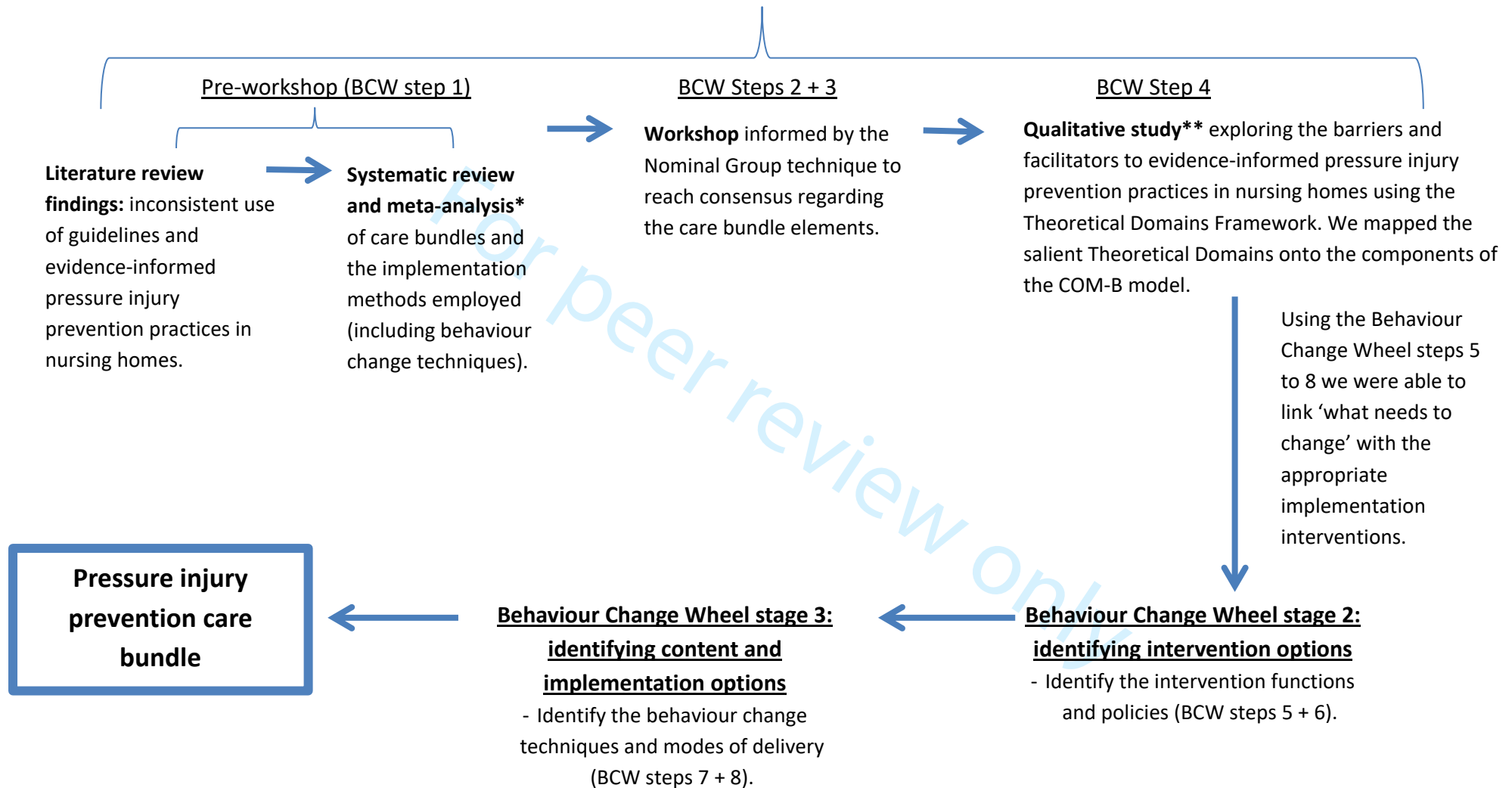
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### Behaviour Change Wheel stage 1: understand the behaviour



\*Methods and findings reported in [14]; \*\*methods and findings reported in [25].



**Care bundle elements:**

- Support surfaces
- Skin inspection
- Repositioning

**Behaviour change techniques:**

- Information about social and environmental consequences
- Information on health consequences
- Feedback on behaviour
- Feedback on the outcome of the behaviour
- Prompts/cues
- Instruction on how to perform the behaviour
- Demonstration of behaviour

review only

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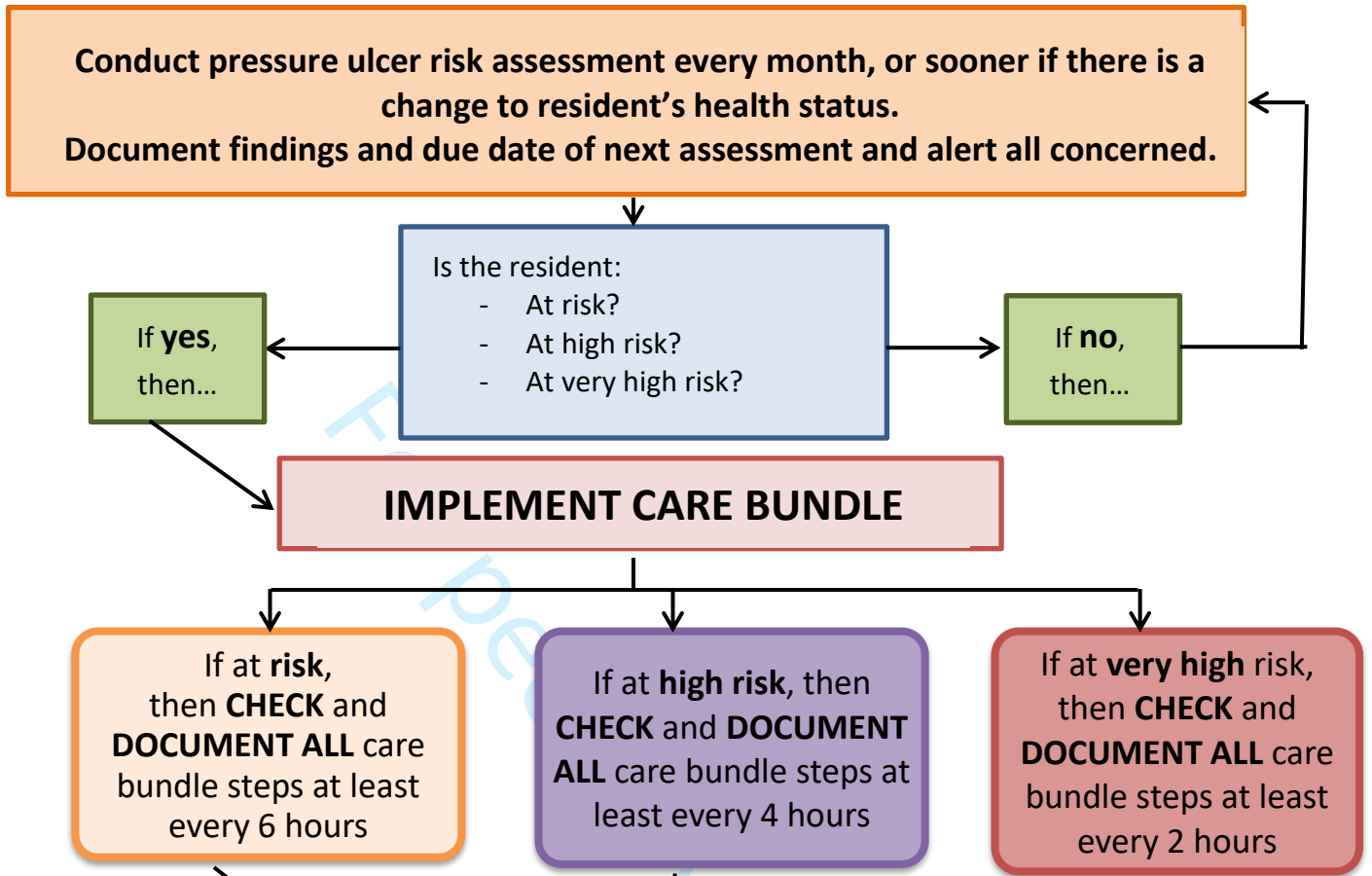


Stage 1: Understand the behaviour	Stage 2: Identify intervention options	Stage 3: Identify content and implementation options
1. Define the problem in behavioural terms	5. Identify intervention functions	7. Identify behaviour change techniques
2. Select target behaviour	6. Identify policy categories	8. Identify mode of delivery
3. Specify the target behaviour		
4. Identify what needs to change		

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For peer review only

## Pressure Ulcer Prevention Care Bundle



Time – use 24 hour clock 00.00 – 24.00				
<b>Support surfaces</b>				
Surface checked for creases, tubing, personal items etc.?				
Equipment checked?				
<b>Skin inspection</b>				
All pressure areas checked?				
Redness/changes to skin? Yes (Y) No (N)? (If Y, document overleaf)				
Is the resident experiencing wound pain?				
<b>Repositioning</b>				
In bed: rotated onto right (R), left (L) side or hoisted (H)				
Sitting: stood (S) walked (W)				
Other (document overleaf)				
<b>Initials</b>				

Write the frequency here

You will need a new form each day

Initial here

All Care Staff PLEASE READ and ensure all residents 'at risk' have forms in their room. Please ask the nurse in charge to explain if unsure



Template for Intervention Description and Replication

The TIDieR (Template for Intervention Description and Replication) Checklist\*:

Information to include when describing an intervention and the location of the information

Item number	Item	Where located **	
		Primary paper (page or appendix number)	Other † (details)
	<b>BRIEF NAME</b>		
1.	Provide the name or a phrase that describes the intervention.	_____	_____
	<b>WHY</b>	Abstract, page 2	
2.	Describe any rationale, theory, or goal of the elements essential to the intervention.	_____	_____
	<b>WHAT</b>	Page 7	
3.	Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers.	_____	_____
	Provide information on where the materials can be accessed (e.g. online appendix, URL).	Pages 9-11	
4.	Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.	_____	_____
	<b>WHO PROVIDED</b>	Pages 9-11	
5.	For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.	_____	_____
	<b>HOW</b>	Page 8	
6.	Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.	_____	_____
	<b>WHERE</b>	Page 18, table 2	
7.	Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.	_____	_____

TIDieR checklist

1			
2			
3		Abstract, page	
4	<b>WHEN and HOW MUCH</b>	13	
5			
6	8. Describe the number of times the intervention was delivered and over what period of time including	_____	_____
7	the number of sessions, their schedule, and their duration, intensity or dose.		
8			
9	<b>TAILORING</b>	Page 15, table 2	
10			
11	9. If the intervention was planned to be personalised, titrated or adapted, then describe what, why,	_____	_____
12	when, and how.		
13	<b>MODIFICATIONS</b>	Page 15	
14			
15	10.† If the intervention was modified during the course of the study, describe the changes (what, why,	_____	_____
16	when, and how).		
17			
18	<b>HOW WELL</b>	N/A	
19			
20	11. Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any	_____	_____
21	strategies were used to maintain or improve fidelity, describe them.		
22			
23	12.‡ Actual: If intervention adherence or fidelity was assessed, describe the extent to which the	N/A _____	_____
24	intervention was delivered as planned.	N/A __	
25			

26 \*\* **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use ‘?’ if information about the element is not reported/not  
 27 sufficiently reported.  
 28

29 † If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol  
 30 or other published papers (provide citation details) or a website (provide the URL).  
 31

32 ‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.  
 33

34 \* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.  
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36 \* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of  
 37 studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the  
 38 TIDieR checklist should be used in conjunction with the CONSORT statement (see [www.consort-statement.org](http://www.consort-statement.org)) as an extension of **Item 5 of the CONSORT 2010 Statement**.  
 39 When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013**  
 40 **Statement** (see [www.spirit-statement.org](http://www.spirit-statement.org)). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see  
 41 [www.equator-network.org](http://www.equator-network.org)).  
 42

43 TIDieR checklist  
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