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**Rationale and Design of a Novel Method to Assess the Usability of Body
Worn Absorbent Incontinence Care Products for Caregivers**

Supplementary Appendices

Appendix I: Context attributes initially identified as important for usability of absorbing incontinence care products in an institutional care environment

Supplementary Table S1: Full simulated patient characteristics*

Characteristics	Included in study
Age	Adult
Gender	Female
Level of incontinence	Simulated: Incontinence
Body shape	Size Medium, without being at the upper or lower limit. Hip measure 85–97 cm (based on: 80–110 cm for the disposable pull-up (TENA Pants) / 71–102 cm for the disposable T-shaped brief (TENA Flex) / 73–122 cm for the disposable brief (TENA Slip)
Skills/experience/training	Not applicable
Physical limitations/capabilities	Can steadily stand with support, can be rolled but the caregiver needs to initiate turn, can't help during changes, can help lift legs in standing position when lift is initiated by the caregiver.
Attitude	Simulated: cooperative, non-violent
Intellectual ability	Not applicable

*The sizes of the disposable brief, the disposable pull-ups and the disposable T-shaped brief are defined in hip measurement. The bodyworn pads + mesh briefs come in different absorption levels but not different sizes. The given hip measures of size Medium of the disposable brief, the disposable pull-ups and the disposable T-shaped brief were used to define a target hip measure of the simulated patient (see: Supplementary Table S2, Appendix I). The sizes of the bodyworn pads + mesh briefs included in the study are defined by a waist measure. To account for the possibility of someone fitting Medium of the disposable brief, the disposable pull-ups and the disposable T-shaped brief but not Medium of the bodyworn pads + mesh briefs, size Small & Large of the bodyworn pads + mesh briefs were also brought to the test site.

Supplementary Table S2: Full caregiver characteristics

Characteristics	Included in study
Age	Working age: 18–65 years (distributed over three different age groups)
Gender	Female and male (a few men in each group)
Employment	Working as a professional caregiver (permanent or temporary) in a nursing home environment, for at least 12 months (distributed over length of experience)
Work task	Regular changes of incontinence care products
Physical limitations/capabilities	Currently working
Product experience	<p>Current experience of at least two test items</p> <ul style="list-style-type: none"> - Changing on their own - Changing on a lying and standing resident <p>(Note: Data were only included in the analysis if the caregiver had previous experience of changing the product alone in the tested position)</p>
Language	Understands Swedish, written and oral
Other	Willingness to be filmed during the sessions and sign a consent and confidentiality form

Supplementary Table S3: Full product characteristics used for the study*

Possible equipment	Spec	Abs	Size
TENA Slip (disposable brief)	710630-21	Plus	Medium
TENA Flex (disposable T-shaped brief)	723230-63	Plus	Medium
TENA Pants (disposable pull-up)	792564-00	Plus	Medium
TENA Comfort (pad)	752846-01	Plus	
TENA Fix, used in conjunction with TENA Comfort (bodyworn pads + mesh briefs)	754056-00 (754054-00) (754058-00)	–	Medium (Small) (Large)

* The sizes of the disposable brief, the disposable pull-ups and the disposable T-shaped brief are defined in hip measurement. The bodyworn pads + mesh briefs come in different absorption levels but not different sizes. The given hip measures of size Medium of the disposable brief, the disposable pull-ups and the disposable T-shaped brief were used to define a target hip measure of the simulated patient (see: Supplementary Table S2, Appendix I). The sizes of the bodyworn pads + mesh briefs are defined by a waist measure. To account for the possibility of someone fitting Medium of the disposable brief, the disposable pull-ups and the disposable T-shaped brief but not Medium of the bodyworn pads + mesh briefs size Small & Large of the bodyworn pads + mesh briefs were also brought to the test site.

Supplementary Table S4: Equipment specification

The following were available in the room during the study:

- Two tables, four chairs
- An adjustable bed including sheets and pillow (bed height at start of change approximately 70 cm)
- A bedside table
- A rubbish bin
- Vinyl gloves, sizes Small, Medium and Large
- The four incontinence care product types: disposable brief (TENA Slip), disposable T-shaped brief (TENA Flex), disposable pull-ups (TENA Pants; size Medium, absorption level Plus) and pad with bodyworn pads + mesh briefs (TENA Comfort; absorption level Plus), used with bodyworn pads + mesh briefs (TENA Fix) of suitable size
- A simulated patient with black clothing: tight, covering, long-armed top and long-legged trousers (with a product applied according to the task sequence of that participant)

Intended setting of use: The intended setting of use was a care environment (herein focusing on a nursing home).

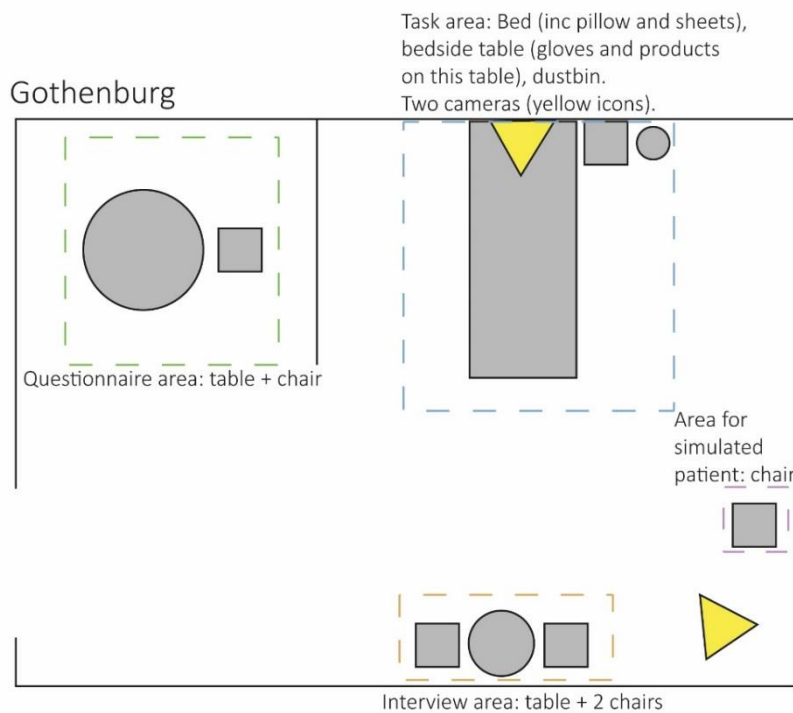
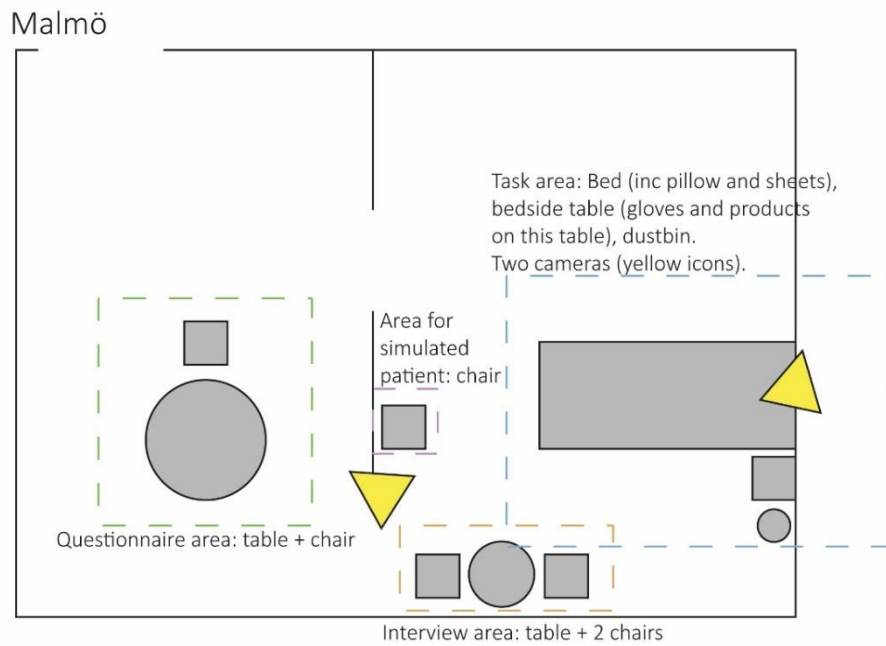
Setting used for the test: The test was conducted by the test moderators in facilities provided by Scandinfo in Malmö and Gothenburg, Sweden. The rooms were configured to represent an end-user's bedroom through use of a bed (adjustable) placed with the headboard against a wall and positioned to allow access from both sides. A bedside table was placed on one side

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of the bed (right-hand side seen from foot end of bed). The gloves were placed on the bedside table. A rubbish bin was placed in proximity to the bedside table.

Two cameras were installed to monitor the task performance. The moderator was situated by a table at side/foot end of the bed. A table and chair was set behind a room divider to provide an undisturbed area for the participant to sit during completion of the questionnaires following each scenario. This area was screened off so that the participant could not see the inspection of the product or the evaluator entering the room while the respondent was completing the questionnaire. (Note: An adjacent room was used by the evaluator. Herein there was a table and chair as well as a screen where the test room was viewed in real time to monitor the changes).

Supplementary Figure S1: Test room setups for Malmö and Gothenburg (Sweden)



Supplementary Table S5: Tasks investigated for each product type.

Products and position for change	Standing	Lying
Disposable brief	X	X
Disposable T-shaped brief	X	X
Disposable pull-up	X	
Pad	X	X

Appendix II: Product fit scoring (English translation)

Penalties are marked as red (critical failure), orange (penalty 0.75), yellow (penalty 0.5) and light green (penalty 0.25), with dark green representing intended fit and receiving a penalty of zero. As the illustrations herein are greyscale the following abbreviations have been used to communicate the used colour codes: R – Red, O – Orange, Y – Yellow, LG – Light green, DG – Dark green. The protocols below are English translations from Swedish.

Supplementary Figure S2: Disposable brief (TENA Slip) product fit scoring for standing and lying

Fit– Slip



TP:

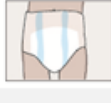
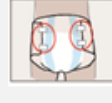
Product: Slip

Position: Standing up/Lying down

Direction



1 Select one

DG   Intended direction
Closed in front

O   Wrong direction
Closed behind

Core height front





2 Select one

  Enter measurement in cm

DG R _____ cm

Core coverage front – lateral

3 Select options which represent both sides

R  LG  DG  LG  R



Fit at waist



4 Enter a number (0.5 cm precision)

 _____ cm

Fastening – upper, left


5 Select one



DG  50-100% Y  30-50%

O  $0 < X < 30\%$ R  0%

Fastening – upper, right



6 Select one


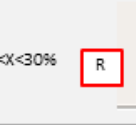
DG  50-100% Y  30-50%

O  $0 < X < 30\%$ R  0%

Fastening – lower, left



7 Select one



DG  50-100% Y  30-50%

O  $0 < X < 30\%$ R  0%

Fastening – lower, right

8 Select one

DG  50-100% Y  30-50%

O  $0 < X < 30\%$ R  0%

Contact with crotch – left

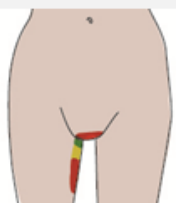
9 Select one

DG 0-1 cm distance between crotch and product position

O $1 < X < 3$ cm distance between crotch and product position

R $X > 3$ cm distance between crotch and product position

R Product in contact with pee point and not crotch



Contact with crotch – right

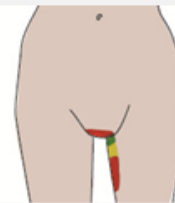
10 Select one

DG 0-1 cm distance between crotch and product position

O $1 < X < 3$ cm distance between crotch and product position

R $X > 3$ cm distance between crotch and product position

R Product in contact with pee point and not crotch



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Fit – Slip

TP:

Product: Slip

Position: Standing up/Lying down



Core coverage back – lateral

11 Select options which represent both sides

				
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Core height back

12 Select one

<input checked="" type="checkbox"/> DG		
<input type="checkbox"/> O		Core does not cover groove between the buttocks

Absorption

13 Select one

<input checked="" type="checkbox"/> DG	Absorbent side facing inward
<input type="checkbox"/> R	Inside out

Note:

- 2. Core height front was for the disposable brief, as for the other products, marked red if the distance between the anterior superior iliac spine and core was more than 10 cm
- 4. Fit at waist for the disposable brief is in the analysis scored red (critical fail) when the measure is more than 8 cm

Supplementary Figure S3: Disposable T-shaped brief (TENA Flex) product fit scoring for standing and lying

Usability of absorbing incontinence care products

Fit – Flex

TP:

Product: Flex

Position: Standing up/Lying down

Direction

1 Select one

DG Right direction Closed in front

DG Right direction Closed behind

Core height front

2 Select one

Enter measurement in cm _____

DG R

Distance between anterior superior iliac spine and core more than 10cm

Core coverage front – lateral

3 Select options which represent both sides

R LG DG LG R

Fit at waist

4 Enter measurement, 0.5 cm precision _____ cm

Fastening – left

5 Select one

DG 50-100% Y 30-50%

O 0<X<30% R 0%

Fastening – right

6 Select one

DG 50-100% Y 30-50%

O 0<X<30% R 0%

Contact with crotch – left

7 Select one

DG 0-1 cm distance between crotch and product position

O 1<X<3 cm distance between crotch and product position

R X>3 cm distance between crotch and product position

R Product in contact with pee point and not crotch

Contact with crotch – right

8 Select one

DG 0-1 cm distance between crotch and product position

O 1<X<3 cm distance between crotch and product position

R X>3 cm distance between crotch and product position

R Product in contact with pee point and not crotch

Belt – closing

9 Select one

DG Closed belt

LG Belt not closed

Absorption

10 Select one

DG Absorbent side facing inward

R Inside out

Usability of absorbing incontinence care products

Fit – Flex

TP:

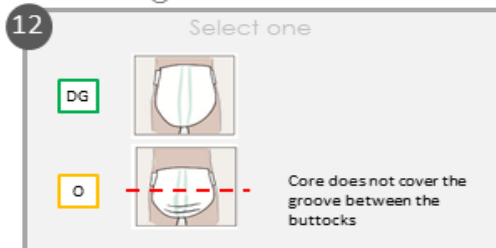
Product: Flex

Position: Standing up/Lying down

Core coverage back – lateral



Core height back



Note:

- 4. Fit at waist for the disposable T-shaped brief is in the analysis scored red (critical fail) when the measure is more than 8 cm


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Supplementary Figure S4: Bodyworn pads + mesh briefs (TENA Comfort/TENA Fix) product fit scoring for standing and lying

Fit: Comfort TP: Product: Comfort Position: Standing up/Lying down

1 Direction

Select one



DG  Right direction

O  Wrong direction

2 Core height front

Select one

Enter measurement in cm _____






DG  R 

Distance between anterior superior iliac spine and core more than 10 cm

CM



3 Core coverage front – lateral



Select options which represent both sides

R  LG  DG  LG  R 

4 Fastening

Select one

DG  Y 

O  R 

5 Absorption

Select one

DG Absorbent side facing inward

R Inside out

6 Contact with crotch – left

Select one

DG 0-1 cm distance between crotch and product position

O 1<X<3 cm distance between crotch and product position

R X>3 cm distance between crotch and product position

R Product in contact with pee point and not crotch

7 Contact with crotch – right

Select one

DG 0-1 cm distance between crotch and product position






O 1<X<3 cm distance between crotch and product position

R X>3 cm distance between crotch and product position

R Product in contact with pee point and not crotch

8 Core coverage back – lateral


Select options which represent both sides


R  LG  DG  LG  R 

Other: _____

9 Core height back

Select one

DG 

O  Core does not cover groove between the buttocks

Note - Supplementary figure S4:


- 4. Fastening for the bodyworn pads + mesh briefs was scored on the alternative that corresponded to the worst fitting side


Supplementary Figure S5: Disposable pull-up (TENA Pants) product fit scoring for standing and lying

Fit- Pants TP: Product: Pants Position: Standing up/Lying down

1 Direction

Select one

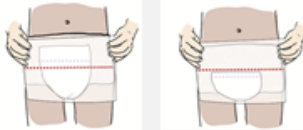
DG  Intended direction

O  Wrong direction

2 Core height front

Select one






Enter measurement in cm _____

 Distance between anterior superior iliac spine and core more than 10 cm

DG R

3 Core coverage front – lateral

Select options which represent both sides

R  LG  DG  LG  R 

4 Absorption

Select one

DG Absorbent side facing inward

R Inside out

5 Contact with crotch – left

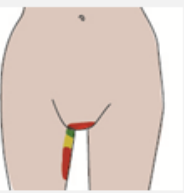
Select one

DG 0-1 cm distance between crotch and product position

O 1<X<3 cm distance between crotch and product position

R X>3 cm distance between crotch and product position

R Product in contact with pee point and not crotch



6 Contact with crotch – right

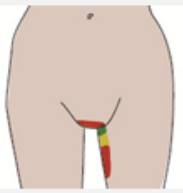
Select one

DG 0-1 cm distance between crotch and product position

O 1<X<3 cm distance between crotch and product position



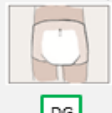

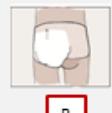
R X>3 cm distance between crotch and product position

R Product in contact with pee point and not crotch




7 Core coverage back – lateral


Select options which represent both sides

R  LG  DG  LG  R 

8 Core height back

Select one

DG 

O  Core does not cover the groove between the buttocks

Appendix III: Time and Workload – Summary of actions and postures

Supplementary Table S6: Start and stop criteria for time on task.

Task	Start stage	End stage	Comment
Change product	Task initiated by participant (Participant grabs either unused product or used product)	Participant indicates that the task is completed (either by words or physical indication)	All interaction time is logged Time is subtracted for time spent on actions other than person/product handling such as: <ul style="list-style-type: none"> • Handling the bed • Getting glasses, etc. • Talking to the moderator about subjects not directly connected to the performance of the task, e.g. the respondent stops performing the task to explain how he/she normally performs the procedure at work

Supplementary Table S7: Loading postures described as a result of changing absorbing incontinence products in patients who were lying down.

Lying change			
Action	Definition	Start state	End state
Turnovers ~ 90 degrees	Turning the patient ~ 90 degrees until lying on side. Turnover can be performed in various ways: from oneself, towards oneself, with or without a pull sheet. All these actions are regarded as the same action and, therefore, weighted the same	Participant initiates turn	Turn is stopped after ~ 90 degrees
Lifting and repositioning	Lifting or repositioning an arm, a leg or another body part. Also, includes turning the patient partially (patient not lying on side, held up by care giver) and repositioning of entire body.	Body part is lifted/repositioned	The body part is put down
Reaching over	Reaching over to work on the other side of the patient. Defined as working with the product within a given area. (Lifting body part on the other side of the bed is categorised as a lift)	Leaning over and working with the product on the other side of the patient	When the caregiver is no longer working in the given area

Supplementary Table S8: Loading postures described as a result of changing absorbing incontinence products in patients who were standing up.

Standing change			
Action	Definition	Start state	End state
Back flexion	Going from a straight back to a flexed/laterally bent or twisted back	Going from an un-flexed to flexed/laterally bent/twisted back	Back in the straight position

Clarifications:

- The actions are regarded as mutually exclusive
- Time and workload for applying/removing gloves are not included in the analysis
- Time is included for disposing of the product in the waste bin
- Workload is not included for disposing of the product as it depends on the type and height of the rubbish bin

Supplementary Table S9: Actions and their inherent postures.

Change situation	Actions	Explanation	Postures		
			Trunk	Arm	Weight
Lying	Turnover	Turning the patient ~90 degrees	T2	A3	Wi3
Lying	Reaching	Reaching to work with product on the opposite side of the person	T3	A3	–
Lying	Lifting/repositioning	Lifting or repositioning the person/body part	T2	A2	Wi2
Standing	Flexion	Back in a non-upright position	T5	–	–

Supplementary Table S10: Posture weight factors, based on Kurowski *et al.* (2014)

Trunk		Weighting factor
T2	Moderate flexion	1.16
T3	Severe flexion	1.73
T5	Lateral bent/twist flex	1.72
Arm		Weighting factor
A2	1 arm over 60 degrees	0.16
A3	2 arms over 60 degrees	0.31
Weight in hand with inclined trunk		Weighting factor
Wi2	4.55–22.68 kg	2.36
Wi3	>22.68 kg	4.01

Workload was defined as a function of time and load of the inherent postures in a predefined set actions, and the weight factor resulting on the spine.

$$v_{i,j,4} = PWI_{i,j,4} = \sum_{m=2}^5 W_{T_m} \times S_{T_m} + \sum_{n=2}^3 W_{A_n} \times S_{A_n} + \sum_{o=3}^7 W_{L_o} \times S_{L_o} + \sum_{q=1}^3 W_{W_{iq}} \times S_{W_{iq}}$$

S = Time in posture

W = Weighting factor

T_m = Trunk posture

A_n = Arm posture

L_o = Leg posture

W_{iq} = Weight in hand inclined trunk

Appendix IV: Example of questionnaire (English translation)

The questionnaire was based on the third edition of the Post-Study System Usability Questionnaire (PSSUQ; Sauro & Lewis, 2012), but the questions were tailored to target areas of importance when changing an absorbing incontinence care product. As the test participants change absorbing incontinence care products every day, and as such are generally considered easy to handle, the questionnaire was designed to assess a high standard for ease of use. The aim was to differentiate between the products, as it was assumed that all products would meet a lower standard. All statements were positively phrased, asking each carer to compare the present product with past experience and rating was made on a 5-point Likert scale from “totally disagree” to “totally agree”.

The questionnaire below is an English translation from Swedish.

Table S11: Example of questionnaire (English translation)

Questionnaire – Changing on a care recipient who is lying down

Your answers will help us to understand which aspects of the pads you are satisfied or dissatisfied with. Please respond to each statement based on your experience of changing the pad **alone on an incontinent (urinary) care recipient who is lying down during the change.**

If the pad comprises two parts, please answer the questions based on the assumption that you are changing both parts.

Please read each statement and indicate the extent to which you agree or disagree with it. If a statement is not relevant, please select “Don't know”.

Please write comments to elaborate on your answers.

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In my experience of changing pads on a care recipient who is lying down, this pad is...		Disagree completely			Agree completely		Don't know
		1	2	3	4	5	
1	...the easiest to take off	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	...the easiest to put on	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	...the one that most often falls into position at the first attempt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	...the easiest to adjust	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	...the one with the best way of fastening the pad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	...the one that stays in place most securely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	...the one I think the care recipient feels most satisfied with	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	...the best pad on the market	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments: _____