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FORCE REQUIRED TO MOVE PATIENTS USING PATRAN® SLIDE SHEETS ON DIFFERENT SURFACES

Tests by Jamar Health Products, Inc.

ABSTRACT

BACKGROUND: When moving a patient with a PATRAN® brand slide sheet, the forces required are affected by the surface(s) the patient is on. Logic indicates other slide sheets would be affected similarly. Prior studies on these forces used test patients or dummies with a maximum weight of 250 lbs., and on a single surface. We set out to determine the effect of common medical surfaces on the force required to move patients of varying weights.

METHODS: We tested three surfaces: a 350#-rated mattress, a hard, flat table to simulate an X-ray table, and a padded massage table in place of an exam table. A PATRAN slide sheet was placed under dummies of weights between 171 and 400 pounds, and the dummies were boosted and transferred using multiple methods. The forces required for each action were measured and recorded. Weight up to 400 pounds is reported for inserting the slide sheet, but only weights up to 350 pounds are reported for boosting moving/transferring the patient, due to mattress weight restrictions.

RESULTS: The softer the surface, the more the test dummy sank into it and usually a greater force was required to move it. The surface material that was immediately under the slide sheet also affected the force required. Transferring the dummy by the segmented method required less force compared to traditional methods. We also tested using a slide board underneath the PATRAN during transfer on the massage table. The maximum force required to transfer was about the same with or without the slideboard.

CONCLUSIONS: The test data can be used to aid in deciding how many caregivers are needed to move patients, and how heavy a patient to move with a PATRAN.

OVERVIEW and PREPARATIONS

Goals:

- 1) Measure the force required to boost and transfer patients of different weights on common medical surfaces.
- 2) Compare the forces required to transfer patients of different weights by the parallel method (a typical lateral transfer) to the segmented method.

- 3) Measure the force required to transfer patients of different weights using a PATRAN slide sheet on top of a slide board.
- 4) Measure the force required to insert a PATRAN slide sheet by unfolding it under patients of different weights without log-rolling.

Equipment:

- 1) Variable weight dummy (like a rescue dummy)
- 2) Calibrated digital scales reading in 0.1 or 0.01 lb. (generally accurate to 0.1 lb)
- 3) Massage tables that are similar to some exam and surgical tables
- 4) Hard table similar to an X-ray table
- 5) Poly/cotton blend bed sheets
- 6) Invacare Solace® mattress, maximum rated for a 350-pound patient
- 7) Slide board
- 8) PATRAN slide sheets, Product Nos. 8377 and 8378

Reporting results:

- 1) All weights and forces are reported rounded to the nearest pound.
- 2) The dummy was moved at least five times per test, and the minimum and maximum forces were recorded. The minimums were averaged (mean). The mean was then rounded and recorded on the chart.
- 3) Only pulling force was used to move the dummy. All force data has been measured and averaged.

Forces:

Minimum force: Except when the slide board is used, the minimum force is the average amount of force that caused the dummy to start to move. See **SKETCH 3** to understand the minimum force involved with the slide board.

Maximum force moving dummy: The maximum force is the average (mean) of the maximum forces used to move the dummy.

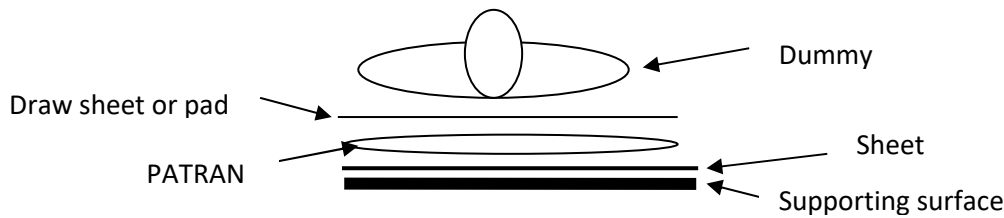
Maximum force unfolding PATRAN: When inserting a PATRAN slide sheet under a patient using the unfolding method, there were two people, one on each side of the dummy. Due to the difficulty of using an instrument to replicate the hand movements required to insert the PATRAN, the reported force was exerted by one person. The force on each side by each person would be similar.

Other pertinent factors:

- 1) The surfaces were dry.
- 2) The dummy rested directly on the draw sheet that was used to pull it. The dummy's weight was always directly over the PATRAN (See **SKETCH 2**), which was underneath the draw sheet.

- 3) The dummy was not log-rolled to get a PATRAN or slide board under it, nor were any parts of the dummy lifted during movement.
- 4) The maximum weight dummy moved was 350 pounds, because that was the highest mattress rating.
- 5) The supporting surfaces were level, which neither aids nor hinders moving a patient.

SKETCH 1 End view of test setup for unfolding insertion (exaggerated distance between dummy and supporting surface):



CONDUCTING the TESTING

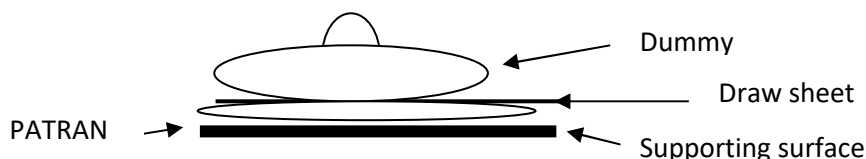
Unfolding method of insertion:

The PATRAN slide sheet was folded three times, making four layers, per the unfolding method of insertion instructions (video and written instructions available at www.patran.net). Only the maximum force was entered on the chart. Generally the maximum force occurred when pulling the PATRAN taut (eliminating the folds) under the dummy's torso.

A PATRAN was unfolded under a 400-pound dummy. Maximum force used was 32 pounds when the PATRAN was unfolded between the vinyl massage table cover and a sheet. The maximum force used was 30 pounds when it was unfolded between the sheet and an incontinence pad. These are the two most common insertion locations when boosting or transferring patients.

Conclusion: Using the force measuring scale took more effort than directly using one's hands due to inability to replicate the hand and wrist action. Still the effort was below 35 lbs., which is the force usually considered safe.

SKETCH 2 End view of test setup for moving patient (exaggerated distance between draw sheet, PATRAN and supporting surface):



Boosting:

“Boosting” means moving the patient toward the head of the bed and also may be referred to as “pulling up in bed” or “repositioning.”

The surface did affect how much force was required to boost the dummy; these values can be seen in Table 1. The dummy sunk into the massage table foam padding a bit. Then during movement – both boosting and transfer – the table’s foam padding and cover bunched up in front of the dummy, making a little hill, which contributed to the difference between the minimum and maximum force. In the Coefficient of Friction section that can be found later in this document, the charts show “boost” lines that are more horizontal than the “transfer” lines. The more horizontal the line, the less the COF changed. See the COF charts below.

Lateral parallel transfer:

The surfaces affected the force required to transfer the dummy. On both the massage table and the mattress, the maximum required force occurred as the dummy approached the edge of the surface from which it was being moved. That occurred because the dummy compressed and sank into the cushion, so moving the dummy required an uphill motion or compressing the cushion in front of it. This was most pronounced on the mattress at the long sides, which have much stiffer foam rubber cushioning than the center to prevent patients from rolling out of bed.

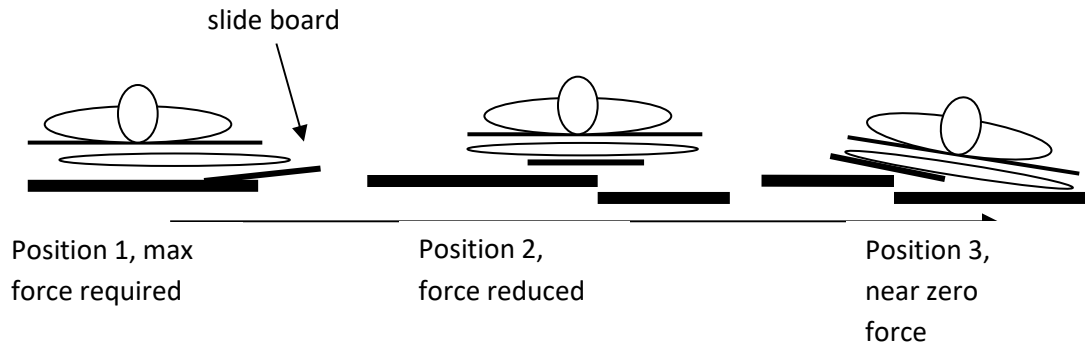
Transfers were done with the destination massage table 2.5 inches lower than the originating massage table. The maximum forces were as shown on the chart in the massage table row. When the dummy moved down the hill created by the difference in elevation it picked up speed and the pulling force was near zero and hard to measure. Any measurement with our instruments would have been inaccurate so this force was not recorded or used as a minimum.

PATRAN and slide board:

The slide board was only used on the massage table. The dummy wasn’t log-rolled to put the slide board underneath it. Rather the PATRAN was under the dummy, then the dummy and PATRAN were pulled over the slide board. The maximum force recorded occurred when pulling the dummy over the edge of the slide board. The dummy sunk into the massage table so it had to be pulled up an incline to get onto the slide board.

When the dummy was half on the slide board, the force required to move it decreased. As the dummy left the slide board it was sliding slightly downhill, sinking into the padding of the destination massage table; that is where the force was near zero.

SKETCH 3 End view of dummy on slide board in three positions:



Segmented transfer:

Segmented transfer is a technique during which the patient's upper body is moved and somewhat pivoted at a different rate than the lower body (see instructional video clips on PATRAN website). The maximum force occurred while moving the dummy's upper body. There was more variance in the forces measured. The segmented transfer required less force than a regular transfer, in which the patient's spine and legs are kept parallel to the long side of the bed or table.

The segmented transfer could be very useful in reducing caregiver injuries. However, it requires practice and may not be practical for all patients. It's important to prevent excessive bending in the patient's spine. If the surfaces are at different elevations, the patient's spine will flex where the surfaces meet if the patient isn't on a slide board. Therefore, with this technique, it may be better to keep surfaces at the same height. Still this is a very valuable and effective technique when used properly on applicable patients.

FINDINGS and CONCLUSIONS

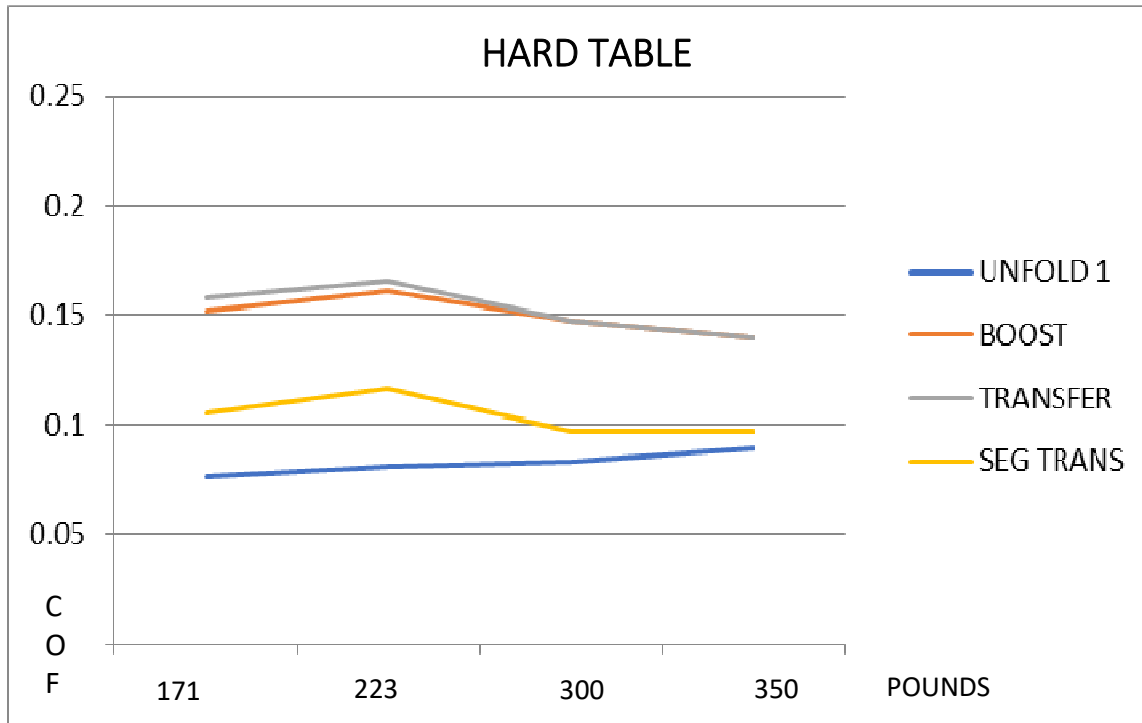
Application and repeatability:

Surfaces do impact how much force is required to move patients using PATRAN slide sheets. Softer, deeper mattresses require more force to transfer patients than harder, shallower mattresses. Air mattresses should be put on maximum inflation (when medical conditions allow) while moving patients.

The charts below can be used as a general guide for how much force will be required to move patients. Consideration should be made for the moving technique and patient's medical condition. Consider that some caregivers moving a patient will do more work than others, so more caregivers may be needed to adhere to the 35-pound maximum.

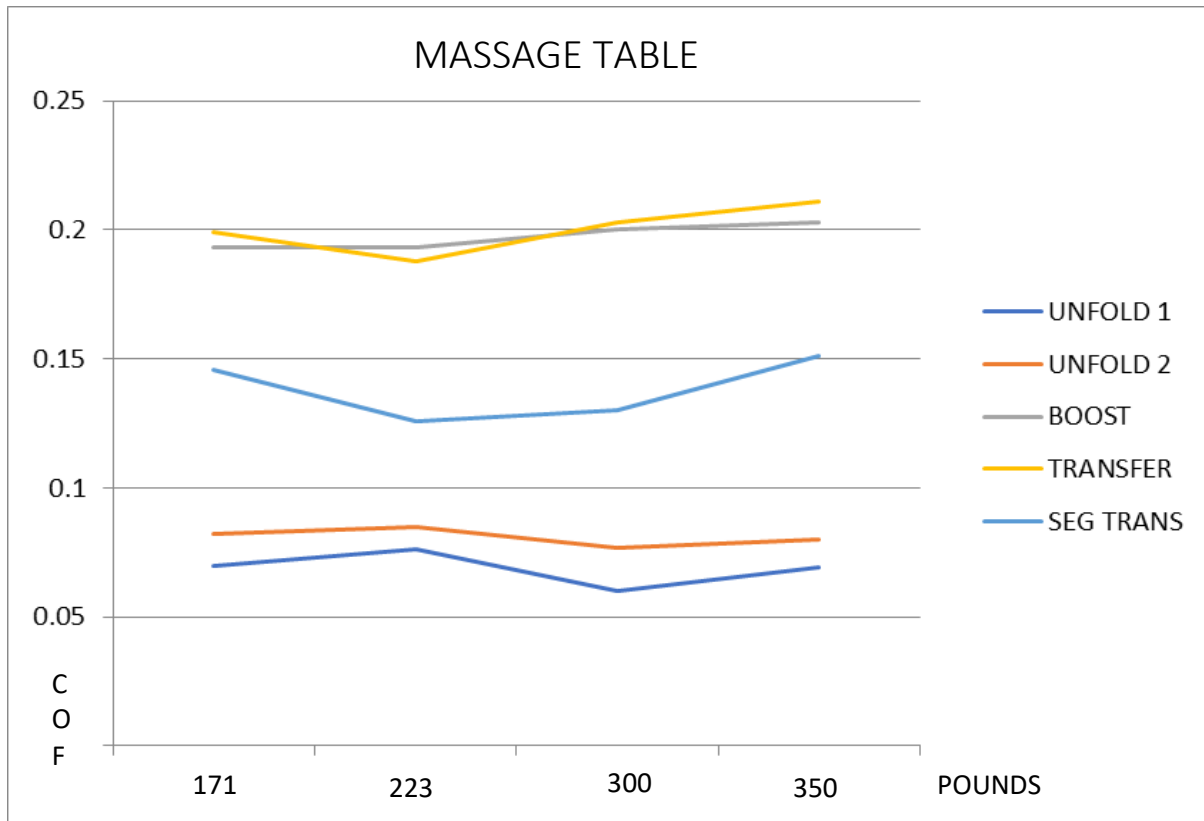
KINETIC COEFFICIENT OF FRICTION (COFK)

In the “Hard Table” chart below, the bottom blue line is associated with unfolding the PATRAN under the dummy. The boosting and standard transfer COFs are nearly identical. However, no lines are horizontal and straight. This means that the effective COF varies some as the dummy weight changes. Note: The COF variance in boosting and transfer is from about 0.14 to 0.16.

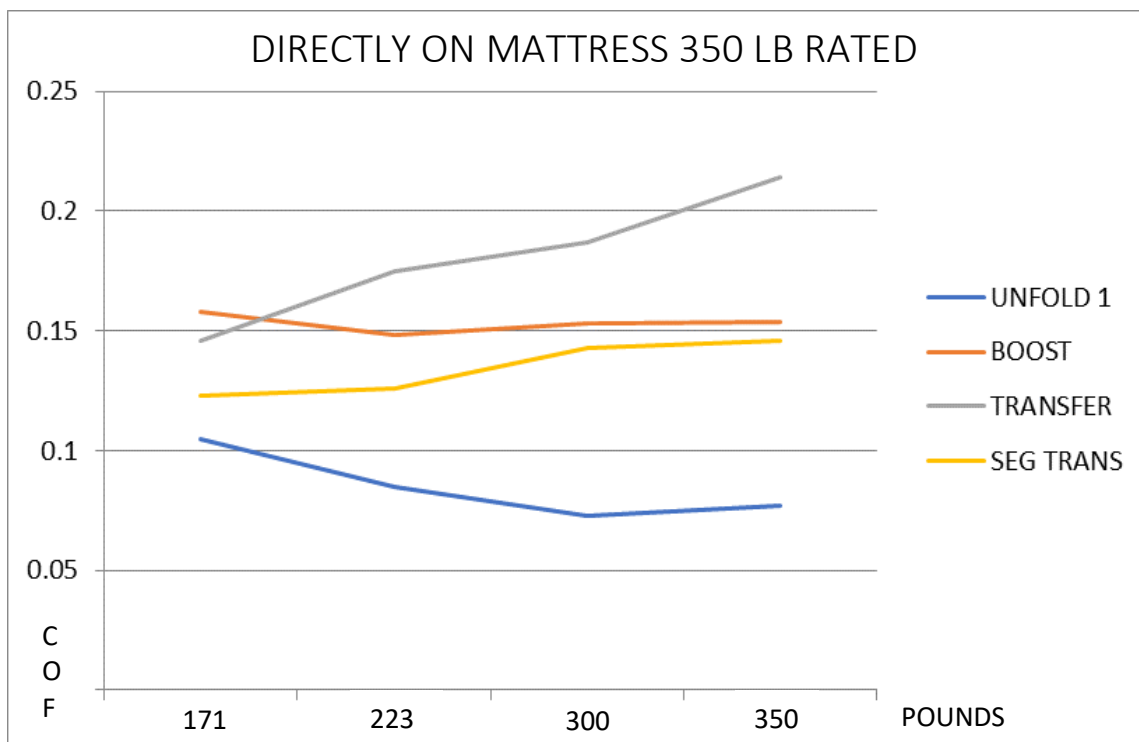


It isn't strictly correct to calculate COF on surfaces that create hills in front of the weight moved, which is what happened on the massage table and mattress. However, the results are interesting.

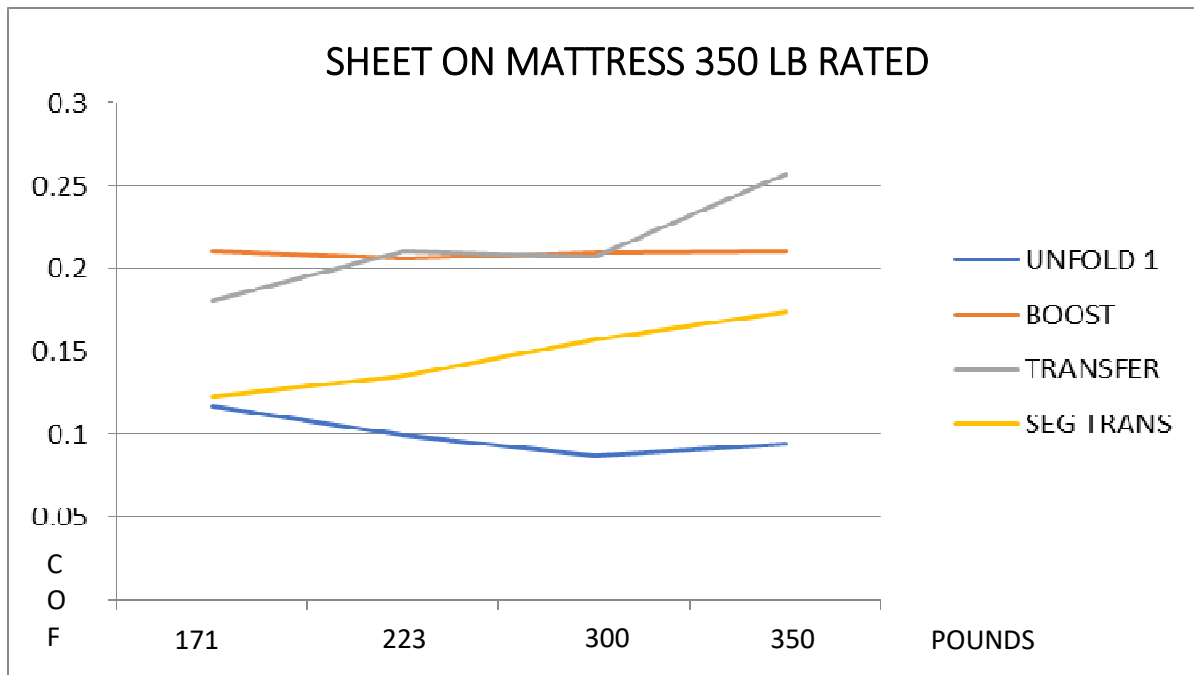
Below is the graph of data associated with the massage table. Again, the boosting and transfer COFs are nearly the same. However, the COFs are higher than on the hard table. Now they are between 0.18 and 0.21. The highest force for each weight was measured as the table padding bunched up in front of the dummy. The bottom blue line is from unfolding the PATRAN between the sheet and the massage table vinyl cover. The red line is from unfolding the PATRAN between the bed sheet and a draw sheet.



The chart below shows data associated with moving the dummy directly on the mattress. This often occurs during lateral transfer and sometimes during boosting. During these tests, the PATRAN was directly on the nylon mattress ticking (mattress and pillow covers), the draw sheet was on top of the PATRAN, and the dummy was on top the draw sheet. The bottom blue line is associated with unfolding the PATRAN between the mattress ticking and the draw sheet. The affect that stiff mattress side cushioning has on increasing the transfer COF is clear. The dummy sinks into the soft center of the mattress and has to be moved uphill to and over a long side. However, boosting moves toward the short edge of the mattress, which has the same cushioning as the center. This data makes it clear that changing PATRAN orientation to roll in the direction of movement for boosting is not necessary.



The chart below reflects the data associated with moving the dummy with the PATRAN on a fitted sheet that is on the same mattress as above. This often occurs during boosting, but could also occur during lateral transfer. The bottom blue line represents unfolding the PATRAN between the fitted sheet and the draw sheet.



The kinetic COF lines in the above charts used the “Max” data from the following chart “FORCE REQUIRED TO MOVE PATIENT ON DIFFERENT SURFACES USING PATRAN SLIDE SHEETS.” Use “Min” data to calculate the static COF.

Table 1.

FORCE REQUIRED TO MOVE PATIENT ON DIFFERENT SURFACES USING PATRAN® SLIDE SHEETS BY JAMAR HEALTH PRODUCTS, INC.									
Dummy weight (lbs.)	171		223		300		350		PATRAN Location
Force used (lbs)	Min	Max	Min	Max	Min	Max	Min	Max	
Hard table									
Unfolding Insertion		13		18		25		31	Between sheet and pad
Boost	23	26	29	36	36	43	46	58	On poly cotton sheet
Transfer	20	27	27	37	30	44	37	49	On poly cotton sheet
Segmented transfer	14.5	18	18	26	19	29	23	34	On poly cotton sheet
Massage table									
Unfolding Insertion		12		17		18		24	Under sheet
Unfolding Insertion		14		19		23		28	Between sheet and pad
Boost	21	33	32	43	45	60	55	71	On vinyl cover
Transfer	20	34	30	42	43	61	57	74	On vinyl cover
Segmented transfer	14	25	18	28	25	39	32	53	On vinyl cover
Transfer w/slideboard	24	31	29	43	48	60	52	73	On slide board
350# rated mattress									
Unfolding Insertion		18		19		22		27	Between mattress and sheet
Boost	20	27	24	33	34	46	40	54	On mattress cover
Transfer	18	25	24	39	34	56	50	75	On mattress cover
Segmented transfer	10	21	19	28	20	43	32	51	On mattress cover
Unfolding Insertion		20		22		26		33	Between fitted sheet and drawsheet
Boost	24	36	31	46	43	63	57	74	On fitted sheet
Transfer	19	31	30	47	44	62	50	90	On fitted sheet
Segmented transfer	12	21	21	30	30	47	33	61	On fitted sheet