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## **PATRAN<sup>®</sup> USE REQUIRES LESS EFFORT ON AIR MATTRESSES THAN ON FOAM MATTRESSES**

By Jamar Health Products

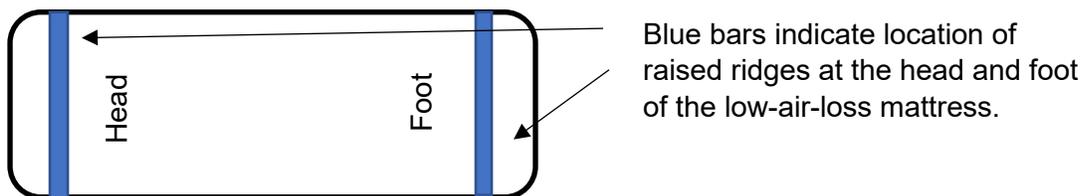
### **PURPOSE**

Most health care providers have weight guidelines for safe patient handling equipment use. In 2015, Jamar Health Products [published](#) the force required to move different weights using PATRAN<sup>®</sup> slide sheets (Jamar, Wisconsin) on various surfaces, including a 350 lbs.-rated foam mattress. However, during in-service training for PATRAN<sup>®</sup> slide sheet use, transferring a person on an air-filled mattress seemed easier than performing the same task on most foam mattresses. Jamar recently tested whether the force required to move weights on an air mattress is different than on a foam mattress when using PATRAN<sup>®</sup> slide sheets.

### **EQUIPMENT**

Jamar used a new Solace foam mattress (Invacare Corp., Ohio), which has long edges that are stiffer than the center, and a used KAP4 low-air-loss (LAL) mattress (KAP Medical, California). Like the foam mattress, the LAL mattress is rated for 350 lbs. and has a nylon cover. In addition, the LAL mattress has an air pump with a digital readout. The LAL mattress has a maximum inflate pressure of 35 mm Hg. Figure 1 shows the position of noticeable raised ridges at the head and foot on the LAL mattress when inflated.

**Figure 1** Low-air-loss mattress



Force tests on the LAL mattress were done with a pressure of 35 mm Hg on the digital display. No bolsters were used. There are many brands of mattresses on the market and Jamar has no preference to any mattress manufacturer. Mattresses used in this study were chosen as representative of products made from like materials.

PATRAN<sup>®</sup> slide sheet product #8378 (green), (72 inches long by 36 inches wide) was used in the 2015 force tests and its manufacturing lot was not tested for coefficient of friction (COF) by an independent laboratory.



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PATRANbari® slide sheet product #1845 (pink), manufacturing lot P13 (78 inches long by 45 inches wide) was used for the LAL mattress force tests. Jamar had a PATRAN from this lot tested by an independent laboratory for COF to ASTM International standard 1894. The results were a COF static (COFs) of 0.159 and COF kinetic (COFk) of 0.106. The same tow sheet and force instruments used in the 2015 tests were used for the LAL mattress tests in 2019.

### COEFFICIENT OF FRICTION

Coefficient of friction is the force required to move an object divided by the object's weight.

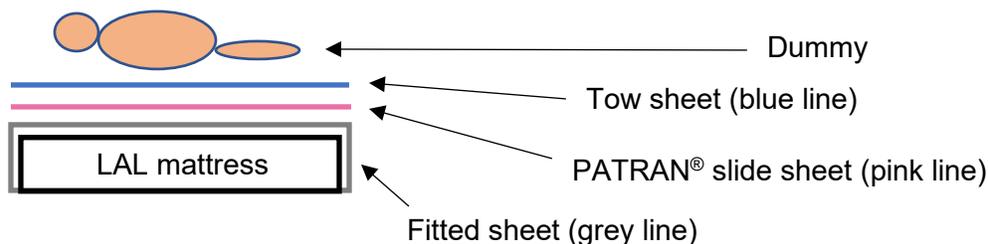
ASTM International standard 1894, which uses a weight less than 1 lb. or less than 0.5 kg, is the gold standard test for comparing the slip of one product to another under identical conditions and for determining baseline COFs and COFk. COFs is related to the force required to start the object moving and occurs over a very short distance. COFk is the force required to keep the object moving. Jamar's force test used weights far greater than 1 lb. on top of surfaces that may not be level or may bunch in front of the weight, causing conditions to be different for each test.

The COF data in Tables 1 and 2 were calculated to indicate whether the dummy sank into the mattress or if the surface irregularities changed with weight. ASTM International calculates COFk using the average (mean) force to move the weight over a prescribed distance five times. The force data shown in Tables 1 and 2 is the maximum force required during the five moves (COFmax). Using a maximum force and heavy weights makes the basis of the COF calculation different than and not comparable to ASTM International's calculation.

### PROCEDURE

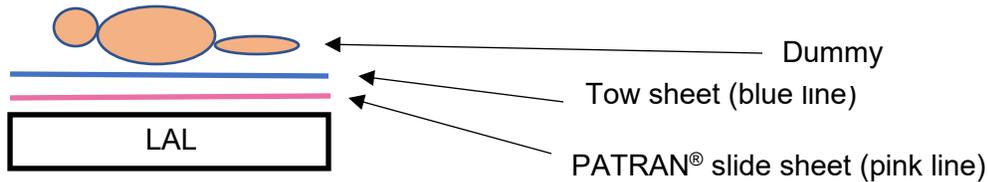
Usually, but not always, boosting/repositioning of a patient is completed with a PATRAN® slide sheet on top of a fitted sheet. However, transfers of patients from one surface to another are often done with a PATRAN® slide sheet directly on the mattress cover. Therefore, both foam and LAL mattresses were tested with a PATRAN® slide sheet on a 200-thread-count polycotton fitted sheet and with PATRAN® slide sheet directly on the mattress cover. Figures 2 and 3 clarify equipment positioning.

**Figure 2** PATRAN® slide sheet on fitted bed sheet



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**Figure 3** PATRAN<sup>®</sup> slide sheet on mattress cover



### DATA

Each force measurement was recorded to the nearest pound and the COFmax calculation was rounded to the nearest hundredth. During the distance the weight was towed much of the force used to move the dummy was several pounds less than the maximum shown. The LAL mattress ridges may have caused the boosting/repositioning force to be slightly greater. The LAL mattress published weight limit was exceeded for testing purposes only. Jamar recommends **against** exceeding the manufacturer's limits during clinical use.

Table 1. Transfer Data (weights and force in lbs.)						
Dummy weight	171	223	250	300	350	400
Foam mattress max force on sheet	31	47	NT	62	90	NT
Foam mattress COFmax on sheet	0.18	0.20	NT	0.21	0.26	NT
LAL mattress max force on sheet	26	34	37	41	50	58
LAL mattress COFmax on sheet	0.15	0.15	0.14	0.14	0.14	0.15
Foam mattress max force on cover	25	39	NT	56	75	NT
Foam mattress COFmax on cover	0.15	0.15	NT	0.19	0.21	NT
Foam mattress max force on cover	23	29	32	39	43	51
Foam mattress COFmax on cover	0.14	0.13	0.13	0.13	0.12	0.13

COFmax, coefficient of friction at maximum force; LAL, low-air-loss; NT, not tested.



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Dummy weight	171	223	250	300	350	400
Foam mattress max force on sheet	36	46	NT	63	74	NT
Foam mattress COFmax on sheet	0.21	0.22	NT	0.21	0.21	NT
LAL mattress max force on sheet	27	34	42	49	62	70
LAL mattress COFmax on sheet	0.16	0.15	0.17	0.16	0.18	0.18
Foam mattress max force on cover	25	33	NT	46	54	NT
Foam mattress COFmax on cover	0.15	0.15	NT	0.15	0.15	NT
LAL mattress max force on cover	24	31	34	41	47	52
LAL mattress COFmax on cover	0.14	0.14	0.14	0.14	0.13	0.13

COFmax, coefficient of friction at maximum force; LAL, low-air-loss; NT, not tested.

### CONCLUSIONS

It takes much less force to transfer heavy weight on a LAL mattress than on a foam mattress using PATRAN® slide sheets on either a fitted sheet or the nylon cover. There is less difference between the two mattress types in the force required to boost weight when directly on their nylon covers.

The increase in transfer COFmax with heavier weights using the foam mattress is due to having to move the dummy uphill. The small deviation of LAL mattress COFmax for transferring heavier dummy weights shows the dummy did not have to be moved uphill, a benefit of the LAL mattress.

Health care providers could increase their PATRAN® use weight guidelines on surfaces that do not require moving patients uphill. Some examples are most X-ray tables, surgery tables and LAL mattresses without bolsters.

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