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Scientific Basis for the Selection of Absorbent Underpads that Remain Securely Attached to Underlying Bed or Chair

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ABSTRACT: The occurrence of pressure ulcers in patients is very high in certain high-risk groups. These special high-risk groups include elderly patients, patients with spinal cord injuries, or any individual with an impaired ability to reposition. Prevention of pressure ulcers is by far the best treatment of this condition, warranting certain interventions and preventive measures. One major risk factor to be minimized is the exposure of skin to moisture. Underpads are often used to protect the skin of patients who are incontinent. These products effectively absorb moisture and present a quick-drying surface to the skin. The construction of an underpad should accomplish three goals. First, its backing should have a low coefficient of friction to prevent frictional skin injuries. Second, an inner absorbent core should rapidly contain moisture and disseminate it throughout the entire pad. Third, the core and coverstock should successfully work together to retain moisture and prevent wet-back or fluid return.

The purpose of this study was to determine the performance of three commercially available underpads in reducing the development of pressure sores in patients at high risk. In this study we selected three underpads that could be securely attached to either the underlying bed or the chair. The three performance parameters examined were absorbent capacity, wet-back prevention, and holding security of the underpads. Measurements of these performance parameters can be easily replicated in other laboratories. The results of these studies provide a scientific basis for selecting and purchasing an underpad to prevent pressure ulcers in patients. In this comprehensive evaluation, we assess an absorbent underpad with polyethylene flaps and two absorbent underpads with adhesive. The absorbent capacity results showed Tranquility® SlimLine® Peach Sheet to be the most absorbent. The wet-back results showed Tranquility® SlimLine® Peach Sheet to be the only underpad with no wet-back, with no fluid returning through the coverstock. The Tranquility® SlimLine® Peach Sheet Underpad has four adhesive

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strips attached to each of the four ends of the underpad surface. These 5 cm long strips secure well to the seat of a wheelchair or chair. In contrast, they do not maintain secure attachment to a bed sheet, making the bed sheet vulnerable to urine or stool penetration.

When the clinical staff used the Tuckable™ on the bed surface, they were all impressed by the secure fit of the plastic wings, which easily tucked around the mattress. The wings remained in place throughout the night. Realizing the stability of the Tuckable™ underpads, the clinical staff suggested that the Tuckable™ underpad be placed first on the bed, then the Tranquility® SlimLine® Peach Sheet can be placed on top of the Tuckable™ underpad, using the four adhesive strips to attach it to the surface of the Tuckable™ underpad. All of the staff were impressed that the adhesive strips remained securely attached to the Tuckable™. This clinical decision was found to be very cost efficient, because the Tuckable™ could remain in place more than a week without changing.

Even though we have developed a unique scientific basis for the selection of underpads for use on either chairs or beds, it can be a financial challenge to the patient or healthcare setting to use these products, because Medicare provides no reimbursement for underpads, an invitation to pressure ulcer formation. In the absence of responsible federal government policy, we are making recommendations for the selection of a cost-conscious and responsible company that sells incontinence products—Home Deliver Incontinent Supplies Co., Inc., (HDIS), Olivette, Missouri.

KEY WORDS: Tranquility® SlimLine® Peach Sheet Underpad, StaPut® underpad, Tuckable™ underpad, super-absorbent polymer, pressure ulcer prevention, absorbent underpad, absorbent capacity, wet-back, security, Medicare reimbursement, home delivery incontinent supplies company, adhesive tape

I. INTRODUCTION

It has been estimated that more than a million individuals develop pressure ulcers each year.[1] The US Department of Health and Human Services has reported the prevalence of pressure ulcers to be 10% in acute care and 4% in homecare.[2] According to the latest reports released by the Centers for Medicare and Medicaid Services, the prevalence in long-term care facilities is 9%.[3] The cost for pressure ulcer treatment for the United States has been estimated to exceed 1.335 billion annually.[4] Nursing home residents with pressure ulcers have more hospitalizations and emergency department visits and higher mortality rates. The Centers for Medicare and Medicaid have long-term regulations that include a standard that "a resident who enters the facility without pressure sores does not develop pressure sores unless the individual's clinical condition demonstrates that they were unavoidable" (section 483.25(C) 1).

Prevention of pressure ulcers is by far the best treatment of the condition, warranting certain interventions and preventive measures. One major risk factor to be minimized is the exposure of skin to moisture. A patient's skin may be exposed to a variety of substances that are moist: urine, stool, perspiration, or wound drainage. Although these substances may contain factors other than moisture that irritate the skin, moisture alone can predispose the skin to serious injury and subsequent pressure ulcers.[5,6] Underpads are often used to protect the skin of patients who are incontinent. These products effectively absorb moisture and present a quick-drying surface to the skin. Because these pads are designed to reduce injury attributed to the moisture associated with urinary and fecal incontinence, it is reasonable to assume that they would serve a similar function in those instances in which the source of moisture is perspiration or wound drainage.

An underpad may also reduce the friction or shear forces between the skin and the underlying bed sheet. Friction injuries to the skin occur when a patient moves across a coarse surface, such as bed linens. Most friction injuries can be avoided with appropriate techniques when patients are moved so that their

skin is never dragged across the linens. Placement of an underpad whose backing has a low coefficient of friction beneath the patient is a reliable means of reducing these frictional forces, thereby minimizing the potential for injury.

The construction of an underpad should accomplish three goals.[7] First, its backing should have a low coefficient of friction to prevent frictional skin injuries. Second, an inner absorbent core should rapidly contain moisture and disseminate it throughout the entire pad. Third, the core and coverstock should prevent wet-back, successfully working together to retain moisture and prevent fluid return.

The purpose of this study was to determine the performance of three commercially available underpads to reduce the development of pressure sores in patients who are at high risk. The three performance parameters examined were absorbent capacity, wetback prevention, and holding security of the underpads. Measurements of these performance parameters can be easily replicated in other laboratories. The results of these studies provide a scientific basis for selecting and purchasing an underpad to prevent pressure ulcers in patients. The underpads involved in this study could be securely attached to either a chair or bed surface. This security of attachment has two benefits. First, it prevents the underpad from wrinkling beneath the patient, which could irritate the overlying skin. Second, it prevents leakage of urine, feces, or other body fluids that would penetrate the underlying surface if the underpad were dislodged.

II. MATERIALS AND METHODS

II.A. Basic Concepts

Underpads are absorbent sheet-like products that are placed on top of the bed or chair of a patient who is incontinent to contain urine for both comfort to the patient and the protection of the furniture and bedding. Their basic structure consists of three layers: a fluid-impermeable backing sheet against the bed, a fluid-permeable coverstock on the body-contacting surface, and an interposed absorbent core. The backing sheet is composed of a strong film of hydrophobic material, usually a polyolefin, rendering this side an effective moisture barrier and reinforcing the product as a whole. A low coefficient of friction is preferable to allow the underpad to shift easily with patient's movements.

The coverstock or top layer exists to contain and conceal the underlying absorbent core, while also directly contacting the patient's body. A nonwoven fabric is used, and its characteristics are derived from three factors: the nature of the polymeric material, the method of fiber assembly, and the technique of web bonding. To perform as an effective coverstock, a lightweight, low-density material in the form of a smooth, soft web is suggested. This unique web must freely allow fluid to pass through its openings into the interior of the pad but then inhibit the reverse flow (wet-back). A hydrophobic, nonabsorbent material such as polypropylene is preferred, so that no liquid is attracted to this outer layer.

Two types of webs, carded and spunbonded, can serve as a coverstock. Carding is a process that separates staple fibers with fine wires or combs, aligning them essentially parallel to the machine direction. This process leads to a weakness in the cross direction. A carded web requires an adhesive, usually a cross-linked acrylic binder, to hold the web fibers together. In contrast, spunbonded webbing is a more complicated, more effective, procedure. This process begins with polymer chips that are melted, extruded through spinnerets as infinitely long fibers, and then collected on a conveyor belt in random array. As the fibers cool, web bonding occurs. Finally, embossing may be done to the coverstock, in which a pattern is pressed into the sheet by passing it between heated rolls that have a raised design. This treatment adds a three-dimensional character to this layer, allowing an adequate separation between the body-contacting surface and the absorbent core beneath.

The absorbent core exists as a bulky, loosely formed web known as a *batt,* which is composed of very short fibers in random array. Absorbency is highly dependent on the number of free fiber ends available to

attract and retain fluid; thus the loose fibers of the batt, or the *fluff,* effectively serve this goal. The fibers are cellulosic in nature, and delineated, bleached wood pulp is most commonly used. In addition to absorbency, an effective wicking mechanism is desirable—that is, the pad should rapidly direct fluids away from the initial wetting site to more remote areas for storage, minimizing local saturation and maximizing the pad's capacity. Unfortunately, the large interfiber spaces of the fluff, although excellent for absorbency, have a poor wicking capability. Decreasing the pore size between fibers improves the capillary action that promotes fluid movement. Therefore, compression of certain areas of the batt successfully provides a means of fluid wicking. Typically, a diamond pattern is pressed into the batt, oriented to direct fluid horizontally away from the patient's body. Such compacted regions also add a degree of stability to the otherwise flimsy batt. A second means of support is often included: at least one tissue layer of denser cellulosic wood pulp surrounds the batt, maintaining its integrity. These reinforcement sheets may even be heat-bonded directly to the batt with the compressed diamond pattern.

A recent advance in absorbent products has been the addition of a superabsorbent polymer, or SAP, to the fluff that significantly increases the total amount of fluid that can be absorbed. The polymer is a hydrocolloid material, typically a cross-linked polyacrylate, that is embedded within the batt as a powder. Upon the addition of a liquid, it converts to a gel particle swollen with fluid but retains its original shape and remains undissolved. Currently, SAPs can absorb up to 70 times their original weight in urine and swell to an average particle size of 1–2 mm.

The final underpad product is completed by a hot melt construction. The polyolefin backing is folded up and over all three layers and heat-sealed to maintain the shape and integrity of the complete product. This rectangular product is known as an *underpad.* Two variations of this final construction step exist. One is to include adhesive strips in the four corners of the backing to keep the underpad in place. A second innovation is to extend the backing on two sides so these flaps can be tucked under the sides of the mattress to prevent the pad from slipping. (This type of pad is referred to as a *drawsheet*).

This study examined and evaluated three individual underpads that could be attached to either the underlying chair or bed surface. Each is a variation of the basic three-layered structure outlined above: a coverstock, an absorbent core, and a backing.

III. UNDERPADS

In this comprehensive evaluation, we assess an absorbent underpad with polyethylene flaps as well as two absorbent underpads with adhesive.

III.A. Absorbent Underpad With Polyethylene Flaps

The Tuckable™ drawsheet (PaperPak USA, San Dimas, California) has a weight of 162.5 gm and an absorbent surface size of 68.6 cm × 91.4 cm (Table 1). Extending from two opposing sides are 16.5-inch polyethylene flaps that tuck securely under each side of the mattress or chair, preventing dislodgement. Its four-layered structure begins with an embossed coverstock of spunbonded polypropylene that is thermally

TABLE 1. Absorbent Underpad for Bed

Underpads	Manufacturer	Dimensions (entire underpad)	Dimensions (absorbent surface)
Tuckable®	Paper-Pak Products, La Verne, CA	88.9 cm x 175.2 cm	68.6 cm x 91.4 cm

TABLE 2. Absorbent Underpads with Adhesive

Underpads	Manufacturer	Dimensions (entire underpad)	Dimensions (absorbent surface)
StaPut®	Kendall Company, Mansfield, MA	76 cm x 91 cm	67.5 cm x 76.3 cm
Tranquility® SlimLine® Peach Sheet Underpad	Principle Business Enterprises, Dunbridge, OH	54.6 cm x 82.5 cm	25.0 cm x 77.4 cm

fixed to the underlying tissue layer. The cellulose fluff is heat-bonded to the polyethylene backing.

III.B. Absorbent Underpads with Adhesive

The Tranquility® SlimLine® Peach Sheet Underpad (Principal Business Enterprises, Dunbridge, Ohio) measures 54.6 cm × 85.5 cm and weighs 139.4 gm (Table 2). The coverstock is a spunbonded polypropylene web with a unique layering process. The fiber collecting rolls move very quickly, creating a web with near-parallel fibers that is very strong in the horizontal direction. Its advanced embossing process further reinforces the coverstock in this left-to-right orientation. The second layer, a tissue paper, is much thicker and stiffer than in the other pads, helping to prevent wet-back. A large amount of cellulose fluff serves as the absorbent core, and placing it between two tissue layers and thermally bonding them together enhances its high integrity. Homogeneously mixed within the fluff is a superabsorbent polymer, probably a polyacrylate.The polyethylene backing serves as the moisture barrier, with added adhesive strips on each corner to hold its position on either the bed or chair surface.

The StaPut® underpad (The Kendall Company, Division of Tyco Healthcare, Mansfield, Massachusetts) measures 76 cm × 91 cm. It has an absorbent core that is a fluff polymer that contains a POLY-FRESH SAP. On its back surface it has two separate longitudinal plastic strips that can be peeled off, leaving an adhesive that can become adherent to either the bed or chair surface. Once the plastic strips are removed, the surface of the adhesive is on the same level as that of the backing.

IV. BIOMECHANICAL PERFORMANCE.

Three major performance parameters of each underpad were studied: product absorbency, coverstock wetback prevention, and security of underpad attachment.

The total absorbence capacity is defined as the maximum amount of liquid held by the product, which includes liquid both absorbed by all of the materials and in the void space. A comparative absorbent capacity test was used, and samples included all layers of the product intact, not individual components. Each dry sample was initially weighted and then emerged in water and left for 15 minutes to ensure uniform saturation. Each underpad was drained for 30 seconds and weighed to get a value of the total absorbent capacity. The process was repeated using three underpads of each type. To determine absorbency of the sample, the weight of the dry underpad was compared to the subsequent weight of the same underpad after water absorption.

Wet-back is an indication of the liquid forced back through the coverstock when a saturated underpad is placed under load or pressure. Several factors influence the extent of wet-back: the amount and type of nonwoven web used as the coverstock, the presence of SAP in the absorbent core, and the use of an intermediate layer between the cover and the core. Wet-back of each underpad was compared by saturating the area with 20 mL of dyed H_2O; 10 minutes after saturating a blotter paper was placed onto the coverstock over the site of saturation. A 0.3 kg weight was placed over the blotter paper for 15 seconds. Each underpad's wet-back was graded on arbitrary scale of 0–5, with 0 being no obvious wet-back and 5 being excessive wet-back or saturation.

Clinicians judged the underpad performance, in part, by the security of attachment of the underpad to either the bed or the chair. Clinicians positioned the respective underpads on either the bed or chair before the patient was positioned on the underpads. When the patient was removed from the underpad, the clinician determined if the underpad remained in place.

V. RESULTS

The performance of the absorbent underpads was judged by three different parameters: absorbent capacity of the underpad, wet-back prevention, and security of the underpad to the bed or chair surface.

V.A. Absorbance Capacity and Wet-Back

The absorbance of the underpad was judged by two different parameters: absorbance capacity and wet back prevention. The absorbent capacity results showed the Tranquility® SlimLine® Peach Sheet to be the most absorbent (Table 3). The absorbent capacity of the Tranquility® SlimLine® Peach Sheet Underpad was 2.08- and 2.11-fold greater than the absorbent capacity of the StaPut® and the Tuckable™, respectively.

The wet-back values for the underpads were very disturbing. The wet-back results showed Tranquility® SlimLine® Peach Sheet to be the only underpad with no wet-back, that is no fluid returning through the coverstock (Table 4). The other wet-back values were as follows: StaPut®, 2; Tuckable®, 2. The presence of a wet surface on the StaPut® and Tuckable™ means that the skins surface will be in contact with a wet underpad, an invitation to pressure ulcer formation!

V.B. Underpad Security

In this performance study, the security of the three different underpads to either the bed or chair was determined by different modalities. The Tranquility® SlimLine® Peach Sheet Underpad has four adhesive strips attached to each of the four ends of the underpad surface (Fig. 1). These 5 cm long strips secure well to the seat of a wheelchair or chair (Fig. 2). If the strips are attached to the metal framework of the back of a wheelchair that either tilts or reclines, these adhesive straps become easily dislodged, offering the potential for wrinkling beneath the skin of the user. Consequently, we remind our staff to position the tape only to the seat of a motorized wheelchair. In addition, they do not maintain a secure attachment to a bed sheet, making the bed sheet vulnerable to urine or stool penetration. The clinicians were disappointed with the adherence of the longitudinal strips of adhesive of the StaPut® underpads, which did not maintain a secure attachment to either a seat or bed surface.

When the clinical staff used the Tuckable™ on the bed surface, they were all impressed by the secure fit of the plastic wings, which easily tucked around the mattress (Fig. 3). The wings remained in place throughout the night (Fig. 4). Realizing the stability

TABLE 3. Absorbency H_2OmL/cm_2

Chair underpad product	H_2OmL/cm^2
Tranquility® SlimLine® Peach Sheet Underpad	2.89
StaPut®	1.39
Tuckables®	1.37

TABLE 4. Wet-Back

Chair underpad product	Wet-back Score
Tranquility® SlimLine® Peach Sheet Underpad	0
StaPut®	2
Tuckables®	2

FIGURE 1. The adhesive strips at four ends of the Tranquility® SlimLine Peach® Sheet Underpad attach securely to the **(a)** wheelchair or **(b)** chair.

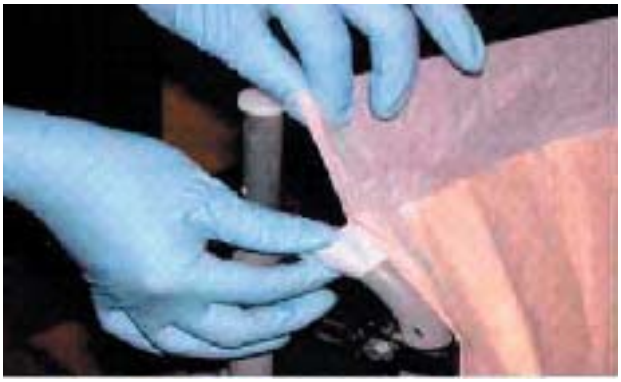

FIGURE 2. Close-up photograph of one adhesive strip of the Tranquility® SlimLine Peach® Sheet Underpad attached to a wheelchair.

of the Tuckable™ underpads, the clinical staff suggested that the Tuckable™ underpad be placed on the bed first, after which the Tranquility® SlimLine® Peach Sheet can be placed on top of the Tuckable™ underpad, using the four adhesive strips to attach it to the surface of the Tuckable™ underpad (Fig 4). All of the staff were impressed that the adhesive strips remained securely attached to the Tuckable™. When the Tranquility® SlimLine® Peach Sheet became soiled, it was easily removed from the Tuckable™ underpad, with no evidence of penetration of urine or feces through the backing of the Tranquility® SlimLine® Peach Sheet Underpad. In the absence of any soilage, a new Tranquility® SlimLine® Peach Sheet Underpad was used on the surface of the Tuckable™

FIGURE 3. Note that the polyolefin flaps of the Tuckable™ underpad can be easily positioned under the mattress of the bed.

FIGURE 4. After the flaps are positioned between the mattress on both sides of the bed, the Tuckable™ underpad remains securely on the bed surface, despite patient movement. When the adhesive strips of the Tranquility® SlimLine Peach® Sheet Underpad are attached to the Tuckable™ underpad, the Tranquility® SlimLine Peach® Sheet Underpad remains in place beneath the patient. Removal of the Tranquility® SlimLine Peach® Sheet Underpad is necessary only if there is soilage in the underpad that never penetrates through its backing, allowing a new Tranquility® SlimLine Peach® Sheet Underpad to be placed over the adherent Tuckable™.

underpad. This clinical decision was found to be very cost efficient because the Tuckable™ could remain in place for more than a week without changing.

VI. DISCUSSION

Many studies have examined the effects of underpads on the skin condition of incontinent adults or infants. However, few studies involved some form of control or comparison group or included testing for statistical significance. Four studies conveyed suffi cient information to determine that the investigators were comparing cloth products with products designed to absorb moisture and present a quick-drying interface with the skin.[8-11] In all four of these studies, investigators reported either a significant improvement in skin condition or a significantly lower occurrence of skin rashes for subjects who used products specifically designed to absorb moisture when compared with subjects who used products made of cloth.

It is important to note that the key feature evaluated was whether the product was specifically designed to absorb moisture to present a quick-drying surface to the skin. Although these careful, scientific studies confirmed that moisture predisposes to dermatitis, other studies in our laboratory demonstrated that moisture also markedly enhances the frictional forces of bedsheets, thereby predisposing to skin ulcerations.[7] The coefficients of friction of either wet cotton or wet cotton/polyester sheets were two times greater than those of comparable dry sheets. Because these wet sheets have such high coefficients of friction, hospital personnel must replace wet sheets with dry sheets before patient transfer. The use of an underpad between the patient's skin and the bed linen is always a reliable technique to ensure dryness and minimize the frictional forces between the skin and the bed sheeting. The disposable underpads tested in this study had fluid-impervious backings that were effective barriers to moisture transmission.

The Tranquility® SlimLine® Peach Sheet Underpad had three structural components that provided optimum product performance by enhancing absorbency and inhibiting wetback. It was the only underpad studied that possessed SAP, which provided an absorbent capacity far greater than other underpads. This SAP irreversibly held the moisture to prevent fluid wet-back. Second, its thick intermediate tissue layer between the coverstock and core limited the moisture to the pad's interior, inhibiting its return to the outer surface. Finally, because its coverstock was a spunbound rather than a carded web, its moisture containment capacity was further enhanced.

The adhesive-tape backing of the Tranquility® SlimLine® Peach Sheet Underpad is one additional favorable feature. Once the patient is positioned comfortably on the product, its adhesive strips can be secured to the chair, maintaining its position on the chair after patient repositioning. It is important to emphasize that the healthcare worker must be reminded to attach the adhesive strips only to the seat cushion of motorized wheelchairs that can either tilt or recline, because the movement of the back of the wheelchair dislodges any attached adhesive straps, making the end of the underpad susceptible to wrinkling beneath the patient's skin. These unique features of the Tranquility® SlimLine® Peach Sheet Underpad provide a scientific basis for its selection for patients seated on chairs who are prone to developing pressure ulcers.

Our clinical studies, however, demonstrate that the Tranquility® SlimLine® Peach Sheet Underpad is not a reliable underpad for use on beds. Although its adhesive strips remain securely attached to the bed linen, repositioning of the bed linen caused by patient movement will move the underpad. In addition, the small size of the Tranquility® SlimLine® Peach Sheet Underpad covers only a limited bed surface area. In contrast, the Tuckable™ underpad can be securely positioned on the bed surface by tucking its polyolefin flaps under the mattress. Unfortunately, the Tuckable™ underpad has a relatively poor absorbent capacity and is susceptible to wet-back.

In the absence of a reliable and effective bed underpad, our staff found a unique solution to this potentially devastating problem. After the flaps of the Tuckable™ were positioned securely beneath

the mattress, the adhesive strips of the Tranquility® SlimLine® Peach Sheet Underpad were attached to the underlying Tuckable™ absorbent product lying securely on the bed surface. We were delighted to find that the soiled Tranquility® SlimLine® Peach Sheet Underpad would never allow either wetback or penetration through its backing, allowing theTranquility® SlimLine® Peach Sheet Underpad to be removed without soilage of the underlying Tuckable™. Our clinical staff was able to repeatedly use the unsoiled Tuckable™ by replacing the soiled Tranquility® SlimLine® Peach Sheet Underpad, a cost saving to the patient, hospital, long-term care facility, and nursing home. Even though we have developed a unique scientific basis for the selection of underpads for use on either chairs or beds, it can be a financial challenge to the patient or healthcare setting to use these products because Medicare provides no reimbursement for underpads, an invitation to pressure ulcer formation.[12] In the absence of responsible federal government policy, we are making recommendations for the selection of a cost-conscious company that sells incontinent products, Home Delivery Incontinent Supplies Co., Inc. (HDIS), Olivette, Missouri.

VI.A. Supplier of Incontinent Products

HDIS has specialized in discreet home delivery of bladder control products since 1986. HDIS carries the widest variety of bladder control supplies, including hard-to-find styles, which are always in stock. Customers always receive friendly and knowledgeable service from their award-winning customer care staff. HDIS offers free product samples to try before buying and free shipping anywhere in the continental US. When customers schedule automatic deliveries on their Personalized Delivery Plan™, they receive an additional 5% off their regular low prices. HDIS also accepts manufacturer's coupons, just like a store. If consumers qualify for Medicaid, they can contact them for availability in their state. HDIS will help determine if their purchases qualify and will bill Medicaid directly.

Key to HDIS's service are its friendly, knowledgeable customer care representatives, who spend as much time as the caregiver wants to listen and advise on incontinence management and quality-of-life issues. Incontinence educational materials include brochures, cards, and a free lifestyle newsletter offering tips on living with incontinence. Topics covered range from specific conditions that cause incontinence to foods that affect bladder control.

The focus of the educational materials is to promote awareness that incontinence is abnormal at any age, is curable or at least manageable, and should be brought without embarrassment to the attention of a medical provider, said Becky Cooper, HDIS assistant product manager. "Women especially will put up with incontinence for a three and a half years on average before seeking help. Sadly, they don't realize how many simple techniques there are, such as pelvic muscle exercise, which can help. Our materials teach solutions like this."

To receive these free educational materials on incontinence, including HDIS's newest brochure,"Resources for Caregivers," call 1-800-2MY-HOME® (1-800-269-4663) or go online to hdis.com.

VII. CONCLUSION

The occurrence of pressure ulcers in patients is very high in certain high-risk groups. These special high-risk groups include elderly patients, patients with spinal cord injuries, or any individual with an impaired ability to reposition. Prevention of pressure ulcers is by far the best treatment of this condition, warranting certain interventions and preventive measures. One major risk factor to be minimized is the exposure of skin to moisture. Underpads are often used to protect the skin of patients who are incontinent. These products effectively absorb moisture and present a quick-drying surface to the skin. The construction of an underpad should accomplish three goals. First, its backing should have a low coefficient of friction to prevent frictional skin injuries. Second, an inner absorbent core should rapidly contain moisture and disseminate it throughout the entire pad. Third, the

core and coverstock should prevent wet-back, successfully working together to retain moisture and prevent wet-back or fluid return.

The purpose of this study was to determine the performance of three commercially available underpads to reduce the development of pressure sores in patients who are at high risk. In this study we selected three underpads that could be securely attached to either the underlying bed or the chair. The three performance parameters examined were absorbent capacity, wet-back prevention, and holding security of the underpads. Measurements of these performance parameters can be easily replicated in other laboratories. The results of these studies provide a scientific basis for selecting and purchasing underpads to prevent pressure ulcers in patients.

In this comprehensive evaluation, we assess an absorbent underpad with polyethylene flaps as well as two absorbent underpads with adhesive. Three major performance parameters of each underpad were studied: product absorbency, coverstock wet-back prevention, and security of underpad attachment.

The absorbent capacity results showed Tranquility® SlimLine® Peach Sheet to be the most absorbent. The wet-back results showed Tranquility® SlimLine® Peach Sheet to be the only underpad with no wet-back—that is, no fluid returning through the coverstock. The Tranquility® SlimLine® Peach Sheet Underpad has four adhesive strips attached to each of the four ends of the underpad surface. These 5 cm long strips secure well to the seat of a wheelchair or chair. In contrast, they do not maintain a secure attachment to a bed sheet, making the bed sheet vulnerable to urine or stool penetration. When the clinical staff used the Tuckable™ on the bed surface, they were all impressed by the secure fit of the plastic wings, which easily tucked around the mattress. The wings remained in place throughout the night. Realizing the stability of the Tuckable™ underpads, the clinical staff suggested that the Tuckable™ underpad be placed on the bed first, after which the Tranquility® SlimLine® Peach Sheet can be placed on top of the Tuckable™ underpad using the four adhesive strips to attach it to the surface of the Tuckable™ underpad. All of the staff were impressed that the adhesive strips remained securely attached to the Tuckable™. This clinical decision was found to be very cost-efficient because the Tuckable™ could remain in place more than a week without changing.

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