

Economic Impact of Ultrasorbs® AP Absorbent Pads

In Prevention of Hospital-Acquired Pressure Ulcers

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Economic Impact of Ultrasorbs® AP Absorbent Pads *In Prevention of Hospital-Acquired Pressure Ulcers*

- Ultrasorbs® AP pads were effective in reducing the incidence of hospital-acquired pressure ulcers by an average of 3% in incontinent patients admitted without a pressure sore.
- The cost savings is estimated at \$96.72 per incontinent patient admitted to the hospital.
- The annual budget impact is estimated at \$773,760.00 mainly due to the implementation of Ultrasorbs® AP pads.

EXECUTIVE SUMMARY

Background

The Centers for Medicare and Medicaid Services recently announced that it will stop reimbursing hospitals for certain hospital-acquired conditions considered preventable in the hospital setting. This reimbursement change was made in October 2008. Pressure ulcers are included in the category of hospital-acquired conditions. Pressure ulcers are a potential complication of prolonged bed rest. Incontinent patients are especially prone to pressure ulcers if moisture is not managed adequately. We examined the impact of a highly absorbent pad (Ultrasorbs® AP (UAP); Medline Industries, Inc., Mundelein, Illinois) with superior strength, breathability and durability in an incontinent population at New York Methodist Hospital; Brooklyn, New York (NYM) where the incidence of hospital-acquired pressure ulcers averaged about nine percent.

Methods

We conducted a retrospective query of medical charts identifying incontinent patients admitted to the hospital between October 2007 and May 2008 who had no pressure ulcer on admission. We assessed the incidence of pressure ulcers, risk profile using the Braden Scale Score (sensory perception, mobility, activity, moisture, and nutrition), age and methods used for prevention (pressure redistribution, skin care, incontinence management and nutrition) four months before and four months after implementation of Ultrasorbs® AP. A cost analysis and decision model is used to determine the economic impact of the pad.

Results

The incidence of hospital-acquired pressure ulcers (HAPU) is reduced by an average of three percent after implementation of Ultrasorbs® AP. The expected value (cost savings) is \$96.72 per incontinent patient admitted to the hospital. Savings is attributed to reduction in materials, nurse labor, laundry support and the reduction of HAPU's.

Conclusion

The annual budget impact of implementation of Ultrasorbs® AP at NYM is estimated at \$773,760.00.

HOSPITAL CHALLENGE

New York Methodist Hospital in Brooklyn, New York is an acute-care hospital. The facility has 651 beds. The average length of stay in the hospital is 6.2 days.

In the fourth quarter 2007 (October 1, 2007 to December 31, 2007), the hospital began investigating methods to reduce the incidence of HAPU's. Incidence throughout the facility was ten percent, which is above the national average. The hospital was using evidence-based prevention methods including risk assessment with the Braden Scale, patient turning, pressure redistribution mattresses, skin care, incontinence care and nutritional assessment under the auspices of the National Pressure Ulcer Advisory Panel (NPUAP) guidelines.¹ However, diapers and undergarments were not being used for incontinent patients.

Laundryable pads with a disposable blue chux pad were used to absorb fluids and wick away moisture from the skin.

It was discovered that 78% of the patients with a HAPU were incontinent of urine and/or feces (see Figure 1).

This prompted the introduction of a new method to manage incontinence in the hospital. The current method of incontinence management was not working to absorb the fluids and keep it away from the skin. The wound care nurse decided to explore the use of Ultrasorbs® AP for incontinence management instead of the laundryable pads and blue chux. After a trial of the Ultrasorbs® AP pad within the institution the Ultrasorbs® AP was implemented hospital-wide on February 1, 2008.

Figure 1: Hospital-Acquired Pressure Ulcers

	Hospital-Acquired Pressure Ulcers October 1, 2007 to December 31, 2007
All Admissions (Incidence) – Both Incontinent and Continent	10.0%
Percent of HAPU Patients Incontinent	78%

COST SAVINGS-HOSPITAL RESOURCES/MATERIALS

Ultrasorbs® absorbent pads continue to be used at the hospital allowing a comparison of before and after costs of the product. Prior to implementation of Ultrasorbs® AP pads a nurse technician would place approximately four washable pads and one blue chux absorbent pad under the patient four to five times per day. Nursing required an average of 15 minutes for the change including removal of pads, sheets and replacement. Launderable pads went

to the hospital laundry department for washing with bleach and disposable chux went into the medical waste bin.

One Ultrasorbs® AP is used approximately four to five times per day. A nurse technician takes an average of 5 to 10 minutes at each change to remove the old pad, discard it into medical waste and replace it with a new one. The cost savings of hospital resources and materials are (see Figures 2-7).

Figure 2: Nurse Labor

Method	Labor	Cost/Minute ^a	Minutes per Change	Changes per Day	Minutes per Day	Total Cost
Launderable pads	Nurse Technician	\$0.332	15	4.5	67.5	\$22.41
UAP	Nurse Technician	\$0.332	10	4.5	45.0	\$14.94
Cost Savings per Patient per Day (\$22.41 - \$14.94)						\$7.47

a. The hourly rate for the nurse technician is \$18.00 (add \$1.92/hr for benefits) –NYM data.

Figure 3: Materials (Launderable pads, Blue Chux and Ultrasorbs® AP)

Method	Cost of individual pads ^b	Pads per change	Changes per Patient per Day	Pads used per Patient per Day	Cost per Patient per Day
Launderable pads^b	\$0.04	4	4.5	18	\$0.72
Blue Chux	\$0.50	1	4.5	4.5	\$2.25
Total cost of launderable pads and blue chux per patient per day					\$2.97
UAP	\$1.52	1	4.5	4.5	\$6.84
Total cost of Ultrasorbs® pads per patient per day					\$6.84
Cost Difference of Materials per Patient per Day (\$2.97-\$6.84)					-\$3.87

b. Cost of launderable pads is \$3.97 each with a 10 week life (Depreciation cost determined to be \$0.04 per pad)

Figure 4: Laundry (Launderable pads) - Washer and Dryer Depreciation Costs

Machine	Purchase Price	Anticipated Life of Machine (Years)	Depreciation Cost per Day ^c	Loads ^d Patient /Day	Depreciation Cost of Loads Patient/Day
Washer	\$1,000.00	10	\$0.28	.10	\$0.03
Dryer	\$1,000.00	10	\$0.28	.10	\$0.03
Cost Savings per Patient per Day from Laundry Machines					\$0.06

c. Asset depreciation calculator used to determine depreciation cost per day¹²

d. It is estimated that 10% of a load of wash or dryer is 1 patient launderable pads per day (18 pads used).

Depreciation Cost per day * Loads Patient / Day = Depreciation Cost of Loads Patient/Day

$\$0.28 * 0.10 = \$0.028 \sim \$0.03$ per day

Figure 5: Laundry (Launderable pads) – Washing and Drying Costs

Machine	Water Cost per Load	Detergent - Bleach Cost per Load ¹³	Power Cost per Load ¹⁴	Labor Cost per Load ^e	Percentage of Load per Patient per Day	Washing & Drying Costs per Patient per Day
Washer	\$0.09	\$0.14	\$0.23	\$3.20	.10	\$0.37
Dryer	————	————	\$0.74	\$4.80	.10	\$0.55
Cost Savings per Patient per Day from Washing and Drying Launderable Pads						\$0.92

e. Hourly wage for laundry worker is \$9.59 including benefits.¹⁵ We estimate 20 minutes for each wash and 30 minutes for each dryer. 10% of the load is attributed to one patient.

Washer: $((\$0.09 + \$0.14 + \$0.23 + \$3.20) * .10) = \$0.366 \sim \0.37

Dryer: $((\$0.74 + \$4.80) * .10) = \$0.55$

Figure 6: Medical Waste Disposal Costs

Product	Volume Capacity ^f (Ounces)	Average Urinary Collection per Change (Ounces)	Changes per Patient per Day	Total Waste per Patient per Day (Ounces)	Medical Waste Disposal Cost per Ounce ^g	Medical Waste Cost per Day per Patient
Blue Chux	5	5	4.5	22.5	\$0.02	\$0.45
UAP	15	8	4.5	36.0	\$0.02	\$0.72
Cost Difference per Patient per Day for Medical Waste Disposal						-\$0.27

f. Volume capacity estimated from marketing materials for each product related to capacity.

UAP absorbs and holds 3 times its weight.

g. Regulated medical waste cost per pound estimated at \$0.30 per pound.¹⁶

Figure 7: Total Cost Savings for Hospital Resources & Materials

The total cost savings per incontinent patient per day in the hospital related to the use of Ultrasorbs® absorbent pads compared with use of launderable pads and blue chux is:

Nurse Labor Cost Savings PPD*	\$7.47
- Increase in Underpad Cost PPD	-\$3.87
+ Decrease in Machinery Depreciation PPD	+\$0.06
+ Reduction in cost to Wash and Dry Launderable Pads PPD	+\$0.92
- Increase in Medical Waste Disposal Cost PPD	<u>-\$0.27</u>
Net Cost Savings PPD	=\$4.31

Cost Savings per Incontinent Patient per Avg. LOS = \$4.31 * 6.2 days = \$26.72**

*PPD is per patient per day

**LOS is length of stay

EXPECTED VALUE OF HAPU PREVENTION

Incontinence can be defined as the uncontrolled elimination of urine or fecal material from the body. When controlled this material is either deposited away or washed away from the body to maintain a hygienic environment. When uncontrolled the waste can collect on the skin and cause various factors which contribute to skin breakdown and ultimately pressure ulcers.^{2,3,4}

A retrospective review of incontinent patient records admitted to NYM with primary diagnosis unrelated to wounds or pressure ulcers was completed from October 1, 2007 to September 2008. Hospital administration gave approval for the data collection with consideration for patient privacy and need for understanding the benefits of products or procedures to prevent pressure ulcers.

Objective

The objective of the review is to determine the expected value of Ultrasorbs® AP in preventing hospital-acquired pressure ulcers in incontinent patients. Expected value is the value of an intervention when the outcomes of that intervention are averaged over many patients. An “expected-outcome decision maker” chooses the treatment that gives the best outcome (cost savings) when averaged over many patients.

Methods

Decision Analysis

A simple decision tree model framework⁵ is used to determine the expected value of HAPU prevention whereby we are comparing the average incidence of pressure ulcers four months before the implementation of Ultrasorbs® AP to the following four month period use of Ultrasorbs® AP for incontinence. For each alternative, the costs of pressure ulcer treatment and benefits (reduced incidence of pressure ulcers) are listed sequentially and displayed graphically. The expected value of HAPU prevention is used in the overall analysis with cost savings of materials and resources to determine the overall value of Ultrasorbs® AP.

Sensitivity Analysis

After running a decision analysis with base-case data, we completed a sensitivity analysis by changing the values of key variables through plausible ranges to see how it affects the overall expected value of HAPU prevention. The role of sensitivity analysis is to evaluate the robustness of the study while identifying what source of uncertainty weights more on the study’s conclusions.⁵

Risk Analysis

Risk of pressure ulceration in the incontinent population in each time period was compared using an independent T-Test of Means for Braden Scale Scores. The Braden Scale consists of six subscales that evaluate a patient’s sensory perception, activity level, mobility, and nutrition status and the skin’s exposure to moisture, friction, and shear forces.⁶ On five subscales (sensory perception, mobility, activity, moisture, and nutrition), patients can receive scores from 1 to 4, with 4 representing the

highest. On the remaining subscale (friction and shear) patients are ranked from 1 to 3. Adding the six subscale scores yields a total Braden Scale score, which can range from 6 to 23. Lower total scores are associated with a higher risk of developing pressure ulcers. In terms of predictive validity, the Braden Scale has demonstrated sensitivities that range from 70% to 100% and specificities ranging from 64% to 90%.^{7,8,9} Age is another risk factor for pressure ulcers in hospitalized patients.² We randomly selected incontinent patients to compare the Braden scores and age from each period.

Incidence Rate of Pressure Ulcers

The incidence of HAPUs is determined using the following equation:

Incidence =
$$\frac{\text{Number of patients developing new pressure ulcers in defined period}}{\text{Number of incontinent patient admissions in defined period}} \times 100$$

Secondary Diagnosis;

Pressure Ulcer Treatment Cost Analysis

Cost determination of pressure ulcer treatment is estimated from the literature and calculations for inflation.^{10,11} Costs of treatment for a pressure ulcer secondary to the patient’s primary diagnosis are broken down into stages of pressure ulceration (see Figure 8).

The 2008 HAPU costs represent an estimate of costs for pressure ulcer treatment above the cost for which the patient originally came into the hospital for. For stage I and stage II pressure ulcers items such as nursing time, overhead, and dietary are already provided to patients, regardless of whether or not they developed an ulcer. Extra costs for stage I and II’s include dressings, ointments and pressure redistribution beds. For stage III, IV and unstageable pressure ulcers the costs include extra nursing time, ointments, pressure relief mattresses, dressings, overhead and physician time. These costs are conservative estimates based on 1997 benchmark cost estimates from Beckrich et. al. and U.S. medical cost inflation from 1997 to 2008.^{10,11}

Figure 8: Pressure Ulcer Treatment Cost Analysis

Description	Stage	2008 Cost of HAPU Treatment	
		Low Cost	High Cost
Stage I: Nonblanchable erythema	Stage I, Stage II	Low Cost	\$200.00
Stage II: Partial-thickness skin loss		High Cost	\$800.00
Stage III: Full-thickness tissue loss	Stage III, Stage IV, Unstageable	Low Cost	\$21,500.00
Stage IV: Full-thickness tissue loss with exposed bone, tendon or muscle		High Cost	\$35,000.00
Unstageable: Full-thickness tissue loss in which the base of the ulcer is covered by slough and/or eschar in the wound bed			

Results

Risk Analysis-Braden Scale Scores and Age

A random sample of incontinent patients admitted four months before and four months after February 1, 2008 was selected for comparison of Braden scores and age. Incontinent patients admitted between October 1, 2007 and Jan 31, 2008 had an equivalent mean Braden Scale risk score and age compared to incontinent patients admitted February 1, 2008 to May 31, 2008 (Significance $p > 0.05$):

Independent T-Test, Braden Scale Scores

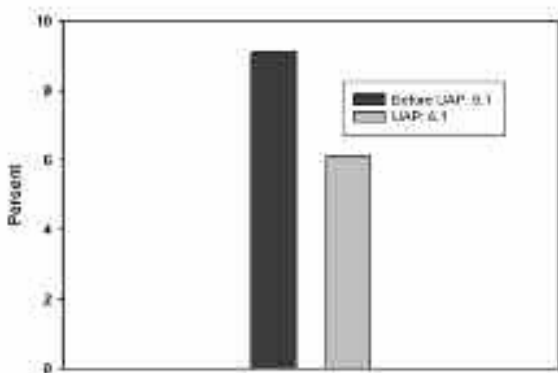
Group	N	Mean	Std. Dev.	Sig. (2-tailed)
Before UAP	250	13.70	3.59	0.535
UAP	310	13.50	3.80	

Independent T-Test, Age

Group	N	Mean	Std. Dev.	Sig. (2-tailed)
Before UAP	309	80.88	10.47	0.556
UAP	434	80.32	13.50	

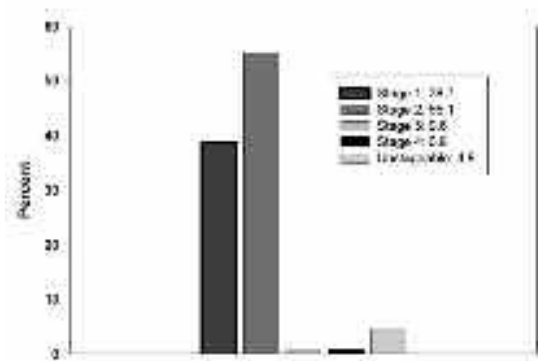
Incidence of Hospital Acquired Pressure Ulcers

The average incidence of HAPU's in incontinent patients admitted to NYM from October 1, 2007 to January 31, 2008 and February 1, 2008 to May 31, 2008 is 9.06% and 6.14%, respectively. That is a 32% decline in HAPU's from the before period to after period:

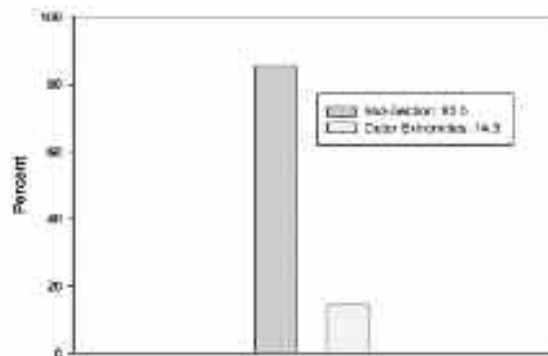


Pressure Ulcer Severity and Anatomical Location

HAPU's that developed during both periods were predominately stage 1 and 2 in severity:

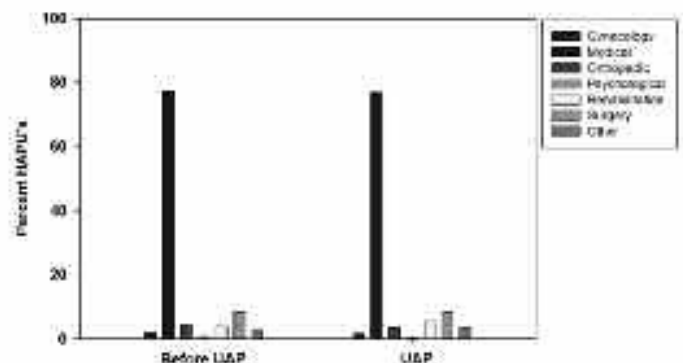


There were more ulcers formed in the mid-section of the body (hip, trochanter, sacrum, buttocks, and lower back) than outer extremities (legs, feet, head,



Prevalence of Pressure Ulcers by Service

There is an equivalent percentage of HAPU's formed by hospital service ($\chi^2 = 0.247$) during the period before Ultrasorbs® AP and after:



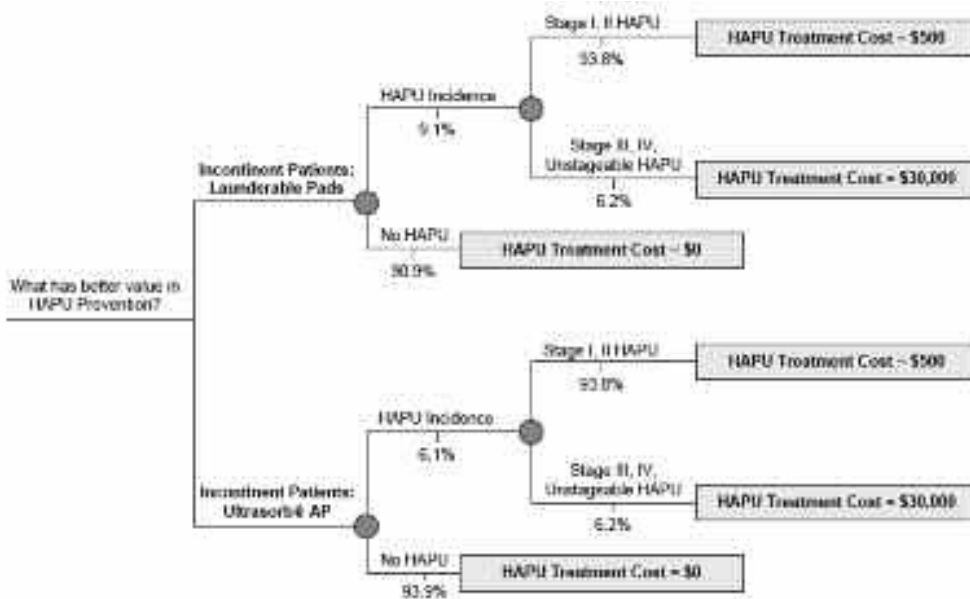
Expected Value Decision Analysis

In the decision model we used the following data for a base-case and sensitivity analysis:

Factor	Patient/Wound	Range		Reference
Probability of HAPU with use of Ultrasorbs® AP	Incontinent	Low	5.1%	NYM Data
		Base	6.1%	
		High	7.3%	
Probability of HAPU with use of Launderable Pads and Blue Chux	Incontinent	Low	8.0%	NYM Data
		Base	9.1%	
		High	10.4%	
Probability of Stage I or II HAPU	HAPU	93.8%		NYM Data
Probability of Stage II, III or Unstageable	HAPU	6.2%		NYM Data
Cost of HAPU Treatment	Stage I and II Combined	Low	\$200	Beckrich 1999, ¹⁰ Inflation Calculator ¹¹
		Base	\$500	Beckrich 1999, ¹⁰ Inflation Calculator ¹¹
		High	\$800	Beckrich 1999, ¹⁰ Inflation Calculator ¹¹
	Stage III, IV and Unstageable Combined	Low	\$21,500	Beckrich 1999, ¹⁰ Inflation Calculator ¹¹
		Base	\$30,000	Beckrich 1999, ¹⁰ Inflation Calculator ¹¹
		High	\$35,000	Beckrich 1999, ¹⁰ Inflation Calculator ¹¹

A simple decision tree model is used to calculate the expected value (cost savings from reduced HAPU treatment) for each time period. The base model and calculations:

$$\text{Launderable Pad Cost per Incontinent Patient Admitted to Prevent HAPUs} = (.091^{**}((.938^{**}\$500^{\circ}) + (.062^{**}\$30000^{\circ}))) + (.909^{**}\$0^{\circ}) = \$212.00$$



$$\text{Ultrasorbs® AP Cost per Incontinent Patient Admitted to Prevent HAPUs} = (.061^{**}((.938^{**}\$500^{\circ}) + (.062^{**}\$30000^{\circ}))) + (.939^{**}\$0^{\circ}) = \$142.00$$

^a HAPU incidence launderable pads; ^b Incidence of Stage I,II HAPU's; ^c Avg. cost of treatment for stage I,II HAPU; ^d Incidence of stage III,IV, unstageable HAPU's; ^e Avg. cost of treatment for stage III,IV, unstageable HAPU; ^f No HAPUs; ^g Cost of no HAPU is \$0.0; ^h HAPU incidence Ultrasorbs AP

The expected value for HAPU prevention of Ultrasorbs® AP compared with the use of launderable pads and blue chux pads is estimated at a savings of \$70.00 per incontinent patient admitted to the hospital (see Figure 9).

Sensitivity Analysis

Probabilities and costs were changed one at a time in the model based on plausible ranges of probabilities of occurrence and cost.

Testing Sensitivity of *Ultrasorbs® AP* Probability of HAPU

Sensitivity analysis shows a robust outcome attributed to switching from launderable pads and blue chux to Ultrasorbs® AP exclusively. Using plausible ranges of HAPU incidence (probabilities), we demonstrated consistent savings of Ultrasorbs® AP. The minimum cost savings is \$42.00 and maximum \$100.00 per incontinent patient admitted to NYM. If the HAPU incidence was equivalent there would be no savings (see Figure 10).

The main effect variable in the model is the incidence of HAPU's.

Figure 9: Value for HAPU prevention of *Ultrasorbs® AP*

Launderable Pad cost per Incontinent Patient	\$212.00
- Ultrasorbs® AP cost per Incontinent Patient	<u>-\$142.00</u>
Cost Savings per Incontinent Patient with Ultrasorbs® AP	=\$ 70.00

Figure 10: Testing Sensitivity of *Ultrasorbs® AP* Probability of HAPU

	Probability of HAPU with Launderable Pads and Blue Chux	Probability of HAPU with Ultrasorbs® AP	Savings Attributable to Ultrasorbs® AP (per Incontinent Patient Admitted)	Cost with Launderable Pads and Blue Chux	Cost with Ultrasorbs® AP
Study Findings	9.1	6.1	\$70.00	\$212.00	\$142.00
Other Scenarios Reviewed	9.1	5.1	\$93.00	\$212.00	\$119.00
	9.1	7.3	\$42.00	\$212.00	\$170.00
	9.1	9.1	\$0.00	\$212.00	\$212.00
	8.0	6.1	\$44.00	\$186.00	\$142.00
	9.1	6.1	\$70.00	\$212.00	\$142.00
	10.4	6.1	\$100	\$242.00	\$142.00

Testing Sensitivity of HAPU Treatment Costs

Changing HAPU treatment cost does not have a significant effect on the difference in this evaluation. We have used conservative cost estimates in the HAPU prevention model. Clearly, if the cost of pressure ulcer treatment goes up there is a greater savings potential for the hospital using Ultrasorbs® AP. In fact, this is true for any product or program where a reduction in HAPU's occurs (see Figure 11).

Testing Sensitivity of HAPU Severity (Stage I, II Incidence)

In this evaluation there was a high percentage of HAPU's that were stage I or II. If the proportion of HAPU's shifted to greater severity (lower probability of stage I or II) then the expected value and cost savings of Ultrasorbs® AP becomes much higher than launderable pads (see Figure 12).

Figure 11: Testing Sensitivity of HAPU Treatment Costs

Factor	Wound	Range		Expected Value \$ Savings per Incontinent Patient per LOS
Cost of HAPU Treatment	Stage I and II Combined	Low	\$200	\$61.00
		Base	\$500	\$70.00
		High	\$800	\$79.00
	Stage III, IV and Unstageable Combined	Low	\$21,500	\$54.00
		Base	\$30,000	\$70.00
		High	\$35,000	\$79.00

Figure 12: Testing Sensitivity of HAPU Severity (Stage I, II Incidence)

	Probability of Stage I or II Outcome	Expected Value Ultrasorbs AP	Expected Value Launderable Pads	Cost Savings (per Incontinent Patient Admitted)
Study Findings	93.75%	\$143.00	\$213.30	\$70.30
Other Scenarios Reviewed	75.00%	\$480.40	\$716.60	\$236.20
	81.25%	\$367.90	\$548.80	\$180.90
	87.50%	\$255.40	\$381.10	\$125.70
	100.00%	\$30.50	\$45.50	\$15.00

TOTAL COST SAVINGS AND BUDGET IMPACT

Total Cost Savings

The total cost savings attributed to using Ultrasorbs® AP is \$96.72 per incontinent patient admitted to NYM:

Cost	Savings per Incontinent Patient per LOS
Materials, Nursing Labor, Laundry and Waste Disposal - (Page 6)	\$26.72
HAPU Prevention – (Page 12)	\$70.00
Total Hospital Savings per Incontinent Patient per LOS	\$96.72

Budget Impact

New York Methodist Hospital treats approximately 8,000 incontinent patients per year. The budget impact is estimated at \$773,760.00 per year directly related to improved performance of managing incontinence with Ultrasorbs® AP.

8,000 Incontinent Patients * \$96.72 = \$773,760.00
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SUMMARY

We investigated the economic impact of Ultrasorbs® AP at NYM comparing the launderable and blue chux pads used four months before implementation of Ultrasorbs® AP and four months after. The main clinical endpoint is prevention of hospital acquired pressure ulcers (HAPU's). Considering the expenditures to treat patients with HAPU's and the lack of reimbursement from Medicare and Medicaid Services, the major economic impact is cost of HAPU treatment.

A retrospective review of medical records from incontinent patients admitted to NYM demonstrated the incontinent population had similar risk characteristics for HAPU's using Braden Scale scores four months before Ultrasorbs® AP and four months after ($p=.535$). Age is also a factor for HAPU breakdown. The average age of incontinent patients admitted before and after is 80.88 and 80.32 respectively ($p=.556$). All patients at NYM, in both periods received equivalent HAPU prevention methods recommended by the NPUAP. The only difference was a switch to Ultrasorbs® AP February 1, 2008.

Although Ultrasorbs® AP cost more than launderable pads and blue chux, nursing labor and laundry costs dropped. Waste disposal cost increased due to the high absorbent capacity of Ultrasorbs® AP. The estimated cost savings from labor, materials, laundry and waste removal attributed to using Ultrasorbs® AP is \$26.72 per incontinent patient admitted to NYM.

The HAPU incidence dropped 32% to an average of 6.1% after Ultrasorbs® AP was implemented and remains at that level today. The expected value across the incontinent population admitted to NYM is \$70.00 per incontinent patient due to reduction in treatment costs of HAPU's.

Finally, the overall net economic impact realized from Ultrasorbs® AP is \$96.72 per incontinent patient admitted to NYM. With approximately 8,000 incontinent patients admitted on a yearly basis, the budget impact to NYM is \$773,760.00.

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