

Improving Quality of Care and Reducing Cost Burdens Through NPWT Management Automation

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Objective

To demonstrate the patient care benefits of an automated Negative Pressure Wound Therapy (NPWT) inventory management system through 43-month retrospective study at a Level 1 Trauma Center located in Tennessee.

Background

Standard NPWT Management Model

The most common management model for NPWT treatment requires the use of at least two devices, one in the hospital and another for when the patient needs to be discharged. The process often flows as follows:

- Hospital personnel are responsible to manually document care and usage for each patient
- Hospital pays a daily rental fee even if the device is used for only a few hours
- Patient discharge from hospital requires coordination between hospital and DME representative
 - DME must obtain insurance approval prior to discharge for outpatient care utilizing documentation provided by hospital
 - NPWT Unit for use during outpatient treatment must be delivered by Durable Medical Equipment (DME) provider
 - ◊ If outpatient unit is unavailable, then a transitional unit may be supplied resulting in an unnecessary charge/delay in care
 - An additional dressing change usually will be required to allow transition to an outpatient unit

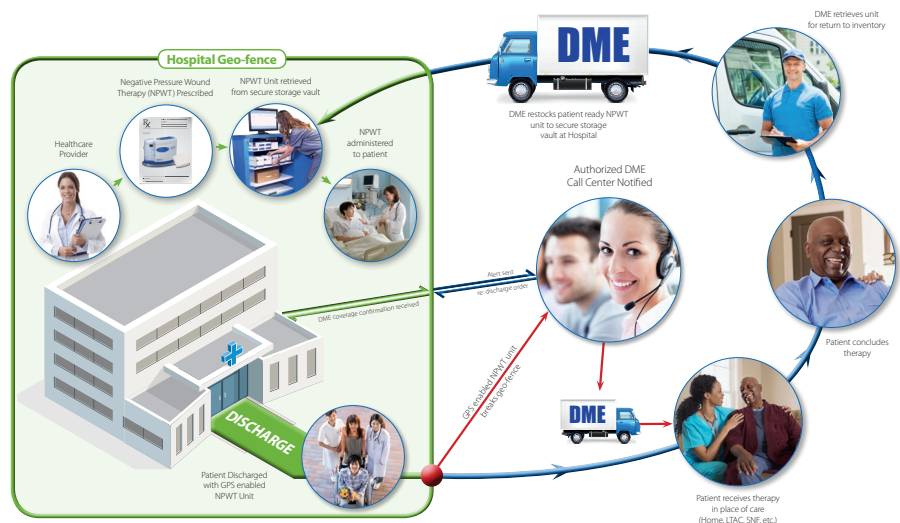
There are significant challenges in this model:

- Significant clinician time is required to complete paperwork and perform transitional dressing changes to allow discharge
- Errors in documentation can lead to lost or inaccurate charges or delay in discharge
- If insurance denies coverage or discharge process is delayed, then hospitalization is prolonged and medical costs are increased
- Further complicating this process, multiple DME companies provide units to a hospital for outpatient NPWT

Automated Negative Pressure Wound Therapy (NPWT) Management Model

- Automated inventory management system for NPWT developed to address limitations of standard NPWT management model
- GPS and RFID enabled NPWT units allow for inpatient and outpatient care utilizing **one pump**
 - Unit management is automated via a cloud-based software system
 - Units placed in secured inventory cabinets located on site at hospital
 - System minimizes involvement of hospital personnel in managing NPWT units and eliminates most paperwork
- Automated NPWT Management Workflow
 - Unit removed from secured location and digitally assigned to patient by hospital personnel
- System begins tracking patient days on therapy ensuring accurate rental days
- System securely transfers electronically encrypted medical information to an in-network DME to expedite insurance approval process
 - at start of therapy
- At discharge, patient is sent home with inpatient unit and one week of dressing supplies
 - Transition to outpatient care managed by DME occurs automatically when patient leaves hospital utilizing GPS signal
 - At conclusion of therapy, DME retrieves, reprocesses, and returns unit to the secured inventory location
- System automatically increases/decreases number of units available in secured location based on hospital utilization
- Dressing Supplies also RFID tagged to track patient supply needs once discharged

One Patient
=
One Pump



Methods

- Designed as a retrospective interrupted time series to evaluate impact of automated NPWT system compared to the standard system.
 - Pre-Intervention Period: Feb 2015 – Jan 2017: (442 NPWT Cases)
 - Post-Intervention Period: Feb 2017 – August 2018: (531 NPWT Cases)
- Pre-Intervention system:
 - Hospital utilized hand documented logs for NPWT vendor to determine daily billing per unit
 - Discharge to outpatient care was affected by dressing changes, DME wait times and lack of pre-approvals
- Post-Intervention System:
 - RFID/GPS enabled NPWT Units maintained in one secured inventory location (67 Units)
 - Dressing supplies and discharge kits RFID tagged and maintained in second secured inventory location
 - ◊ System automatically replenished dressing supplies and discharge kits based on usage
 - Tablet used to capture e-signature for receipt of supplies
- Data Analysis:
 - Outlier data removed to minimize bias.
 - Segmented linear regression was to model pre-intervention and post-intervention means:
 - ◊ Clinical Outcomes: Length of Stay, Average Case Cost, Number of Dressing Changes per Patient
 - ◊ Quality Metrics: Complication Rate, Readmission Rate, and Mortality Rate
- Significant differences between periods were identified with the Wald test

RESULTS

• The GPS/RFID Inventory Management System accurately tracked utilization of 531 patients receiving NPWT

- Number of NPWT patients managed by system increased from 18.21 patients per month to 27.95 patients per month
- Despite increased utilization, complication rates, readmission rates, and mortality rates remained unchanged (Table 3).

• Decreased hospitalization duration by automating discharge process:

- The system significantly reduced geometric length of stay by 1.47 day (p-value: 0.0125) per patient
- Reduction in length of stay represents approximately **780 hospital days saved** post implementation
- Average case cost reduced by \$3,361.39 per patient

• Observed reduction in number of dressing changes per patient

- Patient utilization increased 53.5%
- Days on therapy decreased resulting in an average savings of \$3630 per patient
- Dressing changes per case reduced by 0.22 (p-value: 0.37) representing a 6% reduction
 - ◊ 116 eliminated dressing changes
 - ◊ Estimated Clinical time saved (45 minutes per dressing) 87 hours

Table 1: Savings actualized over post intervention period

	Per Patient	Total Post-Implementation (531 Patients)
Days Saved	1.47 days	780 days
Dressing Change Reduction	0.22 dressing change	116 dressing changes
Dollars Saved	\$ 3,361.39	\$1,784,898

Table 2: Automated NPWT System reduced length of stay and overall case costs

Time Period	Geometric LOS (Days)	Geometric Case Cost	Dressing Changes/Case
Pre-Intervention	12.96	\$20,820.35	3.74
Post Intervention	11.48	\$17,458.96	3.52
Difference	1.47	\$3,361.39	0.22
p-value	p=0.0125	p=0.073	p=0.37

Table 3: Change to Automated NPWT System had no effect on complication, readmission, and mortality rates

Time Period	Complication Rate	Readmission Rate	Mortality Rate
Pre-Intervention	22.53%	15.12%	2.11%
Post Intervention	22.41%	16.63%	1.94%
p-value	p=0.965	p=0.947	p=0.855

Discussion and Conclusion

- Automated NPWT Management System improved care efficiencies and reduced cost
 - Decreased dressing changes for patients improving quality of care
 - Onsite home-health kits removed barriers to discharge
 - GPS management of NPWT devices eliminated lost pumps (5/year average) representing cost avoidance (~\$70,000/year)
 - System dashboard enables monitoring of real-time usage with meaningful reporting analysis capabilities
- System allowed medical center to **eliminate approximately 780 inpatient days** and realize an **estimated \$1,784,813 cost savings** during the study