

# Assessing the Need for Negative Pressure Wound Therapy Utilization Guidelines: An Overview of the Challenges With Providing Optimal Care

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## ABSTRACT

Negative pressure wound therapy (NPWT) has evolved beyond its original design as a stationary, reusable system (traditional NPWT [tNPWT]) and is now also available as a single-use, portable device (sNPWT). No established guidance exists for selecting the appropriate system to treat specific wound types in various settings. This article reviews the current practice and challenges associated with NPWT. Relevant literature was reviewed to provide a background on current practice. An online quantitative survey was performed during October and November 2018 among users of NPWT based in acute care settings across 6 countries (Australia, France, Germany, Italy, the United Kingdom, and the United States) to elucidate the operational and financial components considered in determining and/or thwarting efficacious use of NPWT. Data from recruited participants were collected, analyzed, and tabulated by an independent research company. All findings were reported as numbers/percentages. Wound size and depth, as well as the amount and/or type of exudate, were found to be among key factors in selecting NPWT; patient quality of life in terms of mobility, independence, and attitude toward treatment may be factors in adherence with prescribed care. Clinicians were not consistently knowledgeable about the financial and operational challenges of utilization presented by large fleets of NPWT pumps, nor were other institutional employees such as payers and discharge planners. Evidence-based recommendations are needed to guide decisions regarding NPWT systems, which in turn may improve therapy implementation, access to care, and patient quality of life, while driving operational and financial efficiencies for health care providers.

## KEY WORDS

negative pressure wound therapy, single-use negative pressure wound therapy, wound management, quality of life, operational efficiencies, financial efficiencies

## INDEX

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From its inception, and given the evidence that it is an efficacious component in wound healing, negative pressure wound therapy (NPWT)—a wound care system that comprises a sealed dressing to which negative pressure is applied—has been utilized and studied in a variety of clinical and research scenarios. It has been shown to help foster a favorable environment for wound healing by promoting moist wound healing, improving tissue perfusion, stimulating tissue granulation and angiogenesis, and changing the bacterial environment.<sup>1</sup>

In its original or traditional design (tNPWT), NPWT is useful for a variety of

wound types, per a wide-ranging review by Apelqvist et al.<sup>2</sup> It has been shown to be effective in acute wounds resulting from abdominal<sup>3</sup> and cardiac surgery,<sup>4</sup> and it is an important component of the armamentarium necessary to manage complex, nonhealing wounds such as diabetic foot ulcers (DFUs),<sup>5</sup> venous leg ulcers (VLUs),<sup>5</sup> pressure injuries,<sup>6</sup> complex orthopedic surgical and trauma wounds,<sup>7</sup> and burns.<sup>8</sup> A large retrospective study (N = 1107) has demonstrated that 2 available commercial systems were found to deliver comparable clinical outcomes in a broad range of chronic and acute wounds.<sup>9</sup> A further study

in acute and chronic wounds also concluded that there were no significant differences between the 2 devices being studied.<sup>10</sup>

Over the years, improvements have been made to the way NPWT can be delivered, which enhanced the capabilities of NPWT devices, giving clinicians providing care more choices and improving the experiences of patients undergoing treatment. Traditional NPWT is considered to comprise a dressing system that includes a wound filler (that may be foam or gauze) applied to a wound that is then sealed with an adhesive drape to which subatmospheric pressure is delivered using a reusable powered pump.

The clinician can choose a specific pressure setting to be delivered continuously or an upper and lower range that is delivered intermittently for predetermined defined periods of time. The fluid drawn from the wound using the “negative” pressure is collected into a canister by a tubing. Evolving incarnations of NPWT devices now include single-use disposable systems (sNPWT) and NPWT with instillation (NPWTi) in which a solution is infused and allowed to dwell in the wound for a determined time period. Negative pressure wound therapy also has been combined with other treatments such as silver-impregnated dressings,<sup>11</sup> dermal regenerated matrix dressings,<sup>12</sup> and skin grafts.<sup>13</sup>

Negative pressure wound therapy is often considered to be an expensive wound management option; however, its cost effectiveness can be measured in decreased length of hospital stay, less frequent dressing changes, and fewer complications and/or additional surgeries.<sup>14</sup> In addition, research has shown various forms of NPWT are cost-effective in wounds of various etiologies, as noted in a retrospective review<sup>15</sup> and a long-term care cost utilization study.<sup>16</sup>

### CLINICAL CHALLENGES FOR PROVIDERS AND PATIENTS

Negative pressure wound therapy is not without challenges, including the need for regular replacement of the filler, which necessitates (often painful) dressing changes that are generally associated with the ingrowth of granulation tissue into the foam filler as observed in animal models<sup>17</sup>; device size and the need to be plugged to a power supply, limiting mobility; and low patient tolerance.<sup>18</sup> These concerns can impact patient quality of life. Fagerdahl<sup>19</sup> found NPWT-associated pain could be reduced with the use of a gauze filler. Kim et al<sup>20</sup> noted patients may lack confidence in the ability of their health care provider to implement NPWT treatment, owing to the fact that staff expressed concerns about lack of training and experience with the NPWT system. In addition, the device may be difficult and costly to procure.<sup>21</sup> A systematic review of the relevant literature<sup>18</sup> found patients may want to

terminate tNPWT because it restricted their movement, lowered their self-esteem, raised their dependency on others, and lessened their self-control; treatment anxiety also played a role.

Advancements and modifications to NPWT systems have addressed several of these issues: single-use (sNPWT) pumps are smaller than tNPWT pumps and lighter; may be battery or mechanically powered, thus not requiring a main power supply; and may function without the need for a canister because excess fluid evaporates through the outer layer of the dressing, all contributing significantly to enhanced portability.

### SINGLE-USE NPWT

There is now considerable evidence to show that sNPWT is an effective prophylactic treatment for the prevention of surgical site infection in closed incisions.<sup>22-25</sup> Evidence is growing to demonstrate that sNPWT can be as effective, if not more effective, compared with tNPWT in the management of chronic lower extremity wound such as VLU and DFUs.<sup>5,26</sup> Single-use NPWT was found to be appropriate for low to moderately exuding wounds that fit within the dressing and are no deeper than 4.5 cm.<sup>27</sup> In addition, sNPWT can be used on a range of closed incisions involving the knee, hip, abdomen, and thorax as long as the dressing conforms to the dimensions of the region.<sup>28</sup> A key factor in determining whether sNPWT can be placed in lieu of tNPWT is the amount of wound exudate: sNPWT is indicated for low to moderately exuding wounds.

### Patient quality of life

Pain is a frequently mentioned factor in the decision of whether to use NPWT.<sup>29</sup> Patient discomfort has been shown to be lessened when gauze is used as a filler rather than foam.<sup>21</sup> Single-use NPWT systems that function without the need for a wound filler can negate much of the pain associated with dressing changes as well as allow the dressing to remain in place undisturbed for up to 7 days.<sup>6</sup> A retrospective cohort study<sup>30</sup> showed patients provided with a sNPWT device that had a dressing with a

silicone-based wound contact layer did not complain of pain or discomfort.

The size and portability of sNPWT offers greater patient freedom and less interruption to activities of daily living. For example, the study conducted by Hurd et al<sup>31</sup> showed that among 326 home care patients treated with PICO (Smith + Nephew), more than 90% were able to shower/bathe, 93% could perform daily activities, 99.7% did not report discomfort during wear, and 97.5% were pleased with treatment with the sNPWT system.

### Practitioner feedback

The Hurd et al<sup>31</sup> study of home care patients also showed most nurses (82%) were pleased with the sNPWT system; 86% found the dressing was easy to apply. In addition, changes to clinical practice due to the COVID-19 pandemic have shown how sNPWT can be used to successfully manage patients in the community, reducing the frequency of visits to the outpatient department for dressing changes.<sup>32</sup>

### CHOOSING THE APPROPRIATE NPWT SYSTEM

Before commencing the therapy, clinicians must decide which NPWT system is appropriate to achieve the treatment and patient objectives. During treatment with NPWT, regular wound assessment is necessary to monitor progress and identify patients suitable to transition to another form of NPWT or perhaps to a more conventional dressing, such as an absorbent foam, depending on both patient and wound needs. A multicenter, randomized study of 164 patients with VLUs or DFUs treated with either sNPWT or tNPWT showed sNPWT produced statistically significant improvement in wound progression toward healing over the treatment period; the authors concluded it should be chosen over other types of NPWT for these types of wounds.<sup>5</sup> Increasingly, sNPWT is being applied in the primary and home care setting, where it is described as having the potential to improve the efficacy of wound management and help reduce the reliance on hospital-based care.<sup>28</sup>

While the decision to select one type of NPWT over another is fundamentally based on wound- and patient-related considerations, clinicians' decision making is progressively more influenced by operational and practical considerations concerning the implementation of the therapy. For example, research by Dowsett et al<sup>33</sup> recognized that while nurses are most commonly tasked with wound management, semi-structured interviews conducted among nurses noted standardized training on NPWT was lacking, particularly in the areas of improving knowledge and understanding of appropriate use beyond the basic evidence for treatment; pump management; formal, interactive training; and healing efficacy.<sup>34</sup> Recent nurse guidance publications<sup>35</sup> inferred NPWT involved numerous steps, was labor intensive, and was far from risk-free, particularly among patients who are elderly and/or ill. However, nurses recognized the benefits of NPWT; in a prospective, multicenter, non-comparative clinical investigation (N=152 patients) by Hurd et al,<sup>36</sup> NPWT relieved nursing burden and improved patient quality of life (NPWT reduced pain and odor), with most wounds (91%) progressing toward healing.

### ECONOMIC CONSIDERATIONS

Delhougne et al<sup>37</sup> explored the economic ramifications of using different forms of NPWT and showed there was a considerable economic benefit to using sNPWT. Wilkins et al<sup>38</sup> underscored operational issues such as low NPWT system utilization, pump losses, billing disputes, and the time necessary to manage logistics and length of hospital stay, along with the complexities and costs inherent to discharge with tNPWT pumps.

Discharge planners are rarely, if ever, mentioned in the NPWT literature, yet they play a key role in wound management beyond the acute care settings, ensuring (1) patients have an appropriately timed discharge with access to the products (such as NPWT) necessary to remain on the desired trajectory in the care continuum and (2) the health care institution is paid for the services and products provided.

**Table. Overview of survey respondents (all from acute care settings)**

RESPONDENTS	NUMBER (%), N=346
<b>Clinicians</b>	<b>185</b>
Doctors/surgeons	95 (27%)
Nurses	90 (26%)
<b>Nonclinical personnel</b>	<b>161</b>
Procurement/ Finance managers/ directors Pharmacist Pharmacy technician Payer	146 (42%)
Medical engineering/equipment management	15 (4%)

ed. In addition, discharge planners must safely navigate NPWT insurance coverage, and discharge pathways must consider the way in which NPWT is accessed, paid, or reimbursed within the particular facility. Notable differences exist based on the facilities reliance on private insurance or public health care reimbursement systems; within countries, the relationship between payers and providers can prove variable and complex to navigate.

Also, discharge planning must commence while determining patient capability to adhere to the therapy and the recommended setting in which post-acute care should be provided. Safe and expeditious discharge impacts both the clinical and financial well-being of patients and the health care institutions that serve them. A systematic review of quantitative, qualitative, and health economic studies found that extra days spent in the hospital are responsible for almost 31% of total costs, the cancellation of elective procedures, and delays in treatment, all of which affect the provision of services, especially for older patients.<sup>39</sup>

With these clinical and financial considerations in mind, it has become ever more important to raise awareness of the need to both justify the value of NPWT in clinical practice and to recognize and address the challenges and inefficiencies in the provision of NPWT versus alternative therapies.

### OBSTACLES TO NPWT SELECTION AND USE

To better understand the obstacles to

tNPWT system selection and use, an independent survey was commissioned by Smith + Nephew to examine the clinical, operational, and financial factors involved in tNPWT decision-making.<sup>40</sup> The online survey was conducted by Kantar in October and November 2018, with the sponsor remaining anonymous to the survey participants. Ethnographic research identified stakeholders who were involved in the clinical, operational, and financial aspects of NPWT. Number and percentages were reported.

### SURVEY RESULTS

In total, there were 346 respondents to the survey from 6 countries (Australia, France, Germany, Italy, the United Kingdom, and the United States; **Table**). Most respondents used 3M + KCI systems (72%) or Smith and Nephew systems (26%). The survey determined 3 main problems associated with tNPWT: (1) lost and/or misplaced pumps due to patient transfer/discharge to other wards or facilities; (2) low fleet utilization when pumps were not promptly returned, not properly stored, or went unused; and (3) lack of visibility of the therapy provision (ie, a lack of patient monitoring systems). Overall, 40% of respondents had no way to track pump utilization, with an additional 20% not being sure if tracking was possible. The greatest challenge reported by clinicians concerned handling pump logistics, while non-clinicians had the most problems with managing patient

discharge with a tNPWT pump and fleet optimization. The aforementioned challenges were found to have an impact on human resources involved in the overall provision of care, with nonclinical respondents reporting they spent, on average, more than 5 hours a week managing administrative tasks related to tNPWT.

Across all respondents, nearly 20% reported having lost tNPWT pumps in the previous year; of which, nearly one-third confirmed having paid for lost pumps. Overall, 10% of tNPWT fleets are believed to get misplaced and eventually lost over the course of 1 year, adding to workload and financial implications burdening the provision of care while underscoring the need for better tNPWT fleet management. Queries and disagreements over costs of NPWT also were highlighted by survey participants who had oversight of billing; on average, 11% of NPWT invoices were disputed.

## DISCUSSION

Evidence shows that tNPWT and sNPWT are viable options for use in wound care in a variety of wound types and across multiple settings. Although evidence supports the use of both forms of NPWT and despite the broad availability of NPWT systems, no clear clinical decision-making guidelines have been established as to what constitutes the best system for a specific scenario—for example, whether sNPWT should be the first choice based on the evidence or whether tNPWT should subsequently be replaced by sNPWT and at what point. In short, guidelines are lacking with regard to when to initiate, change, or discontinue NPWT use in acute and chronic wounds, or whether to initiate treatment with a tNPWT or sNPWT device, and when to transition between the 2 types. Treatment strategies should include minimizing the amount of time NPWT is used and focusing on the treatment objectives of NPWT use. Ways to identify appropriate measures to know when these objectives are met and establish a decision point for when treatment should be discontinued or switched between sNPWT or NPWT devices are needed.

In addition, patient quality of life

concerns, along with nursing perceptions that NPWT can be difficult to properly apply, remain obstacles to confident use. The independent survey showed clinical and nonclinical stakeholders had limited knowledge of the operational and financial ramifications of tNPWT fleet management, which were found to negatively impact human resources, access to care, and patient discharge. The 3-phase pilot evaluation of pump management and utilization in a large UK health trust by Wilkins et al<sup>38</sup> investigated possible solutions to misplaced/lost pumps and low pump usage and provided insights into ways to improve clinical and operational processes.

The online survey shed some light on concerns about funding and accessing NPWT. The COVID-19 pandemic has underscored the need for NPWT in terms of healing and preventive therapy to reduce the amount of complications, surgical interventions, length of stay, wound dressings changes, and contact between patients and medical personnel. Experts also are providing guidance to help address confusion, misinformation, and misperceptions about reimbursement for NPWT, reflecting uncertainties that might be reconciled through clear clinical recommendations. The World Union of Wound Healing Societies<sup>41</sup> developed a consensus document that highlights the factors that need consideration when choosing the appropriate negative pressure system, but this document is limited to amount and type of exudate; operational and financial components also should be part of the decision. An international group of expert clinicians<sup>42</sup> developed recommendations for optimal use of tNPWT versus sNPWT, basing their guidance on wound size, exudate level, density of exudate, and location of the wound; again, their determinations did not address operational and financial factors.

Choosing between NPWT options can be challenging; individual patient factors should determine whether tNPWT or sNPWT is appropriate and at what stage of wound healing each type of NPWT is most beneficial.

Further research that incorporates what is known about the various types of NPWT,

along with clinical and economic considerations, will enhance clinicians' understanding of the impact of NPWT selection and ultimately improve wound management outcomes for patients.

## LIMITATIONS

The current state of knowledge and practice creates a paradigm of care; it is possible innovation and changes in health care delivery might alleviate some of the challenges associated with NPWT use.

## CONCLUSIONS

An assessment was conducted of the benefits and challenges of incorporating tNPWT and sNPWT into wound management based on what is shown in the current published literature along with the results of an international survey conducted among the stakeholders involved in their use. Findings elucidated concerns regarding a lack of (1) clinical guidance with regard to which type of system to utilize for different wound types and care settings and (2) knowledge of solutions to address financial and operational inefficiencies correlated to the utilization of tNPWT devices. Exudate management and patient quality of life were found to be key clinical factors in determining which system to utilize. Administrative issues such as lost or damaged pumps, the discharge process, and the implications of additional length of stay and cost along with perceptions that NPWT use can be complicated, may thwart effective utilization. Additional research to establish evidence-based recommendations and guidelines for the most efficacious and effective use of tNPWT and sNPWT use is warranted. **W**

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