

Evaluation of the impact of restructuring wound management practices in a community care provider in Niagara, Canada

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ABSTRACT

The burden of chronic wounds is substantial, and this burden is set to increase as the population ages. The challenge for community health services is significant. Wound care is labour intensive, and demand for services is set to increase at a time when the availability of nursing resources is likely to be severely limited. In March 2005, the Niagara community health care provider implemented a radical reorganisation of wound management practices designed to ensure that available resources, particularly nurse time, were being used in the most efficient way. An evaluation of the impact of the reorganisation has shown improvements in clinical practice and better patient outcomes. The use of traditional wound care products reduced from 75% in 2005 to 20% in 2007 in line with best practice recommendations, and frequency of daily dressing changes reduced from 48% in 2005 to 15% in 2007. In a comparison of patients treated in 2005 and 2006, average time to healing was 51.5 weeks in 2005 compared with 20.9 weeks in 2006. Total treatment cost was lower in 2006 by \$10 700 (75%) per patient. Overall, improvements in wound management practice led to a net saving of \$3.8 million in the Niagara wound care budget.

Key words: Canada • Community care • Evaluation • Niagara • Wound management

INTRODUCTION

Objectives

The prevention and care of chronic wounds, including pressure ulcers, venous and arterial leg ulcers, diabetic foot ulcers and surgical site infections, is recognised as a major priority by a growing number of Canadian health care organisations. Increasingly, work is underway to better understand the negative impact of

chronic wounds on patient health and well-being and the substantial burden wound care places on health care staff and organisations. As this understanding evolves, opportunities to improve wound prevention and management are gradually being identified and exploited.

These relatively recent developments follow many years during which the costs of chronic wounds – to both patients and health care institutions – were poorly understood and access to best practice methods and technologies was inconsistent. Wounds were managed by nurses and other clinicians and caregivers without essential systems of support such as specialised clinical training, links to allied health care professionals, established best practice guidelines, measuring and monitoring tools and focused commitment from health care organisations.

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Early efforts to improve wound care have met with some success while also highlighting the difficulties and challenges associated with implementing wound management measures in contemporary health care environments. Initial efforts have focused primarily on the introduction of advanced products and technologies into the clinical setting, a strategy that has been effective in other areas of health care. New products such as dressings based on moist wound-healing principles and new technologies such as negative pressure therapies have produced results in some cases. These early efforts have also raised questions about whether these results can be sustained on a permanent basis.

Wound care has traditionally been an integral part of basic nursing, and any attempt to improve wound management must therefore address fundamental issues of nursing practice that go well beyond selection of products and technologies. Effective and sustainable solutions must necessarily involve comprehensive management approaches, led by nurses and physicians but fully supported by health care administrations, with networks across sectors and disciplines.

This study presents an evaluation of the implementation from 2005 of a comprehensive approach to advanced wound management in a community health care setting in Southern Ontario. The Niagara Community Care Access Centre (CCAC) implemented a broad multifaceted strategy, including diverse measures ranging from the implementation of evidence-based best practices at the clinical level to the development of networks involving physicians and allied medical professionals, to the introduction of systems for measuring, monitoring and evaluating wound management products, technologies and therapies. Data collection and analysis over a period of more than 2 years have produced findings related to implementation issues, clinical outcomes, patient health and quality of life, resource utilisation, access to the health care services in the community, programme sustainability and a number of areas for further investigation.

The burden of chronic wounds in Canada

Chronic wounds are common across all sectors of Canadian health care, and there is growing evidence that the burden of chronic wounds in Canada is already high and likely to increase.

The prevalence of pressure ulcers across all health care settings in Canada has been estimated at 26% (1). Most pressure ulcers are superficial, but a significant proportion involves severe tissue damage. A Stage 3 ulcer, for example, involves full-thickness skin loss, which may extend down to the underlying fascia. A Stage 4 ulcer shows extensive destruction, tissue death and/or damage to muscle or bone. A severe pressure ulcer can be life-threatening.

At least 1.3 million Canadians have diabetes – 4.4% of the population (2). Including undiagnosed cases, the total may be as high as 2 million. Approximately one in seven patients with diabetes will develop a foot ulcer at some time in their life (3). Foot ulceration carries with it a high risk of infection and amputation. The age-adjusted rate of lower limb amputation is estimated to be 15 times higher in individuals with diabetes than in the general population (4).

Leg ulceration has a number of underlying causes, but most are related to vascular deficiency. Based on local prevalence studies (5), it is likely that there are at least 45 000 individuals with an active leg ulcer at any time in Canada. Leg ulceration can be extremely painful and debilitating, and recurrence is common.

Surgical site infections are the third most common health care-acquired infection in Canada, after urinary tract infections and pneumonia (6). Among surgical patients specifically, the average rate of surgical site infection in Canada is 4.5%, and this represented 40% of all health care-acquired infections among these patients. The situation is made more significant by the growing presence of MRSA and other antibiotic-resistant infections. Between 1995 and 2003, MRSA rates increased in a sample of Canadian hospitals from 0.46 cases per 1000 admissions to 5.10 cases per 1000 admissions ($P = 0.002$) (7).

The prevalence of chronic wounds is strongly related to age (8), and forecast trends in the age distribution of the Canadian population mean that the number of patients with a chronic wound is likely to increase substantially in the future. The number of Canadians aged 65 years and above is expected to increase from 4.3 million today to between 8.9 and 9.4 million by 2031 (9). By that time, those aged 65 years and above will account for 23–25% of the total population compared with 13% today (9).

Wounds have major implications for patient health and quality of life. Wounds cause pain, suffering, sepsis, infection, nausea, fatigue,

depression, psychological disturbances, loss of function, loss of mobility and personal financial cost. In some cases, wounds may lead to amputation and even death (10). For many patients, wounds are a significant and preventable barrier to the successful recovery from, or management of, a wide range of medical conditions from routine surgical interventions to chronic conditions such as diabetes.

The implications for community care are particularly significant. Community care providers across Canada are attempting to deliver services to an ageing population facing a growing prevalence of chronic disease and disability. Most community care organisations in Canada face additional pressures as acute care facilities attempt to reduce the length of hospital stays and rely more heavily of community services. Overall, community care programmes must care for patients who are older, with more serious and complex health issues, and therefore at greater risk of wounds. At the same time, wound care is labour intensive, and wound care absorbs valuable and increasingly limited nursing resources, and this limits the ability of community programmes to expand services in line with constantly changing health care needs.

Despite the high costs to both patients and health care organisations, wounds are rarely identified as a top priority by health care administrations. The systems and resources have not yet been established to accurately measure wound prevalence and costs, to implement evidence-based clinical best practices, to provide organisation-wide support to clinicians or to monitor clinical outcomes.

The Niagara region

The Regional Municipality of Niagara includes a diverse urban/rural area that incorporates 12 local municipalities concentrated in the Niagara Peninsula of Southern Ontario. The total population is 430 000. The region faces a complex mix of demographic and socioeconomic pressures that have important implications for health care in general and wound care in particular. The population of Niagara is older than that of Ontario as a whole and is ageing at a faster rate. The median age in Niagara is 42.1 years compared with 39.0 years in Ontario as a whole (11). Data from the 2006 Canadian Census (11) show that the percentage of the population aged 65 years and above in Niagara is 17.7% compared with 13.5% for Ontario. If

population grows in line with the forecast for Canada as a whole, in the next 25 years, the proportion of the Niagara population aged 65 years and above is likely to double. The region also faces particular health challenges arising from a combination of factors – relatively low incomes, social isolation, lifestyle issues such as smoking and obesity and increasing prevalence of chronic diseases such as diabetes.

The comprehensive restructuring of wound management practices in the Niagara CCAC is evolving within this context. The demand for wound care is already high and likely to increase further. Wound management services that are efficient and clinically effective are seen as an important prerequisite for enabling the CCAC to offer greater access to the community and meet growing demands for an increasingly broad range of health services.

Niagara Community Care Access Centre

The Niagara CCAC was established in 1997 as the health care organisation responsible for the delivery of in-home health care. The CCAC coordinates care delivered by several private sector agencies. The organisation serves a patient population of about 20 000 per annum, with about 3000 on the patient roster at any given time. As this is written, the Niagara CCAC is in the process of being integrated into a larger Local Health Integration Network (LHIN).

Like many community care organisations in Canada, the Niagara CCAC has been under constant pressure to improve access, increase patient load, improve and expand services and provide services to patients with increasingly complex and acute medical conditions. The region has an ageing population with an increasing prevalence of chronic diseases. Hospitals in the region face constant pressure to improve patient turnaround, resulting in the transfer of many acute care patients back into the community more quickly than in the past.

In 2004, wound management was identified by the Niagara CCAC as an important priority and an opportunity to improve patient care, reallocate limited nursing resources and, ultimately, improve patient access.

CHANGING WOUND MANAGEMENT PRACTICES

Traditionally, wounds have been managed almost exclusively by nurses as a part of routine

care regimens. Surveys have showed wide variations in the clinical management of wounds (12,13), although the most common wound care therapies have been based on low-cost dry gauze dressings along with creams and other non advanced therapies.

The treatment of chronic wounds has not been considered a high priority beyond the nursing community. Nurses have typically managed wounds to the best of their abilities while lacking essential resources such as assessment tools and techniques, evidence-based best practice guidelines, advanced dressings and other wound-healing therapies and tools for monitoring, measurement and evaluation. Wound management has typically lacked the recognition and organisation-wide support of senior health care administration.

The status of wound management practices within the Niagara CCAC reflected this general situation at the beginning of the study period. Wound management practices in Niagara CCAC were characterised by the following:

- Inconsistent assessments of wound type, stage, causes and the associated pain, discomfort, health risks and quality-of-life impacts for patients;
- Limited data on the prevalence of wounds and the costs of wounds to both the patients and the CCAC;
- Dry gauze dressings used as the single most common therapy;
- A variety of advanced dressings based on moist wound-healing principles in use but without clear and consistent selection criteria based on best practice guidelines;
- Limited clinical training focused on the application of new dressings;
- Application of advanced therapies such as negative pressure (V.A.C.) therapy, but with no clear criteria and guidelines to determine where such therapies are most effective, and no systems for measuring clinical outcomes;
- No systematic monitoring and reporting and evaluation of wounds;
- Decentralised control over the selection and purchasing of wound care dressings and technologies and no coherent plan or systems for measuring or monitoring costs and effectiveness;
- Few consistent linkages between clinicians involved with wound care and allied medical professionals such as physiotherapists, chiropractors, occupational therapists, etc.

Early efforts to address wound management in Niagara were initiated in 2004. Advanced wound dressings were introduced and made available throughout the CCAC, and clinical training to support the application of the new dressings was provided. Initial data on wound prevalence rates and management practices were collected.

In early 2005, an advanced practice nurse was hired to lead a more thorough and comprehensive reorganisation of wound management practices. Key elements of the new practice regime included

- Consistent application of evidence-based, clinical best practice guidelines for wound management. The guidelines were developed by the Registered Nurses Association of Ontario (RNAO) (14). Key practices implemented in accordance with the guidelines included
 - Complete assessment by clinicians trained in wound management, including patient history, physical assessment, psychosocial assessment, pain assessment, risk assessment, vascular assessment and nutrition assessment,
 - Identification and management of causative factors and interventions such as surfaces, offloading, etc.,
 - Collaboration with interdisciplinary team (occupational therapist, physiotherapist, chiropractor, nutritionist, etc.) and
 - Selection or application of appropriate local wound treatments (i.e. debridement, bacteria or infection control, wound cleansing, moist wound healing, compression therapies and adjunctive therapies such as electrotherapy and negative pressure therapy),
- Training for clinicians based on best practice guidelines,
- Criteria for the purchase and use of specialised technologies such as negative pressure therapy; measurement and monitoring of results,
- Nutrition programmes,
- Systems for measuring, monitoring and reporting on clinical outcomes,

- Education for patients, families and caregivers,
- Establishment of wound care clinic,
- Prevention strategies,
- Restructuring relationships with private service delivery agencies to implement best practice guidelines and
- Work with purchasing to ensure appropriate products are available.

Efforts have been underway to implement these and related wound management practices within the Niagara CCAC from early 2005 to early 2007.

EVALUATION RESULTS

The impact of implementing new wound management practices has been evaluated through a series of audits carried out annually from 2004 to 2007. Data were collected at four points: in the fall of 2004, just prior to the introduction of the advanced practice nurse and then for three consecutive years in March 2005, 2006 and 2007. Data collection tools and methodologies have evolved. Surveys have been refined and expanded so that not all data are available for the full study period extending back to 2004. Overall, however, the data provide a relatively long-term view of the impact of practice changes as well as the ongoing pressures faced by the organisation in managing wounds. As noted, these data represent the Niagara CCAC only. Although practices originally applied in Niagara are beginning to be extended throughout the new LHIN, no survey data are available for the larger area.

Each of the nursing agencies providing home care within the CCAC was asked to complete a questionnaire giving details of all clients on their active caseload. The number of clients covered by responses to the questionnaire varied between 669 (in 2005) and 1090 (in 2006) from a total of approximately 3000 clients on the active caseload at any time. Approximately 50% of clients covered by the survey had a wound (range 51–56%) that was being treated at home (Table 1).

The distribution of patients by wound type is shown in Table 2. The distribution is fairly consistent between years, with non healing surgical wounds representing the largest single wound type (between 32% and 38% of the total) in each year and other chronic wound types generally accounting for less than 15% of the

Table 1 Survey responses

	2004	2005	2006	2007
Clients being treated*	837	669	1090	915
Clients with wounds (<i>n</i>)	471	344	584	470
Clients with wounds (%)	56	51	54	51

*Number of clients covered by responses to the survey questionnaire.

total. Data on the distribution of wounds are missing for 2004.

Wound management practices

A broad range of wound management practices consistent with RNAO best practice guidelines were introduced throughout the Niagara CCAC from early 2005. Best practice guidelines recommend moist wound healing and the utilisation of advanced dressings based on moist wound-healing principles. Traditional dressings such as dry gauze are no longer considered best practice. Immediately before the introductions of best practice guidelines (in March 2005), 75% of patients were treated with traditional dressings and 48% of patients had their dressings changed daily or more often (Table 3). Seventy-four percent of dressings were changed at least every 2 days. In 2006 and 2007, the proportion of patients treated with traditional dressings had reduced to 20% and 22%, respectively, and the proportion changed daily or more frequently had reduced to 14–15%. In 2005, the median dressing change frequency was once per 1–2 days. In 2006 and 2007, the median change frequency was approximately once per 3 days.

A reduction in dressing change frequency is particularly significant in the community, given the high percentage of nursing visits that involve wound care and the travel time required to visit a patient at home. It is estimated in Niagara that each dressing change requires an average of 1 hour of nursing time at a cost of

Table 2 Distribution of patients by wound type

	2005	2006	2007
Pressure ulcer (%)	13.8	16.9	13.4
Leg ulcer (%)	11.0	13.6	14.7
Foot ulcer (%)	13.8	15.0	16.4
Surgical wound (%)	35.7	37.9	31.5
Other wounds (trauma, malignant fistula and burn) (%)	25.7	16.6	24.0

Table 3 Frequency of dressing change

	2005	2006	2007
Daily or more frequently (%)	48	14	15
Once per 2 days (%)	26	5	19
Once per 3 days (%)	19	17	37
Once per 4 days (%)	2	15	13
Once per 5 days (%)	0	22	0
Once per 6 days (%)	0	9	0
Once per 7 days (%)	6	18	18

\$51. Even a relatively small reduction in the frequency of dressing changes from once per 1–2 days to once per 3 days reduces the costs of nurse time by \$119 (50%) per patient per week. More significantly, nurse time is reduced by an average of 140 minutes per patient per week, which frees nurses to spend time on other patient-related activities.

Compression therapy for venous leg ulcers is one of the cornerstones of best practice wound management. The use of compression therapy has increased significantly in Niagara from 35% of eligible ulcers in 2004 and 2005 to 88–90% in 2006 and 2007. The high rate of utilisation reflects successful implementation through clinical assessments and training. In addition, compression therapy involves relatively low initial costs for bandaging (borne by the CCAC) and low ongoing management costs for compression stockings (borne by the patient) that improve compliance.

Clinical outcomes and treatment costs

It was anticipated that the implementation of evidence-based clinical best practices for wound prevention and management would lead to improved clinical outcomes. One indicator of improved outcomes for patients is the proportion of patients with a severe pressure ulcer. Between 2005 and 2007, the share of pressure ulcers in total of chronic wounds remained constant at around 13% (Table 2). However, the proportion of pressure ulcers at Stage 3 and above reduced from 39% to 24%, indicating that efforts to prevent ulcers becoming more severe were successful.

One of the major challenges in wound care is that many patients suffer with chronic wounds for extraordinarily long periods of time. It is not uncommon for leg ulcers to persist for years. In the CCAC audit carried out in March 2005, the average duration of ulcers being treated in home

care was 55 weeks (14 months). The most likely reason that wounds remain unhealed is lack of adequate diagnosis and treatment choices, which fail to address the underlying cause of the wound. In the audits at March 2006 and March 2007, following the introduction of best practice principles, the average duration of wounds had been reduced to 23 and 21 weeks, respectively.

This evidence is indicative of the positive impact of the new assessment and treatment procedures on healing times, but prior wound duration is only an indirect indicator of time to healing. To carry out a more direct evaluation of the impact of the introduction of clinical practice changes, a random sample of 100 patients was selected from those being treated at the date of the audit in March 2005. Medical notes were obtained for each of these patients covering the period from first presentation to wound healing. Information was obtained from the notes on length of treatment and treatment costs. A similar sample was taken from patients being treated at the date of the audit in March 2006, and the same information was collected for the period from first presentation to healing. These two samples provide a comparison of patients treated before and after the introduction of clinical practice change (Table 4).

The average time to wound healing was lower in the 2006 sample by almost 31 weeks (60%) – 51.5 weeks for the 2005 sample compared with 20.9 weeks for 2006. The other notable difference

Table 4 Random samples of patients treated in 2005 and 2006

	2005 (100 patients)	2006 (100 patients)
Average weeks to heal	51.5	20.9
Average frequency of dressing change (per week)	5.09	2.18
Total dressing changes to healing	262	45.6
Nurse cost per dressing change (\$)	51	51
Total nurse cost per patient (\$)	13 362	2326
Material cost per dressing change (\$)	3.75	28.31
Total material cost per patient (\$)	983	1291
Total cost per patient (\$)	14 350	3617

is in the average frequency of dressing change – 5.09 per week in 2005 compared with 2.18 per week in 2006. This represents a change from an average dressing duration of 1.4 to 3.2 days, consistent with a shift from traditional dressings to modern dressings with superior moisture-handling properties.

The reduction in dressing change frequency and the shorter healing time contribute to a reduction in the overall costs of wound treatment. The total cost per patient was \$14 350 for patients in the 2005 sample compared with \$3617 for patients treated in 2006. The most important component of cost is the cost of nurse time. In the 2005 patient sample, 93% of the total cost of treatment was represented by the cost of nurse time, and this highlights the significant impact of reducing frequency of dressing changes through the use of advanced dressings. For patients treated in 2006, nurse time accounted for 64% of the total. The introduction of advanced dressings had the effect of reducing total cost overall by releasing nurse time for other uses.

The difference in the cost of nurse time was more than \$11 000 per patient – \$13 362 per patient in 2005 compared with \$2326 per patient in 2006. The difference represents an average of 217 fewer dressing changes required to heal the wound. At 60 minutes per change (including travel time), this equates to a potential saving of 217 hours of nurse time per patient. The unit cost of dressings and other materials was approximately eight times higher in 2006 than in 2005 (\$28.31 compared with \$3.75), but because of the shorter time to heal and lower frequency of dressing change, overall expenditure on dressings and materials was only 30% higher (\$983 per patient in 2005 compared with \$1291 per patient in 2006).

To improve the validity of the comparison between pre- and post-intervention populations, separate samples were drawn from patients treated in 2005 and 2006 and an attempt was made to correct for major confounding differences in patient and wound characteristics. These samples (each of 50 patients) were matched for patient age, wound type, wound duration, wound size and major comorbidities (Table 5).

The results are consistent with those found in the larger samples. The average time to wound healing was shorter by 33 weeks (60%) – 54.5 weeks for the 2005 sample compared with 21.9 weeks for patients treated in 2006. The

Table 5 Matched samples of patients treated in 2005 and 2006

	2005 (50 patients)	2006 (50 patients)
Average weeks to heal	54.5	21.9
Average frequency of dressing change (per week)	5.89	2.9
Total dressing changes to healing	321	63.5
Nurse cost per dressing change (\$)	51	51
Total nurse cost per patient (\$)	16 371	3239
Material cost per dressing change (\$)	3.75	26.99
Total material cost per patient (\$)	1204	1714
Total cost per patient (\$)	17 575	4952

frequency of dressing change was also lower in the 2006 sample – 5.89 changes per week in the 2005 sample compared with 2.9 changes in 2006. This represents an average dressing duration of 1.2 days in 2005 and 2.4 days in 2006.

The total cost per patient was \$17 575 for patients in the 2005 sample compared with \$4952 for patients in the 2006 sample – a reduction of \$12 600 per patient. The difference in the cost of nurse time is more than \$13 000 per patient (\$16 371 compared with \$3239). At 60 minutes per dressing change, the difference in nurse time between the two samples is equivalent to 258 hours per patient. Expenditure on dressings and other materials is \$510 (42%) per patient higher in the 2006 sample.

DISCUSSION

The negative impact of chronic wounds on patient well-being and the burden that wound care places on health care staff and organisations is already substantial in Canada, as it is in most developed countries. In the future, the prevalence of chronic wounds will increase disproportionately as the population ages. In the next 25 years, the population of Canada aged 65 years and above is expected to more than double from 4.3 today to around 9 million by 2031. The risk of leg ulceration, foot ulcers and pressure ulcers are all related to the presence of chronic conditions, which are more prevalent in an older population.

The challenge for community health services in the face of these trends is significant. Wound care is labour intensive and is heavily dependent on the availability of well-qualified nurses. The number of patients requiring wound treatment is set to increase at a time when growth in the availability of nursing resources is likely to be severely limited. Community health services will come under additional pressure as acute care facilities seek to reduce length of stay by discharging patients earlier and with more complex health care needs.

An effective and sustainable solution requires a comprehensive management approach to wound care, which is focused on ensuring that available resources, particularly nurse time, are used in the most efficient way possible consistent with improving outcomes for patients. In March 2005, following a series of diagnostic audits, Niagara CCAC implemented a radical reorganisation of wound management practices designed to improve the consistency of clinical practice and improve wound-healing outcomes. Key elements of the new wound management practices included consistent application of evidence-based clinical guidelines, training for clinicians based on agreed best practice, availability of appropriate wound management products and technologies, criteria for efficient use of products, active preventive strategies and systems for measuring wound area and for monitoring healing.

An evaluation of the impact of the measures implemented from 2005 has shown consistent improvements in clinical practice and patient outcomes and an overall reduction in the cost of treatment. The use of traditional wound care products such as dry gauze was reduced in line with best practice recommendations, and the frequency of dressing change was also reduced. Preventive measures were put in place to reduce the risk of pressure ulceration and foot ulcers in patients with diabetes. A comparison of patients treated in 2005 and in 2006 showed that average time to heal was shorter in 2006 by more than 50% and frequency of dressing change was also lower. As a result, total treatment cost was lower in 2006 by an average of \$10 700 per patient. The combined effect of shorter healing times and less frequent dressing changes resulted in a total of 217 fewer nurse visits per patient required to heal a wound.

The results that have been achieved in Niagara were built on an initial diagnostic

audit of wound management practices, which established a baseline for the evaluation and also identified key areas in which practice and patient outcomes could be improved. Subsequent training and management reorganisation were focused on these key areas for improvement. Niagara CCAC is unlikely to be unique, and the results that have been achieved in this study could be replicated elsewhere. Similar improvements in outcomes and reductions in treatment cost have been reported elsewhere following reorganisation of leg ulcer services (15,16).

Overall, improvements in wound management practice led to a net saving of \$3.8 million in the wound care budget of the Niagara CCAC in 2006 or 2007. Equally important is the fact that improvements in clinical practice have significantly reduced the amount of nurse time required to heal a wound, and this will put the community health service in Niagara in a strong position to cope with the forecast increase in demand for wound care treatment in the future.

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