Wound Prevalence in Canada: Reflection After 20 Years

By Pamela E. Houghton, PT PhD

Introduction

Prevalence and incidence are well-established epidemiological measures that estimate the frequency of a condition. In all areas of research, it is important to ensure similar language and a common understanding of the clinical implications of the data are being used.

While determining the frequency of wounds in health care can be very informative, care must be taken when conducting and interpreting the data. Estimating the prevalence and/or incidence of wounds is made more challenging because wounds are not identified diseases, but rather common secondary complications of many diseases such as spinal cord injury, diabetes and cardiovascular disease.

It is important to know whether prevalence or incidence should be determined. Often these measures are confused, and the different frequency measures are not fully appreciated (see box on page 47).[1–5] Another common misconception relates to how these prevalence and incidence data are reported and interpreted. It is important that wound care practitioners can link the right methods and calculations to the correct intended use of the data. For example, prevalence data may not be the best indicator of quality of care or effectiveness of prevention strategies, since values will change with the number of people admitted who have a wound.

Sometimes prevalence surveys are made more resource intensive because data are collected to answer questions beyond those which are needed to determine the proportion of people with wounds. Wound care practitioners want to know if their efforts to implement certain prevention strategies are effective. Researchers and clinicians need to resist the temptation to make comparisons and inferences across sites, between countries and over time. These comparisons and interpretations should only occur if similar methods

are employed and people with similar risk levels are surveyed.

The overall objective of this article is to help wound care practitioners contribute to our knowledge about the number, severity and type of various wound etiologies and to use these measures to raise awareness about the personal and economic burden that non-healing or complex wounds pose. This article will focus on more commonly occurring types of wounds, including pressure ulcers/injuries (PIs), diabetic foot ulcers (DFUs), mixed venous arterial lower leg ulcers (LLUs), skin tears and surgical site infections (SSIs).

This article will specifically:

- Define different frequency estimates (prevalence and incidence) and explain how each measure can be used to inform decisions
- Summarize Canadian prevalence and incidence studies and review the different methods used to derive estimates
- Explain key methodological features that improve accuracy and factors that determine wound prevalence

Definitions

Prevalence is the proportion of a defined population who have the condition (a wound) at the particular point or period in time.[5] Prevalence studies involve determining the total number of people who have a particular type of wound and includes both those who were admitted with the condition and those who develop the condition while on service. Procedures used to estimate the prevalence of a condition usually involve a cross-sectional design, which provide a "snapshot in time."

There are different types of prevalence, depending on the period of time over which data are collected. *Point prevalence* is a commonly reported measure that involves identifying the number of cases that exist in a defined population over a short period—usually one or fewer days. This type of prevalence usually involves "the blitz approach," where a team of assessors evaluates patients in an entire facility/organization over a few hours or one day. *Period prevalence* involves recruiting people who meet inclusion criteria over several weeks or months: for example, using sequential recruitment of all patients who are admitted to the service or those who undergo a procedure or surgery.

Prevalence and Incidence Defined[5]

Prevalence is the proportion of a defined population who have the condition (a wound) at the particular point or period in time.

Incidence is the number of new occurrences who develop the condition (wound) over the observation period.

Incidence is the number of new occurrences who develop the condition (wound) over the observation period.[5] This longitudinal study design requires following eligible people for several weeks or months to identify those who develop the condition (wound). While this type of frequency estimate is generally more difficult to perform, it can provide valuable information about who, when and where in relation to wound development. Patient- and procedure-related risks can be determined, prevention interventions can be evaluated and quality of care can be assessed.

A more popular measure used to evaluate prevention programs and quality of care is determining *facility-acquired* or *nosocomial* wounds. This involves determining the number of people who develop a wound(s) between the time of admission and discharge. This hybrid study design requires having processes in place to ensure all patients are assessed on admission to identify those starting without a wound and that all those patients included in the study are assessed regularly while on service to ensure no new wound occurrences are missed.

Why Prevalence Studies Are Important

While all three of these frequency measures can provide valuable information, how the data are interpreted and used depends on what measure is

estimated and the methods and calculations used to make the estimate (see Figure 1). Many groups and organizations have used prevalence studies to raise awareness about how often wounds occur as a secondary complication of different disease conditions. Knowing how many people have the condition in a health-care setting helps decision makers know what resources are needed to prevent or treat the condition (e.g., number of pressure redistribution surfaces). Wound prevalence has been used to estimate the burden of illness to the facility/organization and when performing economic analyses and budget planning. Since the number of nosocomial PIs has been associated with quality of care and sometimes termed "never events," many facilities conduct PI prevalence surveys as part of quality improvement programs. In addition, recording the prevalence of wounds before and after interventions that address risk factors known to predispose patients to wounds has been used to evaluate the effectiveness of prevention programs. Several reports have shown that sharing prevalence and incidence estimates within a health-care organization can motivate staff and patients to change practices and complete prevention activities.[6–8] Most clinicians appreciate that preventing this devastating and costly condition from occurring in the first place has the greatest potential to make an impact for both patients and health-care systems.

Studies that estimate wound prevalence are more plentiful than those estimating incidence, perhaps because it is more challenging to obtain accurate estimates of wound incidence. More controversy exists in the literature regarding the best way to obtain an accurate value for wound incidence. Some feel only patients who initially do not have a wound should be included when determining incidence.[1,5] However, others feel it is still possible to develop a second wound, and therefore these patients should not be excluded. Additionally, many feel wound incidence estimates are only helpful when people at risk of wounds are included;[4] however, the best method to objectively determine who is and isn't at risk is debatable.

Studies that estimate wound prevalence are more plentiful than those estimating incidence, perhaps because it is more challenging to obtain accurate estimates of wound incidence.

National survey tools and processes have been created to identify the number and severity of PIs in other countries. The European Pressure Ulcer Advisory Panel (EPUAP) convened a panel

Figure 1: Calculations to Estimate Prevalence and Incidence

$$\textbf{Prevalence} = \frac{\text{Number of people with wound}}{\text{Total number of people assessed at that time}} \times 100$$

$$\textbf{Facility-acquired prevalence} = \frac{\text{Number of people who developed a new wound since admission to facility}}{\text{Total number of people admitted to facility over same time frame}} \times 100$$

$$\textbf{Incidence} = \frac{\text{Number of people who develop a new wound over the time followed}}{\text{Total number of people followed over the same time period}} \times 100$$

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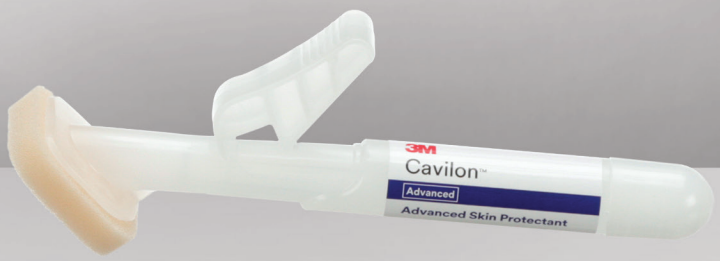

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to agree upon a standardized method for prevalence of PIs.[9] This initiative resulted in a standardized survey tool to determine PI prevalence that includes information about PI risk (the Braden Scale for Predicting Pressure Sore Risk) and documentation of prevention strategies for each patient assessed.[10] This prevalence tool was then used by several countries, including India,[11] Jordan,[12] Sweden,[13] Norway[14] and Ireland/UK,[15] to raise awareness about the high prevalence of PIs across health-care systems. Similar national prevalence surveys have been conducted annually over multiple sites throughout the U.S.[16] The advantage of these national initiatives is that annual prevalence data were collected similarly across all sites. Therefore, values could be combined and compared between geographical locations and before and after prevention strategies were implemented.

Review of Canadian Prevalence Studies

Woodbury and Houghton conducted a systematic review of research literature that reported the prevalence of PIs in Canadian health-care settings between 1992 and 2001.[17] This exhaustive review of Canadian data revealed that only seven studies were published between 1992 and 2001 and involved a total of just over 18,000 people. Most of these Canadian-based publications determined point prevalence using clinical exams of greater than 90% of patients admitted to the facilities. However, many of these published studies included relatively small sample sizes (fewer than 200 people) and focused on specific patient groups or specific hospitals or homes. Results showed pressure injury prevalence estimates derived from earlier Canadian studies varied widely, between 2.8 and 36.8%.[17] This is not surprising, since methods and target populations surveyed were so different across the studies. Houghton and Woodbury also identified gaps in data about the prevalence of other types of wounds, including DFUs and LLUs.[5]

Table 1 summarizes prevalence data available from Canadian sites since the Woodbury and Houghton review in 2003.[17] In addition to the Woodbury and Houghton report, there were nine published reports[18–26] from Canadian sites that provided prevalence estimates (see Table 1). There were three additional Canadian studies available, but it was not possible to extract prevalence values from them.[27–29] A systematic search of multiple databases was not conducted for this review; however, other systematic reviews of prevalence studies that have been published recently did not identify any additional Canadian studies.[30–33]

Woodbury and Houghton provided the first report that pooled estimates of point prevalence from unpublished data collected via clinical exam of most patients in 39 health-care sites (n > 45,0000) located in different provinces in Canada between 1990 and 2003.[17] Careful appraisal of methods allowed authors to select data that estimated point prevalence of PIs using similar high-quality methods. Using the data that existed, the prevalence of PIs was found to range between 15.1 and 29.9%, depending on health-care setting.[17] The precision of these prevalence estimates is good, since 95% confidence intervals were tight, and pooled sample sizes were over 4,000 for each of the four health-care settings reported. This study produced the first national estimate of the prevalence of PI across health-care settings in Canada = 26.0% (95% CI = 25.2–26.8%).

Since 2003 there have been five Canadian studies published that reported the prevalence of PIs.[18–21,23] Three of these appeared to have employed similar definitions and assessment tools and employed a direct clinical exam to identify PIs, including stage 1 (NPIAP), in acute care hospitals.[18,19,23] However, a wide range of values for the point prevalence of PIs was found—between 12.8%[19] and 29.2%.[18] While two of the studies that examined the prevalence of PIs in Canadian acute care facilities found over 20% of patients were affected,[18,23] Vanderkopf and colleagues found 12.9% of acute care patients in 2008 had stage 1–4 PIs.[19] Furthermore, repeated prevalence studies conducted each year from 1994 to 2008 consistently reported prevalence rates below 13% in these hospitals located in eastern Ontario.[19] Maida and colleagues focused on people who

Table 1: Canadian Prevalence Studies, 2003 to 2020

Authors	Population Assessed	Health Setting	Wound Type	Design/Method	Data Source	Prevalence
Woodbury & Houghton, 2003	AC (11); N = 4831	AC	PIs	Retrospective data collected from point prevalence, cross-sectional studies that used the same methods involving head-to-toe skin assessments by trained and independent assessors of >90% of all patients in the facility/organization over 1-day period. A standardized tool was used to evaluate data collection methods = average methodological score was over 6/9. Most point prevalence surveys were organized/resourced by wound care industries that provide pressure redistribution equipment or supplies, therefore bias to overestimate prevalence estimates cannot be eliminated.	Data previously collected using clinical exam and similar methodology to derive an aggregate estimate of point prevalence in 4 different health-care settings	AC = 25.1% (23.8–26.3%)
	LTC (18) N = 3390	LTC	PIs			LTC = 29.9% (28.3–31.4%)
	Home (4) N = 1681	Home	PIs			Home = 22.1% (20.9–23.4%)
	Mixed (6) N = 4180	Mixed	PIs			Mixed = 15.1% (13.4–16.7%)
	Total (39) N = 14082		PIs			Overall = 26.0% (25.2–26.8%)
Groeneveld et al., 2004	N = 513; 416 adults; 97 children	2 AC and TC facilities Ontario	PIs	Prospective cross-sectional determination of point prevalence. All inpatients were assessed over an 8-hour period by 3-member trained multi-disciplinary assessment team (inter-rater reliability confirmed). NPUAP staging system to categorize based on wound severity. Pressure injuries were identified by head-to-toe skin assessment (including stage 1 PI = 48%). "Point prevalence rate" assumed to be reported per patient (not wound). Study supported by industry.	Clinical exam (head-to-toe skin assessment) by 3 multidisciplinary staff members over 8-hour period	All PIs = 26.3% PIs Adults = 29.2% PIs Children = 13.1%
Vandenkerkhof et al., 2011	N = 12,787 over 15 yrs (853/yr)	2 AC in Ontario	PIs	Prospective cross-sectional determination of point prevalence. Annual 1-day point prevalence census in two acute care facilities (amalgamated) in Ontario over a 12-hour period. Dedicated assessors were trained in a head-to-toe assessment procedure, wound staging (NPUAP, 2009) and risk assessment for pressure injuries (Braden). Data collected each year between 1994 and 2008. Stage I+ = at least one pressure injury Stage I–IV or unstageable. Stage II+ = proportion of patients who had Stage II P^ or higher.	Clinical exam (head-to-toe) by specially trained team	Stage I+ (2007) = 12.8% Stage II+ (2006) = 7.9%
Woo et al., 2015	N = 203,035 unique patients	All sites in Ontario	PIs	Retrospective data from Institute for Clinical Evaluative Sciences (ICES) available from publicly funded health-care services including admitted to acute, home, long-term and continuing care in Ontario. Annual prevalence = number of individuals with PIs within the time period (year) over the total number of individual data available within ICES in the same year.	Administrative database Annual prevalence	2013 All setting = 8.6% Acute = 10.2% Home = 3.7% LTC = 8.4% CCC = 22.6%
Maida et al., 2008	N = 664 cancer (70% pts) 593 followed	Consultative palliative care program (hospital and community) Ontario	All wounds	Prospective longitudinal observational study. Sequential referrals to specialized service May 2005 to June 2006. Initial assessment within 24 hours of referral and followed q24–48 hrs until death or end of study. PI risk assessed using Braden. PI classified by NPUAP. DFU classified using Wagner. Palliative Performance Scale (PPSv2) assessed. "Period prevalence" = Prevalence at baseline (referrals over 24-month period). Most data reported as frequency of wounds. *Calculation of prevalence required.	Clinical exam by specialist wound management team Prevalence (initial Ax) Incidence over 24 months until death.	*All wounds = 84% *Malignant = 14.5% *Pressure = 39.4% *DFU = 5.5% *VLU+Art = 17.3%

cont'd. . . .

AC = acute care
LTC = long-term care
TC = tertiary care
CCC = complex continuing care

Authors	Population Assessed	Health Setting	Wound Type	Design/Method	Data Source	Prevalence
Denny, 2011	2,625,991	AC, LTC+CCC home all Canada 2011–2012	"Compromised Wounds"	Retrospective data extracted from 3 administrative databases over 1 year period 1) Discharge Abstract Database (DAD) (AC – not Quebec); 2) Long-term care and hospital-based CCC Continuing care reporting system (CCRS) NL, NS, MB, SA, BC, ON, YU 3) Home care reporting system (HCRS) ON, BC, YU. Included several wound etiologies including PIs, LLUs, "any chronic wound," skin barrier breaches. All compromised wounds reported for each health-care setting. 90% patients included were in acute care database	Data extraction from large national administrative database	Acute Care = 3.7% Home Care = 7.3% CCC = 28.2% LTC = 9.6%
Hurd et al., 2009	N = 3099	Acute care 13 sites Canada	All wounds	Data were collected over a 1–2-day period using software loaded on to a handheld computer and head-to-toe assessments; audits were carried out in each hospital by the same independent team of advanced practice nurses using standard data collection forms; members were trained in the clinical assessment of wounds and use of a standardized data collection tool; PIs were staged using NPUAP classification system. *Calculation of prevalence required Study supported by industry	Skin assessment point prevalence (1–3 days) audit team	All = 41.2% (30–68%) PI = 22.9% SSI = 6.3% *DFU = 1% *LLU = 1%
LeBlanc et al., 2020	N = 380 aged 65 yrs or older	4 LTC facilities in Ontario	Skin tears	Prospective cross-sectional point prevalence determined over 1 day at each of 4 facilities. 4 trained researchers performed all assessments. ISTAP classification used to categorize skin tear severity. 410 subjects recruited from 1160 residents of 4 LTCs = 40% of population.	Skin assessment point prevalence (1 day)	Skin tear = 20.8% 95% CI (16.9–25.3)
Reid et al., 2006	169 of 322 residents with diabetes	Northern Indigenous community of 5597	DFUs	Cross-sectional cohort study July to August 2000 where people known to have diabetes and living in the community were invited to undergo a foot exam. Demographic, foot and ulcer characteristics were recorded.	Standardized foot exam	DFU = 5% had present ulcer
Hopkins et al., 2015	16,883 admissions in 2011	AC, LTC, home and clinics in Canada	DFUs	Annual prevalence Retrospective economic analysis linked 4 mandatory national health administrative databases and used codes to identify cases of DFU. Acute care (DAD) – most responsible diagnosis ICD-10 codes OP clinic and ER visits (NACRS) – Ontario Home and LTC (HCRS & CCRS): InterRai MDS Prevalence: total number of unique cases by year and rates per 100,000 population	Administrative databases	DFU = 75.1 per 100,000 general population (0.75%)

attended a specialized oncology service and found a very high proportion of this specialized high-risk population were troubled with wounds in general (84%), including malignant wounds (14.5%) and PIs specifically (39.4%).[21] Woo and colleagues produced the only study that derived PI prevalence from a large administrative database for Ontario health-care institutions (ICES) and reported the lowest value for PI prevalence (8.6%).[20] Surprisingly, this analysis of the Ontario databases also revealed a relatively low proportion of people with PIs in Ontario LTC facilities (8.4%)[20] compared with previous reports that reported PI prevalence detected between 20% and 29%.[17]

Prevalence data for other wound types such as skin tears,[24] leg wounds of mixed arterial/venous etiology[21] and DFUs[25–26] are sparser. Four reports examined DFU prevalence;[21,23,25,26] however, the target populations surveyed for the presence of DFUs were vastly different, including Indigenous

communities,[25] cancer survivors,[21] acute care patients[23] and the general population.[26] As a result, the prevalence of patients with DFUs receiving care from Canadian health-care systems remains to be determined.

In 2011, Denny and colleagues at the Canadian Institute for Health Information (CIHI) estimated the prevalence of "compromised wounds" in patients located in various health service environments in Canada using three large administrative sources of data (discharge data DAD, CCRS and HCRS).[22] These "compromised wounds" included PIs, arterial-venous wounds, skin barrier breaches such as cellulitis, and other chronic wounds. Analysis of CIHI data produced prevalence estimates that ranged between 3.7% in acute care to 28.2% in complex continuing care beds.[22] Because over 95% of the 2.3 million people included in the data were in acute care hospitals, the overall prevalence of compromised wounds was less than 4%. The authors recognized that current data collected in Canadian health-care systems do not capture all wounds and therefore drastically underestimate the true extent of the problem.[22] While diabetes was identified as a risk factor for those who had wounds, researchers were unable to determine the prevalence of DFUs in the Canadian health system.

Ho and colleagues compared cases with PIs that were identified via nursing consult reports (considered gold standard) to those recorded in Discharge Abstract Databases (DADs) in a large tertiary acute care hospital in Alberta.[34] Using two different sets of ICD 10 codes in the DAD database, the highest sensitivity for detecting PI prevalence was only 39%. They concluded that the biggest source of health-care data (CIHI) may not be accurate for determining PI prevalence.[34] This Canadian study, which questioned the utility of health-care databases for accurate prevalence estimates, is consistent with results from Sweden. Gunningberg and Ehrenberg compared prevalence estimates derived from chart review versus direct skin assessment when the same patients were assessed at the same time in the same facility.[35] They found PIs identified from chart review resulted in prevalence values that were less than half those identified in head-to-toe skin assessments.[35] Thus, relying on current coding and data collection systems in Canadian health-care facilities/organizations will be unlikely to help illustrate how many people are affected by wounds and will not help us show how great the burden of non-healing wounds are to Canada's health-care systems.

Discussion

This review of Canadian literature reveals the lack of information regarding the true prevalence of common wound types in Canada. While many groups have tried to tackle this question, the variation of approaches and/or methods used leave us no closer to estimating the extent of the problem in Canada's health-care systems. Many international organizations, researchers and epidemiologists have written guidance documents about how best to determine the number of people affected by wounds.[1,3,9] This has resulted in several different ways of estimating wound prevalence. However, what is consistent is that all researchers working in this field agree that a standardized method must be used if the goal is to derive a national wound prevalence estimate.

PIs identified from chart review resulted in prevalence values that were less than half those identified in head-to-toe skin assessments.

First, it must be decided what type of prevalence is being estimated. Point prevalence is most commonly collected. This involves a defined data collection event (a blitz) so that wound prevalence data are collected over hours or, at most, one day.

This has been done in other countries on an annual basis for national pressure injury surveys.[10,12,14,15] Perhaps we could do this in Canada not just PIs, but also other common types of wounds such as LLUs, DFUs and surgical site infections.

Other key questions to ask when conducting prevalence studies are summarized in the box below. The content of this list was taken from Loney and colleagues[36] and adapted for wound prevalence by Woodbury and Houghton in 2003.[17] These methods include using a team of qualified and unbiased assessors who conduct a direct clinical exam and apply predefined criteria to distinguish and document wounds of different etiologies. Providing very clear definitions to be applied during the prevalence survey and specific criteria that describe the patient group and type of wounds that will be estimated (i.e., the denominator of prevalence equation) is equally important. A mechanism is needed to ensure either all (> 90%) or an appropriate random sampling method is used to correctly identify eligible patients. By clearly defining inclusion criteria, smaller facilities with similar case mixes can be combined so that an adequate sample size of at least 300 people is obtained and the precision of prevalence estimates is maintained.

How prevalence data are reported is also important. First and foremost, it is critical that all prevalence estimates are based on the number of people with wounds. Since patients often have multiple wounds, it is important to have a system in place to decide which wounds will be counted and that all prevalence data including subgroup analysis are expressed by number of people assessed, not number of wounds identified. A 95% confidence interval around each prevalence estimate is the most accepted statistic to show the precision of the overall wound prevalence value.

Finally, when interpreting prevalence values, it is critical to fully consider the setting or wound

Key Methodological Considerations for Prevalence Studies

- Is point prevalence the type of estimate that is collected (i.e., data were collected over a short time period [1–3 days])?
- Were definitions and criteria clearly laid out prior to commencing the study?
- Was prevalence determined for a defined population of people receiving care from a health-care organization/facility (i.e., patients rather than general population or entire community)?
- Were prevalence estimates calculated based on the number of patients with wounds (not the number of wounds identified)? Is there a system established to select which wounds will be counted in people with multiple wounds?
- Was a direct clinical exam such as head-to-toe skin assessment used to identify and classify wounds (rather than a chart review or administrative database)?
- Did the project involve trained assessors who are known to be able to reliably identify and categorize the particular wound type? Were these assessors independent and unbiased from the results of the prevalence survey (i.e., preferably not clinicians who are responsible for the care of the wounds they are counting)?
- Was a sample size of at least 300 eligible patients examined included in the estimate?
- Were at least 90% of a clearly defined target population sampled? Alternatively, was an acceptable random sampling method used to identify and recruit the majority of eligible patients?
- Do all prevalence estimates include the mean value expressed as a percentage of those examined as well as 95% confidence internals?
- Were the results accompanied by clear description of the patient characteristics and health-care settings so that the data can be applied/combined with similar settings/populations?

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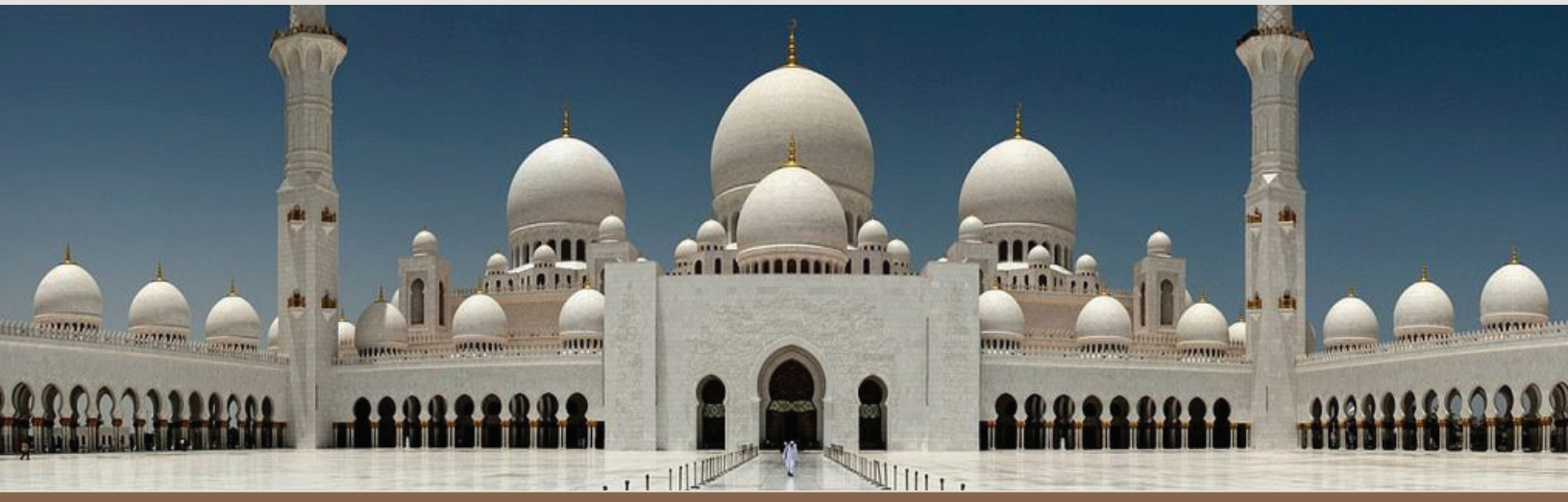

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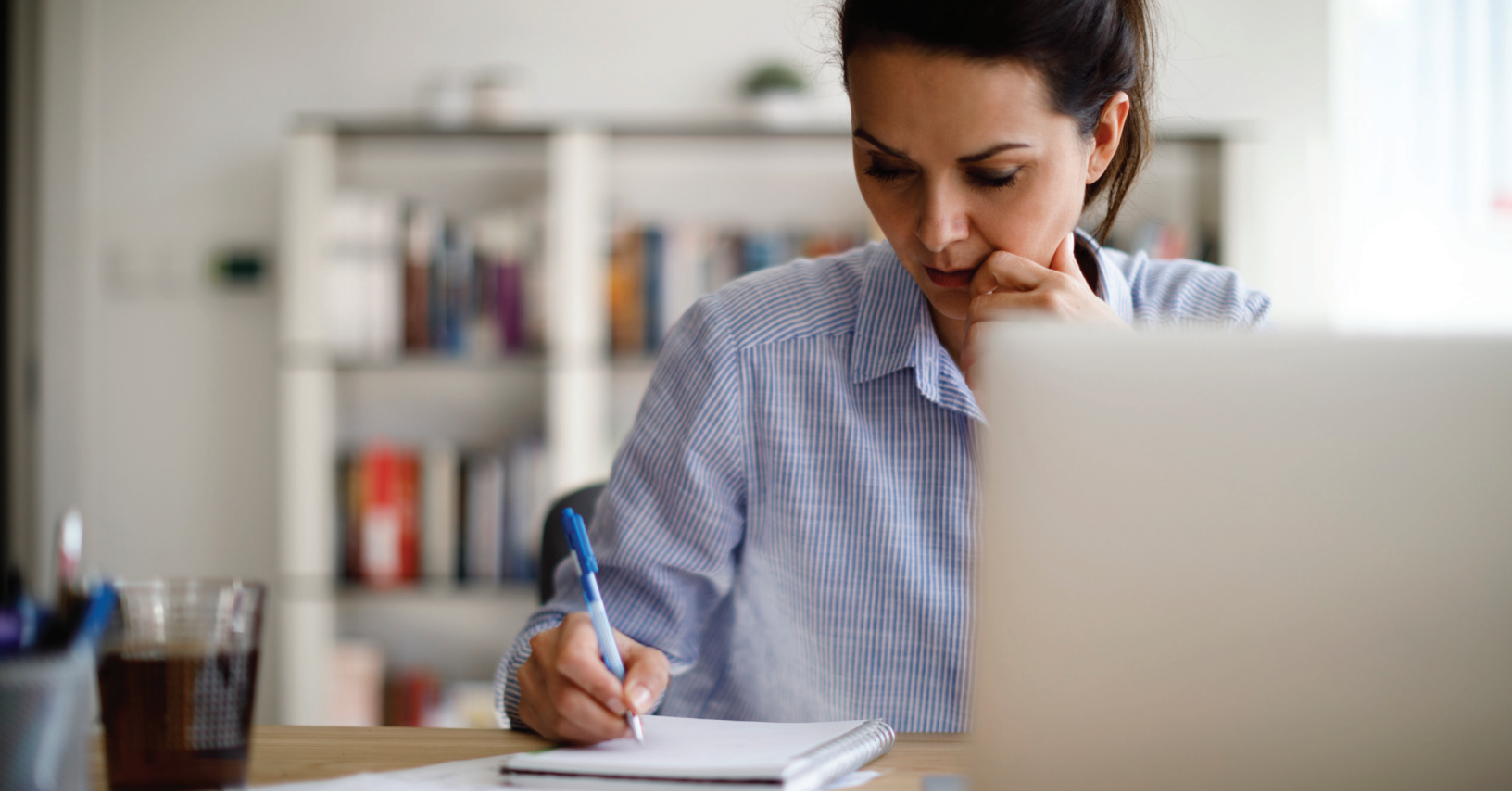

care service where the estimate came from, as this will ultimately determine characteristics and risk of the patients included in the survey.

Summary and Next Steps

A review of current literature that has been published about the prevalence of wounds in Canada turned up limited research. What has been done shows the wide variation in methods used to calculate these prevalence estimates. The discussion of current literature was meant to help those involved in prevalence studies in their facility/region to consider key concerns in terms of data collection, analysis and reporting that are known to influence prevalence values.

Many groups are involved in determining wound prevalence of different wound etiologies. Hopefully, we can move toward a standardized approach to managing wound prevalence data that leaders in wound care can use in many health-care sites across Canada. To this end, a group of researchers and students in the master's in Wound Healing program at Western University are involved in developing and delivering a national survey. This survey will identify researchers/leaders and health-care facilities/organizations who are currently, or could potentially, collect wound prevalence data in a standardized way. We also need to determine those that can share aggregate prevalence data in an anonymized fashion so that it can be pooled for many different health-care facilities/centres right across Canada. If you are interested, please contact Pamela Houghton at phoughto@uwo.ca.

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