

Increased Nursing-Time Requirements Due to Pressure Sores in Long-Term-Care Residents in Quebec

William D'hoore, MD, PhD; Ann-Lise Guisset, MA; Charles Tilquin, PhD

ABSTRACT

OBJECTIVE: To test the hypothesis that pressure sores significantly influence the nursing workload, after taking confounding factors into account, ie, patients' characteristics simultaneously associated with the occurrence of pressure sores and the nursing-time requirements.

DESIGN: Retrospective analysis of administrative data for a cohort of long-term-care residents (Planification Informatisée des Soins Infirmiers Requis database). Two methods were used to control for confounding factors: analysis of covariance and sample restriction.

SETTING: Long-term-care institutions of Quebec, except exclusively psychiatric and private centers.

PATIENTS: Data was available for the 13,555 residents aged 65 or more whose health status changed during the year 1993-1994.

RESULTS: Prevalence of sores was 4.0% (544/13,555). Before any adjustments were made, residents with pressure sores needed, on average, 63 minutes more than the residents without pressure sores. Two confounding factors were identified: dependence in the activities of daily living and physical mobility. Analysis of covariance showed that the adjusted increase in daily nursing care was 19 minutes. In the second analysis, a restricted homogeneous sample for the confounding factors was used (5,849 patients, including 414 patients with pressure sores). According to this method, the adjusted increase in daily nursing care was 17 minutes. In both analyses, the increase was noticeable in the spheres of alimentation, mobilization, and treatments.

CONCLUSIONS: The presence of pressure sores significantly influences the nursing workload, even after eliminating the influence of confounding factors. Because nursing time can be translated into cost, effective prevention strategies and strategies of reducing the costs of treating sores should be analyzed (*Clinical Performance and Quality Health Care* 1997;5:189-194).

Pressure sores are a frequent, although often avoidable, complication among institutionalized patients.^{1,2} The prevalence of pressure sores in nursing homes has been estimated to range from 2.4% to 24%.³⁻⁶ Their consequences can be evaluated from both health and economic viewpoints. Adverse health consequences of pressure sores are well known. Pressure sores reduce quality of life and are associated with complications such as osteomyelitis, arthritis, anemia, and septicemia.⁷

Economic consequences are documented less often, and, when they are, figures are not accurate. On a

From the Centre des sciences hospitalières et médico-sociales (Dr. D'hoore and Ms. Guisset), Université catholique de Louvain, and the Département d'administration de la santé (Dr. Tilquin), Université de Montréal, Quebec, Canada.

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Address reprint requests to William D'hoore, MD, PhD, Centre des sciences hospitalières et médicosociales, École de santé publique, 30 Clos Chapelle-aux-champs, Box 3037, B 1200 Brussels, Belgium.

national scale, available studies report costs as high as £6 to £300 million per year in the United Kingdom⁸ and \$5 billion in the United States.¹ It has been estimated that the cost of hospitalized patients with pressure sores is, on average, five times higher than the average cost calculated for all patients admitted to the same units during the same period, while the average cost of patients at risk is four times higher.⁹ A study in surgical patients (coronary artery bypass graft and total hip replacement) shows the cost of additional days of hospital stay for patients with pressure sores is roughly \$4,000 per patient.¹⁰ In the absence of detailed cost analysis, most of the excess costs likely are due to an increase in length of stay, which is two to five times higher in patients with sores.^{9,10} In nursing homes, length of stay is not a good proxy for cost estimation, and little is known about the economic impact of decubitus ulcers.

An important part of the economic evaluation lies in the measurement of the increase in nursing resource consumption attributable to pressure sores. It is commonly assumed that pressure sores induce an increase in nursing-time requirements,¹¹ and an estimate of 7 to 20 minutes' nursing time per pressure ulcer treatment has been proposed.¹² However, little objective data is available to support those assumptions. Such an evaluation is difficult for two reasons. First, one needs a valid nursing-workload measurement tool, and this tool must be used on large samples to compute accurate estimates. Second, patients suffering from pressure sores present a large array of characteristics,^{3,4,6,13,14} such as impaired mobility and high dependence in the activities of daily living (ADL), which have their own effects on the nursing workload and make it difficult to determine whether the increased nursing requirements are due to the pressure

sores or to other characteristics. Therefore, the purpose of this study was to test the hypothesis that pressure sores significantly influence the nursing-time requirements, after taking into account other factors that simultaneously influence the nursing workload. Two methods were used to fulfill this objective: sample restriction and analysis of covariance.

METHODS

Database

The required nursing-time measurement tool. The nursing-time requirements were measured with a tool called Planification Informatisée des Soins Infirmiers Requis (PLAISIR).¹⁵ This tool is used in Quebec and Switzerland to assess the needs of patients in long-term care. It allows multidimensional data to be collected on the residents. It is considered as a minimum basic data set, with an emphasis on the elementary services required by the resident.

The first section of the PLAISIR questionnaire is used to identify the resident, to describe his or her biopsychosocial profile, and to identify the therapies and treatments the resident receives (except nursing care, which is considered in the questionnaire's second part). The main sections of the first part of PLAISIR allow for the following:

- Assessment of handicaps according to the five dimensions of the handicap code (extent of mobility, dependence in ADL, occupation, social integration, orientation) of the International Classification of Impairment, Disabilities, and Handicaps.¹⁶ Each dimension is measured on a scale of nine categories. For example, the mobility scale is graded as follows: (1) fully mobile, (2) variable restriction of mobility, (3) impaired mobility, (4) reduced mobility, (5) neighborhood restriction, (6) dwelling restriction, (7) room restriction, (8) chair restriction, and (9) total

restriction of mobility. The nine grades of dependence in ADL are (1) fully independent, (2) aided independence, (3) adapted independence, (4) situational dependence, (5) long-interval dependence, (6) short-interval dependence, (7) critical-interval dependence, (8) special-care dependence, and (9) intensive-care dependence.

- Assessment of deficiencies in 16 psychological and sensorial functions: short- and long-term memory, thinking, perception, wakefulness, orientation, decision making, drives, motivation, mood, behavior, language, sight, hearing, making self understood, and ability to understand others. Each dimension is assessed on a scale of four categories.

- Identification of medical diagnoses (up to nine diagnoses) and of the patient's psychological problems among a list of 13 problems: physical and verbal abuse; disturbs others; agitation; wandering; persistent anxiety, sadness, expression of distress, withdrawal, suicidal thoughts, thoughts of death, awakening with unpleasant mood, and hypersomnia.

- Identification of factors for reduction or loss of mobility among a list of 15 factors; determination of the type of disability (limitation, immobility, amputation) affecting the limbs and body parts; identification of the mechanical devices used among a list of 12 devices; identification of the physical and chemical means of protection used (from a list of 13 restraints); and specification of the frequency at which they are used (rarely, sometimes, often).

- Specification of the rehabilitation services received (minutes and days per week) in the fields of physiotherapy, occupational therapy, speech therapy, and nursing; specification of the frequency of medical visits, and description of the specific treatments received among a list of 10 treatments (inhalation therapy, parenteral feeding, pressure ulcers, and others).

The last and most extensive part of the tool is devoted to the explicit identification of the nursing actions required to fill the need of the individual in loss of independence. A comprehensive nomenclature of nursing and assistance actions has been developed. This nomenclature is structured by area of needs (respiration, feeding and hydration, elimination, hygiene, mobilization, communication, treatments, and diagnostic procedures). The first five categories correspond to what generally is called basic care; the last two correspond to technical care. Communication is a category in itself. For every possible action, the assessor specifies the type of compensation required (guidance, partial help, complete help, necessity of constant presence or not), the category and number of staff members required to perform this nursing action, and the weekly and daily schedule. The account of nursing actions is realized retrospectively for the last 7 days. Each nursing action is associated with a normative value measuring the time required to perform it once; so, thanks to the PLAISIR data collection form and the normative values, it is possible to calculate the mean number of nursing hours required per day for each resident. We will try to show the association between this variable and the presence of pressure sores, after adjustment for other variables.

Although the PLAISIR System is based mainly on the evaluation of *required* nursing actions, one rubric deals with a few specific *given* treatments. In this rubric, one item collects the treatments of pressure sores. A distinction is made between care for first- or second-stage pressure sores and care for third- or fourth-stage pressure sores: (1) first and second stages: erythema, abrasion, or blisters; (2) third and fourth stages: destruction of skin and subcutaneous tissue, which may extend to muscles, tendons, or bones.

In this study, we consider that residents with pressure sores are the ones

whose pressure sores were treated at the time of the PLAISIR evaluation.

The PLAISIR System is applied according to a strict protocol that guarantees the reliability of its measure of care intensity. The main characteristics of this protocol are the following:

1. Each assessor follows a 2-day group training session, followed by 2 days of individual training using the format of an interrater reliability test;

2. All PLAISIR forms are centralized and desk-reviewed by nurses. Reviewers systematically contact the assessor by telephone to correct the evaluations;

3. Random verifications are done in institutions by reviewers;

4. The same required care standards must be applied by all assessors;

5. A reference manual (available on request) detailing each action and defining the way to measure the action frequency and other parameters is at the disposal of the assessors.

The population. The population of this study is long-term residents in Quebec (centres d'hébergement et de soins de long séjour or nursing homes). Some institutions are private while others are public. Most residents are elderly. The residents are assessed with the PLAISIR system at the time they are being institutionalized or whenever their health status changes, therefore requiring a new assessment.

Residents entered in our study were all the residents aged 65 years or older who had been assessed with the PLAISIR system during the year 1993 to 1994; namely the 13,555 new residents or residents whose health status changed during that year among the 40,000 residents in Quebec.

Statistical methods. Association between pressure sores and some patients' characteristics is known.^{3,4,6,13,14} Some of those characteristics also influence the nursing workload.¹⁷ The characteristics simultaneously correlated

with the presence of pressure sores and the nursing workload are called confounding factors. Those factors must be taken into account in order to study the distinctive influence of pressure sores on required nursing time.

A preliminary analysis consisted of determining the main confounding factors. The first step was to determine risk factors for pressure sores. The second step consisted of determining factors that predict the daily nursing-time requirements. Then, variables that are common to both phenomena were isolated.

We first performed a stepwise logistic regression to select risk factors for pressure sores. The logistic regression included 27 variables known for their effects on the development of pressure sores. Those variables were chosen among the indicators of the handicap profile. The influence of the same set of variables on the daily nursing-time requirements then was tested with stepwise multiple regression (ordinary least squares regression) to select the predictors of required nursing time. Variables that were associated both with pressure sores and nursing workload were considered as confounding factors and kept for the next steps of the study.

To quantify the amount of daily required nursing time attributable to the pressure sore, two techniques were used. The first one is called analysis of covariance. It allows utilization of all of the information available in the database. This method consists of extracting the influence of a quantitative variable, the confounding factor, on a dependent variable, ie, the nursing-time requirement in this study. An analysis of variance is applied on the residuals, on the basis of a partition criterion, ie, the presence or absence of pressure sores in this study. This technique allows calculation of mean required nursing time, adjusted for the confounding factors, for each class of the categorical variable.

TABLE 1
UNADJUSTED MEANS OF DAILY REQUIRED NURSING TIME PER RESIDENT

	Without Pressure Sores (Min/Day) N=13,011	With Pressure Sores (Min/Day) N=544	Whole Sample (Min/Day) N=13,555
Basic care	123.6	178.1	125.8
Technical acts	12.8	22.1	13.1
Total time *	157.7	221.2	160.3

* Total time is the sum of basic care, technical acts, and communication.

TABLE 2
RESULTS OF THE ANALYSIS OF COVARIANCE: ADJUSTED MEAN REQUIRED TIME

Variable	R ²	Without Pressure Sores (Min/Day) N=13,011	With Pressure Sores (Min/Day) N=544	Difference (Min/Day)
Basic care	0.77	125.3	136.6	11.3*
Technical acts	0.03	12.8	21.7	8.9*
Total time†	0.76	159.5	178.6	19.1*

* $P < .0001$.

† Total time is the sum of basic care, technical acts, and communication.

The sample restriction was used to retain residents homogeneous for the confounding factors. By definition, the distribution of patients with and without sores on a confounding factor are different. The sample restriction consists of keeping only the strata where residents with sores are concentrated, so as to remove variation in the confounding factor.

The statistical analysis was performed with the Statistical Analysis System (SAS, 6.07 release, SAS Institute, Cary, NC).

RESULTS

Sample

The population studied was very old (mean: 83 years, extremes: 65 and 113 years) and mostly female (72% were women in the total sample). Residents usually had reduced mobility; approximately three quarters of the sample

had mobility reduced to the room floor, the armchair, or the bed. Moreover, residents usually were very dependent for the ADL; more than 85% of the sample had a handicap level equal to or higher than 7 (on a 9-level scale).

Five hundred forty-four residents (4% of the sample) had pressure sores, ie, they were given specific treatments for pressure sores. Among those residents, 483 (3.8% of the sample) received treatments for first- or second-stage pressure sores while 66 residents received treatments for third- or fourth-stage pressure sores. Among the 544 patients, 5 were treated both for first- or second-stage sores and for third- or fourth-stage sores.

On average, the daily required time per resident was 2 hours 40 minutes (Table 1). The variability of nursing intensity was quite large; the interquartile difference is approximately 2 hours. Seventy-

eight percent of this time is devoted to basic care. Technical care accounts for a much lower proportion of the total.

Confounding Factors

The nursing-time difference between the raw mean for patients with pressure sores and without pressure sores is 63 minutes. To measure the increase in required time specifically due to the pressure sores, confounding factors were taken into account.

The stepwise logistic regression was used on 27 variables to select the factors predicting the occurrence of pressure sores. Four variables were selected at a significance level < 0.05 (mobility, ADL, gender, and orientation).

A least squares multiple regression showed that physical mobility, dependence in the ADL, and drives were associated significantly with the required nursing time. Fifteen other variables were statistically significant at a P value of $< .05$. However, adding these 15 variables in the model already including physical mobility, ADL dependence, and drives resulted in a negligible improvement of the R^2 (less than 1%). These variables were considered to be weakly, maybe spuriously, associated with required nursing time and were not included in the final model.

Only two variables were found to influence significantly the occurrence of pressure sores and the required nursing time. Those variables are physical mobility and the dependence in the ADL. These two variables then were considered as confounding factors.

Analysis of Covariance

Table 2 shows the mean required time adjusted for the confounding factors. The net effect of the pressure sores on the required nursing time was 19 minutes. The absolute difference between the patients with pressure sores and the patients without pressure sores was

low for the basic care (11 minutes) and the technical actions (9 minutes). In relative terms, basic care increased by only 9%, while the time required to perform the technical actions increased by 70%.

A more detailed analysis (Table 3) describes which kind of care was more influenced by the presence of a pressure sore. Pressure sores mainly affected time required for alimentation (+3.9 minutes or 14%), mobilization (+6.5 minutes or 9%), and treatments (+7.4 minutes or 296%).

Sample Restriction

We restricted the sample to retain strata homogeneous for the confounding factors (physical mobility and the dependence in the ADL) with the constraint of keeping as many patients with pressure sores as possible. We selected patients who had both a score of 8 or 9 on the physical mobility scale and a score of 8 or 9 on dependence in the ADL scale. The resulting sample included 5,849 patients. Among those patients, 414 (76% of the total patients with pressure sores) had pressure sores. Only 130 patients with pressure sores were lost because of the sample restriction.

The statistical analysis on the restricted sample provided us with results similar to the ones of the analysis of covariance (Tables 3 and 4). The increase in required nursing time attributable to the presence of pressure sores was similar with the two techniques used (19.1 and 17.1 minutes, respectively). However, the mean required nursing time was far higher for the restricted sample, because the heaviest cases were selected. The relative increase in required time was higher with the analysis of covariance than with the sample restriction (8% and 12%, respectively). The difference in increased required time was mainly noticeable for the basic care (+9% in the analysis of covariance vs +5% in the sample restriction). The

TABLE 3
ADJUSTED DIFFERENCES IN MEAN REQUIRED NURSING TIME BETWEEN PATIENTS WITH OR WITHOUT PRESSURE SORES, RESULTS BY TYPE OF CARE

Type of Care	Covariance Analyses (N=13,555)		Sample Restriction (N=5,849)	
	Without Sores N=13,011	With Sores N=544	Without Sores N=5,435	With Sores N=414
Communication	21.4	20.2	21.9	20.7
Alimentation	27.0	30.9*	45.0	50.1*
Elimination	28.9	30.0	43.7	43.9
Hygiene	35.7	35.4	42.7	42.1
Mobilization	33.8	40.3*	58.4	62.3*
Breathing	0.7	1.1	0.9	1.3
Treatments	2.5	9.9*	2.8	10.2*
Diagnostic methods	2.8	3.5*	2.6	3.7*
Intravenous therapy	0.1	0.1	0.1	0.1
Drugs	6.6	7.2*	6.5	6.9*
Other treatments	2.5	9.9*	2.8	10.2*

* $P < .01$.

TABLE 4
RESULTS OF THE SAMPLE RESTRICTION: ADJUSTED MEAN REQUIRED TIME (N=5,849)

Variable	Without Pressure Sores (Min/Day) N=5,435	With Pressure Sores (Min/Day) N=414	Difference (Min/Day)
Basic care	189.9	199.0	9.1*
Technical acts	12.9	22.2	9.3*
Total time†	224.7	241.9	17.1*

* $P < .0001$.

† Total time is the sum of basic care, technical acts, and communication.

increase in nursing time required to perform the technical actions was 70% and 72%, respectively, for the analysis of covariance and for the sample restriction.

DISCUSSION

The objective of the study was to measure the significance of the increase in daily required nursing time attributable to the presence of pressure sores. Before any adjustment was made, the residents with pressure sores needed, on average, 63 minutes more than the resi-

dents without sores. However, the increase attributable to pressure sores was 19 or 17 minutes, respectively, depending on the analysis used to take the confounding factors into account: analysis of covariance or sample restriction. In absolute terms, both methods led to quite similar results. Our results are similar to those of Frantz and colleagues.¹²

The main results presented in this study are statistically very significant:

- The analysis of covariance and the sample restriction show that the presence of pressure sores

induces a very significant increase in required nursing time ($P \leq .0001$).

• Pressure sores significantly influence the patients' needs in the areas of alimentation, mobilization, treatments, diagnostic methods, and medications ($P \leq .01$).

Our results are related closely to the specific context of the long-term institutions in Quebec and to the tool used to assess the required nursing time, the PLAISIR system:

• The PLAISIR system allows quantification of required care for each resident. Each nursing action is weighted to convert actions into nursing time. The norms reflect the time necessary for a "referent nurse" to perform the nursing action. A change of those norms could lead to different results.

• The assessor decides the required nursing actions on the basis of the biopsychosocial profile of the resident. While evaluating the required nursing times, he or she is influenced by his or her nursing philosophy, which finds expression in rules, norms, and standards. All the assessors in Quebec attended the same training, and standard requirements were defined. This guarantees a uniformity of evaluation among the institutions in Quebec. However, the nursing philosophy is very much linked to the context. For instance, when the PLAISIR system was applied in Switzerland, nursing committees had to redefine the norms and standards so that they corresponded to their practice.

The results were obtained using an administrative database including 34% of the long-term residents in Quebec during the year 1993 to 1994 (except specifically psychiatric or totally private centers). It has been argued that administrative databases do not give a reliable picture of the long-term-care population when residents are assessed at

fixed intervals,¹⁸ because no information is available on sores that develop and heal between the assessments. This is not the case here, because information is collected on patients with a health status change unless worsenings are more likely to be reported than improvements. A more plausible source of bias is the selective discharge of patients with pressure sores; patients with severe sores are likely to be transferred to acute hospitals and have increased mortality.¹⁹ So, they may be absent from the database, which would result in underestimates of the prevalence of sores and of the increase in nursing time required. It could be interesting to validate our results in studying the evolution of a cohort of residents instead of point assessments.

In conclusion, our results show that, in the specific context of long-term care in Quebec, the presence of pressure sores significantly increases the nursing workload, even after taking into account factors that simultaneously influence pressure-sore occurrence and nursing-time requirements. Pressure sores induce an increase in nursing-time requirements to perform not only technical acts but also basic care. Because nursing time can be translated into cost, it should be interesting to analyze strategies of reducing the costs of treating ulcers, for example, with the implementation of skin-care protocols.²⁰ One should keep in mind that the problem of pressure ulcers also must encompass prevention, which itself is costly.²¹

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