

## Health status utilities and the impact of pressure ulcers in long-term care residents in Ontario

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### Abstract

**Purpose** To estimate health status utilities in long-term care (LTC) residents in Ontario, both with and without pressure ulcers (PUs), and to determine the impact of PU on health-related quality of life (HRQOL).

**Methods** A retrospective population-based study was carried out using Minimum Data Set (MDS) health assessment data among all residents in 89 LTC homes in

Ontario who had a full MDS assessment between May 2004 and November 2007. The Minimum Data Set-Health Status Index (MDS-HSI) was used to measure HRQOL. A stepwise regression was used to determine the impact of PU on MDS-HSI scores.

**Results** A total of 1,498 (9%) of 16,531 LTC residents had at least one stage II PU or higher. The mean  $\pm$  SD MDS-HSI scores of LTC residents without PU and those with PU were  $0.36 \pm 0.17$  and  $0.26 \pm 0.13$ , respectively ( $p < 0.001$ ). Factors associated with lower MDS-HSI scores included: older age; being female; having a PU;

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recent hip fracture; multiple comorbid conditions; bedfast; incontinence; Changes in Health, End-stage disease and Symptoms and Signs; clinically important depression; treated with a turning/repositioning program; taking anti-psychotic medications; and use of restraints.

**Conclusions** LTC residents with PU had slightly though statistically significantly lower HRQOL than those without PU. Comorbidity contributed substantially to the low HRQOL in these populations. Community-weighted MDS-HSI utilities for LTC residents are useful for cost-effectiveness analyses and help guide health policy development.

**Keywords** Health-related quality of life · Long-term care · Minimum Data Set · Health Status Index · Ontario/Canada · Utilities

## Introduction

Pressure ulcers (PUs) commonly occur in long-term care (LTC) residents and impose a significant financial as well as health burden on health care systems [1]. PUs usually develop over bony prominences on the body as a result of pressure, shearing forces, or friction [2, 3]. For LTC residents, the development of a PU is associated with many concomitant conditions and a range of symptoms. Qualitative work has shown that the impact of both PU and related treatments is wide ranging, with physical, emotional, social, and financial aspects affected, while pain, restricted activities, changes in body image, and the loss of independence/control are profound [4–7]. It is, therefore, important to quantify the impact of PU on an individual's health-related quality of life (HRQOL) [5]. While community-based preference (utility)-weighted HRQOL measures are a preferred measure of burden of illness [8], the impact of PU on utility-weighted HRQOL in LTC residents has not been quantified previously.

Current guidelines recommend the use of preference-based measures (utilities) that represent community preferences for economic evaluations performed from the societal perspective [8]. Utilities measure health-related quality of life (HRQOL) on a scale of 0 (dead) to 1 (perfect health) providing information on the level and value of health states [9]. Population-based studies typically use multi-attribute or indirect HRQOL measures [10]. In this approach, health status is determined by responses to a multi-attribute health status classification system, and utility weights are assigned to each health state based on preference measurements taken from random samples of the general population (community preferences).

The Minimum Data Set (MDS) is used in over 19 countries (including mandated use in nearly all US nursing homes and several Canadian provinces) and is the most widely used health assessment instrument for institutional LTC settings [9]. Applications of data captured in the MDS include health care planning [10], case-mix [11], quality improvement [12], and outcome measurement [9, 13]. The MDS-derived utility-based HRQOL measure (Minimum Data Set-Health Status Index, MDS-HSI) has shown analogous group-level results with the Health Utilities Index 2 (HUI2) [14, 15]. By combining the health status assessment information from the MDS with multi-attribute HUI2 community-based population utility scores for various health states, the MDS-HSI measures community preferences for health states experienced by LTC residents. Our objectives were to use the MDS-HSI to estimate health status utilities in LTC residents in Ontario, both with and without PUs, and to determine the impact of PU on HRQOL.

## Methods

### Setting and population

All residents in 89 LTC homes in Ontario who had a full MDS assessment were included in this analysis. If a person had more than one full assessment, one was randomly selected. This sample was representative of the population in the 89 LTC homes during the study period between May 14, 2004 and November 7, 2007. The 89 homes were selected by the Ontario Ministry of Health and Long-Term Care as the first wave of implementation sites for the MDS and were chosen to be representative of geography, size, and ownership; all 620 Ontario homes will adopt the MDS by 2012.

### Data sources

#### *Minimum Data Set*

LTC population-based data from the MDS 2.0 Canadian version was used to derive MDS-HSI scores for LTC residents in Ontario. The reliability and validity of the MDS for clinical practice and research purposes have been demonstrated in several studies [16–19]. The MDS comprises over 400 items and includes detailed measures of clinical diagnoses and conditions and health status including cognition, self-care, mobility, sensation, emotion, and pain. Trained assessors completed MDS assessments, with the majority (68%) including participation by residents and 27% including participation by both residents and their family.

## Measures

### *Minimum Data Set-Health Status Index*

The MDS-HSI is based upon the Health Utilities Index Mark 2 (HUI2), encompassing six attributes to define health states: cognition, self-care, mobility, sensation (vision, hearing, and speech), emotion, and pain [20–23]. Each HUI2 attribute has four or five levels, ranging from severely impaired to no impairment/normal. The HUI2 uses standard gamble-based Canadian community preference weights to obtain a cardinal index of HRQOL with a range of –0.02 through 1.0. A score of 0 represents dead and 1.0 represents the best possible health one could expect to achieve [20–23]. A negative score implies health states worse than dead. A difference of 0.03 or more on an overall score is considered clinically important based on cross-sectional and longitudinal comparisons of known groups [24]. The MDS-HSI is a validated preference-based utility score that can be generated from routine MDS assessments. The MDS-HSI is derived by mapping specific MDS elements to each attribute of the HUI2 classification system and then assigning scores using the HUI2 preference weights [17]. Earlier work has established a relationship between the HUI2 and the MDS-HSI in older community-dwelling and institutional LTC clients [15]. The MDS-HSI has been shown to have good construct and convergent validity (i.e. MDS-HSI scores and related summary functioning scores are highly correlated), as well as good discriminant validity measured in different populations [14, 15].

Details of the derivation of the MDS-HSI can be found in Wodchis et al. [14, 15]. Similar to the HUI2 measure, the MDS-HSI was derived in two steps: first, relevant items from the MDS assessment were mapped onto the HUI2 health status classification system; second, subjects were assigned MDS-HSI scores using the Canadian HUI2 community preference weights [21–23].

### Measurement

The MDS records the number of PUs at stage I through IV [25]. We categorized residents as having a PU if they had one or more PUs at stage II or higher [26]. We also collected information about demographic characteristics—age, gender, and marital status; comorbid conditions—any infection, underlying active diseases, number of diseases, bladder or bowel incontinence, and bedfast; and clinical interventions—nutritional or hydration intervention to manage skin problems, turning or repositioning program, number of medications, and restraints.

In addition, four health index measures previously developed and validated for use with MDS instruments

were obtained: the MDS Activities of Daily Living (ADL) Self-Performance Hierarchy [27]; the MDS Cognitive Performance Scale (CPS) [28, 29]; the MDS Depression Rating Scale (DRS) [30]; and the MDS Changes in Health, End-stage disease and Symptoms and Signs (CHESS) all reflecting resident health status in the last 7 days [31]. The ADL and CPS scores range from 0 to 6, the DRS from 0 to 14, and the CHESS is scored from 0 to 5 with higher values indicating higher levels of impairment. We also calculated the body mass index (BMI) based on height and weight recorded on the MDS.

### *Statistical analysis*

General linear models were used to determine whether there was a significant difference in the mean MDS-HSI scores between residents with and without PU overall and stratified by measured resident characteristics. *T*-tests were used to compare mean scores in bivariate analyses with a bonferroni correction for multiple comparisons. MDS items considered as potential predictors of HRQOL were categorized into three groups: demographic characteristics; comorbid conditions; and clinical interventions. A full stepwise regression was performed wherein variables that showed a statistically significant ( $p < 0.01$ ) and clinically important difference ( $\pm 0.03$ ) in MDS-HSI scores in bivariate comparisons between having the condition and not (either among residents with PU or among residents without PU) were used as potential explanatory variables in the model, with a probability level of 0.15 for entry and removal and MDS-HSI as the dependent variable. Demographic characteristics (age group, gender, and marital status) were forced to be retained in the model to control for relationships between these and other comorbidity variables and MDS-HSI scores. ADL and CPS were not included in the regression models because the underlying MDS items are used in the MDS-HSI algorithm. SAS was used for all analyses (SAS Inc, North Carolina, USA version 9.1).

## Results

### Characteristics of LTC residents

A total of 1,498 (9%) of our sample of 16,531 LTC residents had a stage II or greater PU reported on their MDS assessment (Table 1). There were no significant differences in the length of stay or demographic characteristics (i.e. age and marital status) between residents with and without PU except that the proportion of males was higher in residents with PU (34 vs. 30%,  $p = 0.001$ ). The mean  $\pm$  standard deviation (SD) BMI was significantly lower in residents

**Table 1** MDS-HSI of LTC residents by pressure ulcer status and demographic characteristics

| Characteristics    | With pressure ulcer |      |      | Without pressure ulcer |      |      | MDS-HSI<br>PU-Diff <sup>a</sup> |
|--------------------|---------------------|------|------|------------------------|------|------|---------------------------------|
|                    | MDS-HSI             |      |      | MDS-HSI                |      |      |                                 |
|                    | N (%)               | Mean | SD   | N (%)                  | Mean | SD   |                                 |
| Total number       | 1,498               | 0.26 | 0.13 | 15,033                 | 0.36 | 0.17 | -0.10                           |
| Age group (years)  |                     |      |      |                        |      |      |                                 |
| <75                | 178<br>(12)         | 0.27 | 0.14 | 1902<br>(13)           | 0.39 | 0.18 | -0.12                           |
| 75–84              | 544<br>(36)         | 0.26 | 0.14 | 5499<br>(37)           | 0.37 | 0.17 | -0.10                           |
| 85+                | 776<br>(52)         | 0.25 | 0.13 | 7632<br>(51)           | 0.34 | 0.16 | -0.09                           |
| Gender             |                     |      |      |                        |      |      |                                 |
| Male               | 508<br>(34)         | 0.29 | 0.14 | 4494<br>(30)           | 0.38 | 0.18 | -0.10                           |
| Female             | 987<br>(66)         | 0.25 | 0.13 | 10517<br>(70)          | 0.34 | 0.17 | -0.10                           |
| Marital status     |                     |      |      |                        |      |      |                                 |
| Never married      | 91 (6)              | 0.28 | 0.14 | 1138 (8)               | 0.38 | 0.18 | -0.10                           |
| Other <sup>b</sup> | 1407<br>(94)        | 0.26 | 0.13 | 13895<br>(92)          | 0.35 | 0.17 | -0.10                           |

MDS-HSI Minimum Data Set-Health Status Index, SD standard deviation

<sup>a</sup> PU-Diff: All differences in MDS-HSI between residents with and without pressure ulcer are significant using a *t*-test,  $p < 0.001$

<sup>b</sup> Married, separated, widowed, or divorced

with PU than those without PU ( $21.7 \pm 3.3$  vs.  $22.7 \pm 2.8$ ,  $p < 0.001$ ). Residents with PU were more likely to require extensive (41 vs. 26%) or total (67 vs. 34%,  $p < 0.001$ ) ADL assistance and have severe cognitive impairment (based on the CPS) (38 vs. 26%,  $p < 0.001$ ) than those without PU.

#### Comorbid conditions and clinical interventions

Results shown in Table 2 indicate that residents with PU were significantly more likely than those without PU to have a history of urinary (77 vs. 60%;  $p < 0.001$ ) or bowel (66 vs. 41%;  $p < 0.001$ ) incontinence, and infection (22 vs. 11%;  $p < 0.001$ ). Residents with PU were also more likely to have a CHES score of one or above (61 vs. 46%;  $p < 0.001$ ) and weight loss (17 vs. 8%;  $p < 0.001$ ). The mean  $\pm$  SD number of diseases was significantly greater in residents with PU than in those without PU ( $4.6 \pm 2.3$  vs.  $4.3 \pm 2.2$ ;  $p < 0.001$ ). Frequencies of clinical interventions included in Table 3 show that residents with PU were significantly more likely than those without PU to have a history of receiving a nutritional or hydration intervention for skin problems (32

vs. 4%;  $p < 0.001$ ), being on a turning or repositioning program (52 vs. 15%;  $p < 0.001$ ), receiving 12 or more medications (34 vs. 28%;  $p < 0.001$ ), or to be restrained on a daily basis (26 vs. 14%;  $p < 0.001$ ).

#### Health utilities: the Minimum Data Set-Health Status Index scores

The unadjusted means and SDs of the MDS-HSI by LTC residents' PU status and by their demographic characteristics, comorbid conditions, and clinical interventions, and the mean MDS-HSI differences between the two groups are reported in Tables 1 through 3. A statistically significant difference as well as clinically important difference ( $\pm 0.03$ ) in MDS-HSI between residents without PU and those with PU was observed in most variables. The unadjusted mean  $\pm$  SD MDS-HSI score of LTC residents without PU was  $0.36 \pm 0.17$  and the MDS-HSI for those with PU was  $0.26 \pm 0.13$ . Similarly, a 0.10-point or more difference in MDS-HSI between residents without PU and those with PU was also generally observed within levels of demographic variables. The MDS-HSI difference by PU status was also significant and approximately 0.10 points lower in the absence of comorbid conditions. However, the difference in MDS-HSI scores across PU status was smaller (0.05–0.07 points lower among residents with PU) in the presence of comorbid conditions such as incontinence, infections, higher CHES scores, and weight loss. The difference in MDS-HSI scores between residents with and without PU was also smaller among residents receiving nutritional interventions, repositioning program, and non-significant among residents in daily restraints.

#### Factors associated with health utilities (MDS-HSI)

In the final stepwise regression model (Table 4), all variables with significant and clinically important differences in the univariate analysis were also retained by the stepwise procedure in the multivariate model with the exception of weight loss. Older age (85 years and older), being female, having a PU, history of having any infection ( $p = 0.034$ ), having a hip fracture, having multiple diagnoses of chronic conditions (three or more), being bedfast, having bladder or bowel incontinence, higher CHES scores, and clinically important depressive symptoms (depression scale score three or more) were negatively associated with MDS-HSI scores. Additionally, residents having received nutritional or hydration intervention ( $p = 0.016$ ), a turning or repositioning program, antipsychotics, and restraints had lower MDS-HSI scores. Never being married was significantly associated with higher MDS-HSI scores. These factors explained 38% of the variance in the HRQOL. All

**Table 2** MDS-HSI of LTC residents by pressure ulcer status and comorbid conditions

| Characteristics      | With pressure ulcer |      |      | Without pressure ulcer |      |      | MDS-HSI<br>PU-Diff <sup>a</sup> |
|----------------------|---------------------|------|------|------------------------|------|------|---------------------------------|
|                      | MDS-HSI             |      |      | MDS-HSI                |      |      |                                 |
|                      | N (%)               | Mean | SD   | N (%)                  | Mean | SD   |                                 |
| Total number         | 1,498               |      |      | 15,033                 |      |      |                                 |
| Bladder incontinence |                     |      |      |                        |      |      |                                 |
| Usually continent    | 352 (23)            | 0.33 | 0.16 | 6002 (40)              | 0.45 | 0.18 | −0.12                           |
| Incontinent          | 1146 (77)           | 0.24 | 0.11 | 9031 (60)              | 0.30 | 0.14 | −0.06                           |
| Bowel incontinence   |                     |      |      |                        |      |      |                                 |
| Usually continent    | 505 (34)            | 0.33 | 0.15 | 8806 (59)              | 0.42 | 0.17 | −0.09                           |
| Incontinent          | 993 (66)            | 0.22 | 0.11 | 6227 (41)              | 0.27 | 0.13 | −0.05                           |
| Bedfast              |                     |      |      |                        |      |      |                                 |
| No                   | 1328 (89)           | 0.27 | 0.13 | 14716 (98)             | 0.36 | 0.17 | −0.09                           |
| Yes                  | 170 (11)            | 0.19 | 0.10 | 317 (2)                | 0.24 | 0.12 | −0.05                           |
| Any infection        |                     |      |      |                        |      |      |                                 |
| No                   | 1173 (78)           | 0.26 | 0.13 | 13354 (89)             | 0.36 | 0.17 | −0.10                           |
| Yes                  | 325 (22)            | 0.26 | 0.13 | 1679 (11)              | 0.32 | 0.15 | −0.07                           |
| Number of diseases   |                     |      |      |                        |      |      |                                 |
| 0–2                  | 265 (18)            | 0.26 | 0.15 | 3137 (21)              | 0.38 | 0.19 | −0.12                           |
| 3–5                  | 768 (51)            | 0.26 | 0.13 | 7982 (53)              | 0.36 | 0.17 | −0.10                           |
| Six or more          | 465 (31)            | 0.25 | 0.12 | 3914 (26)              | 0.33 | 0.15 | −0.08                           |
| Hip fracture         |                     |      |      |                        |      |      |                                 |
| No                   | 1325 (88)           | 0.26 | 0.13 | 13844 (92)             | 0.36 | 0.17 | −0.10                           |
| Yes                  | 173 (12)            | 0.26 | 0.13 | 1189 (8)               | 0.31 | 0.15 | −0.05                           |
| CHESS                |                     |      |      |                        |      |      |                                 |
| 0                    | 579 (39)            | 0.29 | 0.15 | 8068 (54)              | 0.38 | 0.18 | −0.10                           |
| 1                    | 437 (29)            | 0.26 | 0.12 | 4269 (28)              | 0.34 | 0.16 | −0.08                           |
| 2                    | 286 (19)            | 0.24 | 0.12 | 1950 (13)              | 0.31 | 0.15 | −0.07                           |
| 3                    | 126 (8)             | 0.22 | 0.11 | 577 (4)                | 0.26 | 0.12 | −0.04                           |
| 4–5                  | 70 (5)              | 0.17 | 0.08 | 169 (1)                | 0.24 | 0.11 | −0.07                           |
| Depression scale     |                     |      |      |                        |      |      |                                 |
| 0–2                  | 964 (64)            | 0.29 | 0.14 | 10284 (68)             | 0.39 | 0.17 | −0.10                           |
| Three or more        | 534 (36)            | 0.20 | 0.10 | 4749 (32)              | 0.28 | 0.13 | −0.07                           |
| Weight loss          |                     |      |      |                        |      |      |                                 |
| No                   | 1037 (69)           | 0.26 | 0.13 | 11979 (80)             | 0.36 | 0.17 | −0.10                           |
| Yes                  | 250 (17)            | 0.23 | 0.12 | 1183 (8)               | 0.29 | 0.15 | −0.06                           |

MDS-HSI Minimum Data Set-Health Status Index, SD standard deviation

<sup>a</sup> PU-Diff: difference in MDS-HSI between residents with and without pressure ulcer; *t*-test, *p* value for each variable category <0.001 except CHESS score three category (*p* = 0.004). CHESS, Changes in Health, End-stage disease and Symptoms and Signs—higher values indicate higher levels of clinical instability and risk of death [31]

variables showed significance at a *p* value <0.001 except those shown previously.

Factors with no additional significant effect

Although multiple chronic diagnoses have a significant effect on the residents' HRQOL, individual diagnosis of diabetes, hypertension, other heart problems, arthritis,

osteoporosis, cerebrovascular accident, any psychiatric diagnosis, or eye problem had no significant effect on HRQOL in both residents with and without PU. Furthermore, the number of medications received, having received antianxiety, antidepressant, or antihypnotic medication, hospital stays, emergency room visits, and physician visits were not significantly associated with MDS-HSI scores.

**Table 3** MDS-HSI of LTC residents by pressure ulcer status and clinical intervention

| Characteristics                 | With pressure ulcer |      |      | Without pressure ulcer |      |      | MDS-HSI              |
|---------------------------------|---------------------|------|------|------------------------|------|------|----------------------|
|                                 | MDS-HSI             |      |      | MDS-HSI                |      |      |                      |
|                                 | <i>N</i> (%)        | Mean | SD   | <i>N</i> (%)           | Mean | SD   | PU-Diff <sup>a</sup> |
| <b>Nutritional intervention</b> |                     |      |      |                        |      |      |                      |
| No                              | 1026 (68)           | 0.27 | 0.13 | 11430 (96)             | 0.36 | 0.17 | −0.09                |
| Yes                             | 472 (32)            | 0.23 | 0.12 | 603 (4)                | 0.26 | 0.14 | −0.03                |
| <b>Repositioning program</b>    |                     |      |      |                        |      |      |                      |
| No                              | 716 (48)            | 0.30 | 0.15 | 12825 (85)             | 0.38 | 0.17 | −0.07                |
| Yes                             | 782 (52)            | 0.22 | 0.10 | 2208 (15)              | 0.24 | 0.11 | −0.02                |
| <b>Number of medications</b>    |                     |      |      |                        |      |      |                      |
| 0–5                             | 246 (16)            | 0.24 | 0.14 | 3002 (20)              | 0.36 | 0.18 | −0.12                |
| 6–11                            | 749 (50)            | 0.26 | 0.13 | 7872 (52)              | 0.36 | 0.17 | −0.09                |
| 12 or more                      | 503 (34)            | 0.27 | 0.13 | 4159 (28)              | 0.35 | 0.16 | −0.09                |
| <b>Antipsychotics</b>           |                     |      |      |                        |      |      |                      |
| No                              | 1084 (72)           | 0.27 | 0.14 | 10306 (69)             | 0.37 | 0.17 | −0.10                |
| Yes                             | 414 (28)            | 0.23 | 0.11 | 4727 (31)              | 0.33 | 0.17 | −0.10                |
| <b>Antianxiety</b>              |                     |      |      |                        |      |      |                      |
| No                              | 1244 (83)           | 0.26 | 0.13 | 12533 (83)             | 0.36 | 0.17 | −0.10                |
| Yes                             | 254 (17)            | 0.25 | 0.13 | 2500 (17)              | 0.34 | 0.17 | −0.09                |
| <b>Antidepressants</b>          |                     |      |      |                        |      |      |                      |
| No                              | 936 (62)            | 0.26 | 0.13 | 8861 (59)              | 0.37 | 0.17 | −0.10                |
| Yes                             | 562 (38)            | 0.26 | 0.13 | 6172 (41)              | 0.34 | 0.16 | −0.09                |
| <b>Antihypnotics</b>            |                     |      |      |                        |      |      |                      |
| No                              | 1402 (94)           | 0.26 | 0.13 | 13816 (92)             | 0.36 | 0.17 | −0.10                |
| Yes                             | 96 (6)              | 0.26 | 0.14 | 1217 (8)               | 0.36 | 0.17 | −0.09                |
| <b>Daily restraints</b>         |                     |      |      |                        |      |      |                      |
| No                              | 1113 (74)           | 0.28 | 0.14 | 12895 (86)             | 0.38 | 0.17 | −0.10                |
| Yes                             | 385 (26)            | 0.21 | 0.09 | 2138 (14)              | 0.22 | 0.10 | −0.01                |

MDS-HSI Minimum Data Set-Health Status Index, SD standard deviation

<sup>a</sup> PU-Diff: difference in MDS-HSI between residents with and without pressure ulcer; *t*-test, *p* value for each variable category <0.001 except daily restraint (*p* = 0.0491)

## Discussion

Our study showed that utility scores for LTC residents are low. The unadjusted sample mean MDS-HSI scores were significantly lower for LTC residents with PU than those without PU, with a moderate decrement of 0.10 in utility. This relationship was consistent within several demographic and clinical comorbid categories. PU was slightly (−0.026) and significantly related to HRQOL independent of other resident demographic characteristics, comorbid conditions, and clinical interventions. Comorbidity contributed substantially to the low HRQOL in the study population.

Treatment and prevention of diseases and conditions are expensive. Cost-effectiveness analyses of health care interventions are increasingly used to inform health policy where quality of life measures are being incorporated. But cost-effectiveness analyses often rely on low quality evidence.

For example, in the absence of empirical data, Fleurence et al. [2] in their cost-effectiveness analysis of pressure-relieving devices for the prevention and treatment of PUs, derived utility scores for PU health states via expert panel of five health professionals, using a rating scale technique. Population utilities based on community preference scores such as those presented here are more representative than utilities estimated by small panels of experts [2].

The weights used in the derivation of MDS-HSI are reflective of a community-based population and, therefore, might understate or overstate the LTC residents' own perceptions of their utility scores. Nonetheless, similar to the National Population Health Survey (NPHS, a prospective survey of the health of Canadians) population [32], utility scores in our LTC residents without PU decreased with increasing age and the number of comorbid conditions. The current MDS-HSI scores of LTC residents

**Table 4** Stepwise regression of factors associated with MDS-HIS

| Variable  | Coefficient | SE    | p Value |
|---|-------------|-------|---------|
| Intercept                                       | 0.520       | 0.004 | <0.001  |
| Pressure ulcer status (II to IV vs. 0 to I)     | −0.022      | 0.004 | <0.001  |
| Age group (years)*                              |             |       | <0.001  |
| <75   | Ref         |       |         |
| 75–84   | −0.003      | 0.003 | 0.368   |
| 85 or older                                     | −0.018      | 0.003 | <0.001  |
| Gender* (female vs. male)                       | −0.016      | 0.002 | <0.001  |
| Never married (versus other)*                   | 0.018       | 0.004 | <0.001  |
| Infection (yes vs. no)                          | −0.007      | 0.003 | 0.034   |
| Hip fracture (yes vs. no)                       | −0.018      | 0.004 | <0.001  |
| Number of diseases                              |             |       | <0.001  |
| 0–2   | Ref         |       |         |
| 3–5   | −0.009      | 0.003 | 0.0008  |
| Six or more                                     | −0.018      | 0.003 | <0.001  |
| Bedfast (yes vs. no)                            | −0.049      | 0.006 | <0.001  |
| Bladder incontinence (yes vs. no)               | −0.068      | 0.003 | <0.001  |
| Bowel incontinence (yes vs. no)                 | −0.066      | 0.003 | <0.001  |
| CHESS   |             |       | <0.001  |
| 0   | Ref         |       |         |
| 1   | −0.024      | 0.002 | <0.001  |
| 2   | −0.041      | 0.003 | <0.001  |
| 3   | −0.064      | 0.005 | <0.001  |
| 4–5   | −0.072      | 0.009 | <0.001  |
| Depression scale (three or more vs. 0–2)        | −0.082      | 0.002 | <0.001  |
| Nutritional/hydration intervention (yes vs. no) | −0.011      | 0.005 | 0.016   |
| Turning/repositioning program (yes vs. no)      | −0.049      | 0.003 | <0.001  |
| Antipsychotics (yes vs. no)                     | −0.014      | 0.002 | <0.001  |
| Restraints (yes vs. no)                         | −0.071      | 0.003 | <0.001  |

MDS-HSI Minimum Data Set-Health Status Index, SE standard error, CHESS Changes in Health, End-stage disease and symptoms and signs—higher values indicate higher levels of clinical instability and risk of death

\* Forced into model

are also comparable to a previous study among residents in two LTC homes in Ontario (0.35) [15]. On the other hand, the average utility scores of LTC residents in this study (0.35) is substantially lower than those among community-dwelling populations with chronic conditions of similar age in the NPHS (e.g. urinary incontinence: 0.71) [32] or community-based older frail home care clients (0.60) [14, 15]. These differences may be explained by a higher prevalence of comorbid conditions in LTC residents when compared with community-based populations or by differences in the mode of assessment (i.e. observation versus self-report [16]).

There are a number of limitations to this analysis. First, the cross-sectional nature of our study limits assessment of changes in HRQOL over time. Second, the LTC MDS-HSI scores may not be generalizable to all people with PU in the community or to other LTC settings. Our sample includes only 89 of the over 600 LTC homes in Ontario. There is relatively little information available about the specific 89 homes except that they were selected by the health ministry to be representative of geography,

ownership, and size (in order to provide the provincial ministry with evaluative information for planning and implementation lessons). Finally, the predictors in our models accounted for only 38% of the variability in LTC residents' HRQOL, and we were not able to accurately identify and adjust for facility factors or socioeconomic factors that might impact resident HRQOL.

## Conclusion

In conclusion, our results suggest that the HRQOL of LTC residents is low and that PU has a slight though statistically significant impact on their HRQOL controlling for the effects of comorbid conditions and related treatments. These findings have implications for prevention and treatment of PUs. The MDS-HSI provides an important summary outcome measure for the economic evaluation of PU prevention and care among residents in LTC settings. Future research should examine longitudinal changes in HRQOL associated with the onset of and recovery from PU.

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