

Attachment 13
Proximity to Death, a Modeling Tool for Use in Nursing Homes

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Abstract

Background. While there has been an increase in the proportion of elders who die in U.S. nursing homes, there has been no systematic attempt by facilities to model who is at risk of death and then use this classification to target program initiatives towards these residents. Since 1990, all US nursing homes that participate in the Medicare and Medicaid programs have been mandated to complete an ongoing standardized, comprehensive assessment of each resident's clinical, diagnostic, functional, medical, psychosocial, and cognitive status. The assessment system is called the Minimum Data Set (MDS), and this item base contains the raw elements upon which a proximity to death model could be based. In this paper, we first create such a model (the MDS-Personal Severity Index or PSI), drawing on a diverse array of elements that have been shown to become more prevalent as death is approached, and we then use this information to suggest how this model may identify residents with discrete clinical problems, looking specifically at nutrition and skin status. And, finally, we put forward a recommendation concerning how to use this model to assign residents into a palliative-care follow-up cohort.

Methods. Information was drawn from two data sets. The utility of the MDS items as proximity to death markers was established using a series of consecutive assessment batteries from 2,400 residents at a large long-term care facility (HRCA). The applicability of the proximity to death model was established in a replication sample for facilities across three states: Massachusetts, New York, and Ohio (n=196,289). Analyses examined the relationship of putative risk factors and risk of death over a discrete six-month period of observation using logistic regression.

Results. Twelve percent (12.1%) of the HRCA residents died within six months, and 15% of the Massachusetts residents died within six months. An additive scale composed of items predictive of death in the HRCA sample -- the PSI scale -- has a monotonic relationship with proximity to death, with the probability of dying increasing in a stepped function as the count of risk factors rises. A high-risk cut off on the full scale was established at a count of nine or more of the 25 problems in the PSI; 15.4% of the residents in nursing homes from Massachusetts, New York, and Ohio fall into this high-risk category, and over six months they have a 35.7% death rate, as compared to the 13.5% death rate for the total three-

state nursing home sample. In the comparison of resident PSI score levels to the presence of nutrition and skin problems, there was a steep increase in problem rates for those in the high-risk PSI group.

Conclusion. The PSI should prove to be a useful tool for nursing facilities interested in assessing resident proximity to death, with the goal of moving from a usual program of care to a more palliative focused program of care. The index references a broad spectrum of individual risk factors, including age, ADL dependency, cognitive performance, mood status, and clinical complications such as incontinence, malnutrition, respiratory distress, skin problems. The tool may be useful in identifying residents at higher than average risk of death for whom advanced care planning might be instituted in order to avoid the introduction of unnecessary interventions.

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INTRODUCTION

Approximately one in five of all deaths occur in nursing homes (1) and this rate has been rising over the past few years. At the same time, the care responsibilities of these facilities have become increasingly diverse. In addition to their traditional role as a provider of long-stay care for cognitively and physically impaired residents, nursing homes now serve as a major site of post-hospital rehabilitative and acute care management, specialty mental health care, pediatric care, and hospice care. In this new environment, as roles become more complex, these facilities require new tools to assist staff in carrying out these various functions. From an end-of-life perspective, facilities need a “ruler” that can help them flag residents who might be candidates for a palliative, symptom management care program. Under current Centers for Medicare and Medicaid Services (CMS) rules, all of these residents are subject to the standard MDS assessment and care management guidelines, but there has been little effort by the industry and the regulatory community to focus attention on this segment of the resident population.

Under CMS guidelines, nursing facilities must complete ongoing, standardized assessments on each resident and must use this information to address resident needs. The assessment system is known as the MDS, and since 1990, pursuant to a 1987 Congressional mandate, all U.S. nursing homes complete this assessment of each resident's clinical, diagnostic, functional, medical, psychosocial, and cognitive status (2-4). Assessments are required at admission (the Full assessment), at 90-day intervals throughout the year (the shortened Quarterly assessments), at the time of the annual anniversary of the admission (a Full), and on significant change in the resident's status. Trained clinical professionals (e.g., nurses, social workers, therapists) assess resident performance over all shifts during the prior seven-day period. Each item has its own explicit definition. Each assessor is told to interact with the resident, review the record, and gather information on resident performance from direct care and licensed professional staff.

This comprehensive information set includes a wide variety of items that are relevant to residents near the end of life, and there has been some progress in identifying MDS items that are predictive of the resident's terminal status (5). The most powerful predictor in the MDS is the item “End-stage disease, 6 or fewer months to live,” but as Finne-Soveri has noted, this item is checked for fewer than 1% of residents for any round of MDS assessments (26). It is difficult to make the explicit call as to when someone will

die. Simple yes/no designations on projected length of life, whether for six, three or even two months are fraught with uncertainty, and even the most experienced physicians are reluctant to make such a definitive call for their patients.

The goal of the work described in this paper is to bring together a reasonably comprehensive subset of relevant MDS items for inclusion in a proximity to death summary scale, the MDS Personal Severity Index (MDS-PSI). In addition, we wished to identify a threshold index value on the PSI at which facilities, or CMS under their MDS mandate, may consider moving the resident from the standard array of resident care protocols to a more focused set of palliative-care service protocols. Finally, using this index-value classification, we provide descriptive information relative to two of the most common problem syndromes as death is approached: nutrition and skin.

In constructing the PSI, we had to first assemble a balanced list of individual predictor variables, focusing on measures that others have shown to be associated with proximity to death. Prior research has found the following important in predicting mortality:

- ? Age and gender (5-11)
- ? Functional performance measures include ADLs, cognitive impairment, and general confusion (5-19).
- ? Clinical measures such as pressure ulcers (7), infections (8), incontinence (20), constipation (18), respiratory impairment or shortness of breath (5,6,21), low Body Mass Index or malnutrition (5,7, 8,18,21,22,23), weight loss (10,19,21), and swallowing problem (5,19,21).
- ? Diagnostic conditions, including cardiac impairments (5-9,14), neurological impairment (6), diabetes (7), and cancer (14,17).

We are fortunate that most all of these items are in the MDS and available for modeling here.

METHODS

In developing the MDS-PSI, we selected, *a priori*, a set of items likely to have an increasing prevalence as death was approached, drawing on measures that others have shown to be related to proximity to death (5,10). These were first tested in secondary analysis using data from a single long-term care facility that included documented dates of death; and then these relationships were replicated in a larger cross-facility data set from a single state. We recognized that for many of these items there would be considerable collinearity, and thus not all items were expected to be appropriate candidates for inclusion within

the final PSI risk index, even if they were individually predictive of mortality. In the following we describe our methods to develop the PSI.

MDS Items Related to Proximity to Death. Only one direct measure of possible proximity to death is included in the MDS: the end-stage judgement item. When present, this item has been shown to be an excellent predictor of subsequent length of life (16).

All other available items are more indirect, capturing functional, behavioral, clinical, and other factors that have been shown to have an associative relationship with proximity to death. Items were considered in six domains: demographics, functional measures, disease diagnoses, mood indicators, clinical complications, services utilization. Demographics included age and gender. In the domain of functional performance, we were interested in measures that could capture the cascade of losses as death is approached. We considered dependency in ADL, including ADLs that would be the first to be lost, such as personal hygiene and dressing, and those last to be lost, including bed mobility and eating. Other functional measures reviewed included cognition, communication skills, and balance. For these functional measures, we focused on aspects of performance that reflected the greatest level of dependency. In considering mood, we concentrated on items that reflected a sense of hopelessness, anxiety, and fear; while for diagnoses, we looked at neurological disease, cardiac deficiencies, cancer, diabetes, and anemia. The domain of clinical problems and conditions was the largest and the most diverse. We included indicators of delirium, pain, respiratory distress, infections, skin breakdown, malnutrition, and incontinence. Finally, we considered whether the resident was deemed to be terminally ill or unstable, what services were being received, and the resident's gender, and age.

These individual items are all derived from the MDS, and when scored by trained nurses following the CMS recommended process for completing the MDS assessments (8), these items have excellent reliability (24,25).

Data. The first of the two data sets used for these analyses tracks residents at the Hebrew Rehabilitation Center for Aged (HRCA) in Boston, merged with precise information on the date of death for all decedents. The HRCA is a 720-bed long-term care facility, specializing in the provision of life-care institutional services. The primary analytic file derived from this setting consists of the accumulated assessments for HRCA residents over an eight-year period (1994 - 2001), in which each quarterly and full assessment generates a new case record. Post-assessment death status is then precisely measured, with the

six-month status measure serving as the criterion variable in the bi-variate and logistic modeling effort -- with 12.5% of residents dying by this date. Using this discrete time survival analysis sample accumulation strategy, the analytic file includes 23,132 case records for 2,400 different residents during this period.

Our initial modeling efforts were then replicated in a sample derived from across all nursing homes in three states: Massachusetts, New York, and Ohio. This data set was limited to Medicaid and private pay residents who had been in residency a minimum of three months, $N = 196,289$, and over the ensuing six months 13.5% of these residents died.

Analytic Strategy. In developing the MDS Personal Severity Index (PSI), our goal was to create an index that had elements from across the widest possible array of risk factors found in the MDS. All of these variables were modeled against whether the resident died within six-months following the MDS assessment, and representative measures from each area were then summarized in the MDS-PSI. This was a four-step process. First, the items were identified in the data set. Second, bi-variate odds ratios were calculated for the six-month death status measure within the HRCA data set. Third, the significant items from the prior step were evaluated within a forward-stepping logistic model using the HRCA data set, conditioned on the requirement that the final model contain at least one item from each of the primary risk domains (e.g., delirium, ADL status, cognition). Fourth, these analyses were replicated in the combined Massachusetts, New York, and Ohio data set, and the tabular results presented in this paper are drawn from these analyses.

Two variants of the risk model were created: one using all of the available items in the full MDS assessment; the second limited to items on the shorter MDS quarterly assessment. Once created, we related these two variants of the MDS-PSI to resident death at 3, 6, and 12 months.

Finally, using the assignments of individuals in the Massachusetts, New York, and Ohio combined sample into high and low MDS-PSI status, we also provide descriptive information for two problem syndromes that become more prevalent as death is approached: nutrition and skin.

RESULTS

Distributions and Relationships among MDS Items and Six-Month Death Status . For the full cohort of HRCA residents from 1994-2001, the unadjusted probability of death doubled over each succeeding three-month period. At three months 6.4% of residents had died; this percentage increased to

12.5% at six months and 23.4% at one year. For, the combined Massachusetts, New York, and Ohio cohort, the results were about the same, 7.4% through three months, 13.5% through 6 months, and 23.2% through 12 months.

The preliminary bi-variate analyses presented in Table 1 describe how each of the domains of MDS-based risk measures relate to death status at six months within the HRCA sample. These findings provide a first indication as to whether the hypothesized risk characteristics play a role in identifying residents who can be expected to die in the more immediate future.

TABLE 1 ABOUT HERE

In general, the findings suggest that a wide variety of risk factors have an associative relationship with death by six months. The perspective gained from these bivariate analyses is one of universal system decline, originating in diverse disease, with diverse clinical manifestations.

The second stage, logistic analyses, as summarized in Table 2 for the Massachusetts, New York, and Ohio cohort replication sample, examined each of the significant individual risk items to determine how the six-month death status measure could be replicated from these inputs. Several different analyses were initially completed on the HRCA sample. We first evaluated the items within domains, completing a domain-specific forward-stepping logistic model, and then selected the best candidates from each domain to enter the final model. Using these items, the final logistic model was established at HRCA.

TABLE 2 ABOUT HERE

Table 2 includes information from the Massachusetts, New York, and Ohio combined replication cohort on how each item is scored, its distribution in the three-state sample, the bi-variate odds-ratio for the item (all of which are significant), and the multivariate odds ratios for the items when entered into the two summary models (in this case, with indications as to which items are non-significant when entered into the summary equation).

In the HRCA data set, eighteen items were found useful to form the Quarterly model: Age, cognition, communication, delirium, four ADLs, two mood items, and eight clinical complications. In the replication sample, seventeen of these items enter significantly, including age, cognitive decision making, delirium, all four ADLs, the two mood-status items, and all eight clinical complications. The only measure that entered non-significantly was ability to understand. But, as indicated earlier, as our goal was to insure that each of the key concepts was represented in the summary PSI model, and because this item was

significantly related to six-month death status in the appropriate direction, the item will be retained in the summary Quarterly PSI model [note, in the HRCA sample, all of these items had made a significant independent contribution to the logistic model].

These results suggest that death is more imminent for those who have the following accumulating series of risk factors: they are older, more functionally restricted, more cognitively impaired, are experiencing delirium, sense that something terrible is going to happen to them, have experienced a recent acute episode, are unstable, are bowel incontinent, have lost weight, have a pressure ulcer, have a stasis ulcer, and are judged to have an end-stage disease.

In the Full logistic model, we forced all of the items from the Quarterly model, and stepped in an additional seven items from those selected in the HRCA bivariate analysis. In the final Full model, *none* of the previously significant Quarterly items became non-significant, while the ability to understand item remained non-significant. Added to the model are items that indicate that death is more imminent when the following risk conditions are present: inability to lie flat due to shortness of breath, receipt of oxygen therapy, a problem in swallowing, not being awake in the afternoon, having a skin tear or cut, having a cardiac dysrhythmia or congestive heart failure.

Developing the MDS-PSI and Measuring its Relation to Death Status at 3, 6, and 12 Months .

The purpose of this effort was to develop simple, yet clinically meaningful tools to indicate residents who have a complex array of conditions that place them at an elevated risk of death, although recognizing that the predictions would be rather inexact, and many of the high-risk residents would not die over the ensuing follow-up periods. We thus used the variables identified in our logistic regressions to form simple, additive “counting” scales – our MDS-PSI. Thus, each scale is a count of the number of the risk factors identified in Table 2, with each item condition present adding an equal value of one (1) to the final summary score. For the Quarterly PSI, the scale range is from 0 to 18. In our combine Massachusetts, New York, and Ohio replication sample, the mean value was 3.66 with a standard deviation of 2.89. Only 15.6% of residents had none of these risk factors, and 15.8 had one risk factor (Table 3). Of all of the conditions, residents with one risk factor were most likely to be 90 years of age or older (32%) or to be judged as having conditions or diseases that make them unstable (18%) or to be bowel incontinent (12%). At the other end of the continuum, using a count of five or more as being indicative of residents in the most complex subset, 38.2% of residents had five or more of these characteristics.

TABLE 3 ABOUT HERE

For the Full PSI, the distributional properties are similar: 9.3% have none of the risk factors and 15.2% of the residents have nine or more of these characteristics. The mean value was 4.69, with a standard deviation of 3.39.

For each of the death periods, 3, 6, and 12, months, there is a monotonic relationship between risk classification and death status -- the probability of dying increases in a stepped function as the count of risk factors rises (Table 3). This applies to deaths at each of the three follow-up points, as well as to persons who are alive at a given follow-up point and who are then tracked forward for an additional period of time.

Developing Thresholds for the MDS-PSI. While measuring proximity to death has its origin in a number of different functional and clinical complications, it has not been our goal to focus on these specific items. In fact, for the Full PSI, when fewer than five of these risk factors are present, the rate of death in the ensuing period is actually lower than that of the average rate for the entire cohort. For the Full PSI, we would select a cut-point along the continuum of risk where the residents in the “swing” category have a death rate that is significantly higher than the rate of the average person in the cohort. For this purpose we concentrated on the category in which the death rate for the residents was at least 75% higher than the average death rate for the entire cohort. Thus, the rates of death through 3, 6 and 12 months would be approximately 13%, 24%, and 41%, respectively. Using this criterion, the palliative cut-point for the Full PSI is at 9; i.e., a score of 9 or higher would suggest that the resident should be considered for palliative care. This translates into an assignment of 15.4% of the cases to the palliative review subgroup. The death rates for persons with a score of 9 or higher over 3, 6, and 12 months, are 24.6%, 35.7%, and 49.5%, respectively. From a clinical perspective, once this level of risk was achieved, staff would be asked to consider whether the resident should continue under the traditional program of care or be moved onto a more focused palliative program of care. For the Quarterly PSI, the cut-point would be at 8, and this translates into an assignment of 11.5% of the cases to the palliative review subgroup and death rates over 3, 6, and 12 months of 20.4%, 31.2%, and 44.7%, respectively.

We also established cut-points for two sub-scales that can be derived from the PSI item pool: the PSI-Functional sub-scale (i.e., the items measuring decision making, personal hygiene, transfer, locomotion, and eating); and all other PSI items, i.e., the PSI-Clinical sub-scale (with separate subsets for the Quar-

terly and the Full PSI). Using the above criterion for establishing the cut point, the palliative threshold for the PSI-Functional sub-scale is 5; i.e., a score of 5 suggests that the resident should be considered for palliative care. This translates into an assignment of 15.9% of the cases to the palliative review subgroup, with these residents having a 6-month death rate of 22.2%. This is higher than the rate for the total cohort, but lower than the rates previously shown for the high-risk groups defined for the Full and Quarterly PSIs.

For the two PSI-Clinical sub-scales, a score of 4 or higher applies for the clinical sum calculated for the items on the Quarterly PSI, while a score of 5 or higher applies when the clinical items are derived from the Full PSI. For the Quarterly version of the PSI-Clinical sub group, this translates into an assignment of 10.0% of residents to the palliative review subgroup, and these residents have a 6-month death rate of 34.8%. For the Full version of the PSI-Clinical sub group, this translates into an assignment of 9.7% of residents to the palliative review subgroup, and these residents have a 6 month death rate of 37.0%.

The cross-walk between the PSI-Functional and PSI-Clinical sub-scales shows that while each plays a role in explaining resident proximity to death, the Clinical subset is the more important predictor. For persons who are not at risk on either sub-scale, 10.2% died in six months. For those classified to be at risk based on the Functional sub-scale, but not found to be at risk on the Clinical sub-scale, the 6-month death rate rose by 7%, to 17.4%; while for those residents who were at risk on only the Clinical sub-scale, the six-month death rate rose at three- times this rate, or to a 32.8% death rate by month 6. Finally, for resident's who were at risk on both the Functional and Clinical PSI sub-scales, 38.3% died by 6-months.

Relation of PSI Risk-Group Assignment to two problem syndromes that become more prevalent as death is approached: nutrition and skin. Table 4 presents findings for the Full PSI (the findings for the Quarterly PSI would be about the same), and in each area the high-risk PSI sub-group presents with a significant problem profile, and there are indications that the facilities have begun to respond to these needs. More specifically,

- ? 30% of the residents in the high-risk group have lost 5% or more of their weight in the last 30 days.
- ? 53% have a swallowing problem
- ? 44% have a chewing problem
- ? 47% left 25% or more of their food uneaten at most meals.

- ? In response to these nutritional challenges, facilities have mustered a variety of responsive care strategies.
 - ? 62% of high-risk residents are on a mechanically altered, soft-food diet
 - ? 41% are being monitored for the intake and output of fluids
 - ? 28% are being fed through a tube
- ? 35% of the high-risk residents have a pressure ulcer. 15% have a skin tear and 21% have a bruise. In response to these emerging skin problems,
 - ? 58% of high-risk residents have a pressure relieving device for their chair and 74% have such a device for their bed
 - ? 77% of high-risk residents are on a turning/positioning program

TABLE 4 ABOUT HERE

DISCUSSION

The PSI presents a complex view of resident status. It incorporates factors that are most relevant to residents at the end of life. The functional measures reflect situations of high dependency, where extensive weight bearing or total support is provided. The clinical measures in the model have a high probability of increasing presence as death is approached: respiratory distress, weight loss, bowel incontinence, pressure ulcers, stasis ulcers, and nutritional status. Mood status is represented by measures that capture repetitive calling out and recurrent statements that something terrible is going to happen. Other measures in the model indicate that the nurse assessor believes the resident is approaching death, is experiencing delirium, has recently declined, and is unstable.

When the PSI is cut into high- and low-risk subgroups, for example, using the thresholds provided earlier, a distinct palliative course is suggested for those in the high-risk group. As would be expected, these residents have declined functionally and cognitively, and they present with a discrete array of emerging clinical complications in areas such as nutrition and skin. They have experienced weight loss, and thus have major nutritional issues. Skin problems are much more common, as is the use of devices such as feeding tubes, and there will clearly be a need to balance issues of problem management with concerns for quality of life.

While these findings suggest that the PSI will have potential relevance in a number of clinical and research applications, and our findings rest on data from across a three-state nursing home cohort, for any wider scale use, we must be able to assume that the facility MDS data are accurate. The issue of data accuracy is crucial, and there have been both positive and more questioning reports in this regard. There is little doubt that when facilities follow the standard MDS assessment protocol instructions, accurate data can be expected (24). The only question has been whether large numbers of facilities follow such a course. And, in this regard, the most recent findings are encouraging. Only about 5% of facility homes are likely to have seriously compromised MDS data. In this situation, item reliabilities will mimic those that we have seen in other more research-based MDS work, and the PSI's can be relied upon.

Making a diagnosis of who is near death is difficult, and this new, easily applied tool will advance the ability of nursing homes to move more aggressively into the palliative care arena. In this regard, our analyses of how nutritional and skin problem measures relate to the PSI is instructive. Patients in the higher-risk PSI group are likely to have poor nutritional status and a variety of skin problems.

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Table 1: Bivariate Relationship Between Individual Risk Factors and Death at 6 Months

| Risk Domain | Number of MDS Elements Tested from the Domain | Number of Elements That Were Significantly Related to 6-Month Death Status |
|--------------------------------|--|---|
| Demographic Measures | | |
| Age | 1 | 1 |
| Gender | 1 | 1 |
| Functional Measures | | |
| ADL Performance | 8 | 8 |
| Balance and Falls | 3 | 3 |
| Cognition and Communication | 5 | 5 |
| Diagnoses | | |
| End-Stage Judgement | 1 | 1 |
| Neurological | 13 | 4 |
| Heart and Circulatory | 8 | 4 |
| Cancer | 1 | 1 |
| Diabetes | 1 | 0 |
| Anemia | 1 | 1 |
| Mood | | |
| Hopelessness | 3 | 2 |
| Anxiety, Fear | 8 | 3 |
| Clinical Complications | | |
| Delirium | 6 | 6 |
| Nutritional Status | 12 | 10 |
| Shortness of Breath | 3 | 3 |
| Skin | 9 | 6 |
| Pain | 2 | 0 |
| Bladder and Bowel Incontinence | 2 | 2 |
| Constipation | 1 | 1 |
| Time Awake | 3 | 3 |
| Infection | 9 | 3 |

| | | |
|---------------------------|----|----|
| Hallucination or Delusion | 2 | 1 |
| Unstable, Deteriorating | 3 | 3 |
| Services | 20 | 14 |

Table 2: MDS Predictive of Death Items in the Personal Severity Index (PSI) – For the combined Massachusetts, New York, and Ohio Sample (N=196,289)

| <i>VARIABLE NAME</i> | <i>MDS Defining Code</i> | <i>Percent of Sample With Condition</i> | <i>Univariate Odds Ratio of Item With Dichotomy of Died/Not Died in 6 Months [All Sig.]</i> | <i>For Quarterly MDS Items -- Multivariate Odds Ratio of Items With Dichotomy of Died/Not Died in 6 Months (n=194,155) [ns=not sign]</i> | <i>For Full MDS Items -- Multivariate Odds Ratio of Items With Dichotomy of Died/Not Died in 6 Months (n=89,171) [ns=not sign]</i> |
|---|--------------------------|---|---|--|--|
| ITEMS ON FULL AND QUARTERLY¹ | | | | | |
| Age -- 90 or older | A3_year minus AA3_year | 25.9 | 1.67 | 1.68 | 1.55 |
| Cognitive Decision Making -- Severely impaired | B4 = 3 | 24.6 | 1.79 | 1.06 | 1.10 |
| Delirium -- Periods of lethargy | B5e = 2 | 1.1 | 4.82 | 1.79 | 1.57 |
| Ability to Understand -- Sometimes/Rarely | C6 = 2,3 | 32.0 | 1.69 | 1.03 ns | 1.00 ns |
| Transfer -- Extensive, Total, Did not occur | G1bA = 3,4,8 | 52.1 | 2.37 | 1.11 | 1.07 |
| Locomotion -- Extensive, Total, Did not occur | G1eA = 3,4,8 | 47.1 | 2.66 | 1.46 | 1.31 |
| Eating -- Extensive, Total, Did not occur | G1hA = 3,4,8 | 30.0 | 2.39 | 1.37 | 1.27 |
| Personal Hygiene -- Total, Did not occur | G1jA = 4,8 | 42.5 | 2.10 | 1.05 | 1.09 |
| Sad Mood, Repetitive Verbalizations -- Daily | E1c = 2 | 3.2 | 1.70 | 1.21 | 1.11 |
| Sad Mood, Something Terrible About to Happen -- Daily | E1g = 2 | 0.4 | 1.59 | 1.18 | 1.49 |
| Acute Episode -- Yes | J5b = 1 | 4.7 | 2.28 | 1.48 | 1.13 |
| Unstable -- Yes | J5a = 1 | 22.7 | 1.99 | 1.51 | 1.43 |
| Change in Care Needs -- Deteriorated | Q2 = 2 | 8.7 | 2.85 | 1.61 | 1.46 |
| End Stage Disease -- Yes | J5c = 1 | 1.0 | 9.67 | 5.16 | 4.56 |
| Bowel -- Occasional, Frequent, Incontinent | H1a = 2,3,4 | 51.4 | 2.04 | 1.16 | 1.20 |
| Weight Loss -- Yes | K3a = 1 | 9.0 | 2.97 | 1.87 | 1.75 |
| Pressure Ulcer -- Stages 1 thru 4 | M2a = 1,2,3,4 | 9.2 | 2.86 | 1.70 | 1.58 |
| Stasis Ulcers -- Yes | M2b = 1,2,3,4 | 1.5 | 2.29 | 1.92 | 1.81 |
| ITEMS ON FULL, BUT NOT ON QUARTERLY | | | | | |
| Inability to Lie Flat Due to Shortness of Breath -- Yes | J1b = 1 | 3.2 | 3.15 | | 1.36 |
| Oxygen Therapy -- Yes | P1g = 1 | 7.6 | 3.51 | | 1.90 |

| | | | | | |
|--------------------------------|---------|------|------|--|------|
| Problem Swallowing -- Yes | K1b = 1 | 16.7 | 2.41 | | 1.39 |
| Time Awake Afternoon -- Yes | N1b = 0 | 16.3 | 2.09 | | 1.31 |
| Cardiac Dysrhythmias – Yes | I1e = 1 | 13.2 | 1.57 | | 1.26 |
| Congestive Heart Failure – Yes | I1f = 1 | 21.6 | 1.75 | | 1.43 |
| Skin Tears or Cuts – Yes | M4f = 1 | 5.6 | 2.59 | | 1.65 |

Table 3: Near Death Distribution Across the Personal Severity Index (PSI) -for the combined Massachusetts, New York, and Ohio Sample

| SCALE SCORE | Quarterly Model – Percent in Each Category | Quarter - Percent in Each Category Who Died in Three Months | Quarter- Percent in Each Category Who Died in Six Months | Quarter - Percent in Each Category Who Died in Twelve Months | Full Model -- Percent in Each Category | Full - Percent in Each Category Who Died in Three Months | Full - Percent in Each Category Who Died In Six Monthsⁱ | Full - Percent in Each Category Who Died in Six Twelve Months |
|--------------------|---|--|---|---|---|---|---|--|
| 0 | 15.6 | 1.9 | 4.4 | 9.5 | 9.3 | 1.4 | 2.9 | 6.3 |
| 1 | 15.8 | 3.2 | 7.3 | 14.6 | 12.0 | 2.2 | 5.1 | 10.8 |
| 2 | 11.7 | 4.6 | 9.5 | 18.4 | 11.5 | 3.7 | 7.7 | 14.9 |
| 3 | 9.7 | 5.3 | 11.4 | 20.9 | 10.4 | 4.7 | 9.7 | 18.6 |
| 4 | 9.0 | 6.6 | 13.2 | 23.4 | 9.3 | 5.7 | 11.7 | 21.2 |
| 5 | 8.4 | 8.2 | 15.3 | 26.6 | 8.5 | 7.7 | 14.0 | 24.3 |
| 6 | 7.8 | 10.0 | 18.3 | 30.2 | 7.9 | 9.1 | 16.7 | 28.4 |
| 7 | 10.1 | 10.6 | 18.6 | 29.8 | 8.1 | 10.3 | 18.3 | 29.9 |
| 8 | 7.0 | 14.6 | 24.7 | 37.8 | 7.8 | 12.1 | 20.9 | 32.8 |
| 9 | 3.0 | 22.3 | 33.8 | 48.4 | 6.0 | 16.7 | 26.3 | 39.6 |
| 10 | 1.2 | 34.3 | 47.2 | 60.1 | 4.0 | 21.1 | 32.1 | 47.0 |
| 11 | 0.5 | 44.2 | 55.8 | 68.5 | 2.4 | 27.3 | 40.7 | 55.5 |
| 12 | 0.2 | 54.8 | 62.7 | 73.8 | 1.4 | 37.6 | 50.4 | 63.7 |
| 13 | 0.1 | 67.5 | 76.6 | 80.0 | 0.7 | 46.2 | 58.0 | 71.4 |
| 14 | 0.0 | 57.9 | 84.2 | 89.5 | 0.4 | 52.3 | 63.4 | 74.0 |
| 15+ | 0.0 | | | | 0.3 | 57.6 | 69.1 | 73.6 |
| | | | | | | | | |
| TOTAL | | 7.4 | 13.5 | 23.2 | | | | |

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Table 4: Relationship of Personal Severity Index (PSI) for Full Model to Presence of Nutrition and Skin Problems for the combined Massachusetts, New York, and Ohio Sample [note, all findings are significant]

| Measure (QM) | PSI Risk | Group |
|--|---------------|----------------|
| | % Low Risk | % High Risk |
| NUTRITIONAL MEASURES | | |
| Swallowing problem | 10.1 | 53.1 |
| Chewing problem | 20.2 | 44.4 |
| Weight loss of 5% or more in last 30 days | 8.5 | 30.4 |
| Leaves 25% or more of food uneaten at most meals | 34.0 | 46.8 |
| Dehydrated, output exceeds input | 0.3 | 3.5 |
| Insufficient fluid, did not consume all/almost all liquids provided during last 3 days | 4.3 | 11.2 |
| On a mechanically altered diet | 38.6 | 61.7 |
| Parenteral/IV for nutrition | 0.5 | 3.9 |
| Feeding Tube | 4.7 | 28.5 |
| Nutrition/hydration to manage skin problems | 10.6 | 32.3 |
| Monitoring on intake/output of fluids | 16.2 | 41.4 |
| SKIN PROBLEMS | | |
| Skin desensitized to pain or pressure | 4.2 | 10.2 |
| Presence of pressure ulcer | 7.2 | 34.7 |
| Presence of stasis ulcer | 1.5 | 3.1 |
| Abrasions, bruises | 9.4 | 20.9 |
| Skin tears | 3.9 | 15.0 |
| Presence of surgical wound | 4.2 | 7.3 |
| Use of pressure relieving devices for chair | 39.0 | 58.2 |
| Use of pressure relieving devices for bed | 45.8 | 74.0 |
| Turning/positioning program in effect | 28.6 | 77.2 |
| Ulcer care | 6.1 | 27.6 |
| Application of dressings | 9.7 | 30.6 |
| Application of ointments | 24.5 | 43.6 |

| | | |
|--|------|------|
| Other preventative or protective skin care | 53.0 | 67.4 |
|--|------|------|

¹ Gender could also have entered the Full PSI model, but the decision was made not to use this item.