

# Predicting Nursing Home Financial Distress Using the Altman Z-Score

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## Abstract

This article uses a modified Altman Z-score to predict financial distress within the nursing home industry. The modified Altman Z-score model uses multiple discriminant analysis (MDA) to examine multiple financial ratios simultaneously to assess a firm's financial distress. This study utilized data from Medicare Cost Reports, LTCFocus, and the Area Resource File. Our sample consisted of 167 268 nursing home-year observations, or an average of 10 454 facilities per year, in the United States from 2000 through 2015. The independent financial variables, liquidity, profitability, efficiency, and net worth were entered stepwise into the MDA model. All of the financial variables, with the exception of net worth, significantly contributed to the discriminating power of the model. K-means clustering was used to classify the latent variable into 3 categorical groups: distressed, risk-of-financial distress, and healthy. These findings will provide policy makers and practitioners another tool to identify nursing homes that are at risk of financial distress.

## Keywords

Altman Z-score, discriminant analysis, nursing home closure, financial ratios, financial distress

### What do we already know about this topic?

Financial distress in nursing homes can negatively impact health and access for vulnerable populations.

### How does your research contribute to the field?

This research provides a method to categorize nursing homes at risk-of-distress using the modified Altman Z-score.

### What are your research's implications toward theory, practice, or policy?

Given the increasingly precarious financial situation of many nursing homes, the modified Altman Z-score method may help identify nursing homes at risk of financial uncertainty, which could be used by managers and policy makers to intervene prior to nursing home closure.

Nursing homes play a critical role in our health care system, often being described as “safety net” institutions or “care-takers of last resort.”<sup>1</sup> Nursing homes face many external and internal operating challenges and pressures, such as competition,<sup>2</sup> changing demographics,<sup>3</sup> staffing requirements,<sup>4</sup> changing reimbursement models,<sup>5</sup> and increased regulation.<sup>6,7</sup> With all of these external and internal challenges, nursing homes are under tremendous financial pressure, which can result in organizational failure. There have been over 1223 nursing home closures from 2000 to 2014.<sup>8</sup> While not all nursing home closures are due to financial difficulties; given the increased number of bankruptcies in the health care industry from 2010 through 2014, this is a growing area of concern.<sup>9</sup> Nursing home organizational failure and financial distress can negatively impact health and access for vulnerable nursing home residents.<sup>10</sup> Given the rate of nursing home closures and the changing environment, it is important to identify nursing homes that are in financial distress.<sup>11</sup>

The Altman Z-score is a financial distress prediction model that has been used to identify financially distressed organizations in other industries.<sup>12,13</sup> A review of the literature indicated a limited number of national studies that use the Altman's Z-score or other financial distress prediction models within the health care industry.<sup>14–16</sup> The purpose of this article is to apply and validate the use of a modified Altman Z-score to predict financial distress within the

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**Table 1.** A Listing of All Variables Used in the Calculation of the Modified Altman Z-Score Along With Definitions and Sources.

Variable	Definition	Operationalization	Data source
Liquidity ratio	$X1 = \text{Working capital} / \text{TA}$	$(\text{Current assets [CA]} - \text{current liabilities (CL)}) / \text{TA}$	Medicare Cost Reports 2000-2015
Profitability ratio	$X2 = \text{Retained earnings} / \text{TA}$	Fund balance / TA	Medicare Cost Reports 2000-2015
Efficiency ratio	$X3 = \text{Earnings before interest and taxes} / \text{TA}$	$(\text{Net patient revenue} - \text{total operating costs}) / \text{TA}$	Medicare Cost Reports 2000-2015
Net worth	$X4 = \text{Book value of equity} / \text{TL}$	$(\text{TA} - \text{TL}) / \text{TL}$	Medicare Cost Reports 2000-2015

Note. TA = total assets; TL = total liabilities.

nursing home industry, which is the first in this context. Practitioners and state policy makers could use these findings to intervene in nursing homes that are at risk of closure. This could have important health implications for communities that lack alternative long-term care providers.

### Conceptual Model

While there may be no formal definition of financial distress,<sup>16</sup> it is often defined as the late stage of organizational decline that precedes bankruptcy.<sup>17</sup> Financial distress prediction models are used to predict the likelihood of a firm experiencing financial difficulties and possible closure due to bankruptcy.<sup>18</sup> Several financial distress prediction models use the financial ratio approach to measure the financial status of an organization. These ratios are derived from the firm's financial statements, and attempt to provide stakeholders with a snapshot of the organization's financial health. The Altman Z-score goes one step further and examines these financial ratios simultaneously to assess the organization's financial health or likelihood of distress. Multiple discriminant method (MDA) is an example of a financial ratio model that examines all the ratios simultaneously.<sup>12,19,20</sup> MDA assigns specific weights to different ratios depending on their interaction effect on the dependent variable.<sup>21</sup> MDA provides a linear relationship in which the solution is provided as the difference between two or more possible alternatives.<sup>22</sup>

In 1968, Altman utilized the MDA approach to create a model to predict financial distress in the manufacturing industry: the Altman Z-score. The Altman Z-score approach examines multiple financial ratios simultaneously to predict the likelihood of a firm's bankruptcy or financial distress. Altman examined several key financial ratios such as liquidity, profitability, efficiency, and productivity.<sup>19</sup> Altman's Z-score is the output of different financial ratios or variables in determining the likelihood of financial distress or bankruptcy.<sup>12</sup>

In 1993, Altman applied the model to examine general service organizations, which resulted in a 4-variable model.<sup>19</sup> This iteration was used to examine the service industry but not specifically health care. We will refer to this model as the

modified Altman Z-score throughout the rest of the article. The revised 4-variable "Z-score" model to predict financial distress in the service industry is:

$$Z = 6.56(X1) + 3.26(X2) + 6.72(X3) + 1.05(X4)^{19}$$

In this model Z = overall index; X1 = working capital / total assets; X2 = retained earnings / total assets; X3 = earnings before interest and taxes / total assets; X4 = equity (book value) / total liabilities. The cutoff scores to group firms "at risk for financial distress" in the Altman and Hotchkiss<sup>19</sup> study are as follows: financially distressed firms have a score of Z less than 1.10; firms that have the possibility of financial distress have a Z-score of 1.10 and 2.60; and healthy firms have a Z-score greater than 2.60. Continuing in the same schema of Altman, we will utilize the same three grouping categories.

The financial ratios in one service industry should still be relevant in another. As such, we hypothesize that the modified Altman Z-score approach should be a valid model to predict financial distress in the nursing home context. Therefore, the following hypothesis is proposed:

**Hypothesis 1:** The modified Altman Z-score model will be able to significantly predict nursing home financial distress.

While the modified Altman Z-score model may be a valid approach for nursing homes, each of the ratios in the modified Altman Z-score model will have to be evaluated to determine whether they are significant predictors of financial distress among nursing home. The operationalization of these variables (liquidity ratio, profitability ratio, efficiency ratio, and net worth) can be found on Table 1.

*Liquidity ratio* is working capital divided by total assets. Working capital is calculated by subtracting current liabilities from current assets. Liquidity is important to an organization because it is a measure of an organization's access to cash and other unrestricted current assets.<sup>23</sup> This measure represents the organization's ability to meet its obligations without having to get external funding or by liquidating long-term assets. Within the nursing home context, liquidity

indicates how long the organization will be able to fund its current operations. The financial liquidity of a nursing home is an important measure in the organization's success or failure; therefore, the following hypothesis is proposed:

**Hypothesis 2:** The liquidity ratio will significantly contribute to the discriminant equation predicting nursing home financial distress.

*Profitability ratio* is retained earnings divided by total assets. This financial ratio is an indicator of the organization's ability to accumulate earnings based on its assets. For-profit organizations try to maximize profitability for shareholders. Even though not-for-profit organizations are not driven by profit maximization, they still need to be profitable to ensure operations.<sup>24</sup> Retained earnings, net assets or fund balance represents the cumulative amount of the difference between revenues and expenses for business from the date the organization came into existence.<sup>25</sup> All organizations (for-profit or not-for-profit) have to remain profitable in order to continue their operations; therefore, the following hypothesis is proposed:

**Hypothesis 3:** The profitability ratio will significantly contribute to the discriminant equation predicting nursing home financial distress.

*Efficiency ratio* is earnings before interest and taxes divided by total assets. This ratio is also known as the operational or activity ratio. This ratio is an indicator of how effectively an organization is using its assets to generate earnings before obligations such as interest and taxes.<sup>26</sup> Altman<sup>12</sup> determined this activity ratio captured the true productivity of the firm's assets separate from any leverage factors, such as debt or taxes.<sup>12</sup> An organization's success is based on the earning power of its assets. This ratio makes the comparison of for-profit and not-for-profit organizations equivalent, because it discounts issues like tax status or ownership status. This is important with nursing homes because as of 2014, 30% of all nursing homes were not-for-profit.<sup>8,27</sup> For organizations to remain profitable in a changing and turbulent environment, they have to remain efficient. Therefore, the following hypothesis is proposed:

**Hypothesis 4:** The efficiency ratio will significantly contribute to the discriminant equation predicting nursing home financial distress.

*Net worth* is the book value of equity divided by total liabilities. This ratio is an equity measure because it measures a company's net worth against its accumulated debt.<sup>12,19</sup> This ratio shows how much the firm's assets can decline in relation to total liabilities before the firm becomes insolvent.<sup>19</sup> The book value of equity or net worth is derived by examining the difference in the organization's total assets and total liabilities.<sup>19</sup> The book value reflects historical costs of assets

and is traditionally more predictable and less volatile in the long term as compared with market value. The book value of a firm provides a snapshot of the organization's financial health by examining its net assets in relation to total liabilities. Organizations with a higher percentage of net assets in relation to total liabilities may be able to weather financial difficulties better as compared with organizations with lower net assets; therefore, the following hypothesis is proposed:

**Hypothesis 5:** Net worth will significantly contribute to the discriminant equation predicting nursing home financial distress.

## Methods

### Data

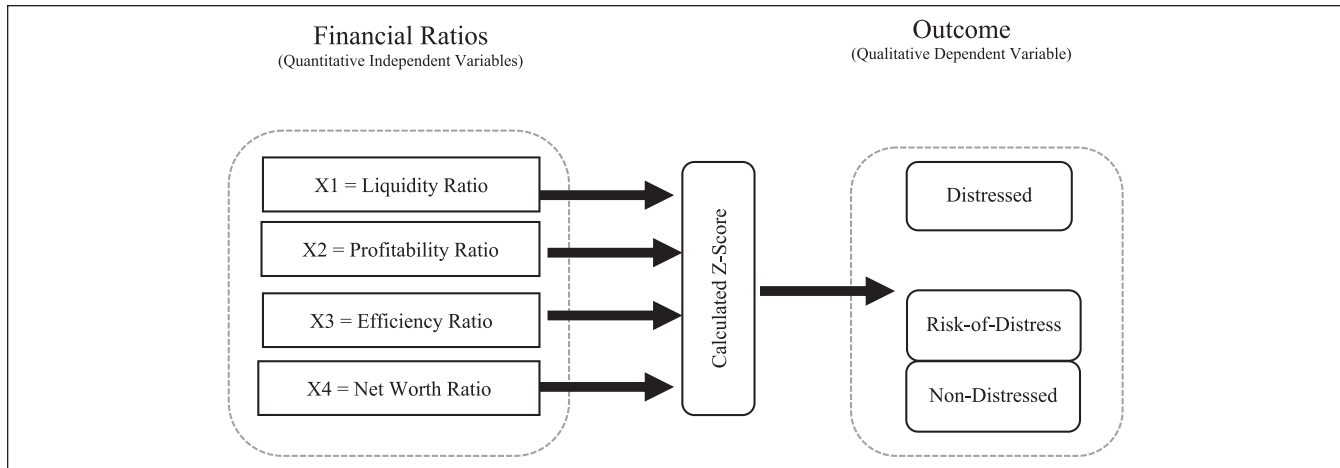
This research utilizes data from 3 different sources: Medicare Cost Reports, Brown University's LTCFocus, and the Area Resource File from 2000 to 2015. Medicare Cost Reports provides financial data for nursing homes that participate in the Medicare program. Brown University's LTCFocus data provide nursing home organizational, demographic, quality, and market information. This data set is the amalgamation of multiple sources of data, including the Minimum Data Set, CMS's Nursing Home Compare, Area Resource File, Bureau of Labor Statistics, Residential History File, OSCAR/CASPER, and state policy surveys. The Area Resource File (ARF) provides market and demographic information for the county.

### Sample

This sample consisted of all Medicare participating nursing homes in the United States from 2000 through 2015. There were 255 269 nursing home-year observations in this sample, or an average of 15 954 nursing homes per year. First, all hospital-based nursing home observations were excluded, because these organizations may have different organizational structures as compared with free standing facilities ( $n = 391$ ). Second, we excluded nursing homes with no ARF data and those that did not report any Medicare financial data ( $n = 54\,403$ ). Third, the data were additionally cleaned by examining each financial variable per year because one of the assumptions of multiple discriminant analysis (MDA) is the normality of data. Observations with financial variables that were  $\pm 5$  standard deviations from the mean were dropped ( $n = 33\,207$ ) as to remove extreme values. This left an analytical sample of 167 268 nursing home observations or an average of 10 454 nursing homes per year.

### Dependent Variable: Financial Distress Categories

Similar to Altman and Hotchkiss,<sup>19</sup> the dependent variable is categorical and consists of three groups: financial distress, risk-of-financial distress, or healthy. In this study, *financial distress* is defined as when an organization is no



**Figure 1.** Modified Altman Z-score model.

longer viable as a “going-concern” due to the organization’s inability to sustain its operations.<sup>28</sup> Organizations that are at *risk-of-financial distress* are simply at moderate risk of experiencing this financial distress.<sup>12</sup> When organizations are “at-risk” of being in financial distress, often they can take proactive measures to prevent organizational failure by increasing revenues, decreasing expenses, and/or securing long-term financing.<sup>12</sup> Organizations that are healthy or *financially healthy* are classified as being a “going-concern.” Under the “going-concern” assumption, an organization will continue to operate as long as the business is viable.<sup>29</sup>

To categorize nursing homes into 1 of the 3 financial distress categories, we first had to identify the nursing homes that had closed or remained open. To determine whether an organization was closed, a facility specific identification number was obtained from Brown University’s LTCFocus. This unique identifier assigned to the facility was used to track the organization over time despite name, owner, and other changes. This variable is similar to the approach that Castle utilized in his previous research on nursing home closures.<sup>30</sup> While we identified 1696 nursing home closures from 2000 to 2015 using LTCFocus data, after merging the data with Medicare Cost Reports and subsequent data cleaning, the number of nursing home closures fell to 386.

### Predictor Variables: Modified Altman Financial Variables

The 4 primary variables of interest are the liquidity, efficiency, profitability, and net worth ratios from the modified Altman Z-score model. These variables were discussed in the conceptual framework and operationalized in Table 1.

### Analysis

Bivariate statistics were examined for all variables included in the analysis. The purpose of this study is to identify nursing homes that are in financial distress, risk-of-financial

distress, and healthy. Given the categorical nature of the dependent variable, we used MDA to analyze the 4 financial variables proposed by Altman. MDA has the advantage of accounting for all the variable interaction effects.<sup>12</sup> This methodological approach removes potential ambiguities and quantifies the weights given to specific variables.<sup>22</sup> MDA results in a linear combination equation in which the independent variables will discriminate best between the groups in the dependent variable based on the observation’s individual characteristics.<sup>12,31</sup> Figure 1 is a visualization of this model to provide greater clarification.

The modified Altman Z-score can also be seen in the equation format below:

$$F = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

In the MDA equation above,  $F$  is the latent variable formed by the linear combination of the dependent variables ( $X_1$ ,  $X_2$ ,  $X_3$  and  $X_4$ ) and the canonical discriminant function coefficients ( $\beta_0$ ,  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$  and  $\beta_4$ ). The standardized discriminant coefficients, or partial weights, indicate the relative importance of the independent variables in predicting the classification of the groups in the dependent variable.<sup>31</sup> To account for a possible skewed distribution, given the different proportion of open and closed nursing homes, group proportional prior probabilities was used in the MDA.<sup>32</sup> Once the Z-score equation was estimated, K-means clustering was used to group the data according to some notion of similarity, in conjunction with the discriminant analysis (ie, financial distress, risk-of-financial distress, and healthy). For this analysis, the level of statistical significance was set at  $\alpha = 0.05$  and Stata 14 used.

## Results

### Bivariate Results

Bivariate results are summarized in Table 2.  $T$  tests were performed for each of the 4 financial variables specified by the



**Table 2.** Bivariate Analysis of Modified Altman Financial Variables for Open and Closed Nursing Homes (2000-2015).

	Closed			Open			T value	
	N	Mean	SD	N	Mean	SD		
Altman variables								
Liquidity ratio	386	(0.12)	0.60	166 882	0.067	0.448	10.956	**
Profitability ratio	386	(0.20)	0.97	166 882	0.226	0.718	11.526	**
Efficiency ratio	386	(0.25)	0.43	166 882	0.044	0.314	18.505	**
Net worth	386	1.19	2.79	166 882	1.508	2.696	2.323	*

\* $P < .05$ . \*\* $P < .001$ .

modified Altman model, liquidity, profitability, efficiency, and net worth, as it related to open and closed nursing homes. There were statistically significant differences ( $P < .001$ ) between closed and open nursing homes in terms of the liquidity, profitability, and efficiency. The only ratio that was different was net worth, and while it was significant ( $P < .05$ ) between closed ( $M = 1.19$ ) and open ( $M = 1.51$ ) nursing homes, it was not statistically significant as the other variables.

### Multiple Discriminant Analysis Results

One of the key assumptions for deriving the discriminant function is the lack of collinearity of the independent variables. Pairwise correlations of the financial variables ranged between 0.09 and 0.42; mitigating the concerns of potential multicollinearity.

Prior to running the multiple discriminant model, we examined how well each independent variable(s) would contribute to the discriminating power of the model. A Wilk's lambda test was run for each iteration of the independent financial variable's combination. The independent financial variables (liquidity, profitability, efficiency, and net worth) were entered stepwise into model. The Wilk's lambda produces a value that ranges from 0 to 1, where 0 means total discrimination and 1 means no discrimination. Starting with the liquidity ratio, the Wilk's lambda,  $\Lambda = 0.9996$ , with each subsequent addition of a variable (liquidity and profitability,  $\Lambda = 0.9991$ ; liquidity, profitability, and efficiency  $\Lambda = 0.9977$ ) the model continued to improve, until net worth was added into the model. When net worth was added into the model, the Wilk's lambda stayed the same, yet the F-statistic went down. When looking at net worth alone, the Wilk's lambda was  $\Lambda = 1.000$ , indicating no discrimination.

Using the discriminant function standardized coefficients, the modified Altman Z-score was calculated for each observation as follows:

$$F = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

$$F = \beta_0 + (0.18 \times \text{Liquidity}) + (0.30 \times \text{Profitability}) \\ + (0.81 \times \text{Efficiency}) + (0.14 \times \text{Net Worth}) + \varepsilon$$

After the modified Altman Z-score calculations, K-means clustering, a form of vector quantization, was used to classify the latent variable into 3 categorical groups, distressed, risk-of-financial distress, and healthy. The cutoff scores to group firms "at risk-of-financial distress" are as follows: financially distressed firms have a score of Z less than  $-0.1082$ ; firms that are at risk of financial distress have a Z-score between  $-0.1081$  and  $0.7767$ ; and healthy firms have a Z-score greater than  $0.7768$ . A summary of the K-means clustering and the cut-points can be found in Table 3.

After establishing the cut-points, there was a need to see how well the modified Altman Z-score clustered groups (distressed, risk-of-financial distress, healthy) related to actual nursing home closure. Financial distress is to be the worst financial condition before bankruptcy and closure. It was assumed that distressed and at risk-of-distress nursing homes would have a higher probability of failure as compared with healthy. A significant interaction was found ( $\chi^2 = 294.8$ ,  $P < .001$ ) with the Pearson chi-square statistic as it related to financial distressed grouping and closure. Out of the 386 nursing homes that closed, 217 were classified as distressed and 117 of classified as at risk-of-distress. A summary of the crosstabs can be found on Table 4.

When the modified Altman Z-score clustered groups (distressed, risk-of-distress, healthy) were compared with closures-1-year-prior, an average of 44% of the closed organizations were correctly classified as being financially distressed and 46% were classified as risk-of-distress. When comparing the modified Altman Z-score distressed group with actual closures-2-years-prior, only an average of 41% of the closed organizations were correctly classified as being financially distressed. But once again, over 44% of the closed organizations were categorized as risk-of-distress. Three-years-prior to closure, the modified Altman Z-score distressed group accurately predicted 39% of actual closures and put 42% of the actual closures in the risk-of-distress group. A summary of these findings is presented in Table 5.

### Discussion

The goal of this study was to evaluate the effectiveness of using the Altman Z-score within the nursing home industry to explore financial distress. The main hypothesis that the

**Table 3.** The K-Means Determined Cut-Points of the Modified Altman Z-Score for Nursing Homes (2000-2015).

	N	Mean	SD	Minimum	Maximum
Distressed	34 819	-0.493	0.380	-2.592	-0.1082
Risk-of-distress	96 584	0.277	0.239	-0.1081	0.7768
Healthy	35 865	1.277	0.431	0.7768	3.4987

**Table 4.** Modified Altman Z-Score Identified Financial Distressed Nursing Homes as Compared With Actual Closed Nursing Homes (2000-2015).

	Distressed	Risk-of-distress	Healthy	Total	
Open	34 602.0	96 467.0	35 813.0	166 882	Actual results
	34 738.6	96 361.1	35 782.2	166 882	Expected frequencies
	0.5	0.1	—	0.7	$\chi^2$ contribution
Closed	217.0	117.0	52.0	386	Actual results
	80.4	222.9	82.8	386	Expected frequencies
	232.4	50.3	11.4	294	$\chi^2$ contribution
Total	34 819.0	96 584.0	35 865.0	167 268	Actual results
	34 819.0	96 584.0	35 865.0	167 268	Expected frequencies
	232.9	50.4	11.4	295	$\chi^2$ contribution
Pearson chi-square = 294.842			Pr = 0.000		
Cramer's V = 0.0420					

**Table 5.** Predicted Nursing Home Financial Distress as Compared With Actual Nursing Home Failure 1, 2, and 3 Years Prior (2000-2015).

	Distress	Risk-of-distress	Healthy	Total
Actual nursing home closures	217	117	52	386
Expected nursing home closures	80.4	222.9	82.8	386
Actual closures – One year prior to closure	145	151	34	330
Expected frequency of closures – One year prior	44%	46%	10%	100%
Actual closures – Two years prior to closure	119	129	45	293
Expected frequency of closures – Two years prior	41%	44%	15%	100%
Actual closures – Three years prior to closure	103	111	53	267
Expected frequency of closures – Three years prior	39%	42%	20%	100%

modified Altman Z-score would be able to significantly predict nursing home closure was partially supported. The modified Altman Z-score allowed us to create distressed, risk-of-distress, and healthy nursing home groups. We were able to identify closed organizations at the time of failure; however, the accuracy of the distressed grouping decreased to 44% 1-year-prior, 41% 2-years-prior and 39% 3-years-prior. While this is below the threshold cited by other researchers,<sup>33,34</sup> the predictive nature of this model and these groupings are important to examine.

Second, we hypothesized that the 4 financial variables identified by the modified Altman model, liquidity, efficiency, profitability, and net worth would significantly contribute to the discriminating power of the model predicting nursing home distress. Three of the 4 financial ratios, liquidity, profitability, and efficiency were significant predictors in the model. While the net worth ratio was statistically ( $P < .05$ ) different between open and closed nursing homes, this

variable did not significantly contribute to the discriminating power of the model. In future analysis, it may be appropriate to examine other variables that may have better discriminating power. Net worth may not have been an appropriate variable in this context. Net worth, as it was defined for this analysis, is the book value of equity or the difference in the organization's total assets and total liabilities, divided by total liabilities.<sup>19</sup> An alternative option would have been to examine solvency as a predictor of nursing home distress. Solvency ratios assess the amount of debt capital used by an organization and assess whether or not the organization can meet the long-term obligations and have been effective in examining organizational failure in other contexts.<sup>35</sup> Future studies may explore measures of solvency, such as total debt to asset ratio, instead of net worth.

In this study, we used financial ratios to predict financial distress in the nursing home industry. Given the increasingly precarious financial situation of many nursing homes, tools

that may help identify nursing homes at risk of financial uncertainty could be used by managers and policy makers to intervene before it is too late. The use of the modified Altman Z-score method is simply one approach; it may be valuable to further explore this topic using logit and probit analysis,<sup>17,36</sup> recursive partitioning algorithm,<sup>37</sup> and neural networks.<sup>38</sup> In addition, it has been found that nursing homes with improved financial performance are characterized by better resident quality.<sup>39</sup> Nursing homes classified as financially distressed had an increased likelihood of financial difficulties and/or closure. These lack of resources in distressed nursing homes could have the potential to impact the ability to provide care. It is important to examine the factors that may contribute to better or worse financial performance as this can impact not only the quality of care but also access.

## Limitations

There are several limitations to this study. First, the financial data came from the Medicare Costs Reports and not audited financial statements. This differs from Altman's original model that used audited financial statements prepared accordingly to Generally Accepted Accounting Principles (GAAP); however, Medicare Cost Reports that are audited by CMS have been used extensively for as a proxy for financial performance research within the health care and nursing home context. Second, the use of Medicare Cost Reports is limited to nursing homes with Medicare residents. This may have resulted in the exclusion of Medicaid dependent organizations, which may be particularly at risk of financial distress. However, our data analysis indicates this was a relatively small proportion of facilities (566 organizations or 3.6% of the national sample). Regardless, this is something that should be explored in future research.<sup>27</sup> Third, prior to data cleaning, we found that there were 1696 nursing home closures from 2000 to 2015; however, after merging the data with Medicare Cost Reports and subsequent data cleaning, the number of nursing home closures fell to 386. This indicates that possibly organizations that are in financial distress or at high risk of closure may inaccurately report data or fail to submit Medicare costs reports—which is one reason they were excluded from the analysis. Finally, this study only used financial data to classify distressed nursing homes. This study did not account for differences in nursing homes as it related to ownership, affiliation, or other organizational / market factors that may be associated with financial distress and closure. The existing literature has found that organizational and ownership characteristics of a nursing home can have an impact on performance. Even in not-for-profit nursing homes, variations in organizational structures (private secular nonprofit, religious-affiliated, and government) can result in differences in cost-efficiency and allocation efficiency.<sup>14</sup> The structure or affiliation of a nursing home may provide greater access to additional resources

as compared with other nursing homes. For example, religious-affiliated nursing homes may have greater access to contributions as compared with secular not-for-profit, which in turn may impact the likelihood of organizational survival beyond financial performance. Future studies should explore the role of these organizational factors on predicting financial distress.

## Conclusion

This is the first study to develop a financial distress prediction model in the nursing home industry using the modified Altman Z-score. The use and application of this model provides policy makers and other decision makers with another tool to predict nursing home financial distress. Nursing homes, like all other organizations, operate under the “going-concern” assumption, which is the presumption that the firm will continue to operate into the foreseeable future.<sup>29,40</sup> Organizations that are no longer a “going-concern,” are often described as having deteriorating assets or failing operations, which negatively hampers the organization's ability to provide services or products efficiently and effectively.<sup>40,41</sup> Nursing homes that are no longer a “going-concern” or that are financially distressed will likely lack the appropriate resources necessary to provide quality care. When nursing homes do not have the appropriate resources to deliver quality care, this can have serious repercussions.

Nursing homes play a critical role in the delivery of long-term care. Nursing homes that are in financial distress have an increased likelihood of organizational failure and closure. While the number of closures has slowed over the past several years, there was still a significant number of nursing homes that closed, and more that were identified as being financially distressed and at risk of closing. If these organizations close, this can have access to care implications. As the population continues to age, the dependency for nursing homes will grow. Identifying the nursing homes that are at greatest risk of closing provides policy makers opportunities to save these nursing homes before they fail indefinitely. Furthermore, with the increasing number of racial/ethnic minorities entering into nursing homes, the issue of financial distress could also become an issue of health care equity. Nursing home financial distress and closure can also have implications for the resident care quality, population health, long-term care access, and equity. These are additional areas that can be explored using this financial distress model.

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