

Predicting Financial Distress in Indian Healthcare Companies: An Application of the Altman Z-Score Model

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ABSTRACT-This study applies the Altman Z-Score model to evaluate the financial soundness and bankruptcy risk of ten selected healthcare companies in India over the period 2011-12 to 2020-21. Using secondary data drawn from company annual reports, Z-scores were computed and companies were classified into safe, grey, and distress zones. The results indicate that the majority of sampled companies remained in the safe zone throughout the study period, though notable variation exists at the firm level. A one-way ANOVA confirms that differences in Z-scores across companies are statistically significant ($F = 34.96, p < 0.001$), indicating that sector-wide generalisations mask meaningful firm-specific risk. The study offers practical implications for investors, creditors, and healthcare-sector policymakers in India.

Keywords: Altman Z-Score, financial distress, healthcare companies, India, bankruptcy prediction, solvency

1. INTRODUCTION

The healthcare industry in India has witnessed rapid expansion over the past two decades, driven by rising income levels, increasing health awareness, medical tourism, and government initiatives such as Ayushman Bharat. Hospitals, diagnostic chains, and healthcare service providers have increasingly turned to capital markets for expansion funding, making their financial soundness a matter of concern not just for management, but for investors, creditors, and policymakers alike.

Financial distress the inability of a firm to meet its financial obligations can severely disrupt healthcare delivery, affecting not only shareholder value but also patient care and employment. Predicting such distress early allows stakeholders to take corrective action before a company slides toward insolvency. Among the various tools developed for this purpose, the Altman Z-Score model remains one of the most widely used and empirically validated. Developed by Edward I. Altman in 1968, the model uses a combination of financial ratios to generate a single score that classifies firms into safe, grey, or distress zones based on their bankruptcy risk.

This study applies the Altman Z-Score model to a set of listed healthcare companies in India over a ten-year period (2011-12 to 2020-21), a window that captures both stable growth years and the onset of the COVID-19 pandemic a period of unusual stress for the healthcare sector globally.

2. REVIEW OF LITERATURE

Mayela Ravi Teja (2025)¹ examined bankruptcy and financial distress among select companies listed on stock exchanges, covering a three-year period from 2018-19 to 2020-21. The study applied accounting-based prediction tools, including ratio analysis, the Altman Z-score, Grover G-score, Springate S-score, and Zmijewski X-score, to assess the likelihood of financial distress and bankruptcy. Bankruptcy and financial distress were treated as dependent variables, while the various accounting tools served as independent variables. The findings indicated that all the accounting techniques employed were effective predictors of financial distress and bankruptcy.

Dr.Kandarp Chanda, Mrunal Jagdish Mehta(2023)² analyzed the financial health of Tata Motors Ltd. using the Altman Z-score model, one of the most widely used tools for predicting corporate financial distress. The study covered a five-year period from 2017 to 2021 and examined the company's financial position based on the components of the Altman Z-score model. The findings revealed that Tata Motors Ltd. was in the distress zone during the study period, though recent data indicated the company was making notable efforts toward financial recovery.

Farhaan Rashid, Rafi Ahmad Khan, Ishfaq Hussain Qureshi (2023)³ investigated that utilization of the Altman Z score in various sector such as service Industry, Manufacturing, Publiclytraded companies and financial Institutions. The study concluded that three revisions of the Altman's Z score model equation as used in diverse research studies and it as used in constructive and consistent capabilities."

Apergis (2019)⁴ examined financial distress in multinational corporations, focusing on how it relates to firm performance, employment levels, and R&D investment. The study employed logit and hazard models to estimate conditions of financial distress, while a conditional mixed process model was used to ensure consistent and efficient estimation.

Research Gap: While the Z-score model has been extensively applied across manufacturing, banking, and IT sectors in India, relatively few studies focus specifically on healthcare service companies over an extended, comparable time period. This study addresses that gap.

3. OBJECTIVES AND HYPOTHESIS

3.1 OBJECTIVES

- To compute the Altman Z-scores of selected healthcare companies in India for the period 2011-12 to 2020-21.
- To classify the sample companies into safe, grey, and distress zones based on their Z-score values.
- To compare the financial soundness of the selected companies and identify trends over the study period.

3.2 HYPOTHESIS

H0: There is no significant difference in the Z-score values among the selected healthcare companies during the study period.

H1: There is a significant difference in the Z-score values among the selected healthcare companies during the study period.

4. RESEARCH METHODOLOGY

4.1 SAMPLE: Ten healthcare companies listed in NSE were selected for the study based on market capitalization.

1. Apollo Hospitals Enterprise Ltd (AHCL)
2. Fortis Healthcare Ltd (FHCL)
3. Narayana Health Care Limited (NHL)
4. Healthcare Global Enterprises Limited (HGEL)
5. Kovai medical centre and hospital limited (KMCHL)
6. KMC speciality hospital limited (KMCSL)
7. Artemis Medicare Service Limited (AMSL)
8. Indra Prasadha Medical Corporation (IMCL)
9. Lotus Eye Care Hospital Limited (LEHL)
10. Dr Agarwal's eye hospital Limited (DAEHL)

4.2 STUDY PERIOD: 2011-12 to 2020-21 (10 years).

4.3 DATA SOURCE: Secondary data compiled from the annual reports of the respective companies.

4.4 MODEL: The Altman Z-score model (1968) was used, computed as:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

- X_1 = Working Capital / Total Assets
- X_2 = Retained Earnings / Total Assets
- X_3 = EBIT / Total Assets
- X_4 = Market Value of Equity / Total Liabilities
- X_5 = Sales / Total Assets

ZONE CLASSIFICATION

- Distress Zone: $Z < 1.81$
- Grey Zone: $1.81 \leq Z \leq 2.99$
- Safe Zone: $Z > 2.99$

Statistical Tool: Descriptive statistics and one-way ANOVA were used to test whether Z-score values differ significantly across the sample companies.

5. RESULTS AND DISCUSSION

5.1 CONSOLIDATED Z-SCORE TABLE (2011-12 TO 2020-21)

Company	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21
AHEL	17.56	19.39	18.60	22.39	19.53	18.27	12.65	12.82	9.96	23.28
FHCL	39.90	17.94	36.02	37.13	40.91	41.15	29.67	39.19	30.11	50.24
NHL	2.55	2.49	2.66	2.43	19.03	18.68	13.93	11.01	11.56	14.45
HGEL	1.45	1.31	1.29	1.53	8.81	9.75	10.59	5.46	2.52	11.63
KMCHL	4.47	6.49	6.24	11.54	12.25	19.57	15.53	9.23	7.12	9.20
KMCSL	10.64	12.43	6.34	7.13	17.30	20.62	26.79	19.08	15.79	22.16
AMSL	1.72	1.81	2.07	2.85	3.01	2.93	2.99	2.82	3.68	4.00
IMCL	4.93	4.99	5.67	6.45	6.33	6.59	6.86	6.43	6.06	6.08
DAEHL	4.81	4.92	4.93	5.83	6.08	9.70	11.95	8.67	6.08	2.64
LEHL	5.41	4.83	3.52	5.86	9.35	20.86	10.50	10.37	10.68	17.57

Source: Computed from annual reports of the respective companies.

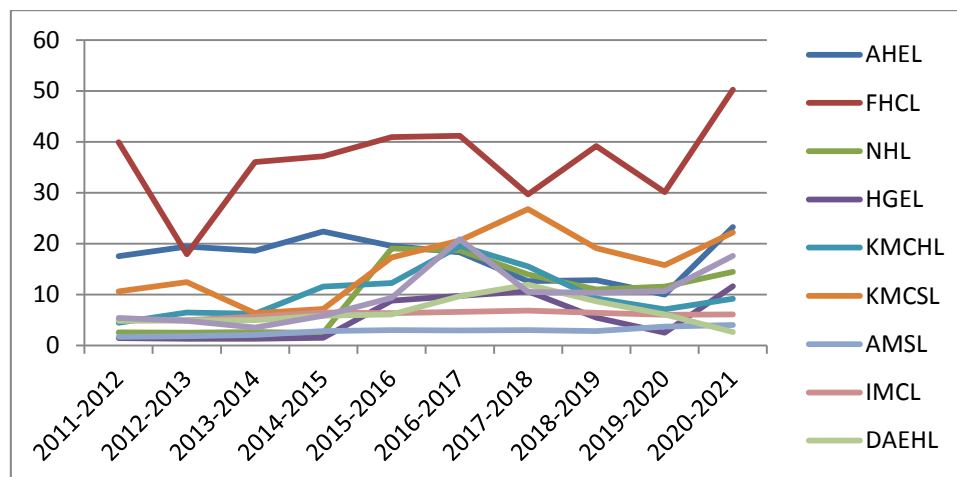


Figure 1: Trend of Altman Z-Scores of Selected Healthcare Companies in India (2011-12 to 2020-21)

5.2 ZONE-WISE CLASSIFICATION SUMMARY (OUT OF 10 YEARS)

Company	Safe ($Z > 2.99$)	Grey ($1.81 - 2.99$)	Distress ($Z < 1.81$)
AHEL	10	0	0
FHCL	10	0	0
KMCHL	10	0	0
KMCSL	10	0	0
IMCL	10	0	0
LEHL	10	0	0
DAEHL	9	1	0

Company	Safe ($Z > 2.99$)	Grey (1.81–2.99)	Distress ($Z < 1.81$)
NHL	6	4	0
HGEL	5	1	4
AMSL	4	4	2

Across the sample, companies spent 84% of firm-years in the safe zone, 10% in the grey zone, and 6% in the distress zone indicating that the Indian healthcare sector, as represented by this sample, was broadly financially sound over the study period, though with clear variation at the firm level.

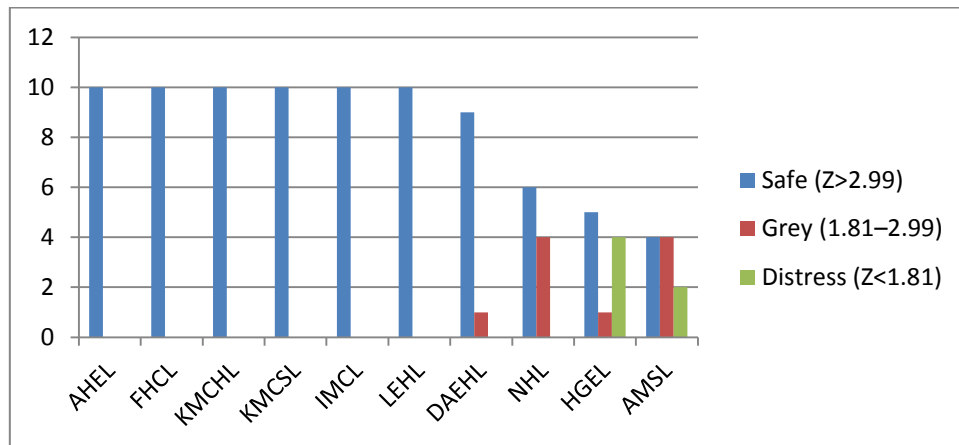


Figure 2: Zone-wise Classification of Companies, 2011-12 to 2020-21 (Years out of 10)

5.3 RANKING BY MEAN Z-SCORE

Rank	Company	Mean Z-Score
1	FHCL	36.23
2	AHEL	17.44
3	KMCSL	15.83
4	KMCHL	10.17
5	LEHL	9.89
6	NHL	9.88
7	DAEHL	6.56
8	IMCL	6.04
9	HGEL	5.43
10	AMSL	2.79

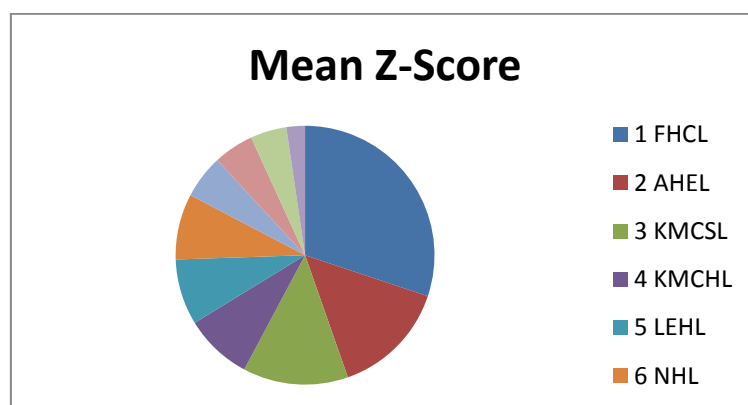


Figure 3: Company-wise Mean Z-Score Ranking (2011-12 to 2020-21)

5.4 DISCUSSION

Six of the ten companies AHCL, FHCL, KMCHL, KMCSL, IMCL, and LEHL remained in the safe zone throughout the entire ten-year period, reflecting consistently strong solvency and low bankruptcy risk. FHCL recorded both the highest mean Z-score (36.23) and the single highest score in the sample (50.24 in 2020-21), suggesting exceptionally strong financial structure, though such high scores also warrant a check on whether X4 (market value of equity/liabilities) is unusually inflating the score in low-liability firms.

NHL and DAEHL showed a shift in financial position over time NHL moved from the grey zone (2011-12 to 2014-15) into a stable safe zone thereafter, indicating improving solvency, while DAEHL showed the reverse pattern, slipping from a strong safe-zone position into the grey zone by 2020-21, a signal worth flagging for the company's post-pandemic financial health.

HGEL and AMSL were the most financially vulnerable firms in the sample. HGEL spent four of the ten years in the distress zone before recovering strongly after 2015-16. AMSL showed the weakest overall performance, with a mean Z-score of just 2.79 the only company, whose average fell within the grey zone and spent six of ten years in the grey or distress zone, only stabilizing in the final two years (2019-20, 2020-21).

6. STATISTICAL ANALYSIS

A one-way ANOVA was conducted to test whether Z-score values differ significantly across the ten selected healthcare companies over the study period.

TABLE: DESCRIPTIVE STATISTICS OF Z-SCORES BY COMPANY

Company	Mean	SD	Min	Max
FHCL	36.23	8.70	17.94	50.24
AHCL	17.44	4.33	9.96	23.28
KMCSL	15.83	6.67	6.34	26.79
KMCHL	10.17	4.67	4.47	19.57
LEHL	9.89	5.61	3.52	20.86
NHL	9.88	6.82	2.43	19.03
DAEHL	6.56	2.75	2.64	11.95
IMCL	6.04	0.65	4.93	6.86
HGEL	5.43	4.33	1.29	11.63
AMSL	2.79	0.75	1.72	4.00

TABLE: ONE-WAY ANOVA RESULTS

Source	F-value	p-value
Between Companies	34.96	< 0.001

Interpretation: Since the calculated p-value (< 0.001) is well below the 0.05 significance level, the null hypothesis (H₀) is rejected. This confirms that there is a statistically significant difference in Z-score values among the selected healthcare companies during the study period the companies do not share a common financial risk profile, and firm-specific factors (capital structure, retained earnings policy, asset utilization) meaningfully drive solvency differences within the sector.

Note: IMCL and AMSL show notably low standard deviations (0.65 and 0.75), indicating stable though very differently positioned Z-score trends, while FHCL's high SD (8.70) reflects strong but volatile financial performance.

7. FINDINGS

- 6 of 10 companies (AHCL, FHCL, KMCHL, KMCSL, IMCL, LEHL) remained in the safe zone for all 10 years, indicating consistently sound financial health.
- FHCL recorded the highest financial strength overall (mean Z-score 36.23; peak of 50.24 in 2020-21).

- AMSL was the weakest performer, with a mean Z-score of 2.79 the only company whose average fell in the grey zone and spent 6 of 10 years outside the safe zone.
- HGEL experienced the most distress-zone years (4 out of 10), though it recovered sharply after 2015-16.
- DAEHL was the only company to show a declining trajectory, moving from safe zone historically into the grey zone by 2020-21 a signal worth monitoring.
- The ANOVA confirms ($F = 34.96$, $p < 0.001$) that solvency positions vary significantly across companies, rejecting the assumption of sector-wide financial uniformity.
- Across all 100 firm-years observed, 84% were in the safe zone, 10% in the grey zone, and 6% in the distress zone pointing to overall sector resilience despite firm-level disparities.

8. CONCLUSION

The application of the Altman Z-Score model to ten selected healthcare companies in India over 2011-12 to 2020-21 reveals that the sector, overall, maintained strong financial health and low bankruptcy risk, even though the disruption of the COVID-19 pandemic in 2020-21. However, financial soundness was not uniform: while firms like FHCL and AHCL demonstrated robust and stable solvency, others such as AMSL and HGEL experienced periods of genuine financial vulnerability. The statistically significant variation across companies (confirmed via ANOVA) underscores that healthcare-sector investors, lenders, and regulators cannot rely on sector-level trends alone firm-specific financial diagnostics such as the Z-score remain essential for accurate risk assessment. Companies such as DAEHL, which show a weakening trend in the most recent year, may warrant closer monitoring going forward.

9. LIMITATIONS AND SCOPE FOR FURTHER RESEARCH

- The Altman Z-score model was originally developed for US manufacturing firms; its coefficients may not perfectly capture the asset and liability structures typical of healthcare/hospital service companies.
- The study is limited to 10 companies and a 10-year period; a larger sample or extended timeframe (including post-2021 recovery years) could strengthen generalizability.
- Future research could apply sector-adjusted or emerging-market variants of the Z-score model (e.g., Altman's Z"-score for non-manufacturers/emerging markets) for improved accuracy in the healthcare context.

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