NORTH-HOLLAND

A Revised Classification Pattern of Hospital Financial Ratios

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Health care administrators, governing boards, and public policy groups employ a broad array of financial ratios to assess hospital performance. However, only a few ratios may be necessary for meaningful insight. Our paper explores the common financial characteristics of performance which can be accurately and parsimoniously summarized by hospital financial ratios. We define a characteristic of performance as a group of ratios which measure essentially the same financial activity of a firm (see footnote 1 in our paper). First, a statistical-based taxonomy of financial ratios was used to explore the financial characteristics of 2,189 U.S. hospitals. Second, the taxonomy was employed to examine the correlations among the specific ratios which signal the characteristics of financial performance. Our findings: 1) indicate that hospital financial characteristics of performance reported in our study are different from previously reported findings in the literature, (which are reviewed in our paper) and 2) provide suggestions for future research in determining the value of the identified characteristics for decision making in the health care industry.

1. Introduction

Financial ratio analysis is an accepted approach to hospital performance evaluation. Hospital administrators, governing boards and public policy groups utilize financial ratios to benchmark the financial health of a hospital or group of hospitals (Glandon et al. 1987, p. 440). Ratios play a role, for instance, in profitability analysis, liquidity evaluation, future profit

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estimation, competitor analysis and prediction of corporate failure. In utilizing ratios, the practitioner or researcher typically draws meaningful insight based on a select group of financial ratios (Gombola and Ketz 1983a, p. 105; Chen and Shimerda 1981, p. 51). Unfortunately, according to Gombola and Ketz (1983a, p. 105), if one lacks an understanding of the empirical relationships among the financial ratios, the select group will be *ad hoc*. This is a dangerous practice to any industry or business organization because decision making based on anything less than the full information available can destroy value (Wruck and Jensen 1994, p. 253).

Our study explores the common characteristics of hospital performance which can be accurately and parsimoniously summarized by hospital financial ratios.[1] First, a statistical based taxonomy of financial ratios is employed to explore the characteristics of performance of 2,189 U.S. hospitals. Second, the taxonomy is used to examine the correlations[2] among the specific ratios that signal the characteristics of financial performance. The findings suggest that the common financial characteristics of hospital performance reported herein are substantially different from those reported in prior research studies, for example, Chu et al. (1991, pp. 48–49) and Cleverley and Rohleder (1985, p. 85).

2. Hospital Financial Ratio Analysis: An Industry Specific Focus

Financial ratio analysis of hospitals needs to be better understood for a variety of reasons. First, the sheer size of the hospital industry makes proper financial assessment important to the nation's economy. For example, according to *The Comparative Performance*... (1993, p. 5), "slightly more than 14 percent of GDP (gross domestic product)" or "approximately $838 billion" was consumed by the health care industry in 1992. In addition, *The Comparative Performance*... (1993, p. 5) notes "hospital expenditures alone increased by 12.4 percent in 1993 to an estimated $363 billion, according to the Health Care Financing Administration... ."

Second, because the hospital industry is different from most other economic sectors with respect to ownership, the focus in financial analysis is different. The vast majority of hospital activity, approximately 80%, takes place under a not-for-profit (NFP) organization structure (Chu et al. 1991, p. 39). The absence of profit as the primary motive for existence creates significant differences between traditional financial analysis taught in corporate finance classes and that applied in the largely NFP hospital

[1] In our study we define a characteristic of performance as a group of ratios which measure essentially the same financial activity of a firm. The word "characteristic" has previously appeared in the literature in regard to similar uses of factor analysis. See, for example, Chu et al. (1991, p. 41).

[2] All references to correlation analysis in our paper are to the Pearson product-moment correlation coefficient.

industry. Creating short-term and/or long-term shareholder wealth is not a concern for the NFP hospital entity. The primary goal of hospital management is long-term, stable financial strength—as is necessary to support the hospital's mission (Glandon et al. 1987, pp. 441–442). For this purpose, analysts employ an industry-specific set of financial ratios in evaluating hospitals (Cleverley and Rohleder 1985, p. 83). Industry-specific ratios are necessary because, according to Chu et al. (1991, p. 47), hospital ratios provide information which is different from that provided from manufacturing and retail firms.

Third, hospitals are very different from most other NFP charitable organizations in their financing policies. Hospitals generate more than 95% of their patient revenue from the delivery of services for which they are paid (Cleverley 1993, p. 4). Philanthropy or tax support is not a sizable source of revenue for most hospitals (Cleverley 1993, p. 4).

Fourth, the hospital industry has experienced an evolutionary change in its economic environment. During the last 15 years, the hospital industry has gone from almost complete reliance on cost reimbursement to an environment where the vast majority of patient revenues are based upon fixed prices (Chu et al. 1991, pp. 40–41). This evolution has increased the level of financial risk in hospitals and has made lenders, public policy analysts, and hospital executives much more interested in the interpretation of financial ratios (Glandon et al. 1987, p. 440).

Fifth, within the past decade industry-specific financial ratios have become available for hospital financial analysis. For example, Cleverley (1993, pp. 492–495) reported 34 hospital (industry-specific) financial ratios. This publication (Cleverley 1993) classifies these ratios as: a) "profitability" (p. 492); b) "liquidity" (p. 493); c) "capital structure" (p. 494); d) "asset efficiency" (p. 495); and e) "other financial measures" (p. 495). *The Comparative Performance...* (1993, pp. 30–42) reported more than 30 hospital (industry-specific) financial ratios. This publication (*The Comparative Performance* 1993) classifies these ratios as: a) "capital structure" (p. 30); b) "liquidity" (p. 31); c) "revenue-expense-profitability" (p. 32), and d) "productivity and efficiency measures" (p. 33).

Although these two publications compress a large amount of hospital data into a useful framework, it is reasonable to assume that some users of hospital data would like to limit their review to fewer than 30 financial measures of performance for a variety of reasons. First, users encounter a problem when deciding which subset of hospital ratios provide the greatest insight to financial analysis (see the discussion in Gombola and Ketz 1983a, p. 105). There is a limit to the amount of information which can be processed effectively in decision making (Driver and Mock 1975, p. 504). Second, there is an inherent redundancy built into financial ratios (Benishay 1971, pp. 174–177). A redundancy exists because like financial variables are used in several ratio calculations (Benishay 1971, pp. 175–176;

Counte et al. 1988, p. 175). Third, the groupings of financial ratios are ad hoc, and, as such, they may or may not be reliable for users to apply (Gombola and Ketz 1983a, p. 105). Therefore, the fundamental issue is to explore the characteristics of financial performance captured by industry-specific hospital financial ratios.

3. Literature Review

Factor analysis is an established statistical approach that can be used for identifying the characteristics of hospital performance captured by financial ratios (see the discussion in Barnes 1987, p. 456). Factor analysis takes a correlation matrix (or covariance matrix) among original variables (ratios) as input, and constructs a new reduced variable set called factors (Gombola and Ketz 1983b, p. 46). Each factor is identified by the specific ratios which correlate with the respective factor (Gombola and Ketz 1983a, p. 109; 1983b, p. 46). According to Benishay (1971, p. 177), each factor, labeled a financial characteristic of firm activity, represents either fully-independent or semi-independent financial information. Thus, factor analysis produces a statistical-based taxonomy whereby a classification scheme identifies a manageable set of firm characteristics (Gombola and Ketz 1983b, p. 46). The smaller set of variables (factors) can be used for predictive, explanatory, or descriptive purposes (Gombola and Ketz 1983b, p. 46).

Factor analysis, however, does not provide guidance in selecting the best ratio to represent a factor (Chen and Shimerda 1981, p. 59). Factor loadings may be similar, yet the exact ordering of variables by loadings can vary with each sample (Chen and Shimerda 1981, p. 59). This means that while factor analysis output may be consistent in the identification of factors, specific loadings may vary among samples, i.e., the output is sample-specific. Thus, Chen and Shimerda (1981, p. 59) conclude:

> The popular procedure of selecting the ratio with the highest absolute factor loading makes the selection sensitive to the sample. Such procedures may be satisfactory for data reduction purposes, but it is certainly not satisfactory for model building or theory construction. (Chen and Shimerda 1981, p. 59)

Three studies have investigated the multiple characteristics of hospital performance captured by financial ratios using factor analysis. Cleverley and Rohleder (1985) investigated the financial dimensions of 29 financial ratios collected by the Financial Analysis Service, a division of the Healthcare Financial Management Association, for the years 1978 to 1980. They (1985, p. 88) found that the 29 ratios captured the following 10 characteristics of financial performance: 1) "profitability;" 2) "short term cash position;" 3) "capital structure;" 4) "liquidity;" 5) "age of plant;" 6) "debt coverage;" 7) "payment mix;" 8) "leverage;" 9) "current asset efficiency", and 10) "fixed asset efficiency."

Counte et al. (1988) factor analyzed 25 ratios from a sample of 114 Illinois community hospitals for 1984. Counte et al. (1988) extended Cleverley and Rohleder's (1985) work and addressed two methodological concerns. First, according to Counte et al. (1988, p. 175), Cleverley and Rohleder (1985) assumed the multiple characteristics of financial performance were independent (not correlated). Counte et al. (1988, p. 176) employed factor analysis and assumed the multiple characteristics of financial performance (factors) were dependent (correlated). According to Counte et al. (1988, p. 175), financial ratios are assumed to be correlated because they consist of similar financial statement variables.

Second, according to Counte et al. (1988, p. 175), the sample employed by Cleverley and Rohleder (1985) represented many different types of hospitals operating under different economic conditions. Counte et al. (1988, p. 175) employed factor analysis within a homogeneous group of hospitals—small community hospitals which voluntarily provided data to the Illinois Hospital Association. The advantage to using a homogeneous group of hospitals is that unique economic and operating conditions should not confound the analysis (Benishay 1971, p. 178). Counte et al. (1988, p. 176) reported that the 25 ratios represented the following five characteristics of financial performance: 1) "liquidity;" 2) "debt structure;" 3) "profitability;" 4) "cash flow management," and 5) "utilization of assets."

Counte et al. (1988, p. 178) concluded that their findings were preliminary and offered two suggestions for future research. They (1988, p. 178) identified their work as preliminary because the analysis was limited to one year and the sample represented only one type of hospital in one location. According to Counte et al. (1988, p. 178), their findings should be validated with a study of hospital financial ratio factor patterns over time and across different types of hospitals. Our study has incorporated both suggestions into the research methodology.

Chu et al. (1991) conducted the most recent study on the multiple characteristics of performance captured by hospital financial ratios. They (1991, pp. 43–44) considered the financial characteristics of 31 financial ratios from 113 Indiana general acute-care hospitals for 1983 to 1987, assuming all factors were independent (not correlated). The 31 ratios used by Chu et al. (1991, p. 44) were selected out of 40 ratios used by Gombola and Ketz (1983a, p. 108). Nine ratios were dropped in the Chu et al. (1991, p. 44) study because the ratios did not apply to the health care industry. For instance, in their (1991, p. 44) study ratios which measured cost of goods sold and/or inventory turnover were dropped. The 31 ratios used by Chu et al. (1991, p. 44) were applicable to the health care industry as well as the manufacturing and retail industry. Their (1991, p. 39) purpose was to determine whether hospital financial ratio characteristics differed from manufacturing and retail firms. The research focus of Gombola and Ketz

(1983a) was to consider the financial characteristics of manufacturing and retail firms. Chu et al. (1991, p. 47) reported that the 31 ratios capture five dimensions of performance which are identical across the hospital, retail and manufacturing economic sectors of business. The five factors are: "a) return on investment; b) cash position; c) debt structure (or financial leverage); d) receivables intensiveness; and e) short term liquidity." In addition, Chu et al. (1991, p. 47) reported a separate working capital flow factor and a separate return on equity factor for the hospital industry. According to Chu et al. (1991, p. 50), their findings provide evidence that the approach to financial ratio analysis used for retail and manufacturing firms is not the same for hospitals.

Nonetheless, according to Chu et al. (1991, p. 51) the factors identified are inconsistent.[3] Within the hospital industry only three factors (debt structure, working capital flow, and receivables intensiveness) remained consistent throughout the five years of the study (Chu et al. 1991, p. 51). The findings may be inconsistent, according to Chu et al. (1991, p. 52), because of the prospective payment system which began in 1983. The inconsistent, results are one reason why Chu et al. (1991, p. 56) suggest that the study of the financial characteristics of hospital financial ratios be extended to periods beyond 1987, which was the last year of their study.

4. Methodology

The methodology employed in our research differs in several ways from prior studies. First, the Financial Analysis Services (FAS) database, owned by the Center for Healthcare Industry Performance Studies (CHIPS), was used in our study for the four-year period 1989 to 1992.[4] Our study includes audited financial statements for 2,189 voluntary non-profit hospitals.

Second, in an attempt to broaden generalizability of our work, the sample was divided according to:

1. Ownership Type (Voluntary Non-Profit)
   - Non-government/not-for-profit (NG/NFP) with net patient revenue less than $25 million
   - NG/NFP with net patient revenue between $25 and $100 million
   - NG/NFP with net patient revenue greater than $100 million

[3] An inconsistent factor is defined, according to Chu et al. (1991, p. 51), as a financial characteristic that did not emerge for each year of study. The Chu et al. (1991, see p. 43) study covered the period 1983–1987. In our study, we have followed the same definition of inconsistent factor.

[4] The FAS database is owned by the Center for Healthcare Industry Performance Studies. The FAS database for 1989 to 1992 is a collection of data from "approximately 3,500" audited hospital financial statements (Cleverley 1993, p. xi).

- Church operated
- Government/non-federal

2. Mission
   - Teaching
   - Non-teaching
3. Location
   - Urban
   - Rural

Table 1 presents the approximate distribution of voluntary non-profit hospitals in the United States[5] compared to the sample of hospitals used in our study, $n = 2{,}189$ (1402 + 314 + 473; see Table 1). If a hospital was not classified under the various classifications noted above or lacked complete data, it was not included in our study. The individual groupings appear to be representative of the U.S. voluntary NFP hospital industry. For example (see Table 1), for the MCR database for NG/NFP hospitals with net patient revenue greater than $100 million, the distribution is about 17% (rounded and averaged for 1989–1992), and for the FAS database for NG/NFP hospitals with net patient revenue greater than $100 million the distribution is about 19% (rounded and averaged for 1989–1992).

A distinct advantage to partitioning the sample is that it allows an investigation of the common financial characteristics across different hospital operating structures, yet the respective sample sizes remain appropriate for valid interpretation of the factor analysis output. Designing a study to examine the financial characteristics of hospitals across different operating structures is another suggestion of Chu et al. (1991, p. 56) for future research.

Third, our study used 28 of the 34 ratios used by Cleverley (1993, pp. 492–495) which are typically employed in financial analysis of a hospital (Table 2). We elected to drop six ratios from the FAS database because of missing data. A missing data code is assigned to the FAS database when a hospital does not provide the information. Using industry-specific ratios is an important extension to this line of research because Chu et al. (1991,

[5] The distributional analysis of voluntary non-profit hospitals in the United States which appears in Table 1 is taken from the Medicare Cost Report (MCR) database (1989–1992). The MCR database is owned by the Center for Healthcare Industry Performance Studies (CHIPS). The MCR database is a collection of data from "approximately 6,000 Medicare provider hospitals" which file a Medicare cost report with the Health Care Financing Administration (Cleverley 1993, p. 518). In our opinion, the MCR database is representative of all U.S. hospitals in regard to ownership type and patient revenue because, as noted by Cleverley (1993, p. xvii), "Medicare cost report data are available for every hospital in the [United States]."

Table 1. Ownership Type (Voluntary Non-Profit) Distribution By Net Patient Revenue

Non-Government/Not-For-Profit

Net Patient Revenue	MCR Hospital Database* 1989-1992 Average		FAS Hospital Database** 1989-1992 Average	
	Population	Percent***	Our Study Sample Size	Percent***
< $25 Million	1084	45%	509	36%
$25–$100 Million	899	38	641	45
> $100 Million	410	17	252	19
Total	2393	100%	1402	100%

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Net Patient Revenue	MCR Hospital Database* 1989-1992 Average		FAS Hospitals Database** 1989-1992 Average	
	Population	Percent***	Our Study Sample Size	Percent***
< $25 Million	214	34%	79	25%
$25–$100 Million	266	43	153	49
> $100 Million	145	23	82	26
Total	625	100%	314	100%

Government/Non-Federal

Net Patient Revenue	MCR Hospital Database* 1989-1992 Average		FAS Hospitals Database** 1989-1992 Average	
	Population	Percent***	Our Study Sample Size	Percent***
< $25 Million	1068	77%	330	70%
$25–$100 Million	202	15	93	20
> $100 Million	114	8	50	10
Total	1384	100%	473	100%

Sources: * Medicare Cost Report (MCR) database (1989–1992). The MCR database is owned by the Center for Healthcare Industry Performance Studies (CHIPS). The MCR database is a collection of data from "approximately 6,000 Medicare provider hospitals" which file a Medicare cost report with the Health Care Financing Administration (Cleverley 1993, p. 518). In our opinion, the MCR database is representative of all U.S. hospitals according to ownership type and patient revenue, because, as noted by Cleverley (1993, p. xvii), "Medicare cost report data are available for almost every hospital in the [United States]."

** Financial Analysis Service (FAS) database (1989–1992). The FAS database is owned by the Center for Healthcare Industry Performance Studies (CHIPS). The FAS database for 1989–1992 is a collection of data from "approximately 3,500" audited hospital financial statements (Cleverley 1993, p. ix).

*** Percentages have been rounded.

p. 44) employed financial ratios which were not specific to the health care industry.

Principal component factor analysis (PCFA) with a direct oblimin rotation of factors was used to sort the 28 financial ratios into the primary financial characteristics of hospital activity. We employed PCFA because,

Table 2. The 28 Financial Ratios and Definitions Used in Our Study

Ratio	Defined
Total margin TMAR	Revenues and gains in excess of expenses and losses/total revenue + net nonoperating gains
Operating margin OMAR	Total revenue − total expenses/total revenue + net nonoperating gains
Operating margin OMRPL	Total revenue − total expenses + depreciation − price-level depreciation/total revenue + net nonoperating gains
Nonoperating gains NONOG	Net nonoperating gains/total revenue + net nonoperating gains
Return on total assets ROA	Revenues and gains in excess of expenses and losses/total assets
Return on investment ROI	Revenues and gains in excess of expenses and losses + depreciation + interest/price-level adjusted total assets
Return on equity ROE	Revenues and gains in excess of expenses and losses/fund balance
Growth rate in equity GRIE	Change in fund balance/fund balance
Current ratio CR	Current assets/current liabilities
Days in patient accounts receivable DAR	Net patient accounts receivable/(net patient service revenue/365)
Average payment period APP	Current liabilities/[(total expenses − depreciation)/365]
Days cash on hand (short-term sources) DCHST	Cash + marketable securities/[(total expenses − depreciation)/365]
Days cash on hand (all sources) DCH	Cash + marketable securities + unrestricted investments/[(total expenses − depreciation)/365]
Equity financing EF	Fund balance/total assets
Long-term debt to equity LTDE	Long-term liabilities/fund balance

(continued)

according to Chen and Shimerda (1982, p. 53), it is a widely-practiced approach to reduce the redundancy found in financial ratios. The advantage of PCFA, according to Lindeman (1980, p. 262), is that the results are more objectively interpretable than common factor analysis. A direct oblimin rotation enhances the interpretation of factor loadings because

Table 2. The 28 Financial Ratios and Definitions Used in Our Study (*continued*)

Ratio	Defined
Fixed asset financing FAF	Long term liabilities/net fixed assets
Cash flow to total debt CFTD	Revenues and gains in excess of expenses and losses +depreciation/current liabilities +long term debt
Capital expense CE	Interest + depreciation/ total expenses − interest − depreciation
Times interest earned TIE	Revenues and gains in excess of expenses and losses +interest expense/interest expense
Debt service coverage DSC	Cash flow + interest expense/ principal payment + interest expense
Total asset turnover TATO	Total revenue + net nonoperating gains/total assets
Fixed asset turnover FATO	Total revenue + net nonoperating gains/net fixed assets
Fixed asset turnover (price-level adjusted) FATOPL	Total revenue + net nonoperating gains/price-level adjusted net fixed assets
Current asset turnover CATO	Total revenue + net nonoperating gains/current assets
Replacement viability REPV	Restricted plant fund balance + unrestricted investments/price-level accumulated adjusted depreciatio
Average age of plant AAP	Accumulated depreciation/depreciation expense
Depreciation rate DEPR	Depreciation expense/gross fixed assets
Capital expenditure growth rate CEGR	Capital expenditures/gross fixed assets

Source: Taken from Cleverley (1993, pp. 492–495).

ratios are assumed to be dependent (correlated), which is most likely true with financial ratio data (Benishay 1971, pp. 174–177).[6]

Three criteria for identifying the hospital financial characteristics were applied in our study when we used PCFA. They are: 1) eigenvalues greater than 1, known as Kaiser's criterion (Ketz et al. 1990, p. 31); 2) an

[6] Counte et al. (1988, p. 175) employed an oblique rotation (assuming factors are correlated) in the factor analysis of hospital ratios. Chu et al. (1991, p. 47) employed an orthogonal rotation (assuming factors are not correlated).

identifiable factor above the level plane on the scree plot, known as Cattell's scree criterion (Ketz et al. 1990, p. 31); and 3) an interpretable common factor (Ketz et al. 1990, p. 32).

5. Results and Discussion

In our study, seven financial characteristics (factors) of hospital performance consistently emerged from the statistical-based taxonomy of hospital financial ratios. The identified factors are based on the three criteria for PCFA noted above while using a direct oblimin rotation.[7] The financial characteristics are: 1) profitability; 2) fixed asset efficiency; 3) capital structure; 4) fixed asset age; 5) working capital efficiency; 6) liquidity, and 7) debt coverage (Table 3). The seven factor solution consistently accounts for 70% to 80% of the total explained variance for each category. This pattern of explained variance for financial ratios suggests the identified factors captured a majority of the information available in the correlation matrix for each category of analysis. In addition, with a direct oblimin rotation the inter-factor correlation among identified factors was low, ranging between .05 and .15. The low correlation means that the identified factors are not substantially related.[8]

Table 3 compares the factors and consistency of factors reported by Chu et al. (1991, pp. 47–50) to that reported in our study. Consistent with Chu et al. (1991, p. 47) are the profit, capital structure, and return on equity factors. Those inconsistent with Chu et al. (1991, p. 47–50) are the fixed asset efficiency, fixed asset age, working capital efficiency, liquidity and debt coverage factors. The difference in the identified factors may be explained by the set of ratios used in each study. Chu et al. (1991, p. 46) employed ratios which typically are applied in manufacturing and retail firm financial analysis. Hospital industry-specific ratios were used in our study. The preliminary findings outlined in Table 3 of our study show a common consistent taxonomy of hospital industry financial factors.

The average cross-sectional factor consistency within each category of analysis (ownership type, mission and location) provides evidence that the identified factors are generalizable over the period of our study (1989–1992). This analysis consists of evaluating the relationship (correla-

[7] Running alternate factor analysis methods produced similar results. The identified factors were consistent as well as the respective ratio loadings to the factors. Plus, the ratios which loaded inconsistently under principal component factor analysis, for example ROE, inconsistently loaded under the alternate methods. Finding similar results with different factor analysis methods is supported by Gorsuch (1983, pp. 121–123) and Ketz et al. (1990, p. 33).

[8] The explained variance, number of identified factors for each hospital category, by year, and inter-factor correlation matrix are available upon request from the first author.

Table 3. Comparative Analysis Chu et al. (1991, p. 51) to Our Study Findings

The Identified Factors Reported by Chu et al. (1991, p. 51)	The Identified Factors Reported in This Study
Return on investment*	Profitability
Cash position*	
Debt structure	Capital structure
Working capital flow	
Return on equity*	Return on equity*
Short-term liquidity*	
Receivable intensiveness	
Cash flow*	
	Fixed asset efficiency
	Fixed asset age
	Working capital efficiency
	Liquidity
	Debt coverage

* Factor did not consistently surface for each period of study. A factor which did not consistently surface is defined as one that does not emerge for each year of study (Chu et al. 1991, p. 51).

tions[9]) of factor scores across the categories of analysis for like factors. The average cross-sectional correlation for the profitability factor is .95. This means there is a significant relationship among the profitability factors across the different categories of analysis and that profitability is indeed a consistent factor. For the remaining factors, the inter-factor correlations range from .73 on the fixed asset efficiency factor to .54 on the liquidity factor. In addition, inter-factor correlation analysis among ownership type, location and mission follows a similar pattern. This level of inter-factor correlation provides evidence that like variables are loading to the same factor among the different categories of analysis. To the best of our knowledge, this is the first study which provides empirical evidence of consistent factor patterns for industry-specific hospital financial ratios.

Tables 4A–5B recap the statistical output from factor analysis based upon hospital category. The tables show the specific characteristics of hospital activity captured by financial ratios over time. Sample sizes, explained variance percentages and correlations listed in these tables are averaged for the period 1989–1992. The discussion focuses on average results because only when a financial characteristic is consistent over time is it reasonable to use it in financial analysis.

[9] The analysis was conducted using PCFA with a varimax rotation. Because correlation coefficients are more widely known and more easily interpreted, calculating correlations between factor scores is preferable to coefficients of congruence, according to Gorsuch (1983, p. 285). However, according to an anonymous reviewer, the correlation coefficient approach assumes linearity which the congruency coefficient does not. Thus, the correlation analysis applied in our study is not necessarily better than congruency coefficient analysis for evaluating factor scores across the categories of analysis.

Table 4A. Factor Summary by Hospital Ownership Type (Voluntary Non-Profit)* 1989–1992

	Non-Government/Not-For-Profit Size in Net Patient Revenue											
	n = 509 < $25 Million		n = 641 $25 to $100 Million		n = 252 > $100 Million		Church Operated n = 314			Government/ Non-Federal n = 473		
Factor	71.3%**		72.8%**		70.3%**		76.3%**			74.5%**		
Profitability	ROA	.93	ROA	.91	OMAR	.93	ROA	.94		ROA	.95	
	TMAR	.90	TMAR	.91	OMRPL	.92	OMAR	.93		TMAR	.93	
	ROI	.89	OMAR	.91	ROA	.92	TMAR	.92		ROI	.90	
	OMAR	.87	OMRPL	.91	TMAR	.88	OMRPL	.90		OMAR	.81	
	OMRPL	.86	ROI	.85	ROI	.86	ROI	.90		ROE	.81	
	ROE	.80			ROE	.83			OMRPL	.80		
							GRIE	.74				
Fixed asset efficiency	FATO	.94	FATOPL	.93	FATO	.97	FATO	.93		FATO	.91	
	FATOPL	.91	FATO	.92	FATOPL	.95	FATOPL	.91		FATOPL	.89	
	TATO	.76	TATO	.80	TATO	.81	TATO	.76		TATO	.89	
			CE(−)	.68	CE(−)	.65						
Capital structure	EF(−)	.79	EF(−)	.85	EF(−)	.86	EF(−)	.92		EF(−)	.93	
	FAF	.76	FAF	.68	FAF	.77	LTDE	.71		FAF	.77	
	LTDE	.67	APP	.66			FAF	.70		LTDE	.77	
							APP	.64		APP	.53	
Return on equity			ROE	.92	GRIE	.88						
			GRIE	.91	ROE	.86						
Fixed asset age	AAP	.85	AAP	.77	AAP	.84	AAP	.88		DEPR(−)	.83	
	DEPR(−)	.81	DEPR(−)	.77	DEPR(−)	.84	DEPR(−)	.83		AAP	.77	
Working capital efficiency	CATO	.87	CATO	.93	CATO	.85	CATO	.92		CATO	.91	
	CR	.73	CR	.69	CR	.85	CR	.73		CR	.74	
	DCHST	.68	DCHST	.64	DCHST	.82	DCHST	.68		DAR	.67	
			DAR	.64			DAR	.61		DCHST	.56	
Liquidity	DCH	.86	DCH	.81	DCH	.85	DCH	.86		DCH	.84	
	REPV	.83	REPV	.75	REPV	.81	NONOG	.80		REPV	.82	
			NONOG	.71	NONOG	.76						
Debt coverage	DSC	.89					TIE	.87		TIE	.88	
	TIE	.87					DSC	.86		DSC	.86	

* Sample sizes, explained variance percentages and correlations listed in this table have been averaged for the period 1989-1992. Correlation values have been rounded to the nearest two decimal points.

** Represents explained variance in total and is a rounded value.

Table 4A recaps the factor analysis results according to hospital ownership type. *Profitability* is the first factor listed for all categories of ownership type. A profitability factor was expected because it is widely recognized that this is a characteristic financial statements are structured to capture. Cleverley and Rohleder (1985, p. 85), Counte et al. (1988,

p. 176) and Chu et al. (1991, p. 47) also identified profitability as a financial characteristic of firm performance. Intra-factor correlation analysis among the ratios loading to the profitability factor indicate that return on assets (ROA), total margin (TMAR), return on investment (ROI), operating margin (OMAR) and operating margin price level adjusted (OMRPL) measures have the highest correlations, ranging from .70 to .95. The correlation among the above variables and return on equity (ROE) is much lower, ranging between .33 and .60 for NF/NFP hospitals with net patient revenue less than $25 million, church operated and government/non-federal hospitals. This indicates that variation in the data set can be explained by a profitability factor which includes ROA, TMAR, ROI, OMAR, and OMRPL.

Fixed asset efficiency is the second factor listed for all categories of ownership type (Table 4A). This characteristic of hospital performance measures the utilization of fixed assets. Cleverley and Rohleder (1985, p. 85) and Counte et al. (1988, p. 176) also identified a fixed asset efficiency factor. Chu et al. (1991) did not identify this characteristic of financial performance because their study did not employ fixed asset efficiency measures. Intra-factor correlation analysis among the ratios indicates that fixed asset turnover (FATO), fixed asset turnover (price-level adjusted) (FATOPL) and total asset turnover (TATO) measures are significantly correlated, ranging between .50 to .90. The correlation among the above variables and capital expense (CE) is much lower, ranging between .30 to .50 for NF/NFP hospitals with net patient revenue between $25–$100 million and NF/NFP hospitals with net patient revenue greater than $100 million. This indicates that variation in the data set can be explained by a fixed asset efficiency factor, which includes FATO, FATOPL and TATO.

Capital structure is the third factor for all categories of ownership type. This factor signals the financial structure of a hospital. Cleverley and Rohleder (1985, p. 85), Counte et al. (1988, p. 176) and Chu et al. (1991, p. 47) also identified a capital structure factor. Intra-factor correlation analysis among the ratios loading to this factor indicate that equity financing (EF) and fixed asset financing (FAF) measures are strongly correlated, ranging between $-.63$ to $-.75$. This means low values for EF imply more debt, while low values for FAF imply less debt. The absolute value of the correlations for the above variables and long-term debt to equity (LTDE) and average payment period (APP) are much lower, ranging from .50 to .09 throughout all categories of ownership structure. This indicates that variation in the data set can be explained by a capital structure factor, which includes EF and FAF.

Return on equity is the fourth factor listed in Table 4A. This finding suggests that return on equity may be a measure of firm performance, but only for the two largest categories of NG/NFP hospitals, those with net

patient revenue greater than $25 million. Return on equity (ROE) and growth rate in equity (GRIE) are the two ratios which load to this factor. Within these two categories of ownership structure, the correlation between ROE and GRIE is .96 and .83, respectively. This indicates that variation in the data set can be explained by a return on equity factor, which includes ROE and GRIE. For all other categories of ownership, the return on equity factor is not present. ROE loads with the profitability factor, and GRIE loads either with the profitability factor or exhibits an inconsistent loading.

Fixed asset age is the fifth factor listed for all hospital ownership categories. This factor represents the approximate age of the hospital equipment and plant. Cleverley and Rohleder (1985, p. 85) identified a fixed asset age factor while Counte et al. (1988) and Chu et al. (1991) did not. The ratio data set used by Chu et al. (1991, p. 46) did not include fixed asset age measures. Intra-factor correlation analysis between the ratios loading to this factor indicate that average age of plant (AAP) and depreciation rate (DEPR) strongly correlate, ranging between $-.54$ to $-.68$. This indicates that the variation in the data set can be explained by a fixed asset age factor, which includes AAP and DEPR. The negative correlation means, for example, that a hospital with a low AAP will have either newer investment or a heavier mix of equipment with shorter depreciable lives and thus higher depreciation rates.

Working capital efficiency is the sixth factor listed for all categories of ownership type. This factor captures the relative efficiency of a hospital's investment in current assets or working capital. Intra-factor correlation analysis among the ratios loading to this factor indicate that the current ratio (CR), current asset turnover (CATO) and days cash on hand (short-term sources) (DCHST) are significantly related with correlations ranging between .45 to .60 among the categories of analysis. Although days in patient accounts receivable (DAR) is listed as a component of this factor, the correlation of this ratio and CR and DCHST was consistently low, ranging between .20 to .05. This indicates that the variation in the data set can be explained by a working capital efficiency factor, which includes CR, CATO and DCHST.

Liquidity is the seventh factor listed for all categories of ownership type. The liquidity factor represents a hospital's access to unrestricted cash and investments which can be used for both short-term and long-term needs. Intra-factor correlation analysis between the ratios loading to this factor indicate that days cash on hand (DCH) and replacement viability (REPV) are significantly correlated, ranging between .41 to .72. This indicates that the variation in the data set can be explained by a liquidity factor, which includes DCH and REPV. An exception to this finding is for church operated hospitals. The correlation between DCH and nonoperating gain

(NONOG) is .59. Thus, for this hospital category the variation in the data set can be explained by a liquidity factor, which includes DCH and NONOG.

Debt coverage is the eighth factor listed for all categories of ownership type, except for NG/NFP hospitals with net patient revenues greater than $25 million. The debt coverage factor represents a hospital's ability to satisfy current and future interest obligations. This finding is consistent with Cleverley and Rohleder (1985, p. 85). Counte et al. (1988) and Chu et al. (1991) did not include debt coverage ratios in their respective studies. Intra-factor correlation analysis among the ratios loading to this factor indicate that debt service coverage (DSC) and times interest earned (TIE) correlate between .45 to .87. This indicates that the variation in the data set can be explained by a debt coverage factor, which includes TIE and DSC.

Table 4B completes the analysis of hospitals by ownership type. This table summarizes the ratios which were not stable when factor analyzed over time and across ownership type. For instance, within the church operated category CE, CEGR, CFTD, GRIE and REPV are identified as unstable because they loaded to a different factor each year. This type of volatility suggests the ratio is not a stable component of financial activity and it is impossible to associate it with a specific factor.

Table 4B. Ratios with Unstable* Factor Loadings 1989–1992

	Non-Government/Not-For-Profit Size in Net Patient Revenue			Church	Government/
	< $25 Million	$25 to $100 Million	> $100 Million	Operated	Non-Federal
Ratios	APP		APP		
	CE			CE	CE
	CEGR	CEGR	CEGR	CEGR	CEGR
	CFTD	CFTD	CFTD	CFTD	CFTD
	DAR		DAR		
		DSC	DSC		
	GRIE				GRIE
		LTDE	LTDE		
	NONOG				NONOG
				REPV	
		TIE	TIE		

* Unstable is defined as a ratio which did not load to the same factor for all periods of our study (1989–1992). For instance, CFTD would be listed as unstable if it loaded to the profitability factor in 1989, the liquidity factor in 1990, the debt coverage factor in 1991 and the profitability factor in 1992. With this pattern of factor loading it is impossible to identify the relationship of CFTD to a particular factor. Chu et al. (1991, pp. 51–52) followed the same procedure when they discussed the stability of ratio factor loadings.

5.1 Further Analysis

Table 5A presents a factor analyzed solution where the sample data were divided according to: 1) location—urban and rural, and 2) mission—teaching and non-teaching. The findings provide evidence that a hospital's location or mission should not alter the framework for financial ratio analysis. The explained variance for these classifications ranges from 70.3% to 77.4%. Further, the intra-factor correlations were similar to the findings when analyzed by ownership type. Therefore, we conclude that financial characteristics are similar for urban, rural, teaching and non-

Table 5A. Factor Summary by Urban, Rural, Teaching and Non-Teaching Hospitals* 1989–1992

Factor	Urban n = 1385 70.3%**		Rural n = 872 71.3%**		Teaching n = 459 77.4%**		Non-Teaching n = 1799 71.3%**	
Profitability	ROA	.87	OMAR	.93	ROA	.92	OMAR	.89
	TMAR	.84	OMRPL	.92	TMAR	.88	ROA	.89
	ROI	.84	ROA	.90	ROI	.86	OMRPL	.88
	ROE	.83	TMAR	.89	ROE	.79	TMAR	.88
			ROI	.88			ROI	.85
Fixed asset efficiency	FATO	.96	FATO	.94	FATO	.95	FATO	.94
	FATOPL	.93	FATOPL	.93	FATOPL	.93	FATOPL	.90
	TATO	.77	TATO	.70	TATO	.74	TATO	.76
Capital structure	EF(−)	.77	EF(−)	.80	EF(−)	.83	EF(−)	.82
	FAF	.65	FAF	.75	FAF	.65	FAF	.79
	LTDE	.62	LTDE	.61	LTDE	.49	LTDE	.64
Working capital efficiency	CATO	.83	CATO	.84	CATO	.85	CATO	.92
	CR	.69	DCHST	.64	DCHST	.73	CR	.77
	DCHST	.69	DAR	.63	CR	.70	DCHST	.59
Liquidity	DCH	.80	DCH	.86	REPV	.87	DCH	.84
	REPV	.76	REPV	.75	DCH	.86	NONOG	.72
							REPV	.62
Fixed asset age	AAP	.84	AAP	.81	AAP	.85	AAP	.83
	DEPR(−)	.78	DEPR(−)	.71	DEPR(−)	.83	DEPR(−)	.76
Debt coverage	TIE	.83	TIE	.87	DSC	.86	TIE	.89
	DSC	.76	DSC	.86	TIE	.82	DSC	.87
Profit margin					OMAR	.83		
					OMRPL	.82		
					NONOG(−)	.82		

* Sample sizes, explained variance percentages and correlations listed in this table have been averaged for the period 1989-1992. Correlation values have been rounded to the nearest two decimal points.

** Represents explained variance in total and is a rounded value.

Table 5B. Ratios with Unstable* Factor Loadings 1989–1992

	Urban	Rural	Teaching	Non-Teaching
Ratios	APP	APP	APP	APP
	CE	CE	CE	CE
	CEGR	CEGR	CEGR	CEGR
	CFTD	CFTD	CFTD	CFTD
		CR		
	DAR		DAR	DAR
	GRIE	GRIE	GRIE	GRIE
	NONOG	NONOG		
	OMAR			
	OMRPL			
		ROE		ROE

* Unstable is defined as a ratio which did not load to the same factor for all periods of our study (1989–1992). For instance, CFTD would be listed as unstable if it loaded to the profitability factor in 1989, the liquidity factor in 1990, the debt coverage factor in 1991 and the profitability factor in 1992. With this pattern of factor loading it is impossible to identify the relationship of CFTD to a particular factor. Chu et al. (1991, pp. 51–52) followed the same procedure when they discussed the stability of ratio factor loadings.

teaching hospitals, and the previous categories analyzed. Table 5B lists the ratios which consistently did not load to a factor for the period 1989-1992.

Interestingly, a profit margin factor surfaced only for teaching hospitals. Intra-factor correlation analysis for NONOG with OMAR and OMRPL is $-.50$ and $-.49$, respectively. This indicates that the variation in this category of hospital can be explained by a profit margin factor, which includes OMAR, OMRPL and NONOG.

6. Summary and Future Research Issues

The objectives of our study were to: 1) identify the consistent financial characteristics of hospital financial performance, and 2) examine the correlations among the ratios that are included in the characteristics of financial performance. Our research is of importance to the health care industry because improved understanding of hospital performance reduces risk and helps management offer effective services within an efficient operating cost structure, benefiting all stakeholders. Table 6 summarizes the consistent financial characteristics and the ratios which loaded onto the factors resulting from a comprehensive factor analysis of industry-specific hospital financial ratios across ownership type, location and mission for the period 1989–1992.

The following discussion serves as a platform for future research suggestions. A limitation of a study which involves factor analyzed data is that it does not link an identified factor to decision making value or usefulness (Chen and Shimerda 1981, p. 59). Once a factor is identified, the interpretation of its meaning and value are a subjective extrapolation (Chen and

Table 6. Summary of Consistent Hospital Financial Characteristics and Related Ratios 1989–1992

Factor Name	Financial Characteristic	Ratios
Profitability	Profitability	ROA, TMAR, ROI, OMAR, OMARPL
Fixed asset efficiency	Fixed asset utilization	FATO, FATOPL, TATO
Capital structure	Hospital financial structure	EF, FAF
Fixed asset age	Approximate age of equipment and plant	AAP, DEPR
Working capital efficiency	Efficiency of investment in current assets and working capital	CATO, CR
Liquidity	Level of unrestricted cash and investments	DCH, REPV

Shimerda 1981, p. 59). The closing section of our paper offers our interpretation of why: 1) each identified factor is important to the health care industry and 2) research into the specific factor is important to the health care industry.

The relative importance of *profitability* to a NFP hospital is noteworthy. Hospitals operate in an increasingly competitive and risky business environment. The ability to acquire resources essential to their mission is heavily related to profitability and marketplace success. The reason is that, according to Cleverley (1993, p. 4), approximately 95% of hospital revenue is generated from patient services. Therefore, hospitals may not be organized to make a profit, but profit is nonetheless a primary factor which affects the attainment of their mission.

Fixed asset efficiency is a financial characteristic of hospital activity that warrants considerable analysis. A problem facing the U.S. hospital industry is excess capacity (Wagner 1994, p. 16). Excessive investment in plant, property, and equipment often leads to lower profitability in today's changing marketplace (Cleverley 1993, p. 108; Wagner 1994, p. 16). This is a significant departure from traditional hospital economics. Prior to 1983, hospitals added plant capacity and technology at a rapid pace because they were assured that these additional costs would be recovered through established cost reimbursement contracts (Chu et al. 1991, p. 40). Thus, new capital investment should be evaluated on the basis of its contribution to the cost-effective delivery of health care services.

The identification of a *capital structure* factor should force analysts and researchers to question traditional hospital financial analysis. Long-term debt to equity (LTDE) typically is relied upon as a measure of a hospital's capital structure (*The Comparative Performance...* 1993, p. 31). Throughout our analysis, however, LTDE did not routinely load on the capital

structure factor. Therefore, an improved measure of hospital capital structure should be considered in future research.

The relative *age of fixed assets* should also be evaluated in the analysis of a hospital. Hospital management must carefully evaluate where to invest capital. Management should place scarce capital dollars into areas where there is an expectation of new revenue growth, such as equipment for expanding outpatient and ambulatory services, and avoid capital expenditures where there is little promise of new revenues. This is especially true for renovation expenditures which may not add new revenues and only increase expenses.

Working capital efficiency is another financial characteristic of hospital activity that warrants additional analysis. As with the fixed asset efficiency factor, working capital investments should be evaluated more on the basis of its contribution to the cost-effective delivery of health care services. Further, the current ratio loaded to this factor and not to the *liquidity* factor. This finding should call into question the traditional application of the current ratio as a liquidity measure for a hospital, as it was for all business organizations by Walter (1957, pp. 31–32). The liquidity factor, as identified in our study, represents the availability of unrestricted cash and investments which can be used for both short-term and long-term needs.

In conclusion, the consistent financial characteristics identified in our study should be considered as a possible guide to improve hospital financial analysis. Further research could evaluate and test the contribution and value each financial characteristic makes to the decision making process. For practitioners the findings may be useful in clarifying the characteristics of financial performance captured by industry-specific hospital ratios.

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References

Barnes, P. Winter 1987. The analysis and use of financial ratios: A review article. *Journal of Business Finance and Accounting* 14(4):449–461.

Benishay, H. Spring 1971. Economic information in financial ratio analysis: A note. *Accounting and Business Research* 1(2):174–179.

Chen, K. H. and Shimerda, T. A. Spring 1981. An empirical analysis of useful financial ratios. *Financial Management* 10(1):51–60.

Chu, D. K., Zollinger, T. W., Kelley, A. S. and Saywell, R. M., Jr. Spring 1991. An empirical analysis of cash flow, working capital, and the stability of financial ratio groups in the hospital industry. *Journal of Accounting and Public Policy* 10(1):39–58.

Cleverley, W. O. 1993. *The 1993 Almanac of Hospital Financial & Operating Indicators*. Columbus, OH: The Center for Healthcare Industry Performance Studies (CHIPS).

Cleverley, W. O. and Rohleder, H. Summer 1985. Unique dimensions of financial analysis service ratios. *Topics in Health Care Financing* 11(4):81–88.

Counte, M., Glandon, G., Holloman, K. and Kowalczyk, J. Nov. 1988. Using ratios to measure hospital financial performance: Can the process be simplified? *Health Services Management Research* 1(3):172–180.

Driver, M. and Mock, T. July 1975. Human information processing. *The Accounting Review* 50(3):490–508.

Glandon, G., Counte, M., Holloman, K. and Kowalczyk, J. Nov. 1987. An analytical review of hospital financial performance measures. *Hospital & Health Services Administration* 32(4):439–455.

Gombola, M. J. and Ketz, J. E. Jan. 1983a. A note on cash flow and classification patterns of financial ratios. *The Accounting Review* 58(1):105–114.

Gombola, M. J. and Ketz, J. E. Summer 1983b. Financial ratio patterns in retail and manufacturing organizations. *Financial Management* 12(2):45–56.

Gorsuch, R. L. 1983. *Factor Analysis* (2nd Ed.). Hillsdale, NJ: Erlbaum Associates.

Ketz, J. E., Doogar, R. K. and Jensen, D. E. 1990. *Across Industry Analysis of Financial Ratios: Comparabilities and Corporate Performance*. New York, NY: Quorum Books.

Lindeman, R. H., Merenda, P. R. and Gold, R. Z. 1980. *Introduction to Bivariate and Multivariate Analysis*. Glenview, IL: Scott, Foresman and Company.

The Comparative Performance of US Hospitals: The Sourcebook. 1993. Baltimore, MD: Health Care Investment Analysis, Inc. and Deloitte & Touche.

Wagner, L. May 1994. Reform may force hospital closures. *Modern Healthcare* 24(20):30.

Walter, J. Jan. 1957. Determination of technical solvency. *Journal of Business* (10)1:30–43.

Wruck, H. W. and Jensen, M. Nov. 1994. Science, specific knowledge, and total quality management. *Journal of Accounting & Economics* 18(3):247–287.