KANSAS NURSING FACILITY PROJECT EVALUATION YEAR 3

For the Kansas Department on Aging

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Preface

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We also wish to thank our project consultants, Marilyn Rantz, RN, PhD and Greg Petroski, MS from the University of Missouri, School of Nursing, who provided guidance, advice, and data.

We also thank the nursing homes that participated in our on-site data collection and in the falls consortium.

Under subcontract, Myers & Stauffer, provided the project with extracts from the Minimum Data Set, including quality indicator and case mix adjustment files.

For any questions or comments concerning this report, please contact the Principal Investigator, Sarah Thompson, at (913) 588-1624 or at **sthompson2@kumc.edu**.

The Stability of Kansas Nursing Home Measures Between 2001 and 2003

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Executive Summary

Research Questions:

1. What is the stability of the nursing home measures, both indicators of quality and measures of facility characteristics that are related to quality indicators (QIs)?
2. What is the stability of the relationship between facility characteristics and deficiencies or QIs over time?
3. What nursing home measures would comprise a valid, reliable, parsimonious set of indicators for broad stakeholder monitoring?

Methods: Using theoretically-based analytic models, the Kansas Nursing Facility Project conducted studies into the quality of nursing homes. The research team has created a longitudinal database that spans three years (2001-2003) and includes data on staffing (cost reports), deficiencies (OSCAR), and QIs from the Minimum Data Set (MDS). This database contains more information than the CMS website and is a rich data resource for researchers to address fundamental questions about the predictors of nursing home quality.

Results:

- A great deal of information is available on resident health status from the Minimum Data Set, in particular the QIs. Most of the 14 QIs examined were stable over time and, therefore, they are useful predictors of the health status maintenance aspect of facility quality. Because there are so many QIs (23), a summary measure would be helpful to consumers

- Statewide, the average number of total deficiencies, D+ deficiencies, and Quality of Care deficiencies went up over the three-year period, while the mean number of G+ deficiencies, Quality of Life deficiencies and substandard care deficiencies went down. These patterns were not consistent across regions and some of the regional changes were considerably more marked than the statewide changes.

- This study identified four measures that could form the basis of a parsimonious set of quality measures: total deficiencies, summary QI score, total turnover rate, and RN wage rate. This information should be available to consumers, providers, policy makers, and regulators. Educational tools based on these measures should be developed for the CMS website which could guide consumers in the selection of nursing home care.

Discussion: The quality of nursing home care is a concern for residents and their families, providers, policy makers, and regulators. Quality, however, is a complex concept with at least three components: the health status of nursing home residents, a safe and supportive physical environment, and resident and family satisfaction with care.

Nursing homes are subject to constant change—change in residents, staff turnover, and change in facility ownership. Understanding the current and future quality of a nursing home in the midst of such an environment is a challenging task. Identifying a parsimonious set of measures is an important objective, in order to assist stakeholders to focus their efforts to provide quality care, governments to develop policies that promote high quality care, and providers identify targets for quality improvement initiatives. This study identified one variable—staff turnover—that was both a stable characteristic of nursing homes and predictive of the number of deficiencies that nursing homes would receive. Other measures of nursing home characteristics that have been related to deficiencies, but not consistently related, include RN wage rates, not-for-profit ownership, RN care hours per resident day, not being part of a multiple-facility chain, smaller bed size.

Implications

- Data on measures of health status (QIs) and the facility environment (deficiencies) are routinely available to all stakeholder groups. Data on resident satisfaction are rarely available and when available, are difficult to compare across facilities.

- Most QIs are stable over time and are therefore useful predictors of that aspect of facility quality.

- Deficiency measures are not as stable as QIs, however, two nursing home characteristics (staff turnover rates and RN wage rates) can help stakeholders assess the reliability of the total deficiency measure.

- Identifying a parsimonious set of measures is an important task that will assist stakeholders to focus their efforts to provide quality care, develop policies that promote high quality care, and identify the providers of high quality care. This study identified four measures that could form the basis of a parsimonious set: total deficiencies, summary QI score, total turnover rate, and RN wage rate.

- Case mix index was the only facility characteristic that had a consistent relationship to the summary QI measure. Quality measures (QMs), which control for case mix, may be a superior measure for a parsimonious set of measures than the unadjusted QIs. QMs have only been available for a few years. It will be important to study the stability of QMs and the relationship of facility characteristics to QMs should be explored.

- Educational tools should be developed for the CMS website which guides consumers in the selection and interpretation of nursing home measures.

Introduction

Providing high quality nursing home care for an aging society is a challenge for policy makers and providers. As the proportion of the population that is elderly continues to increase, the demand for high quality nursing home care in the United States also will increase. The elderly and their families need reliable information on nursing home quality to use in selecting nursing homes. Similarly, policy makers, providers, and regulators need reliable information on the quality of nursing home care in order to target resources efficiently and effectively to expand the availability of high quality nursing home care.

There are three obstacles to developing the information on nursing home quality needed by the various stakeholder groups. First, quality of care is a **complex concept**, having at least three components:

- Maintaining or improving the health status of nursing home residents
- Providing a safe and supportive physical environment, and
- Resident and family satisfaction with the quality of care.

Data are available, or may be developed, on each of the three components of quality. Measures of physiological status of residents are available through the quality indicators (QIs) or quality measures (QMs) collected through the Nursing Home Minimum Data Set (MDS). Measures of the degree to which nursing homes provide safe and supportive physical environments are available from deficiency survey data. Resident and family satisfaction survey data may be collected by nursing homes or others, but are not routinely available.

Due to the fluid nature of nursing home settings—resident turnover, staff turnover, change in ownership—quality indicators and facility characteristics related to quality change from year-to-year. The second challenge is to identify **stable indicators**, that is, measures that are predictive of underlying nursing home quality. A good quality indicator set excludes measures that are subject to a high level of random fluctuation or measures that are not reliable.

The third obstacle to providing consumers, providers, regulators, and policy makers with information on nursing home quality is how to select the key informative measures from among the abundance of data that is available. **Parsimony** is a desirable feature of an outcome indicator set. A parsimonious set would include measures of all relevant concepts, but would be limited to as few measures as possible both to minimize the burden of data collection but also to help focus stakeholders on key elements of quality. Thus, identifying measures that represent root causes of quality outcomes is a necessary step in the development of an effective information tool. Deficiency data, and to a certain extent QI data, exhibit substantial variability from one reporting period to the next.

Background

Since 1999 the United States Centers for Medicare and Medicaid Services (CMS) has compiled information about the quality of nursing homes and posted these data on the public-access website www.medicare.gov. The website presents

information on deficiencies, nurse staffing, QIs, and other nursing home characteristics. (See Appendix Figure A.1 for a screen shot of the CMS website.)

Over the past three years the University of Kansas Nursing Facility Project, funded by the Kansas Department on Aging, has conducted studies into the quality of nursing homes. During that period, the research team has created a database that spans three years (2001-2003) and includes data on staffing (cost reports), deficiencies (OSCAR), and QIs from the MDS. This database contains more information than the CMS website and is a rich data resource for researchers to address fundamental questions about the predictors of nursing home quality. Using theoretically-based analytic models with the longitudinal database, the Kansas Nursing Facility Project reports from Study Years 1 and 2 presented analyses that resulted in recommendations to policy makers, providers, regulators, and consumers.

Data presented in the Year 2 report showed that, within Kansas regions, facility characteristics and quality indicators changed over time. Both earlier reports identified factors that were related to nursing home deficiencies and QIs, although the factors that were the most significant changed from year to year. Staff turnover rates were identified as the single most influential characteristic related to deficiencies in the Year 2 report. Other characteristics of note included metropolitan location, for-profit or chain ownership, size (number of staffed beds), combined aide and LPN hours per resident day, and case mix. In both years, there were significant regional differences in deficiencies and QIs, even after taking regional differences in facility characteristics into account. One of the important findings in the second year report was that different facility characteristics were identified as important factors in each of the annual reports. This result highlights the importance of examining the relationships between facility characteristics and measures of nursing home quality longitudinally to determine which facility characteristics are repeatedly related to facility quality, as it is those characteristics that will be most valuable for stakeholders to monitor.

Report Aims

This report addresses the following questions:

1. **What is the stability of the nursing home measures, both indicators of quality and measures of facility characteristics that are related to QIs?**
2. **What is the stability of the relationship between facility characteristics and deficiencies or QIs over time?**
3. **What nursing home measures would comprise a valid, reliable, parsimonious set of indicators for broad stakeholder monitoring?**

The answers to these questions have implications for stakeholders. From a consumer's point of view, if a measure is found to be stable across time, then they can be assured that the particular data value will remain the same in the near future and, therefore, will be helpful to them in making choices among homes. For example, if a loved one goes to nursing home with a favorable staffing ratio of residents to RNs—a relatively stable measure—the caregiver can be confident that the staff ratio will remain the same in the future. The stability of measures has implications for policy makers, as well. If, however, a measure is volatile; it would be beneficial to identify the source of the instability. One way to examine an unstable variable is to build theoretical models that can be statistically estimated.

This report examines the stability of deficiency measures and QIs. It does not address the stability of resident and family satisfaction with care, as those data are available only for a small sample of Kansas facilities for one year. The stability or volatility of deficiencies and QIs is described, but this report does not decompose the amount of change into true change and unreliability. To do so would require data that currently are not available, specifically two independent measures of QIs and deficiencies at the same point in time. Instead, a discussion of data quality is provided. The report then presents information on the stability of the relationship between nursing home characteristics and deficiencies or QIs and concludes with a discussion of measures that might be included in a parsimonious set of nursing home measures.

Results

Stability—Longitudinal Descriptive Statistics

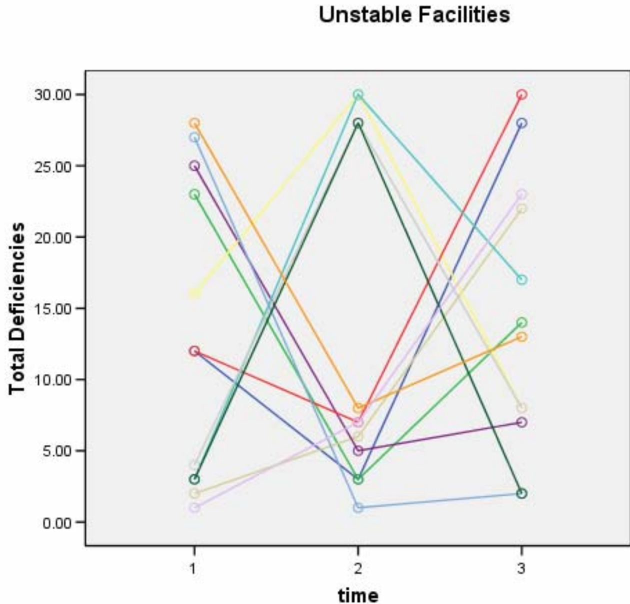
Table 1, which presents means on six deficiency measures for Kansas regions for the years 2001 through 2003, illustrates the difficulty of measuring nursing home quality from the deficiency perspective over time. Statewide, the average number of total deficiencies, D+ deficiencies, and Quality of Care deficiencies went up over the three-year period, while the mean number of G+ deficiencies, Quality of Life deficiencies and substandard care deficiencies went down. These patterns were not consistent across regions and some of the regional changes were considerably more marked than the statewide changes. There was even greater variability among individual nursing homes, with an average change of seven (7) in the total number of deficiencies over the three year period. The range of change in the number of total deficiencies was quite large, from 0 to 27. We categorized the homes as stable or unstable, based on the amount of change that occurred in total deficiencies over the 2001-2003 interval. Examples of stable and unstable patterns are displayed in Figure 1. The alternative specifications of deficiency measures and the large and inconsistent patterns of change, make it difficult to draw conclusions about trends in the quality of Kansas nursing homes, but illustrate the volatility of this measure.

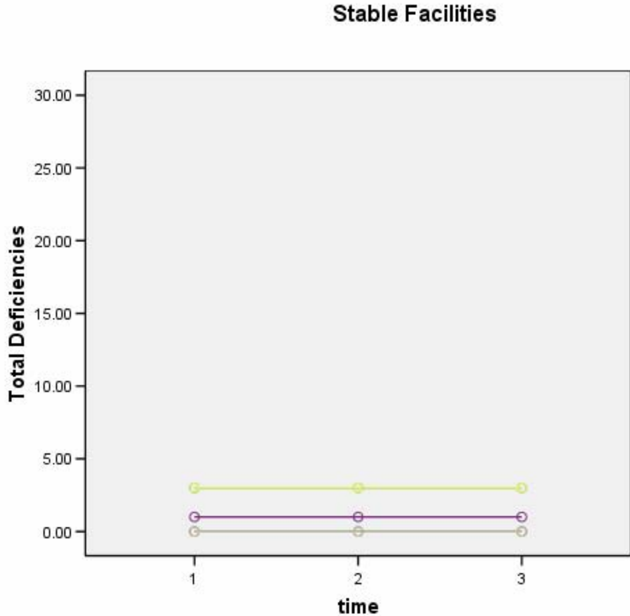
Table 1

Regional Differences in Mean Number of Deficiencies
Kansas Nursing Homes, 2001-2003

Region	Total	D+	G+	Quality of Life	Quality of Care	Substandard Care
	Nursing Homes					
LW						
2001	5.58	4.89	0.53	0.49	1.27	0.02
2002	6.43	6.40	0.43	0.45	1.98	0.07
2003	7.31	7.10	0.43	0.81	2.36	0.02
NC						
2001	5.35	5.04	0.37	0.58	2.16	0.07
2002	5.05	4.68	0.39	0.14	1.98	0.05
2003	4.83	4.47	0.29	0.14	1.85	0.02
NE						
2001	11.64	11.27	1.15	0.79	6.09	0.12
2002	10.79	10.00	0.79	0.32	5.05	0.79
2003	10.47	9.19	0.72	0.50	4.53	0.0
SC						
2001	9.25	9.04	1.25	0.84	3.73	0.10
2002	7.28	6.94	0.33	0.20	2.69	0.03
2003	7.09	6.48	0.33	0.24	2.52	0.02
SE						
2001	8.66	8.52	0.45	0.77	3.48	0.07
2002	9.56	9.42	0.56	0.73	3.73	0.00
2003	10.44	10.26	0.40	0.44	4.32	0.00
W						
2001	3.69	3.56	0.27	0.41	1.64	0.07
2002	6.80	6.73	0.69	0.38	2.76	0.20
2003	6.37	6.33	0.77	0.47	2.63	0.14
State Total						
2001	7.19	6.89	0.64	0.65	2.93	0.07
2002	7.55	7.27	0.52	0.37	2.97	0.07
2003	7.69	7.29	0.47	0.41	3.01	0.03
	Long Term Care Units					
State Total						
2001	4.20	3.95	0.31	0.38	1.49	0.09
2002	4.89	4.72	0.44	0.32	1.86	0.07
2003	5.15	4.93	0.20	0.17	1.91	0.09

Figure 1
Stable and Unstable Nursing Homes
As measured by Total Deficiencies





Measuring Stability with Cronbach's Alpha

Cronbach's alpha is a statistic that can be used to describe stability (Cronbach, 1951). Alpha is frequently used to show the level of agreement among items in a scale. An alternative use is to show association or correlation across observations over time.[1] Alpha can take on values between 0 and 1. As a rule of thumb, many researchers consider that an alpha of 0.70 and higher is adequate stability. In the context of trends in nursing home measures, a high alpha indicates that we can expect the measure to be stable across time. In this study we will describe alphas of:

- 0.71 to 1.00 as **stable**;
- 0.50 to 0.70 as **variable**; and
- below 0.50 as **unstable**.

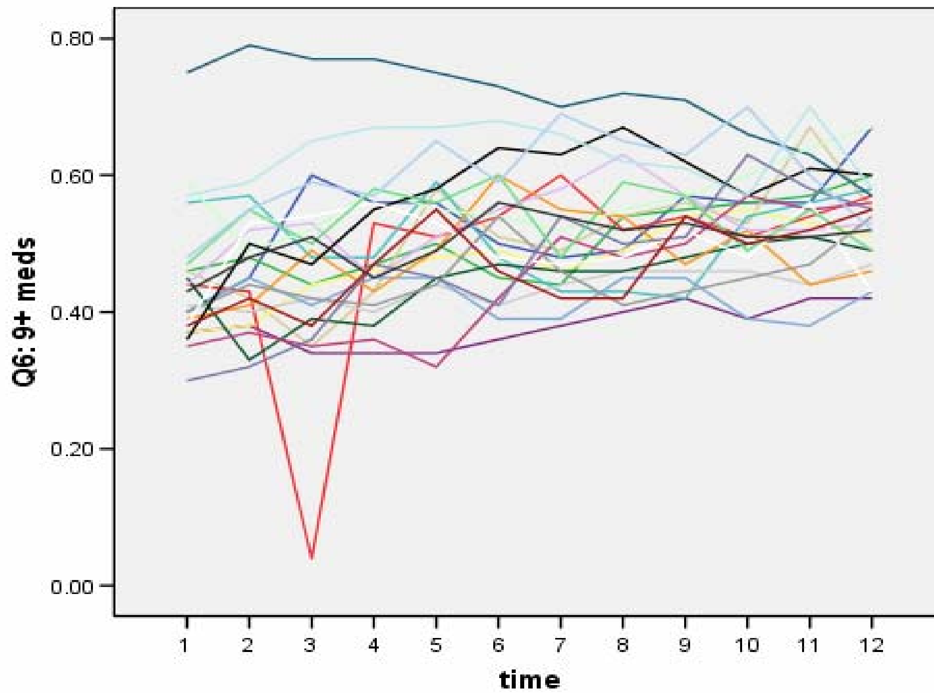
In the longitudinal nursing home dataset, variables are measured with different frequency. Some of the variables are measured quarterly (e.g. Case mix, QIs) while others are measured approximately annually (e.g. deficiencies). As an example calculation for alpha, consider the "use of nine or more different medications (9+)" rate (QI6) across the three years which yields twelve repeated measures (4 quarters x 3 years = 12). Among all the possible correlations, the correlation between 2003 quarter 4 and 2001 quarter 1 was the smallest (0.55). This is not surprising given the large time span between these measures. The largest correlation was between 2002 quarter 2 and 2002 quarter 3 (0.87) – right next to each other. The average correlation among all pairs was 0.73 with 12 observations. The calculation for $alpha = 12 * 0.7293/(1+(12-1) * 0.7293) = 0.975$. Therefore, the 9+ Medications rate is considered stable. To appreciate the stability of the 9+ rate, consider Figure 2 on the following page. A random sample of a set of nursing homes was selected and plotted to show what a stable measure looks like.

[1] More specifically, the formula for Cronbach's alpha is:

$$Alpha = N * rbar / (1+(N-1) * rbar)$$

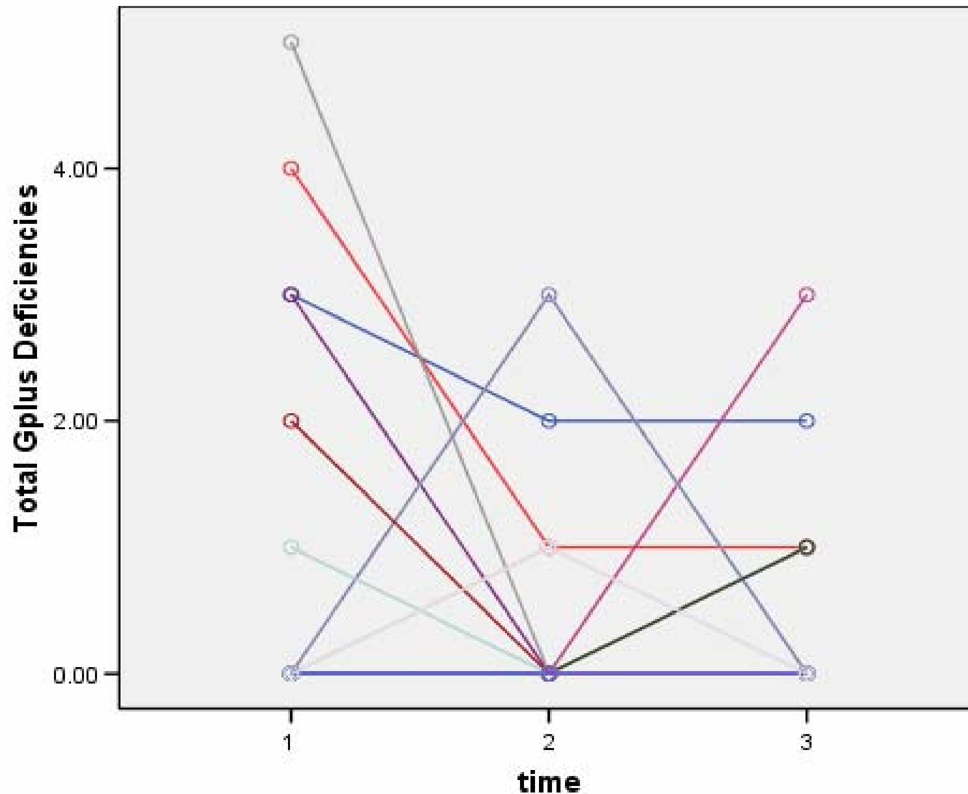
where N is the number of times the measure is taken and *rbar* is the average inter-observation correlation. The alpha formula is both a function of the average correlation (rbar) and the number of measures (observations). One property of alpha is that it approaches 1 as the number of observations gets larger (N) as long as rbar is positive.

Figure 2
A Stable Measure
QI6: 9+ Different Medications (Alpha=0.97)



A second example is of a measure that is unstable (Gplus deficiencies). Among all the possible correlations, the correlation between year 2002 and year 2003 was the smallest (0.004). The largest correlation was between 2001 and 2002 (0.12). The average correlation among all pairs was 0.097 and the number of measures was N=3. The calculation for *alpha*=*3**0.097 /(1+(*3*-1)* 0.097)=0.2437. Therefore, Gplus deficiencies are considered unstable. A random sample of a set of nursing homes was selected and plotted on the following page to show an unstable measure (Figure 3).

Figure 3
An Unstable Measure
Gplus Deficiencies (Alpha=0.24)



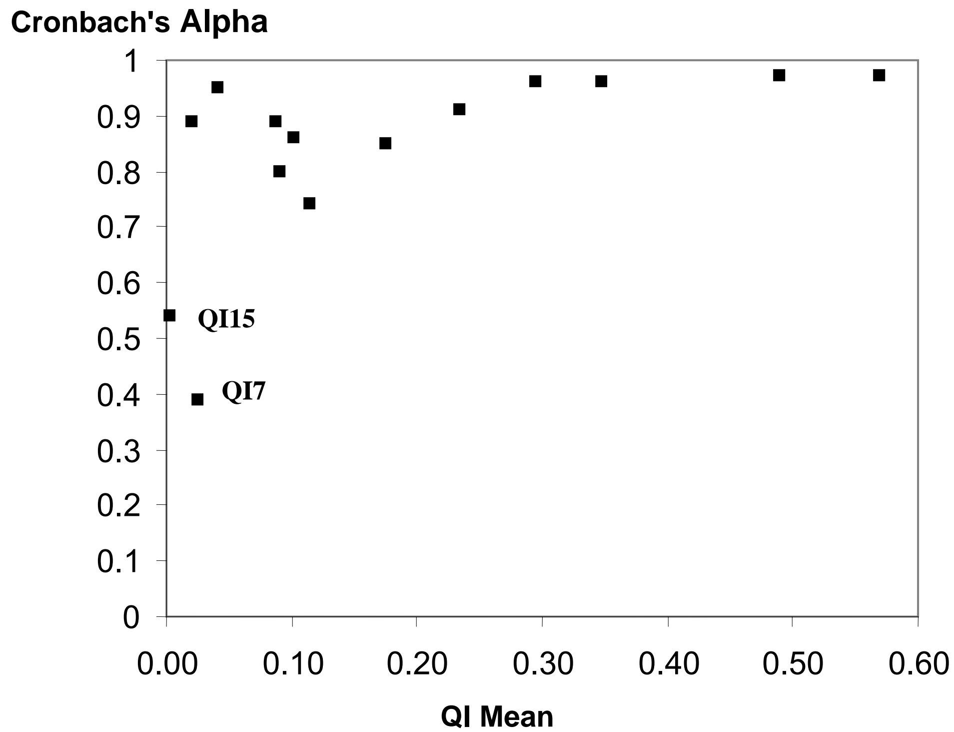
Alpha was calculated for 34 measures of nursing home quality and nursing home characteristics related to quality. The measures are ranked from most stable to least stable in Table 2 and categorized as stable, variable, and unstable. Twelve of the 14 QIs were considered stable measures, in part due to the higher number of observations available on these measures. One QI was considered variable (QI15: dehydration) and one was considered unstable (QI7: incidence of cognitive impairment). The Summary QI measure was found to be variable. Three of the five deficiency measures were found to be variable and two were unstable. The unstable deficiency measures were those with higher scope and severity and are rarer than the other deficiency measures. Nine of the 14 facility characteristics were found to be stable and five were variable. The facility characteristics persistently related to deficiencies (total turnover) and summary QIs (case mix index) were stable. Note that, total turnover is considered stable and total deficiencies is considered variable. Coupled with the fact that many of the QIs are stable, in a later section of this paper we demonstrate a reliable relationship between staff turnover and QIs.

Table 2
Nursing Home Measures Rank Ordered by Stability
(N=288) 2001-2003, State of Kansas.
All measures are annual except '*' which are quarterly.

Rank	Stability	Measures	alpha
1	**Stable**	Q6: 9+ Medications	0.97
2	**Stable**	Q8: Bladder or Bowel Incontinence	0.97
3	**Stable**	Q4: Symptoms of Depression	0.96
4	**Stable**	Q5: Symptoms of depression without antidepressant therapy	0.96
5	**Stable**	Case mix index	0.95
6	**Stable**	Q22: Daily use of physical restraints	0.95
7	**Stable**	RN Skill mix*	0.93
8	**Stable**	OTHER (LPN and CAN) HPRD*	0.93
9	**Stable**	Q9: Occasional/frequent Bowel or Bladder Incontinence—no pan	0.91
10	**Stable**	LPN Skill mix*	0.90
11	**Stable**	Q16: Bedfast residents	0.89
12	**Stable**	Q24: Stage 1-4 Pressure ulcers	0.89
13	**Stable**	Q12: Urinary tract infections	0.86
14	**Stable**	LPN Wage Rate*	0.85
15	**Stable**	CNA Wage Rate*	0.85
16	**Stable**	Q2: Falls	0.85
17	**Stable**	CNA Skill mix	0.84
18	**Stable**	Q13: Weight loss	0.80
19	**Stable**	RN HPRD*	0.76
20	**Stable**	Q17: Incidence of decline in late loss ADLs	0.74
21	**Stable**	All Turnover*	0.73
22	Variable	CNA Turnover*	0.70
23	Variable	Admin Wage Rate*	0.65
24	Variable	Total Deficiencies*	0.64
25	Variable	Summary QIs (Rantz et al, 2000)*	0.63
26	Variable	Total D+ Deficiencies*	0.62
27	Variable	LPN Turnover*	0.57
28	Variable	Total E+ Deficiencies*	0.56
29	Variable	Q15: Dehydration	0.54
30	Variable	RN Turnover*	0.53
31	Variable	RN Wage Rate*	0.50
32	*Unstable*	Q7: Incidence of cognitive impairment	0.39
33	*Unstable*	Total F+ Deficiencies*	0.35
34	*Unstable*	Total G+ Deficiencies*	0.24

Figure 4 presents a scatter plot of the 12 stable QIs (x-axis) and their associated alpha levels (y-axis), showing very high alpha levels for these QIs. Conversely, the alphas for QI15 (dehydration) and QI7 (cognitive impairment) are substantially lower than the rest, reflecting rare reports of these conditions, and therefore unstable character, of these measures.

Figure 4
Alpha Levels for 14 QI Mean Values
Kansas Nursing Homes, 2001



Stability of the Relationship between Facility Characteristics and Outcomes

Variability in the relationship between nursing home characteristics and total deficiencies and a summary QI score is illustrated by the annual change in significant regression coefficients in Table 3. As a multivariate technique, regression models identify facility characteristics that are significantly related to QIs, net of the effects of all of the other characteristics in the model. The results can guide policy makers, program regulators, and providers in identifying key factors to promote quality improvement.

In 2001, total staff turnover and being a for-profit facility (Ownership_Oscar) were significantly related to the total number of deficiencies, with higher turnover rates and for profit ownership being indicative of a higher number of deficiencies. Turnover also had a significant relationship to total deficiencies in 2002, but for-profit ownership did not. Instead, RN hours per resident day, being part of a multi-facility chain, and facility size (Total number of staffed beds—BEDTOT) were significantly related to total deficiencies, with more RN hours, chain membership, and larger facility size being associated with a higher number of deficiencies.[2] Again in 2003, staff turnover had a significant relationship with deficiencies, as did facility size, but not for-profit ownership, chain membership, or RN hours per resident day. In 2003, the LPN wage rate was significantly related to total deficiencies, with higher LPN wages being associated with more deficiencies.[3] Based on this information, it would be difficult for policy makers and nursing home managers interested in improving nursing home quality to promote change in any facility characteristic other than reducing turnover. However, the evidence on the importance of turnover is quite straightforward with this characteristic consistently having a significant relationship to deficiencies and consistently having a large effect size.

As measures of nursing home quality, the 23 specific QIs generally are more stable than deficiency measures, but QIs do not represent a parsimonious set. Thus, Rantz et al (2000) developed a summary QI measure which captures the cumulative degree to which a home's QI values exceed the maximum level determined by a panel of experts to represent acceptable quality of care.[4] The second panel of Table 2 presents regression coefficients for the relationship between nursing home characteristics and the Rantz summary QI measure. The only facility characteristic that was significantly related to the summary QI score over the three year period was the case mix index. Facilities with higher case mix scores (higher resident acuity) had higher (worse) QI scores. In 2001, the case mix index was the only facility characteristic with a significant relationship to QIs.

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[2] The direct relationship between RN hours per resident day and number of deficiencies is unexpected. A possible interpretation is based on the fact that with fixed budgets, nursing homes that have more RNs may have fewer LPN or CNA care hours.

[3] With a fixed budget, a higher LPN wage rate may have resulted in lower wages for other nursing staff or fewer care hours for per resident day.

[4] Higher QI scores indicate lower quality of care.

Table 3

Relationship of Nursing Home Characteristics To Total Deficiencies and Summary Quality Indicator Score 2001-2003 Regression Coefficients

Total Deficiencies

	2001			2002			2003		
Variable	**B**	**p**		**B**	**p**		**B**	**p**	
Intercept	-0.79	0.8857		3.14	0.6227		-1.11	0.8463	
Turnover_all	2.57	0.0017	*	2.71	0.0033	*	3.90	0.0003	*
WageRate_RN	0.00	0.9956		-0.12	0.3697		-0.02	0.8937	
WageRate_LPN	-0.24	0.3464		0.20	0.3671		0.45	0.0470	*
WageRate_CNA	0.34	0.4798		-0.48	0.2678		-0.73	0.0839	
CareHrs_PRD_RN	-1.65	0.3996		-7.45	0.0018	*	-1.90	0.3594	
Case mix_Q1	2.12	0.6844		8.33	0.1765		7.79	0.1493	
Chain_oscar	0.36	0.6596		2.79	0.0019	*	0.91	0.2334	
CoPerCapIncome99	0.00	0.2740		0.00	0.7248		0.00	0.1670	
Ownership_Oscar	3.72	0.0000	*	0.29	0.7658		1.44	0.1104	
CareHrs_PRD_OTHER	1.36	0.0792		-0.50	0.4950		-0.22	0.7342	
BEDTOT	0.02	0.0578		0.03	0.0422	*	0.02	0.0323	*

Summary QI (Rantz et al)

	2001			2002			2003		
Variable	**B**	**p**		**B**	**p**		**B**	**p**	
Intercept	-16.63	0.0139	*	-17.64	0.0132	*	-0.72	0.9184	
Turnover_all	0.56	0.5814		-0.87	0.3974		-0.89	0.5030	
WageRate_RN	0.04	0.7271		0.16	0.2954		0.24	0.1368	
WageRate_LPN	-0.15	0.6339		-0.05	0.8330		-0.74	0.0080	*
WageRate_CNA	0.65	0.2707		0.54	0.2639		1.20	0.0208	*
CareHrs_PRD_RN	-0.85	0.7230		0.74	0.7818		2.22	0.3815	
Case mix_Q1	35.25	0.0000	*	30.73	0.0000	*	15.47	0.0201	*
Chain_oscar	0.17	0.8661		0.27	0.7876		0.64	0.4916	
CoPerCapIncome99	0.00	0.4545		0.00	0.7087		0.00	0.2871	
Ownership_Oscar	1.57	0.1637		1.84	0.0876		2.72	0.0143	*
CareHrs_PRD_OTHER	1.79	0.0607		1.99	0.0158	*	1.96	0.0160	*
BEDTOT	-0.03	0.0743		-0.03	0.0181	*	-0.02	0.1608	
Total Deficiencies	0.06	0.4739		0.03	0.6522		0.01	0.9078	

Note: * indicates a statistically significant relationship at $p \leq 0.05$.

In 2002, Other (LPN and CNA) care hours per resident day and facility size also had significant effects on the summary QI score, with more care hours being associated with higher (worse) QI scores and smaller facilities having higher QI scores. In 2003, case mix index and Other care hours were associated with QI scores, but not facility size. Instead, the LPN and CNA wage rates and being a for-profit facility were significantly associated with the summary QI score. Thus, the only nursing home characteristic with a consistent relationship to the summary QI score was case mix index, a factor that is controlled for in Quality Measures. While other care hours per resident day was significant in two out of three years, the effect size was small and was not in the expected direction. Thus, we know little about nursing home characteristics that contribute to quality as measured by the physiological well-being of residents in the QIs.

Parsimonious Set of Indicators of Nursing Home Quality

One way to identify the most influential nursing home characteristics related to quality measures (deficiencies and QIs) is to begin with a grounded empirical model established by Gajewski et al (2006). The dependent variable in this regression tree model is the maximum difference in the total number of deficiencies from surveys across the 2001-2003 periods (range of total deficiencies). The independent variables are nursing home characteristics from 2001:

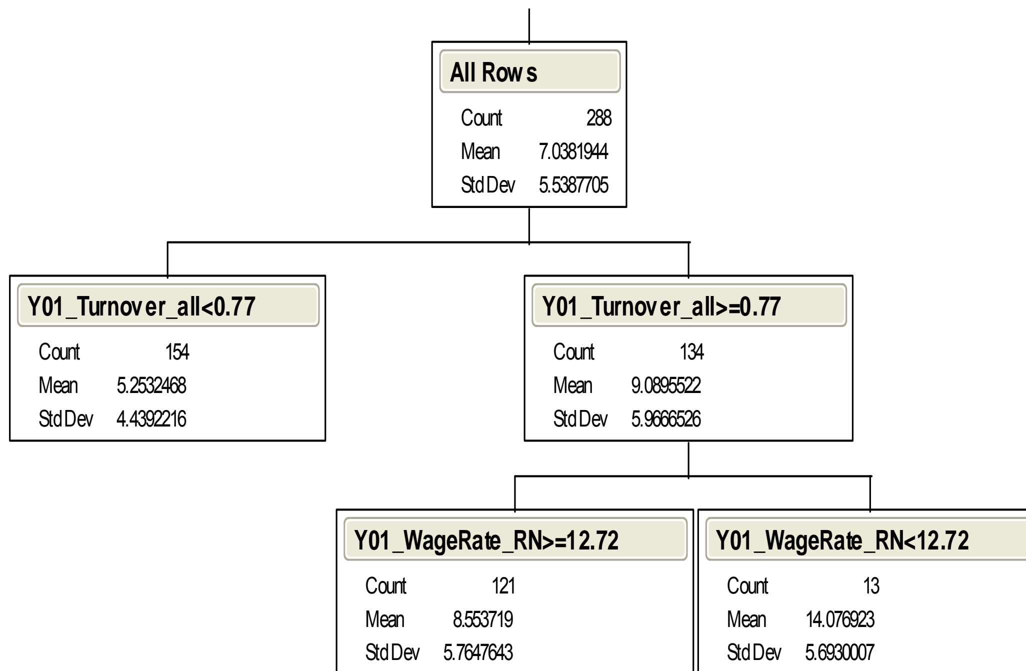
- Number of staffed beds
- Ownership (for profit or not-for-profit)
- Member of a multi-facility chain
- Cash (conversion cycle): time it takes for a nursing home to convert its activities requiring cash back into cash returns. A higher value indicates a cash flow problem
- Case mix index
- Per capita income in the county in 1999 (Census data)
- Mean wage rate of RNs in the home
- Mean wage rate of LPNs in the home
- Mean wage rate of CNAs in the home
- % Nursing care hours supplied by RNs
- % of Nursing care hours supplied by LPNs and CNAs
- Total staff turnover

The model examines how the nursing home characteristics in 2001 predict the volatility in deficiencies over the three year period. The results are presented in Figure 5.

The results indicate that the total turnover rate is the most influential variable in predicting the volatility of the total number of deficiencies. The average range of deficiencies across the three year period was 7. With a statewide mean of 7 deficiencies, that means that the average home may have as few as 0 and as many as 14 deficiencies over a three year period. However, homes with turnover rates less than 77% have a reduced range of deficiencies, on average, plus or minus 5 deficiencies compared with plus or minus 9 for homes with higher turnover rates. When a home has high turnover, knowing the most recent total number of deficiencies in a particular year is not as informative as when homes have turnover rates below 77%. Therefore, consumers would benefit from looking at the turnover rate as well as the total number of deficiencies when choosing a nursing home. If a home has few deficiencies, but a high turnover rate, it may not have few deficiencies in the next two surveys. On the other hand, if a home has either few or many deficiencies, but a low turnover rate, the aspect

of quality represented by the number of deficiencies is likely to be more in line with recent measures over the next two surveys.

Figure 5
Regression tree in which the dependent variable is the range of deficiencies across 2001-2003 (R2=0.16).



Looking at the next level of the regression tree results, we see that among homes with turnover rates above 77%, higher RN wage rates (>$12.72/hour) contribute to the predictive utility of recent survey results. Among homes with higher turnover rates, but also with higher RN wage rates, the expected range of deficiencies would be the current number plus or minus 9 deficiencies in the next two surveys, while homes paying lower RN wage rates would have a range of the current number of deficiencies plus or minus 14 deficiencies.

Conclusions and Recommendations

- Nursing homes are subject to constant change—change in residents, staff turnover, and change in facility ownership. Understanding the current and future quality of a nursing home in the midst of such an environment is a challenging task.

- For nursing homes, quality of care is a complex concept, encompassing the maintenance or improvement of the health status of residents, providing a safe and supportive physical environment, and resident and family satisfaction with the home.

- Data on measures of health status (QIs) and the facility environment (deficiencies) are routinely available to all stakeholder groups. Data on resident satisfaction are rarely available and typically not comparable between facilities.

- Most QIs are stable over time and are therefore useful predictors of that aspect of facility quality.

- Deficiency measures are not as stable as QIs, however, two nursing home characteristics (staff turnover rates and RN wage rates) can help stakeholders assess the reliability of the total deficiency measure.

- There is a wealth of data available on deficiencies, QIs, and nursing home characteristics. Identifying a parsimonious set of measures is an important task that will assist stakeholders to focus their efforts to provide quality care, develop policies that promote high quality care, and identify the providers of high quality care. This study identified four measures that could form the basis of a parsimonious set: total deficiencies, summary QI score, total turnover rate, and RN wage rate.

- Other measures of nursing home characteristics that have been related to deficiencies, but not consistently related, include: not-for-profit ownership, RN care hours per resident day, not being part of a multiple-facility chain, smaller bed size. Continuing to explore the relationship of these characteristics to deficiencies would be important before including them in a parsimonious indicator set.

- Case mix index was the only facility characteristic that had a consistent relationship to the summary QI measure. Quality measures (QMs), which control for case mix, may be a superior measure for a parsimonious set of measures than the unadjusted QIs. QMs have only been available for a few years. It will be important to study the stability of QMs and the relationship of facility characteristics to QMs should be explored.

- Educational tools should be developed for the CMS website which guide consumers in the selection and interpretation of nursing home measures.

Appendix Figure A.1
Example nursing home compare in Kansas

Medicare.gov - Nursing Home Compare - Results Summary - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://www.medicare.gov/NHCompare/include/DataSection/ResultsSummary/ResultsSummary.asp

Search > **Results**

Overview | About Homes | Quality | Inspections | Staffing | Resources

Search Results for the selected nursing homes in Kansas

Nursing Home Summary

Information in the Nursing Home database should be interpreted carefully and used in conjunction with other sources, as well as a visit to the nursing home. We suggest you use our **Nursing Home Checklist** to help evaluate the nursing homes you visit, or contact your long-term care ombudsman or State Survey Agency before making a decision. The phone number for the long-term care ombudsman or State Survey Agency in your area can be found in the **Helpful Contacts** section of this website.

About the Nursing Home	Quality Measures	Total Number of Health Deficiencies	Nursing Staff Hours per Resident per Day	CNA Hours per Resident per Day
	Information for 13 of the 15 quality measures is available	7 Deficiencies	54 minutes	2 hours 52 minutes
			Total Number of Residents: 82	

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