

LITERATURE REVIEW DEVELOPMENT OF STAFFING QUALITY MEASURES- PHASE I

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1. INTRODUCTION AND BACKGROUND

The goal of the Development of Staffing Quality Measures – Phase I special study is to develop measures of staffing in nursing homes that can appropriately be used as quality measures for public reporting. This paper presents a review and synthesis of relevant research to thoroughly understand the “state of the art” in measurement of nurse staffing, including information on the types of staffing measures used in previous studies, data sources for staffing information, and a review of the types of risk adjustment methods that have been used to date. It is intended to apprise the technical expert panel of the most current science in measuring nursing home staffing and to form the basis of their discussion on the best staffing measures to use in public reporting of nursing home quality measures.

Previous studies have shown that staffing is a vital component to quality care for nursing home residents. The goal of a public reporting system is to make information on staffing available to consumers so that they can consider this information when selecting a nursing home. The CMS Online Survey Certification and Reporting System (OSCAR) is the only national data source for nurse staffing information. OSCAR is the source used for the staffing information currently reported on Nursing Home Compare. OSCAR data for each facility are updated every nine to 15 months, are universally collected data from all Medicare and/or Medicaid certified nursing homes, and have consistently defined data elements. Unfortunately, OSCAR is sometimes inaccurate and has a number of inherent limitations (variable reporting period, inaccurate resident and bed counts, and no fields for turnover/retention or other aspects of staffing), which may make it inappropriate to use as the data source for a public reporting system.

Staffing measures derived from Medicaid cost report data are generally better than OSCAR data, but not all states have these data, they are not comparable across states, and there is a lag in reporting. It may, therefore, be necessary to develop a new reporting system that addresses the limitations of OSCAR and Medicaid cost reports, although the development of a new system has some practical limitations including cost of development, feasibility of implementation, and burden to facilities.

Careful consideration of how to best define staffing measures for public reporting is essential so that a clear relationship exists between the reported measure(s) and quality of care. There are some dimensions of staffing that may be important, but are not readily available in a reporting system. For example, the distinction between direct and administrative staff may not be a real distinction in any operational system. Usually, nurse aides become the proxy for direct care. But in practice, nurse aides do a lot of activities that are not "hands on", and conversely, RNs provide a lot of "hands on" care. It is unlikely that any operational reporting system could accurately apportion what is direct and what is indirect or purely administrative (perhaps with the exception of a few administrative positions). There is also the issue of how broadly to define what should be captured as a "nursing" measure. For example, should the system include hours provided by other nursing support staff, such as housekeepers and unit secretaries that may provide some resident care.

Differences across nursing facilities in the average acuity (or case-mix) of their residents affect the amount of nursing time that is required to adequately care for residents. Nursing homes with the same observed staffing level, but different resident case-mix, would differ substantially in

how well their staffing levels meet resident needs. A public reporting system that takes case-mix into consideration will provide more accurate information to consumers. However, there are important issues regarding the type of case-mix adjustment to use and how to incorporate case-mix differences in a public reporting system that need to be considered.

This literature review focuses on defining the “state of the science” in identifying valid and reliable staffing measures, sources for these measures, understanding the link between staffing and quality, and adjusting staffing levels for differences in resident acuity.

2. METHODS

To ensure an inclusive investigation of staffing measures linked to quality outcomes in nursing homes, we used two methods to review the literature. First, the review team conducted a combined electronic literature search of four databases (Ageline, CINAHL, HealthSTAR, and MEDLINE). The search was limited to research articles published from 1975-2003 in the English language. Key words of nursing homes, nursing staff, and quality of health care were combined and duplicates were removed. The electronic search yielded 96 citations. The team also performed a manual review of citations and abstracts to eliminate those articles without a clear research focus. Inclusion criteria for the manual review included (1) publication in a peer-reviewed journal, and (2) a research study of staffing variables linked to quality measures. A total of 45 articles were eliminated, leaving 51 articles identified from the electronic search.

In the second method, the team reviewed relevant CMS and GAO documents relating to staffing to identify original staffing studies that have been completed, but were not identified in the electronic search. In addition, two literature reviews regarding nurse staffing and quality in nursing homes (Davis, 1991; Dellefield, 2000), as well as a consensus paper on recommended staffing standards (Harrington et al., 2000) were consulted to check for key articles that may have been overlooked in the search. A total of 32 articles and government documents were identified from the hand search. Four articles accepted for publication in peer-reviewed journals, but still in press, were added to the final total. This review of staffing measures linked to quality outcomes encompassed a total of 87 citations.

The literature review team carefully reviewed and summarized each article, extracted relevant content, and organized the information around four themes:

- Table 1 describes various staffing measures that have been used in previous studies.
- Table 2 discusses data sources used for staffing or control measures.
- Table 3 presents nursing home quality measures that have been developed.
- Table 4 describes the risk adjustment and control variables that have been used in previous studies.

The synthesis tables outline the strengths and weaknesses of each measure, along with their corresponding references.

Review staff prepared a final table (Table 5) that summarizes all 87 staffing studies that were reviewed for the project. This table includes an alphabetical listing by first author, staffing variables and quality measurement used, and a description of the study and results. The progress of the literature review was discussed bi-monthly during project conference calls. Drafts of the review were shared with the project team for feedback throughout the development of this review. The next section of this paper identifies salient points from the synthesis tables.

3. SYNTHESIS POINTS

Staffing Measures

Two staffing measures were predominant in the literature: 1) the ratio of staff to residents, and 2) the number of staff hours per resident. Most of the studies used some measure of hours per resident day, which is preferable to a measure of hours per facility bed. The majority of studies that used a measure of staffing ratios per resident or bed were older studies for which the more widely used hours per resident measure was probably not available.

Most of the studies we reviewed had separate measures for RN, LPN, and CNA staffing. Staffing measures are usually reported for each category of nursing staff (i.e. RN, LPN/LVN, NA, licensed/non-licensed, or total nursing staff) or by the responsibilities of staff (direct care staff or administrative staff). The CMS studies “Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes, Phases I and II” did not analyze total nursing hours, but this is a widely used measure.

Several studies have found an association between higher total staffing levels and improved quality of care. Previous studies also report that greater numbers of licensed staff are associated with better quality. Increased RN time is associated with improved patient outcomes. Previous studies have also measured the impact of direct care staff on quality care. Only a few studies consider the impact of non-nursing staff (social workers, physicians, dietitians, physical therapists, activity aides, etc.) on quality, although it may be desirable to include information on non-nursing staff in the public reporting system.

Staff turnover is also of interest, however, no reliable consistent measure of staff turnover has been established, and no national source of staff turnover or retention is currently available. Medicaid cost reports for a few states collect turnover information, but a new data collection instrument would be required if the public reporting system were to include turnover and/or staff retention. It appears that payroll systems used by most nursing homes can calculate turnover or staff retention without excessive burden to nursing facility staff.

Although it is possible to calculate turnover and/or staff retention, actual turnover rates are calculated in various ways with no standard method for comparison. Previous studies are inconclusive with regard to the relationship between turnover and patient outcomes. Some studies have found an association between low staff turnover and improved resident outcomes; others have not. One study found that resident outcomes were better for facilities that had higher

retention among nursing staff. A standard, reliable method of reporting and calculating staff turnover would be desirable in a public reporting system, possibly as an addendum to the existing OSCAR system, or as a requirement in the state cost reporting systems.

Staffing Ratios per Resident or per Bed

- Inconsistencies exist in the way staffing ratios are calculated. Ten of the reviewed studies reported staffing ratios as the number of full-time equivalents (FTE) per resident, while five of the studies reported the number of FTEs per bed. A few studies divided FTEs by the total number of residents, while other studies used 100 residents or 100 beds as the denominator.
- Hospital-based homes have higher nursing staff levels. Ownership and certification were also important predictors of total nursing staff.
- Facilities vary with respect to their ratio of nurses to residents. Fifteen of the 87 studies reported staffing ratios as the number of FTE staff to residents or to beds ranging as follows:
 - RNs: 0.06 to 0.25 FTEs per resident
 - LPNs: 0.05 to 0.12 FTEs per resident
 - NAs: 0.21 to 0.38 FTEs per resident

Staffing Hours per Resident per Day (HPRD) or per Bed or per Day

- Staffing ratios are more commonly reported as hours per resident per day (HPRD) (25 out of 87 studies). This is generally calculated from OSCAR data collected over a 2-week period and reported as the total FTEs by category (RN, LPN, NA), multiplied by 70 hours, multiplied by 14 days, then divided by the total number of residents in the facility.
- Less variance is seen when measuring staffing hours per resident day as compared to FTEs per resident or bed. The range for HPRD across studies is as follows:
 - RNs: 0.2 HPRD - 0.7 HPRD
 - LPNs: 0.5 HPRD – 0.7 HPRD
 - NAs: 1.95 HPRD – 3.4 HPRD

Staff Mix

- Qualitative studies have found an association between better training/management practices and improved patient outcomes. Unfortunately, it would not be feasible for a public reporting system to include qualitative measures of management quality or training.
- One study found no significant differences in staffing hours or staff mix across three groups of facilities with good, average, or poor resident outcomes.

Staff Utilization

- Nurse staffing expenditures is an alternative measure to nursing hours. The CMS study Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes, Phase II looked at the relationship between expenditures and quality.

Turnover Rates and Retention

- Of the 87 articles reviewed, 14 studies included a variable regarding turnover rates or retention of nursing staff. The majority of turnover data was obtained from investigator-constructed surveys that had a 43% - 65% response rate. Turnover rates explained from 8.6% (deficiencies) to 31.2% (death rates) of the variance in specific quality measures studied. Annual turnover rates for all nursing staff in these studies ranged from 40% to 190%.
- Average turnover levels were high and there was a great deal of variance across facilities and across the studies. Annual turnover rates by category across all studies ranged as follows:
 - RNs: 35.6% to 116.5%
 - LPNs: 50.7% to 113.88%
 - CNAs: 68.5% to 170.5%

Data Source for Staffing Variables

State-specific Instruments

- All states require cost reports, but these vary from state to state. Staffing measures can be calculated from cost reports in some states; however, in other states no staffing measures can be derived from cost reports. The accuracy of cost reports is also questionable.
- It is not clear if staffing could be calculated consistently across states for direct care staff and administrative staff.
- In particular, two states (CA and TX) collect staffing data that includes turnover data for all direct care staff (aggregated). Texas reports turnover data for Directors of Nursing (DON), but California does not.

Multi-site Instruments

- Information on how staffing varies by weekday/weekend, or by shift, has not been collected in previous studies, but it is believed that short staffing may disproportionately occur at night or on weekends. Due to data limitations, it is not known how this affects quality. Current payroll systems for some facilities would make this information difficult to collect.
- Studies suggest that payroll records are a potential source of staffing data (at least for nursing hours by staff type and turnover/retention), although no reviewed study has used payroll data as part of a large-scale data collection effort.
- Multi-site instruments are limited and not practical for public reporting purposes.

National Databases

- There are few good national resources available. OSCAR is the only national source of consistent staffing data. Medicaid cost reports vary with respect to whether hours worked or hours paid is reported. OSCAR reports hours worked.
- OSCAR is the source of the staffing information on Nursing Home Compare. There are some questions about its accuracy, although it seems to be improving. The two-week time period is a major limitation given variability in facility staffing levels.

- There is no current national source of turnover or retention data.

Quality Measures

Resident Outcomes

- Numerous resident outcomes can be measured (and have been) in many studies.
- Resident-level outcomes are more sensitive measures of quality care and are preferred over facility-level outcomes.
- Resident-level outcomes should include at least the following: pressure ulcers, function, and weight loss.
- Resident-level outcomes should be measured as incidence measures if possible; otherwise very good adjusters are needed.
- Quality of care and resident outcomes are related to staffing, and staffing is definitely critical to quality of care.

Facility Outcomes

- Quality of care and resident outcomes can be measured uniformly across the nation using the MDS.

Risk Adjustment/Control Measures

Case-mix

- There are multiple ways to measure case-mix.
- National data sources for case-mix include MDS and OSCAR.
- RUG-III is the case-mix system used by the Medicare prospective payment system and Medicaid payment systems for about 15 states. It is the most familiar system to the nursing home industry, although there are several studies that suggest that an alternative case-mix system might be better.

Resident Attributes

- Resident attributes are available from both MDS and OSCAR databases.
- MDS data is timelier than OSCAR, and quality indicators can be calculated at the resident-level from MDS data.
- OSCAR data can only be calculated at the facility-level.

Facility Characteristics

- Facility characteristics have been used extensively in research about staffing and quality of care.
- It is not clear whether it would be appropriate to use any facility characteristics in the risk adjustment for a public reporting system, since this would implicitly treat facilities differently based on characteristics such as their size, ownership type, and/or chain affiliation.

Market/Economic Characteristics

- There is some evidence from California cost report data that benefit levels are sensitive to turnover, but these are not currently feasible for a public reporting system.
 - DON and administrator turnover and experience have been used in Texas from state collected data, but again, are not currently feasible for a public reporting system.
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4. PRELIMINARY CONCLUSIONS

A. Which staffing measures should be included in the public reporting system and how should they be collected?

Previous studies have collected turnover and retention data from nursing facilities using a variety of methods. The different methods that one might use to calculate turnover point to the importance of collecting appropriate variables from facilities that are necessary to calculate turnover and retention, rather than asking facilities to calculate these themselves. There is evidence from previous studies that there is 1) a great deal of variance across facilities in turnover and retention; and 2) evidence of a relationship between turnover/retention and quality. This suggests that turnover and retention may be important to include in a public reporting system. Most facilities can derive turnover and retention information from their payroll systems without much difficulty.

Medicaid cost report data cover the entire year, but the staffing variables are not available for all states. States also differ in the types of staffing information that are reported. Therefore, cost reports are probably not feasible as a data source for a national system. A few state-specific sources (California, Texas, and Kansas) show potential for the development of a national data collection tool that includes staffing hours and turnover data for both direct care staff and administrative staff.

Thus far, the literature is not helpful for addressing issues regarding how often staffing measures should be collected or over what time period the data should be collected. Previous studies have not addressed a number of issues that would need to be addressed: 1) How often should data be collected; 2) What staff categories should be included; and 3) What time period should be covered? Previous studies have not addressed how the accuracy of reported staffing data would be verified. It may be desirable to require facilities to submit documentation to verify their staffing information (i.e., payroll records). Details need to be worked out, such as who would do this and how would facilities be selected for verification. We found very few studies that collected data on non-nursing staffing level.

B. *How should differences in facility case-mix be accounted for in a public reporting system?*

There is substantial literature on case-mix for reimbursement purposes, but no studies that consider how to take case-mix into account in a public reporting system. However, the same issues apply. Case-mix adjustment allows us to report staffing levels that consider differences in the needs and acuity of the facility's residents, but it increases the complexity of the system and reduces its understandability to providers and consumers. It may be difficult to reach agreement on the best risk adjustment method. This was a subject of great controversy with the nursing home quality measures. Clearly, any reporting mechanism will need to include both resident and facility adjusters in some fashion.

Potential case-mix adjusters include: RUG-III nursing index, ADL index, OSCAR case-mix variables, other MDS items related to resident staff time requirements, facility characteristics, and risk adjusters used in the CMS study Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes, Phase II. A risk adjustment model can be created using existing indices (e.g., RUG-III), statistical models that examine how staffing levels vary across facilities with different values of the items used in the case-mix, or based on simulations or expert testimony about the amount of nursing time required to care for different types of residents.

Potential data sources include: 1) the MDS database, which would need to link to staffing information (although it may not correspond to the time period covered by the staffing measures, it is still the best available data for case-mix), and 2) the OSCAR database, which contains several measures of facility case-mix and is a low-cost alternative to the MDS. Risk adjustment and resident outcome data should be collected as part of the data collection tool that captures staffing and turnover information.

There are several alternatives for how to present risk-adjusted staffing measures. The case-mix index could be reported. (The California Nursing Home Search includes an "average resident need score" that is based on the facility's RUG-III nursing index.) The case-mix adjustment could work "invisibly" behind the scenes. (This would work like the case-mix adjusted quality measures in the Nursing Home Compare system, and what would be reported is the "adjusted" staffing measure.) Facilities could also be grouped within a case-mix category.

The question of how many staffing categories to include depends on whether the benefits of this level of detail offset the increased administrative burden. It would probably not be feasible to collect information on staffing levels by shift or weekend/weekday even using payroll data. This raises another question of whether or not to include non-nursing staff categories. A few previous studies have collected information on non-nursing staff such as activity or restorative aides, physicians, social workers, dietitians, respiratory, and physical therapists. The benefit of having this information in a public reporting system is uncertain.

In summary, most of the studies we reviewed used a measure of nursing hours (or FTEs) per resident per day. Other studies used a similar measure of staff per facility bed, which ultimately could be converted to nursing hours per resident day. Regardless of the actual staffing measure used in a public reporting system, it should be consistently collected and calculated from facility to facility and state to state. OSCAR is the only currently available national data source for these

measures, but because of its limitations, it may be desirable to design a new data collection instrument.

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Staffing Ratios per Resident or per Bed			
Variable	Strengths	Weaknesses	Reference
Ratio of RNs to residents	An increasing ratio of RNs to residents was associated with higher patient care costs but lower total costs per day. Size, occupancy, profit status, and SNF certification were significant in their cost-increasing influence on all types of costs.	Personal interviews and self-reporting questionnaires provided the data during the 1985 National Nursing Home Survey. Return rates were fairly high with 88.4% of the 1,220 facilities, 80.3% of the 3,439 nursing staff, and 86.1% of the 5,395 residents. No way to establish the validity and reliability of the data.	Felton, B. B. (1993).
Ratio of RNs to patients, and ratio of LVN/NA to patients.	Using OSCAR staffing data, Graber & Sloane (1995) found higher LVN and NA staffing levels were associated ($p > 0.05$) with lower proportions of restrained patients resulting in lower probability of facilities being cited for improper use of restraints. Louwe & Kramer (2001) found staffing ratios to vary widely across units and facilities. Staffing levels and other data was collected during facility site visits. <ul style="list-style-type: none"> • NA to resident ratios varied from 1:3 to 1:27. • NA, LPN, and CMT ratios varied from 1:6 to 1:49. 	Graber & Sloane (1995) found neither RN nor LVN/NA ratios were significant predictors of restraint violation. The ratio of RNs to patient census was near significance for predicted overall restraint use and not in the expected direction (positive sign), possibly acting as another measure of patient acuity or disability. Louwe & Kramer (2001) study used small sample size ($n=17$) in 3 states.	Graber, D.R. and P.D. Sloane, P.D. (1995). Louwe, H. and A.M. Kramer (2001).

Table 1. Staffing Measures

Staffing Ratios per Resident or per Bed			
Variable	Strengths	Weaknesses	Reference
	<ul style="list-style-type: none"> Extremes on higher end of spectrum (1:3 & 1:6) reflect staffing Medicare/sub-acute units. Lower end of the spectrum, especially for NAs reflective of situation when units were staffed below routine levels. 		
FTEs per resident, (RN, LPN, and NA)	<p>Castle & Fogel (1998) reported mean staffing levels for RNs=0.07 FTEs per resident, LPNs=0.12 FTEs, NAs=0.31 FTEs per resident using OSCAR and ARF data from large sample of 15,074 facilities (OSCAR data used). Spector & Takada (1991) differentiated between high, moderate and low impact of staffing (but no specific thresholds were identified) using OSCAR data; reported mean RN ratio=0.06, LPN ratio=0.05, NA ratio=0.28 in Rhode Island homes. Johnson-Pawlson & Infeld (1996) reported mean staffing levels in Maryland facilities of .063 FTE RNs, .096 FTE LPNs, and .394 FTE NAs per resident. All 3 studies showed consistent staffing ratios for RNs (.06-.07) but varied</p>	<p>Castle & Fogel (1998) found increased FTE RNs per resident (OR=1.30), lower FTE LPN (OR=0.76) and lower NAs per resident (OR=0.71) to be more likely in restraint-free homes (only 8% of the homes were restraint-free). Spector & Takada – limited to one state (Rhode Island) and small study (N=80 nursing homes) using pre-OBRA data. Johnson-Pawlson & Infeld (1996) found relationship between RN ratio and deficiencies was not significant (p=.262) but overall staff ratio was significant at p=.032), concluding that while staffing with more RNs does not appear to improve nursing quality, more nursing staff of all</p>	<p>Castle, N. G. and B. Fogel (1998). Johnson-Pawlson, J. and D. L. Infeld (1996). Spector, W. D. and H. A. Takada (1991).</p>

Table 1. Staffing Measures

Staffing Ratios per Resident or per Bed			
Variable	Strengths	Weaknesses	Reference
	ratios for LPN (.05-.12) and NA (.28-.394) due to OBRA changes. Findings are consistent with Spector & Takada (1991) , which demonstrated that higher staff levels were related to functional improvements. Both studies used staffing data from OSCAR.	types does (limited to 1 state).	
RNs, LPNs, NAs per resident. (Defined as total number of FTEs in each category divided by the total number of nursing home residents in the county)	Staffing level estimations explained 12% to 43% of the variance in the effects of market conditions on nursing home staffing. Facilities employ more nonprofessional nursing staff in markets in which professional nurse wages are higher. RN staffing is higher in homes with more private pay residents and lower in for-profit homes. Data from 1987 MMACS used.	Reported staffing means for RN=.04, LPN=.09, Aides=.32. The RN staffing level is lower using total residents in the county than majority of studies using total residents per facility.	Zinn, J. S. (1993).
FTEs per 100 nursing home residents (RN, LPN, NA, support staff).	Using data from the VA Patient Assessment File, Berlowitz et al. (1999) identified mean staffing levels (FTEs/100 residents) in VA nursing homes (n=128). Physician 1.4±0.7 RN 25.5±6.6 Support staff 80.0±20.7 Grabowski (2001) , using national	Different data sources were used in each study, and their accuracy is questionable. Concern has been expressed that the VA Cost Distribution Report may not accurately capture true staffing levels, and the accuracy of OSCAR data has been questioned.	Berlowitz, D. R. et al. (1999). Grabowski, D. C. (2001). Shorr, R. I. et al. (1994).

Table 1. Staffing Measures

Staffing Ratios per Resident or per Bed			
Variable	Strengths	Weaknesses	Reference
	<p>OSCAR data, reported the following staffing per 100 residents (N=15,067 homes)</p> <p>RN 6.56±8.57</p> <p>LPN 12.59±16.47</p> <p>NA 38.52±39.73</p> <p>A positive effect was identified between Medicaid reimbursement and RN staffing. A \$40 increase in Medicaid reimbursement resulted in an increase of 1.11 RNs per 100 residents.</p> <p>Shorr et al. (1994) carried out a longitudinal study of changes in antipsychotic drug use among resident of Tennessee nursing homes (n= 172) surrounding announcement and enforcement of OBRA-87. Changes in drug use were associated with third-shift staffing levels (p=.003). Nursing homes with third shift staffing above the mean, reduced antipsychotic drug use.</p>	<p>Shorr et al. (1994) used self-reported staffing data submitted to the Tennessee Department of Public Health for annual license renewal. This study was restricted to Medicaid patients and one state.</p>	
RNs per bed and LPNs per bed	Nursing homes in flat-rate Medicaid reimbursement states have fewer nurses per bed than similar homes in cost-based reimbursement states. Chain	Data was from 1981 MMACS files prior to OBRA implementation.	Cohen, J. W. and L. C. Dubay (1990).

Table 1. Staffing Measures

Staffing Ratios per Resident or per Bed			
Variable	Strengths	Weaknesses	Reference
	ownership had no significant impact on nursing staff levels. Nonprofit and government homes were not found to have higher levels of staffing than proprietary homes. Hospital-based homes show higher nursing staff levels. Regression results for nurses per bed ($R^2=0.18$) were significant at .05 level or better.		
Direct care staff per bed	The group with the best average resident outcomes had more RN FTEs per 60 beds and a greater percentage of RNs in the staff mix; fewer LPN FTEs and a lower percentage of LPNs in the staff mix; and more NA FTEs but a lower percentage of NAs in the staff mix. Although RN staffing is more expensive, it is key to improving resident outcomes.	Comparison groups based on best-worst average outcomes did not differ in resource allocation patterns. Additional analysis demonstrated that when controlling RN staffing, resident outcomes in high- and low-cost homes did not differ. Data limited to one state.	Aaronson, W. E. et al. (1994). Anderson, R. A. et al. (1998).
Staffing FTE per 100 beds for: Any physician extenders, MD, RN, LPN, nurse aides, specialists, and RN & LPN/NA	On average there were 6 RNs, 10 LPNs, and 35 NAs per 100 beds, and 1 nurse (RN or LPN) to every 2 nurses aides. About 16% of homes had staff physicians (average 0.17 FTE). No association was found between nursing staffing levels and	Quality measurement was based on proxy measures of hospitalization, death or transfer rates, rather than positive resident outcomes.	Intrator, O. et al. (1999).

Table 1. Staffing Measures

Staffing Ratios per Resident or per Bed			
Variable	Strengths	Weaknesses	Reference
	hospitalization, however facilities with greater physicians (>0.08 FTEs) were associated with lower hospitalization rates (AOR=0.79) Based upon a large, multi-state and multi-facility study of a representative group of facilities.		
FT RN/100 beds, PT RN/100 beds, total nursing staff/100 beds, proportion of FT & PT RNs to all nursing staff	Compared data from pre-PPS and post-PPS years. The only significant predictor of FT RN rate was facility certification status; SNF-only homes employed more FT RNs than homes having both SNF and ICF beds. Ownership and certification were important predictors of total nursing staff, total nursing staff was lower in for-profit and SNF/ICF combined homes. The FT RN rate did not predict PT RN rate.	Data from one state (Pennsylvania) all before the implementation of OBRA. (1980, 1982, 1985, and 1987).	Kanda, K. and M. Mezey (1991).

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
Staffing hours per resident, per day (HPRD) for RN or LPN, total nursing hours, or NA, or Medication aide, total	Feuerberg & White (2001) , reported relationships between of all nursing staff (p=.01), RN (p=.10), and NA (p=.05). In	Some studies were relatively small, dated (pre OBRA), and limited to a single state (Cherry, 1991 , n=134; Nyman ,	Anderson, R. A. et al. (1998). Bostick, J.E. (in press). Cherry, R. L. (1991). Dummit, L.A. (2002).

Table 1. Staffing Measures

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
licensed staff (RN and LPN).	<p>Wisconsin, RN HRD was also negatively related to RN turnover ($p=.05$).</p> <p>Harrington, et al. (1998). For 1991-1995 the average ratio of RNs was 0.5 HPRD, LPN/LVN hours was 0.7 HPRD, and NA hours was 2.0 HPRD. Total nursing HPRD was variable across states. In general the North-Central region showed the lowest total nursing HPRD (3.0) compared with the highest levels of 3.3 staffing HPRD in the West. Overall, the model explained 76.5 to 83.7% of the variance for the five categories of staff. The state effects explained 65-80% of the variance, and the independent variable effects explained between 0 and 11.4% of the variance beyond the state effects over the 5-year period for the different categories of staff. A significant relationship was found between nursing hours and quality of life ($p=.05$) (as defined by Nyman (1988) in a sample of 247 Iowa nursing homes. The</p>	<p>1988, $n=247$).</p> <p>Staffing data generally obtained from OSCAR, or other self-reported data source that has been shown to be inaccurate; there is generally no independent validation of staffing data.</p> <p>Martau et al. (2000) used OSCAR data, shown to be less accurate than Medicaid cost reports. Small samples size in this study ($n=54$ facilities) limited statistical power.</p> <p>Schnelle, et al. (in press) – Self-reported staffing. Small regional sample (34 homes in CA).</p> <p>U.S. General Accounting Office (2002) – Staffing data from MS was self-reported for one month and extrapolated for 12-month period due to lack of staffing hours on MS cost reports.</p> <p>Wan (2003) - OSCAR staffing info may not be accurate. Structural aspect of nursing care quality, measured by</p>	<p>Feuerberg, M. and A. White (2001).</p> <p>Harrington, C. et al. (1998).</p> <p>Harrington, C. et al. (2000).</p> <p>Harrington, C. et al. (2001).</p> <p>Hutt, E. et al. (2000).</p> <p>Kramer, A. M. et al. (2000a).</p> <p>Kramer, A. M. et al. (2000b)</p> <p>Kramer, A. M. and R. Fish (2001).</p> <p>Martau, J. et al. (2000).</p> <p>Nyman, J. A. (1988).</p> <p>Rantz M.J. et al. (in press).</p> <p>Schnelle, J.F. et al. (in press).</p> <p>U.S. General Accounting Office (2002).</p> <p>Wan, T. T. (2003).</p>

Table 1. Staffing Measures

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
	<p>relationship between this quality measure and NA hours was not significant.</p> <p>Rantz et al. (in press) found no statistically significant differences across 3 groups (homes with good, average, or poor resident outcomes) in staffing HPRD for total hours or for patient-related hours.</p> <p>Schnelle, et al. (in press) – Homes that reported an average total staffing of from 4.8 HPRD (staff state data) and 4.6 HPRD (administrator interview) were associated with different quality. Homes reporting total staffing statistics between 2.7 and 3.4 were unstable in staffing reports. For “Low” homes (<25th percentile) in 2000, mean staffing HPRD (with SD):</p> <p>RN .29 (±.006) LVN .51(±.11) NA 1.95(±.10)</p> <p>In “High” Homes (75-90th Percentile), mean HPRD (w/ SD):</p> <p>RN .48(±.13) LVN .58(±.14)</p>	<p>nursing staffing variables, accounted for less than 1% of total variance in adequacy of nursing care.</p>	

Table 1. Staffing Measures

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
	<p>NA 3.4 (\pm.000) In the highest homes (90th + percentile), mean HPRD (w/ SD) RN .57(\pm.42) LVN .58(\pm.14) NA 3.4 (\pm.000)</p> <p>Kramer et al. (2000); Kramer & Fish (2001); and Hutt et al. (2000) set staffing thresholds for quality measures studied in both short-stay Medicare admission and long-stay nursing home residents. See table 3 for staffing thresholds associated with quality measures from these studies.</p> <p>Kramer et al. (2000b) synthesized findings of Hutt et al. (2000), hours per resident (HRD) day and turnover. In California, NA HRD were negatively related to NA turnover ((p=.10, n=1,129) and positively related to NA retention (p=.01, n=768). A 1-hour change increase in NA hours per resident day was associated with a one percent increase in retention and a four percent decrease in turnover. In Kansas, LPN turnover was negatively related to LPN HRD</p>		

Table 1. Staffing Measures

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
	<p>($p=.05$, $n=200$). In these states, total HRD were not related to turnover, but in Wisconsin ($n=364$), total HRD was negatively related to turnover Kramer et al. (2000a), and Martau et al. (2000). The following recommendations were made:</p> <ol style="list-style-type: none"> 1. Minimum staffing levels associated with reduced likelihood of quality problems. <ul style="list-style-type: none"> • NA - 2.00 hrs/resident day • Licensed staff (RN + LPN) - 0.75 hrs/resident day • RN - 0.20 hrs/resident day 2. Percentage of facilities falling below these minimum levels <ul style="list-style-type: none"> • NA – 54% • Licensed staff – 23% • RN – 31% 3. Preferred minimum staffing levels (levels above which quality was improved across the board) <ul style="list-style-type: none"> • Aides - 2.00 hrs/resident day • Licensed (RN + LPN) - 1.00 hrs/resident day • RN - 0.45 hrs/resident day 		

Table 1. Staffing Measures

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
	<p>4. Percentage of facilities falling below these minimum levels</p> <ul style="list-style-type: none"> • NA – 54% • Licensed staff – 56% • RN – 67% <p>Wan (2003), using current (1996 and later) national data from OSCAR (n=15,970 facilities over three years, found a weak causal relationship between structural variable (nursing hours) and nursing care adequacy.</p>		
Average annual nursing FTE per patient day (RN, LPN, and NA)	Both cross-sectional and longitudinal analyses performed. For the same level of nursing staff expenditure, more intensive use of LPNs rather than RNs will increase the level of professional nursing FTEs per resident.	Data from one state (Massachusetts). Findings suggest that very strong facility performance on some outcomes measures may very well coexist with very weak facility performance on others.	Porell, F. and Caro, F.G. (1998).
Nursing hours (number of personnel available to care for a resident in a 24-hour period).	Nursing hours, staff mix, prevalence of restraint use by unit, and site were all associated ($p < .10$) with continued use of physical restraints. Data collected by on-site research nurses.	Small sample: 3 nursing homes in one city, sample of 201 residents.	Sullivan-Marx, E.M. et al. (1999).
FT and PT Staffing hours per patient (RN, LPN, NA); Total number of staff; staff-	More RN hours per resident was associated with decreased mortality, improvement in function,	Staffing data was obtained per report of administrator and “charge nurse”, so the accuracy	Linn, M. W. et al. (1977).

Table 1. Staffing Measures

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
patient ratios.	<p>and discharge from the nursing home ($p=.05$) for all measures. Significant relationships between these quality measures and LPN or NA hours per resident were not seen.</p> <p>Total hours (RN, LPN, and NA) associated with quality measures of mortality, function, and discharge were:</p> <ul style="list-style-type: none"> • 2.47 hours, improvement • 2.26 hours, the same • 2.40 hours, deteriorated • 2.27 hours, dead <p>A difference of only about 10% more or less RN staff existed between all outcome groups.</p>	of data is in doubt.	
RN hours per patient	<p>Braun (1991) found that RN hours, nursing process, security, and mean quality significantly improved the prediction of mortality. Zinn (1994) found that higher percentage of for-profit facilities was associated with lower RN staffing.</p>	<p>Braun (1991) used small sample of 11 homes with 390 all male patients, limiting the generalizability of findings. Zinn (1994) data from MMACS could not be tested for inter-rater reliability; also study was cross-sectional rather than longitudinal.</p>	<p>Braun, B. I. (1991). Zinn, J. S. (1994).</p>
RN hours per day	Increasing resident dependence (case mix) and RN HPD were	No way to establish the validity and reliability of the data.	Felton, B. B. (1993).

Table 1. Staffing Measures

Staffing Hours Per Resident per Day (HPRD) or per Bed or per Day			
Variable	Strengths	Weaknesses	Reference
	associated with higher nursing costs ($R^2=0.42$, average patient care costs ($R^2=0.43$), and total costs $R^2=0.38$)		
RN, LPN, and NA minutes per day	Measured 118 minutes of resident specific staff time per day, mostly provided by aides or orderlies.	Labor-intensive data collection.	Fries, B. E. et al. (1994).
Nursing care per patient day by personnel category (RN, LPN, NA). Total professional hours per patient per week.		Measures of quality were not clearly explicated. Study was very small (n=15 Georgia nursing homes). No significant relationships were found among quality of care and structural characteristics of standard monthly charge, hours of patient care by professionals and size.	Longest, B. B. et al. (1975).
Therapy staff minutes per week	An average of 8 minutes a day resident-specific time provided by auxiliary staff.	Labor-intensive data collection.	Fries, B. E. et al. (1994).

Staff Mix			
Variable	Strengths	Weaknesses	Reference
Nursing hours (ratio of RN to LVN hours per resident day).	In a large study (N=455) of California nursing homes, the ratio of RN hours to LPN hours per resident day and health related deficiencies	Dated (1987 OSCAR data). Limited to one state and 365 facilities were excluded from sample due to incomplete data. Excluded homes had	Munroe, D. J. (1990).

Table 1. Staffing Measures

Staff Mix

Variable	Strengths	Weaknesses	Reference
	(p=.098) were found to be related.	higher average RN hours per resident day (p=.03), and lower average salary paid to RNs (p=.07), and lower profits (p=.04) than sample homes.	
Staff mix (ratio of licensed (RN and LPN) to unlicensed (NA) staff available to care for a resident in a 24-hour period.	<p>Rantz et al. (in press) found staff mix was virtually identical across the 3 groups of homes with good, average, and poor resident outcomes. Roughly 70% of staff was NAs, 10-14% were RNs, and 14-20% were LPNs. In the post hoc analysis of statewide cost data there were no statistically significant differences in staffing hours or staff mix across groups.</p> <p>Sullivan-Marx et al. (1999). Nursing hours, staff mix, prevalence of restraint use by unit, and site were all associated (p<.10) with continued use of physical restraints. Data collected by on-site research nurses.</p> <p>Rantz, M.J. et al. (in press)</p>	<p>Sullivan-Marx et al. (1999) used a small sample: 3 nursing homes in one city, sample of 201 residents.</p>	<p>Hicks, L.L. et al. (in press). Rantz, M.J. et al. (in press) Sullivan-Marx, E.M. et al. (1999).</p>

Table 1. Staffing Measures

Staff Mix			
Variable	Strengths	Weaknesses	Reference
	found no significant differences in staffing hours or staff mix across 3 groups of facilities with good, average, or poor resident outcomes.		
Staff intensity measured as FTE staff/100 residents adjusted for case mix	National sample (N=658 Medicaid only homes)	Pre-OBRA data used (1987 data)	Cohen, J. W. and W. D. Spector (1996).
Number of RN, LVN, and aides per total nursing staff	The group with the best average resident outcomes had more RN FTEs per 60 beds and a greater percentage of RNs in the staff mix; fewer LPN FTEs and a lower percentage of LPNs in the staff mix; and more NA FTEs but a lower percentage of NAs in the staff mix. Although RN staffing is more expensive, it is key to improving resident outcomes.	Comparison groups based on best-worst average outcomes did not differ in resource allocation patterns. Additional analysis demonstrated that when controlling RN staffing, resident outcomes in high- and low-cost homes did not differ. Data limited to one state.	Anderson, R. A. et al. (1998).
RN ratio (RNs as a percent of direct care staff)	Not for profit homes had higher levels of care staffing than for profit homes. Although direct care staffing was positively associated with payment rates, the	Limited to single state (Pennsylvania). Positive association between direct care staffing and payment rates may be due to variation in care needs	Aaronson, W. E. et al. (1994).

Table 1. Staffing Measures

Staff Mix

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	measure was negatively associated with the case mix measures. N=449 facilities	associated with the case mix measures used.	

Staff Utilization

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
Resident specific time (RST) from RUG=III (RN, LPN, NA, and total staff)	RUG-III system is component of national Medicare prospective payment system; is used to determine payment for care of Medicare residents in skilled nursing facilities. System reflects need to increase levels of staffing and adjust staff mix in response to resident case mix.	Expert panel member (n=59) estimates were significantly higher than both 1990 RUG-III and 1995/1997 RUG-III RST (resident specific time) ($p>0.003$) for resident descriptions from 12 case mix groups (with exception of RN RST for Rehabilitation Low case mix group for 1995/1997). The author concludes that nursing time associated with RUG-III classification groups may not meet clinical need of residents if used as the basis for staffing.	Mueller, C. (2000).
Staff attributes (numbers of nursing staff, allocation of nursing staff and non-nursing staff, allocation of nursing staff to different units,	The following conclusions resulted from a qualitative study of nursing homes (N=17) in three states. <ul style="list-style-type: none"> • When number of staff 	Site visits were extended (6-10 days), but conclusions were based on data from only 17 facilities. Rich qualitative data obtained, but	Louwe, H. and A. M. Kramer (2001).

Table 1. Staffing Measures

Staff Utilization

Variable	Strengths	Weaknesses	Reference
	<p>were inadequate, care provided was more likely to be inadequate (lack of or delayed response to call lights, food served cold, inadequate or no assistance with eating, inadequate monitoring of residents in general, serious incidents such as fall.</p> <ul style="list-style-type: none"> • Inadequate care did not always relate to an observed negative outcome. • Additional nursing staff (single task workers and management staff) were generally available during the week on dayshifts. • Allocation of staff at peak times, especially at mealtime affected care. • Staff from dementia units was more likely to be pulled to other units. • When dementia units are staffed exclusively with 	<p>findings cannot be generalized.</p>	

Table 1. Staffing Measures

Staff Utilization

Variable	Strengths	Weaknesses	Reference
	<p>NAs, medical and/or behavioral needs may not be recognized or treated in a timely manner.</p> <ul style="list-style-type: none"> • Short staffing (unit staffed with fewer staff than routinely or ideally assigned) disproportionately affected evening and weekend shifts and, was often related to call-ins. Care areas most likely to be compromised by short staffing were personal hygiene, grooming, assistance with mealtime, distribution of snacks, toileting, repositioning, and response to call lights. Incidents (such as falls) and resident altercations appeared to increase. • Facility staff perceptions of quality of care provided by agency staff was often negative, but 		

Table 1. Staffing Measures

Staff Utilization

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>agency staff appeared to “blend in” and quality of care was rarely connected (by study nurses) to agency staff (either negatively or positively). Report to agency workers was often insufficient to encourage provision of adequate care, and when this occurred facility staff experienced increased workload and additional stress.</p> <ul style="list-style-type: none"> • Inadequate supervision on the unit level often resulted in poor implementation of individual resident care plans, clinical guidelines and/or protocols, and unresponsiveness to residents’ needs. • Consistent and adequate supervision was accomplished when there was strong involvement of 		

Table 1. Staffing Measures

Staff Utilization

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>management staff (Especially DON). Inadequate management at this level did not always result in inadequate care, but it became dependent upon skills and motivation of individual nursing staff on each unit.</p> <ul style="list-style-type: none"> Supervision on the unit level was most effective when a system was in place to remind staff to accomplish a task and where the supervisor could easily verify task completion. <p>Nursing skill, knowledge and expertise were important factors in provision of adequate care.</p>		
Staff time utilization (RN, NA and total staff, licensed nursing staff)	Based on a large number of observations (n=2040) made at 15-minute intervals and data collections points (randomly selected) Cardona et al. (1997) concluded that a large	Generalizability of findings is limited. Cardona et al. (1997) observed one 60 bed unit with atypical staff mix (12 RN, 4 LPN, and 20 NA) Only 4% of observations were of LPN staff, so these	Cardona, P. et al. (1997). Louwe, H. and A. M. Kramer (2001).

Table 1. Staffing Measures

Staff Utilization

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>proportion of staff time was spent on “bathing” which included post-incontinence care, grooming and hygiene (total staff 22%; RN 11%, NA 31%). Feeding and helping residents with meals (total staff 12%, NA 16%). Staff performed multiple tasks (total staff 21%, RN 28%, NA 16%) and only 5% of total staff time was personal time that included breaks.</p> <p>Based on a qualitative study of nursing homes from three states (N=17), Louwe & Kramer (2001) observed, “nurses frequently seemed more focused on getting their paperwork done or getting the medication administered than on responding to residents’ needs as they arose.” (p. 6-7)</p>	<p>were not analyzed; LPN observations were included in analysis of total staff. All observations were on day or evening shifts on weekdays (Monday through Friday and staff observed were selected on nonrandom basis.</p>	
NA time required to implement selected care processes linked to resident outcomes	Well designed studies that used experts and literature review to estimate time	Not all care processes performed by NA were considered in either study.	Schnelle, J. F., et al. (2000). Schnelle, J.F, et al. (2001).

Table 1. Staffing Measures

Staff Utilization

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>required for care processes and amount of time available for NAs to provide care. Ran computer simulations using different staffing levels and with and without time allocation for unscheduled events (call light requests). Schnelle et al. (2000) estimated 13.5 to 15.5 FTE's for 24-hour period are needed to complete all care under conditions of high efficiency and nurse aide work productivity. Represents resident to NA ratios of:</p> <ul style="list-style-type: none"> ▪ 5.2 to 6.4 day shift ▪ 7.6-8.1 evening shift ▪ 26.0-26.25 night shift. <p>Simulations run using reduced staffing models suggests that low level of care will occur with staffing ratios existing in many nursing homes, despite high productivity. Schnelle et al. (2001) used MDS from New York and</p>	<p>Time estimates for care processes were estimates; less empirical data was available to support some care processes than others, especially in the 2000 study. Simulations project staffing requirements for typical nursing homes. Did not project time associated with individualized care or staff time to compensate for poor management or high staff turnover.</p>	

Table 1. Staffing Measures

Staff Utilization

Variable	Strengths	Weaknesses	Reference
	<p>Ohio to determine number of residents requiring selected care processes in order to create simulation of facilities with different case mix.</p> <ul style="list-style-type: none"> ▪ FTE's necessary to provide all care in timely basis in 40-bed unit varied from 16 (high workload facility) to 14 (low workload facility) ▪ Change in staffing from 16 to 15 FTE in high workload facilities and 12 to 11 FTE in low workload facilities resulted in reduction in services and increased waiting times. 		
Nursing Assistant (NA) involvement in care planning	<p>Greater involvement in care planning by nursing assistants (NAs) was an objective of the Teaching Nursing Home (TNH) Program TNHs evaluated (n=6) had a significantly higher proportion of NA involvement in care planning that a matched sample of</p>	<p>NA involvement in care planning was one of many interventions included in TNH program. If implemented in isolation, the significance of this intervention might not persist.</p>	<p>Shaughnessy, P.W. et al. (1995)</p>

Table 1. Staffing Measures

Staff Utilization

Variable	Strengths	Weaknesses	Reference
	comparison nursing homes (p<.001).		
Use of Nurse Clinician (APN)	Nurse clinicians with specialized training in geriatrics and gerophysiology were utilized in Teaching Nursing Home (TNH) program. Evaluation of TNHs (n=6) revealed significantly more involvement in care planning by nurse clinicians than in the matched sample of comparison nursing homes (p<.001).	Levels of involvement of nurse clinicians in TNHs studied were not explicated. The authors reported that involvement of nurse clinicians in initial resident assessment, care planning and teaching of nursing home staff increased progressively over the course of the project. Interventions implemented in each TNH varied; impact of nurse clinicians on positive quality outcomes cannot be determined.	Shaughnessy, P.W. et al. (1995)

Turnover Rates and Retention

Variable	Strengths	Weaknesses	Reference
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Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
Total number of RNs, LPNs and CNAs employed in fiscal year minus number employed at end of year divided by number employed at end of year.	<p>2003 study: RN turnover 116.5%; LPN 113.88%; CNA 170.5% Larger size and longer director of nursing tenure and experience explained better resident outcomes. Predictors explained 11% - 21% of the variance in resident outcomes. (Aggressive /disruptive behavior problems (15%), use of restraints (21%), complications from immobility (15%), and prevalence of fractures (11%).</p> <p>1997 study: Organizational variables explained 22%, 9%, and 15% of variance in RN, LVN, and aide turnover, respectively. In discriminant analysis, these variables explained 59% of variance in homes with the lowest versus highest turnover. The proportion of resources allocated to administrative functions and roles was the most important predictor of differences between homes with the best and worst turnover rates.</p>	<p>2003 study: Only 164 out of 380 nursing homes provided sufficient data (43% return rate on surveys from nursing home staff.) An investigator visited each home to collect data and offered a CE program for nursing staff as an incentive to complete the surveys (and response rate was still low).</p> <p>1997 study: Data for 1997 study was obtained from 1989 Medicaid nursing facility cost reports. 469 nursing homes in Texas.</p>	<p>Anderson, R.A. et al. (2003).</p> <p>Anderson, R.A. et al. (1997).</p>

Table 1. Staffing Measures

Turnover Rates and Retention			
<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
Aide turnover rate (number of aide resignations and terminations in the last six months divided by the total number of nursing aides in the home) (licensed nurse turnover rate Grant et al.)	<p>On average, Banaszak-Holl & Hines (1996) found 32% of nursing aides left their jobs in the past 6-month period. 5% of all homes had 75% or greater turnover and 25% of the homes had at least 40% turnover rate. Administrators and DONs were fairly consistent in their estimates of aide turnover (correlation was .79).</p> <p>Grant et al. (1998) found 6 variables which accounted for 20.1% of the variance in a model to predict training methods (low NA turnover, rural location, less staff stability, high licensed nurse turnover, high prevalence of dementia, and presence of an SCU facility).</p>	<p>The survey question did not distinguish among employees voluntarily leaving their jobs and those for whom employment was terminated (Banaszak-Holl & Hines, 1996).</p> <p>Grant et al. (1998) had sample size of 124 nursing homes in Minnesota</p>	<p>Banaszak-Holl, J. and M. A. Hines (1996).</p> <p>Grant, L.A. et al. (1998)</p>
Proportion of RN, LPN, and NA that voluntarily terminate employment in a year (# of full and part time RN, LPN or NA terminating employment/average # of full or part time RN, LPN or NA)	<p>Authors report that the sample was statewide and that a 65% response rate was achieved. Sample size allowed for multivariate analysis, which explained 21.6% of variance for resident discharge rates and 31.2% for death rates.</p>	<p>Generalizability of findings limited by sample that was of limited size (N=122 facilities) and from a single state (North Carolina). Studies are dated (1978-1979 data). Halbur & Fears (1986) suggested that the positive relationship of RN</p>	<p>Halbur, B.T. (1983).</p> <p>Halbur, B. T. and N. Fears (1986).</p>

Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
Natural logs of turnover rates were used to bring skewed distributions closer to normal.	<p>RN and LPN turnover rates were significantly related to resident discharge rates ($p < .05$). Facilities that experienced higher turnover rates of one type of nursing personnel had higher turnover rates of other types ($p < 0.001$)</p> <p>Mean annual turnover rates reported (North Carolina facilities)</p> <ul style="list-style-type: none"> • All staff – 65% • RN – 35.6 SD 49.2 • LPN – 50.7 SD 54.4 • NA - 68.5 SD 65.0 	<p>turnover to discharge rates suggesting that turnover may not always have negative consequences.</p> <p>This relationship was inconsistent with other studies of discharge rates.</p>	
Turnover (number of staff leaving due to voluntary resignation, dismissal or retirement as percentage of FTEs) Separate rates for RN, LPN, and aides.	<p>Munroe (1990) found that staff turnover was a significant explanatory variable for facility quality. Complete sets of financial and operational data was obtained from the Office of Statewide Health Planning and Development (OSHPD) in California Other data on health violations and resident census was obtained from HCFA. N= 455 facilities. As staff turnover increased, facility quality decreased ($p = .08$). An average turnover of 107.34% was reported</p>	<p>Munroe (1990) data was from 1987 and limited to one state (California). 365 facilities were excluded due to incomplete data. In the regression model, facility quality was explained by payment source, the resident case-mix, and staff-turnover when nursing staff mix was controlled. The equation explained only 8.6% of the quality of nursing home care, however this figure was statistically significant ($p = .006$).</p>	<p>Munroe, D.J. (1990). Spector, W. D. and H. A. Takada (1991).</p>

Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
	for all staff. Proprietary facilities had a significantly greater turnover rate than nonproprietary ones (p=.0001). Spector & Takada (1991) found that residents in facilities with low or moderate staffing levels and high mean ADL levels, an indicator of understaffing, were between 30% and 40% less likely to improve. In addition, residents in facilities with low RN turnover were more likely to improve (OR=1.73). Although the impact is large, the result should be viewed cautiously because of only a .10 level of significance.	Spector & Takada (1991) data was from 1984-1986. Also, small sample size (only 56 of 80 facilities responded) limits the study's generalizability. Data was limited to facilities in one state (Rhode Island).	
Turnover (calculation not explained) Determined using a hospital survey	Turnover was identified as a potentially sensitive indicator for nurse-to-patient ratios in hospitals using a modified Delphi expert panel process. Other potentially sensitive indicators included nurse satisfaction, use of overtime, nursing personnel costs per patient day, actual staffing vs. minimal (mandated) staffing, and tracking the use of non-licensed personnel FTEs.	Out of 79 indicators of nursing quality to evaluate nurse-staffing ratios, only 9 (11%) were considered sensitive to nurse-to-patient ratios (given a rating of 7 [on a scale 1-9] or more without disagreement). Another 14 indicators were rated as potentially sensitive (given a score of 7 or greater with disagreement, or 5 or 6	Hodge M.B. et al. (2002).

Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
		with or without disagreement).	
Turnover Percentage (% of total staff and NAs that left the facility during the cost report period (usually one year))	<p>Facility level turnover data (1999) from three states was analyzed by Feuerberg & White (2001)</p> <ol style="list-style-type: none"> Annual turnover rates for all nursing staff (RN, LPN, NA) <ul style="list-style-type: none"> 72% in California; 25% of facilities had turnover of 45% or less and 23% of 100% or more. 63% in Wisconsin; 25% of facilities had turnover of 37% or less and 25% of 81% or more. 85% in Kansas; 25% of facilities had turnover of 50% or less and 25% of 110% or more. Annual NA turnover rates <ul style="list-style-type: none"> 78% in California 76% in Wisconsin 100% in Kansas <p>Feuerberg & White (2001) also reported the following factors as related to higher staff turnover: ownership (for-profit status), size (< 100 beds), lower benefits, and lower NA wages. Turnover for the</p>	<p>There is generally no distinction between voluntary and non-voluntary turnover. Non-voluntary turnover is thought to be beneficial, as it occurs through the termination of unsatisfactory employees. There is an absence of national data reporting of turnover, and there are questions about accuracy of data reported. Feuerberg & White (2001) obtained turnover data different sources for each of the three states sampled, and states used in the sample were selected based on the availability of turnover data. Turnover was calculated differently for each state and all turnover calculations were based on unaudited, self-reported data. Available data did not allow calculation of turnover separately for full and part time staff,; Turnover among part-time staff might be</p>	<p>Feuerberg, M. and A. White (2001) Kramer, A. M. and R. Fish (2001).</p>

Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
	<p>subset of NA staff only was related to hours per resident day (p=.05) in California only. See Table 4 for detailed findings.</p> <p>Kramer & Fish (2001) set thresholds for turnover related to significant quality measures (p<.05) based on analysis of staffing data from California facilities (n=631). Thresholds are the percentage of turnover (of total staff) above which facilities were at increased likelihood of being in lowest decile for quality and below which there were not additional improvements in quality.</p> <ul style="list-style-type: none"> • 47% turnover for hospitalization for UTI • 46% turnover for incident of pressure ulcers. 	<p>expected to have less impact on facility staffing.</p>	
<p>Turnover; comparison of high turnover facilities and low turnover facilities.</p>	<p>Qualitative study comparing high and low turnover facilities from Kansas, Wisconsin, and urban and rural areas of California. Selection of states was based on availability of statewide turnover data (sources not specified).</p>	<p>Pairs of high and low turnover facilities were selected from same location; so small towns were excluded from consideration.</p> <p>Facilities were classified from 1999 state turnover data; might</p>	<p>Eaton (2001).</p>

Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
	<p>Locations within states were selected to represent four types of geographic areas, and pairs of facilities from each location were selected with one facility being in bottom quartile for turnover in state and the other in top quartile. Identified characteristics typical of high and low turnover facilities through staff interviews and ethnographic observation. Management practices associated with low turnover included:</p> <ul style="list-style-type: none"> • High quality leadership and management, offering recognition, meaning, and feedback as well as the opportunity to see one’s work as valued and valuable. • A culture of valuing and respecting the caregivers themselves as well as residents. • Basic high performance HR policies, including wages and benefits, but also in the areas of “soft” skills and flexibility, scheduling, realistic job 	<p>have been classified differently if more current data was used. Low turnover facilities selected from Wisconsin had average turnover of 52%; this is above the 50% level reported to be problematic. Facilities from rural areas of California in high turnover set had average turnover rate significantly lower (96%) than facilities from other areas (range from 165% to 190%). Although rich qualitative data was obtained, contrasts were based on data from only eight facilities.</p>	

Table 1. Staffing Measures

Turnover Rates and Retention			
<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>previews, etc.</p> <ul style="list-style-type: none"> • Thoughtful and effective, motivational work organization and care practices. • Adequate staffing ratios and support for giving high quality care. 		
<p>Turnover rate of the total organization and the turnover rate of nursing assistants only. (Calculated as Total number of FT and PT separations in 12 months divided by average number of FT and PT employees [12 month total employees on payroll at end of each month/12] multiplied times 100.</p>	<p>55% of the homes had a total organizational turnover rate of less than 40%, and 9 percent had a turnover rate over 80%. 45% of the homes had a turnover rate for nursing assistants of 40% or less, and 20% had rates over 80%. Homes with low turnover rates were in smaller communities, smaller in size, and government-owned. High turnover rates were associated with proprietary homes and had no Life Safety Code violations.</p>	<p>Randomly selected sample size of 110 Minnesota nursing homes (25% of all nursing homes in the state in 1976). Questionnaires sent to administrators, response rate not reported in article. Data is very old.</p>	<p>Stryker-Gordon, R. (1979).</p>
<p>Retention (Percentage of total nursing assistants that remained with the facility for the entire cost report period).</p>	<p>Kramer & Fish (2001) identified a linear relationship between retention of NAs and quality when adjusted for case mix (n=631 California nursing homes). California data taken from Long Term Care Facility Integrated</p>	<p>There is no national reporting of staff retention and there are doubts about accuracy of data when available. Of 10 states included in sample by Kramer & Fish (2001), turnover data was only available for</p>	<p>Feuerberg, M. and A. White (2001). Kramer, A. M. and R. Fish (2001). Larsen, P.D. (1993)</p>

Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
	<p>Disclosure and Midi-Cal Cost Reports (1999) collected by Office of Statewide Planning and Development.</p> <p>Thresholds for retention were set by these authors - % nursing aide retention below which facilities were at increased likelihood of being in the worst quartile for quality and above which there were no additional improvements in quality.</p> <ul style="list-style-type: none"> ▪ 43% - 51% for hospitalization for electrolyte imbalance and UTI, respectively. ▪ 40% for functional improvement ▪ 41% for incidence of pressure ulcer ▪ 37% for resisting care improvement. <p>Feuerberg & White (2001) identified facility size as the best predictor (p=.01) of retention for both all direct nursing staff (n=1,129) and the subset of NAs (n=1,155). Retention was 24% higher at facilities with 100-199 beds and 40% higher in facilities</p>	<p>California and only for the subset of NA staff. D</p> <p>Retention has not been studied widely, so relationships among facility characteristics have not been determined. Feuerberg & White (2001) found no relationship between retention and ownership, urban location, county unemployment rate, per capita income, or facility case mix.</p> <p>Larsen (1993) interviewed 16 nursing administrators/directors of nursing using 13 open-ended questions. One DON had 19 years of experience, greatly affecting the mean for this small sample. Average of experience for DONs was 2.5 years.</p>	

Table 1. Staffing Measures

Turnover Rates and Retention			
Variable	Strengths	Weaknesses	Reference
	with more than 200 beds when compared to those with fewer than 100 beds.		

Miscellaneous			
Variable	Strengths	Weaknesses	Reference
Community presence (ombudsman, volunteer or combined programs)	Volunteer programs have no significant relationship with poor care. Only variable contributing significantly to any analysis is RN hours per resident in SNFs.	Limited to Missouri nursing home (n=134) and dated (1984 data' pre-OBRA)	Cherry, R. L. (1991).
RNs, LPNs, and total nursing staff.	Flat-rate reimbursement has a negative impact on RN staffing intensity and a positive impact on LPN staffing intensity.	Pre-OBRA data used (1987 data)	Cohen, J. W. and W. D. Spector (1996).
Licensed nursing hours, and non-licensed nursing hours	Longitudinal study (over 3 year period) and size (N=440 facilities)	Limited to one state (Minnesota) and (data from 1988-1991) during OBRA implementation period	Bliesmer, M. M. et al. (1998).
Number of staff hours worked in a week (averaged) for all categories of staff.	An increased quality of life score was significantly associated with more staff hours. Firms with a greater percentage of supervisory hours were significantly more efficient.	N=296 homes. Included nursing and non-nursing staff (housekeeping, food service, social service, activity program, administrator, and secretaries)	Nyman, J.A. et al. (1990).

Table 1. Staffing Measures

State-specific Instruments

Data Source	Strengths	Weaknesses	Reference
Medicaid Nursing Facility Cost Reports	<p>Data is reported for all Medicaid-certified nursing homes. Quality of the data is monitored through clerical and computer checks for errors and consistency, and facilities are subject to revision of the report until it passes quality review. Provides data on routine operating, nursing, ancillary and capital costs, facility size, and ownership.</p> <p>In sample of Ohio nursing homes (n=78), found that Medicaid cost reports were more accurate than OSCAR data when compared to payroll data, and recommends cost reports as source of staffing measures for analysis of relationships between staffing and resident outcomes (White,2000a). Hutt et al. (2000) and Kramer & Fish (2001) were large, multi-state studies using Medicaid cost report data.</p>	<p>The accuracy of Cost Reports is still not established. States vary as to the types of staffing information they require nursing homes to collect and report. Provides data for the skilled nursing components of Medicaid-certified nursing homes and multilevel facilities. Using these cost reports means excluding facilities that provide only intermediate care and facilities that did not have Medicaid-certification. White (2000a) conclusions about reliability and validity of cost reports based on small sample size (n=78 facilities)</p>	<p>Anderson, R. A. et al. (1998). Anderson, R.A. et al. (2003). Cohen, J. W. and L. C. Dubay (1990). Feuerberg, M., White, A. (2001). Hicks, L.L. et al. (in press). Hicks, L. L. et al. (1997). Hutt, E. et al. (2000). Kramer, A. M. and R. Fish (2001). Rantz, M.J. et al. (in press) Shorr, R. I. et al. (1994). White, A. (2000a).</p>
Brown University survey of nursing home staff turnover in Rhode Island	<p>Not described. Only 56 (out of 103) nursing homes responded to the turnover study.</p>	<p>Low response rates are typically found in turnover surveys. Turnover data are not collected on an ongoing basis. Turnover rates are not</p>	<p>Spector, W. D. and H. A. Takada (1991).</p>

Table 2. Data Sources for Staffing Variables

State-specific Instruments			
Data Source	Strengths	Weaknesses	Reference
		standardized.	
Long-Term Care Facility Integrated Disclosure and Medi-Cal Cost Reports (Disclosure Report). (Collected annually by the Office of Statewide Health Planning and Development (OSHPD). (California).	Statewide source of staffing data from which turnover and retention rates can be determined. Includes annual turnover percentage and the number of staff with continuous service throughout the one-year reporting period. Figures are reported for nurse aide, all direct care staff, a category that includes all employees who provide direct nursing care (e.g. RNs, LPNs, nurse aides, technicians, specialists). Also source of demographic, wage, and benefit data. These reports are edited, corrected as necessary, and entered into the OSHPD database.	Data available only for state of California. State law requires that all LTC facilities in California annually submit complete sets of financial and operational data to OSHPD. Not uniformly collected across states. Does not allow comparison across states. Self-reported data. No inter-rater reliability or validity testing available. No separate turnover figures are available for RNs or LPNs. Also it is not possible to distinguish full and part time employees.	Feuerberg, M. and A. White (2001). Munroe, D. J. (1990).
Client Assessment, Review, and Evaluation Form 3652-A (Texas Department of Human Services). (1990)	Nurses completed Form 3652-A regularly for each Medicaid resident in Texas. Inter-rater reliability and validity of these data were tested every 9 months. Average inter-rater reliabilities of the items used in this study were over 94%.	Cannot make statements about causation because of correlation design. Data from one state only, limiting generalizations.	Anderson, R. A. et al. (1998).
Iowa Outcome Oriented	This survey was intended to	Data not collected across	Nyman, J.A. (1988)

Table 2. Data Sources for Staffing Variables

State-specific Instruments			
Data Source	Strengths	Weaknesses	Reference
Survey of 1983	collect information that could be used to measure the quality of Iowa nursing homes using outcome-oriented variables.	states, cannot be accurately used for national comparisons or replicated in studies in other states.	Nyman, J.A. et al. (1990).
Long Term Care Facilities Survey (LTCFS) conducted by the State Health Data Center, PA Dept. of Health (1980, 1982, 1985, 1987)	The LTCFS annually collects information on nursing home characteristics, such as ownership, Medicare and Medicaid certification, size, occupancy rate, and personnel employed. Also reports information on resident demographic characteristics such as gender, age, payer source, admission, discharge, and LOS.	Self-reported by nursing facilities. Not uniformly collected across states.	Kanda, K. and M. Mezey (1991).
Minnesota Department of Human Services Long-Term Care Division facility profiles. (1988, 1989, 1990)	Completed annually. Information on facility attributes such as size, ownership, and nursing hours per standardized resident day. A standardized resident day is the sum of the number of residents in each case mix category (A-K) multiplied by case mix weights, and calculated on the basis of the facility's census for a given day.	Only Minnesota nursing home resident and facility data were analyzed. Cannot separate the effect of benefits from more active professional nursing that occurs immediately after admission from those that occur later in the patient's course. Assesses outcomes only on an annual basis.	Bliesmer, M. M. et al. (1998).
North Carolina Division of Medical Assistance (DMA), and the N.C. Office of State	DMA provided financial data for each nursing home. OSHP provided information on facility	These data sources depend on self-reported data from each nursing home and there is	Graber, D.R. and P.D. Sloane (1995).

Table 2. Data Sources for Staffing Variables

State-specific Instruments			
Data Source	Strengths	Weaknesses	Reference
Health Planning (OSHP). (1991)	census, size, occupancy, and admissions. The data is reviewed by surveyors and financial auditors, which provides an incentive to provide accurate information.	potential for a certain amount of error.	
PA Dept. of Health LTC Facilities Questionnaire, and Health Profiles of PA Counties. (1987)	Pennsylvania required the completion of a comprehensive questionnaire on annual use, employment, and payment characteristics.	Self-reported data. No inter-rater reliability or validity testing available. Not uniformly collected across states.	Aaronson, W. E. et al. (1994).
Rhode Island Nursing Home Study (1984-1986)	Data on resident characteristics and outcomes measures from an earlier study to evaluate the impact of a new quality regulatory process known as PaCS (patient care and services) developed by HCFA.	Self-reported data. No inter-rater reliability or validity testing available. Not uniformly collected across states.	Spector, W. D. and H. A. Takada (1991).
Missouri Division of Aging annual nursing home survey (1984)	Encompasses all licensed facilities in Missouri and provides information both on nursing home characteristics and quality of nursing care.	No inter-rater reliability or validity testing available. Not uniformly collected across states.	Cherry, R. L. (1991).
Missouri State Board of Health (1984)	Data on volunteer and ombudsman programs collected as part of MO annual statewide survey of all residential care facilities.	Reflects whether or not such programs exist at the nursing home, no causal effect between ombudsman programs and quality of care	Cherry, R. L. (1991).

Table 2. Data Sources for Staffing Variables

State-specific Instruments			
Data Source	Strengths	Weaknesses	Reference
		can be determined.	
Wisconsin Annual Nursing Home Survey WI Psychotropic Screen Protocol (PSP)	Conducted by WI Department of Health and Social Services. Inter-rater reliability of nurses completing the PSP was =+0.99. Staffing turnover data from 1999 survey used by Feuerberg & White (2001) .	Svarstad & Mount (1991) was an exploratory study in small number of facilities (n=7 homes).	Feuerberg, M. and A. White (2001). Svarstad, B. L. and J. K. Mount (1991).
Tennessee Department of Public Health	Longitudinal study (30 months)	Restricted to Medicaid residents, 70% of state nursing home residents.	Shorr, R. I. et al. (1994).

Multi-Site Instruments			
Data Source	Strengths	Weaknesses	Reference
American Health Care Association (AHCA)	1987 membership survey conducted by the AHCA, a national trade organization representing the nursing home industry. Provided data for wages of nursing personnel in 3 categories (RN, LPN, NA).	No reliability and validity testing available. Self-reported.	Zinn, J. S. (1993).
Annual Survey of Hospitals of AHA	Database was supplemented with hospital specific information AHA survey.		Berlowitz, D. R. et al. (1999).
Management Minutes	Used for case mix		Porell, F. and F.G. Caro (1998).

Table 2. Data Sources for Staffing Variables

Multi-Site Instruments			
<i>Data Source</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
<p>Questionnaire (MMQ)</p> <p>Analytic longitudinal history file with more than 500,000 quarterly observations from 4/91 to 6/94 for 78,524 Medicaid residents.</p>	<p>reimbursement of nursing homes on behalf of Medicaid residents in Massachusetts. Is first completed at the time of a nursing home admission or at conversion from private-pay to Medicaid payer status, and then updated quarterly for all residents. Medicaid payments to facilities are based on these data therefore facilities have financial incentives for thorough and accurate reporting of residents' service needs.</p> <p>Formal reliability analysis of MMQ were conducted on a sample of 4,438 Medicaid residents. All reliability results were 80% or higher and are comparable to those reported by others for ADL's with similar data not used for reimbursement purposes, including MDS data (Bathing 99.3%, grooming 98.8%,</p>		<p>Grabowski, D. C. (2001).</p>

Table 2. Data Sources for Staffing Variables

Multi-Site Instruments			
Data Source	Strengths	Weaknesses	Reference
	dressing 98.6%, mobility,90.3% and eating 86.4%). Medicaid staff perform regular audits on facility data to counter the inflation of MMQ scores by facilities to increase their revenue		
Multiphasic Environmental Assessment Procedure (MEAP) (Lemke and Moos)	Designed to measure resources of residential settings for older people in 4 conceptual domains: physical features, policies and programs, human aggregate, and social climate. Individual dimensions of MEAP have demonstrated high levels of internal consistency, inter-rater and test-retest reliability. Can be used in a variety of settings.	Labor intensive, on-site visit by researcher, takes several hours to complete in one home. Requires training to use instrument.	Braun, B. I. (1991).
Nurse Staffing Data Collection Tool	Instrument developed and field tested to test the feasibility of collecting an expanded number of staffing variables from payroll records and contract agency staffing invoices.	Tool field tested in a total of 38 facilities in four states and the tool was found to be lengthy and “formidable” to complete. Original goal to develop a tool that could be verified as part of the survey	Hurd, D. et al. (2001).

Table 2. Data Sources for Staffing Variables

Multi-Site Instruments			
<i>Data Source</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
		process said to be unrealistic based on the wide variability in facility payroll records.	
Payroll data	Payroll records and contract staffing agency invoices are easily accessible and accurate sources for nursing staffing data. Records are relatively straightforward for the data collector to understand and collect. Data collected included paid nursing hours for all permanent nursing employees as well as hours paid to contract nursing staff. Records were found to be available for the previous 6-12 months and generally took no more than 30-40 minutes to extract per facility.	Data elements containing information on shift and day of the week resides in most current payroll and invoice processing systems but currently are not easily extracted. Total nurse staffing hours by licensure type per pay period is available, but other staffing variables (shift, unit, day of the week, and direct care versus administrative care) are available in facility internal records but not feasible to identify.	Feuerberg, M., White, A. (2001) Hurd, D., White, A., Feuerberg, M. (2001).
Resident Assessment Instrument (RAI) Evaluation Survey.	10-state survey of 250 nursing homes undertaken to evaluate the implementation of patient assessment in nursing	Included both closed and open-ended questions, and took DON an average of 30-45 minutes to complete and administrators an average of	Banaszak-Holl, J. and M. A. Hines (1996).

Table 2. Data Sources for Staffing Variables

Multi-Site Instruments			
Data Source	Strengths	Weaknesses	Reference
	homes using the RAI. Separate surveys for directors of nursing (DON) and administrators	15-20 minutes to complete. Found some disagreement between DON and administrators when describing their facilities.	

National Databases			
Data Source	Strengths	Weaknesses	Reference
Area Resource Files (ARF)	Source of local market area data from the Bureau of Health Professions (HRSA). Provides information on workforce characteristics such as gender, education, unemployment rates, per capita income, metropolitan statistical areas (MSAs), etc. In addition, the file contains geographic codes and descriptors, which enable it to be linked to many other files and to aggregate counties into various geographic groupings.	Provides general information with no specifics available regarding nursing home personnel. No staffing data is available from this database, but can be linked to other databases with identifiers.	Cohen, J. W. and W. D. Spector (1996). Feuerberg, M., White, A. (2001). Grabowski, D. C. (2001). Zinn, J. S. (1994).
Medicare and Medicaid Automated Certification System (MMACS)	The MMACS was routinely collected through the Medicare and Medicaid certification process	The MMACS has never been tested for the reliability of data entered by different surveyors (that is inter-rater	Aaronson, W. E. et al. (1994). Cohen, J. W. and L. C. Dubay (1990). Cohen, J. W. and W. D. Spector

Table 2. Data Sources for Staffing Variables

National Databases			
Data Source	Strengths	Weaknesses	Reference
	conducted by state licensure and certification agencies. The annual survey was completed on one day and provided information on staffing, services, and resident characteristics.	reliability). Data were not always collected uniformly within or across states. Does not include facilities that did not seek Medicare or Medicaid certification. The OSCAR system evolved from the MMACS and is now used by CMS during the annual survey process.	(1996). U. S. General Accounting Office (2002). Zinn, J. S. (1993). Zinn, J. S. (1994).
National Medical Expenditure Survey (NMES)	Institutional population information available from the Agency for Health Care Policy and Research provided information on facility size, ownership, hospital-based or free-standing, nursing staff, and resident information.		Cohen, J. W. and W. D. Spector (1996).
National Nursing Home Survey (1985)	Series of national surveys consisting of personal interviews and self-reported data on 6 questionnaires regarding the facility, the expenses of the facility, the current and discharged residents, the registered nurses, and next of kin to residents.	Conducted 3 times (unknown year, 1977, and 1985). Involves self-report and voluntary return of questionnaire from facilities and registered nurses with no reliability or validity testing available.	Felton, B. B. (1993).

Table 2. Data Sources for Staffing Variables

National Databases

Data Source	Strengths	Weaknesses	Reference
On-line Survey and Certification Automated Records (OSCAR)	OSCAR data is currently the only source of comprehensive and uniform data about staffing information (prepared by facilities) for the United States (Harrington et al., 2000). Using OSCAR data requires understanding of its reliability and validity (Kovner et al., 2000). OSCAR data is reported in full-time equivalents (FTE) for a 14-day period. Several researchers have studied staffing and quality by converting this information to staffing hours per resident day (HPRD) while others calculate FTEs per day, per bed, or per resident.	The quality of OSCAR staffing data is limited because it relies on self-reported staffing information from nursing homes collected for only a 2-week period at the time of the actual survey and generally are not audited by surveyors (Harrington et al., 2000). Some facilities may increase their staff during the period around the survey. Thus, the reports may overstate the actual staffing in facilities. Some concerns about accuracy of resident characteristic information because data are aggregated and self-reported by facilities and not audited by HCFA (Harrington & Carillo, 1999). Another limitation is that the available staffing data do not capture differences in education levels, capability, motivation, and experience of staff.	Bostick, J.E. (in press). Castle, N. G. and B. Fogel (1998). Feuerberg, M., White, A. (2001). Graber, D.R., Sloane, P.D. (1995). Grabowski, D. C. (2001). Harrington, C. et al. (2000). Harrington, C. and H. Carrillo et al. (1999). Harrington, C. et al. (2001). Intrator, O. et al. (1999). Johnson-Pawlson, J. and D. L. Infeld (1996). Kramer, A. M. et al. (2000a). Martau, J., M. et al. (2000). Munroe, D. J. (1990). Schnelle, J.F. et al. (in press) Shorr, R. I. et al. (1994). Spector, W. D. and H. A. Takada (1991). U. S. General Accounting Office (2002). Wan, T. T. (2003). White, A., (2000b). Zinn, J. S. (1994).

Table 2. Data Sources for Staffing Variables

National Databases			
Data Source	Strengths	Weaknesses	Reference
		<p>Staffing reports made on a quarterly basis would be more informative than those made for a 2-week period. (Harrington et al., 2000).</p> <p>White (2000b) tested reliability of OSCAR data by comparing to permanent employee payroll records and temporary staff hours from agency invoices. Ohio facilities classified into four groups based on total nursing hours per resident day using OSCAR data (<2.0 hours, n=31; 2.0-2.5, n=21; 2.6-3.6, n=21; and >3.6, n=34).</p> <p>Pearson correlation coefficients relatively low for all facilities (n=98): -0.43 for total staff hours. More highly correlated for licensed staff (0.63 for RN; 0.55 for LPN than for NA (0.36). In low staffed facilities (bottom quartile), correlations were significantly lower except for LPN hours: Total hours –</p>	

Table 2. Data Sources for Staffing Variables

National Databases			
Data Source	Strengths	Weaknesses	Reference
		0.10, RN 0.28, LPN 0.61, NA 0.02. When a set of exclusion criteria were applied, reliability and validity were improved.	
VA Patient Assessment File	Agreement among assessors using the Patient Assessment File has been described. PAF is updated yearly by VA Management Science Group	Studies measuring the accuracy of the PAF are limited	Berlowitz, D. R. et al. (1999).
VA Management Database	Database is updated yearly using data from various VA sources.	Developed by the VA Management Science Group for the 1991 IOM study on physician staffing patterns in the VA.	Berlowitz, D. R. et al. (1999).
VA Cost Distribution Report	Database is supplemented with hospital specific information from the Annual Survey of Hospitals by AHA and with Data on resident staffing levels from the VA Office of Academic Affairs.	Provides estimates of employee time and costs associated with each major medical care program at a VA hospital, including the nursing home.	Berlowitz, D. R. et al. (1999).
VA Office of Academic Affairs	Database is updated yearly using data from various VA sources	Developed by the VA Management Science Group for the 1991 IOM study on physician staffing patterns in the VA.	Berlowitz, D. R. et al. (1999).

Table 2. Data Sources for Staffing Variables

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
Accidents	Resident-level QI's are more reflective of the effects of service styles, or are incidents associated with inadequate or improper care rather than enduring physical chronic conditions of residents.	Not a direct measure of health status change; rather is a QI with observed values that indicate with a high likelihood when substandard care is being provided. Not highly associated with various structural facility attributes.	Porell, F. and F.G. Caro (1998).
Bowel incontinence	Bowel continence improved 55% in teaching nursing homes and only 33% in comparison homes. Rantz, M.J. et al. (in press): Reported that residents in facilities with good outcomes rarely experienced problems with impactions.	Bowel incontinence could be a result of illness (flu or diarrhea) and not necessarily related to inadequate staffing or poor care.	Mezey, M. and J. Lynaugh (1991). Rantz, M.J. et al. (in press) Shaughnessy, P. W. et al. (1995).
Catheter use/ Urinary incontinence/ Percent not toileted/ bladder training	Castle & Fogel (1998) Used the number of residents with urinary incontinence is divided by the overall occupancy to create variable indicating the percentage of residents with incontinence. Following implementation of the Teaching Nursing Home program, stabilization in catheter use (when compared to matched comparison nursing homes) was significant (p=.002 in admission sample;	A process measure of nursing home quality, which is not in itself a measure of health status but may indicate with a high likelihood if substandard care is provided, for example urethral catheterization places the resident at greater risk for UTI, which may result in hospitalization. The incidence of catheter use is low, making impact of staff	Bostick, J.E. (in press). Castle, N. G. and B. Fogel (1998). Cherry, R. L. (1991). Graber, D.R., Sloane, P.D. (1995). Mezey, M. and J. Lynaugh (1991). Nyman, J.A. et al. (1990). Rantz, M.J. et al. (in press) Shaughnessy, P. W. et al.

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>p=.042 in longer-stay sample). Differences in “avoidance of incontinent episodes with timed voiding” was also significant (p=.010) in the longer-stay resident sample (Shaughnessy et al., 1995).</p> <p>Spector & Takada (1991) reported that lower staffing was associated with high urinary catheter use, low rates of skin care, and low resident participation in activities.</p> <p>Cherry (1991) found that higher RN hours were positively associated with a composite of good outcome measures (fewer decubitus ulcers, fewer catheterized residents and UTI’s, and less antibiotic use.</p> <p>Harrington et al. (2000): Urinary incontinence was associated with more deficiencies. Urinary incontinence is a treatable problem and has also been the focus of the survey process, which may explain the association with deficiencies.</p> <p>Rantz, M.J. et al. (in press): In</p>	<p>on this measure difficult to capture. However, toileting and bladder training programs are a major nursing responsibility that can have possible effect on incontinence problems. With fewer staff to focus on toileting, incontinence can be a result.</p> <p>Bostick (in press) found a weak positive association between NA staff time and prevalence of incontinence (OR=1.01, p=.09). No significant associations were found between RN or LPN staff time and bowel or bladder incontinence.</p>	<p>(1995).</p> <p>Spector, W. D. and H. A. Takada (1991).</p> <p>Zinn, J. S. (1993).</p> <p>Zinn, J. S. (1994).</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	facilities with good outcomes, residents were toileted frequently and routinely. Staff not only reported that they toileted residents, they were observed toileting residents.		
Confused/disoriented residents/ organic brain syndrome	Louwe & Kramer (2001) concluded that all staff had major impact on resident outcomes in cognitively impaired residents. The authors further concluded that the absence of licensed nursing staff in Alzheimer/ dementia units (as seen in “some” facilities) resulted in lack of resident monitoring resulting in emerging medical concerns being missed.	Conclusions of Louwe & Kramer (2001) were based on site visits to only 17 facilities (although visits were extended in this qualitative study). Two cases were used to justify conclusions about staff impact.	Aaronson, W. E. et al. (1994). Cohen, J. W. and L. C. Dubay (1990). Graber, D.R. and P.D. Sloane (1995). Intrator, O. et al. (1999). Louwe, H. and A. Kramer (2001). Nyman, J.A. et al. (1990). Porell, F. and F.G. Caro, (1998). Rantz, M.J. et al. (in press) Zinn, J. S. (1993).
Contractures	Anderson, et al. (1998) Calculated a nursing home level score to indicate the percentage of residents in the home for whom the condition was present. Hypothesized that in nursing homes with high-quality care, the prevalence of these conditions	Anderson, et al. 1998 - Homes in the group with the highest levels of RN staffing showed greater improvement in resident outcomes with the exception of verbal aggression, vest and wrist restraints,	Anderson, R. A. et al. (1998). Anderson, R.A. et al. (2003). Porell, F. and F.G. Caro (1998).

Table 3. Quality Measures

Resident Outcomes

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>should be lower.</p> <p>Anderson, R.A et al. (2003) reported predictor variables accounted for 15% of the variance in the prevalence of complications of immobility (decubitus ulcers, contractures, UTIs). Employing a DON with more experience, greater relationship-oriented leadership, and less formalization explained a lower prevalence of complications of immobility.</p>	<p>contractures, and dehydration.</p>	
<p>Pressure ulcers/ pressure sores/ bed sores/ bedfast/ immobility /Skin trauma</p>	<p>Pressure ulcers studied frequently as resident outcome sensitive to staffing. Important cause of morbidity and mortality that can be measured using MDS.</p> <p>Anderson, et al. 1998 - Homes in the group with the highest levels of RN staffing and highest expenses per day showed greater improvement in resident outcomes such as decubitus ulcers, fractures, and UTIs.</p> <p>Anderson, R.A. et al. (2003) reported predictor variables accounted for 15% of the variance in the prevalence of complications of immobility (decubitus ulcers,</p>	<p>When “prevalence” of pressure sores is used, unable to differentiate between those acquired in the facility and those present on admission. Numbers of pressure ulcers small; difficult to achieve statistical power needed to find significance without large sample.</p> <p>Cohen & Spector (1996) failed to show relationship between prevalence of pressure ulcers and staffing ratios ($p < 0.05$) despite sample size ($n=658$ nursing homes; $n=2,663$ residents). Sample in this study</p>	<p>Aaronson, W. E. et al. (1994). Anderson, R. A. et al. (1998). Anderson, R.A. et al. (2003). Berlowitz, D. R. et al. (1999). Bostick, J.E. (in press). Cherry, R. L. (1991). Cohen, J. W. and W. D. Spector (1996). Hicks, L.L. et al. (in press). Hutt, E. et al. (2000). Kramer, A. M. and R. Fish (2001). Mukamel, D. B. and W. D. Spector (2000).</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>contractures, UTIs). Employing a DON with more experience, greater relationship-oriented leadership, and less formalization explained a lower prevalence of complications of immobility.</p> <p>Berlowitz et al. – The development of a pressure ulcer between April and October of 1994 on the VA Patient Assessment File.</p> <p>Bostick (in press) found a significant association between more RN staff and fewer pressure ulcers (OR =0.97, p=.03).</p> <p>Cherry (1991) found that higher RN hours were positively associated with a composite of good outcome measures (fewer decubitus ulcers, fewer catheterized residents and UTI's, and less antibiotic use.</p> <p>Harrington et al. (2000): Higher percentages of behavioral problems, urinary incontinence, and pressure sores were positively associated with quality of life deficiencies.</p> <p>Hicks et al. (in press): Found a</p>	<p>was limited to Medicaid certified homes. “Stabilization of decubitus ulcer pattern” did not differ significantly between Teaching Nursing Homes (n=6) and matched sample of comparison nursing homes (p=.231) (Shaughnessy et al., 1995).</p> <p>In some studies, Patients with Stage 1 ulcer were considered pressure ulcer-free. (Hutt, Lin and Kramer, 2000; Berlowitz et al., 1999; Kramer and Fish, 2001).</p> <p>Bostick (in press) found a significant positive association among higher LPN staffing hours and greater prevalence of decubitus ulcers (OR=1.03, p=.02) and late loss ADL decline (OR=1.02, p=.03).</p>	<p>Nyman, J.A. et al. (1990). Rantz, M.J. et al. (in press) Shaughnessy, P. W. et al. (1995).</p>

Table 3. Quality Measures

Resident Outcomes			
Variable	Strengths	Weaknesses	Reference
	<p>strong association with higher costs when quality of care delivered is lower and a higher incidence of pressure ulcers occur (c-statistic 0.70). While each individual quality of care measure does not make a large contribution to the costs, when considered collectively, they can have a substantial financial impact on the operations of the home.</p> <p>Rantz, M.J. et al. (in press): Found that developing pressure ulcers within the facilities with good outcomes was an infrequent event; the rate of occurrence of facility-acquired pressure ulcers was less than one per facility as recorded by the nurse observer. After accounting for differences in facility size between the groups, facilities with poor outcomes have several times more acquired pressure ulcers than facilities with good outcomes.</p> <p>Hutt et al., 2000; Kramer & Fish, 2001 used “incidence” of pressure ulcers as a measure of quality</p>		

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>over time. Measuring “incidence” differentiates those ulcers acquired in the facility from those present on admission. A resident was considered to have a new pressure ulcer if without one on initial assessment and had a Stage 2 or larger ulcer on subsequent assessment. These large, well-designed, multi-state studies used current longitudinal data have identified relationships between staffing and the “incidence” of pressure ulcers. Hutt et al., 2000 in a study of New York (n=653) and Ohio (n=918) found:</p> <ul style="list-style-type: none"> • Likelihood of a facility being in worst 10% of facilities for pressure ulcer incidence were 4.97 times greater when LPN staffing was less than 0.77 hours per resident day and 2.49 times greater when RN staffing was less than 0.109 hours per resident day. <p>Kramer & Fish (2001) identified staffing thresholds (hours per</p>		

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>resident day below which a facility is significantly more likely to be in the lowest decile for incidence of pressure ulcers or skin trauma and above which there are no additional improvements in quality). Study was well designed; used a large sample (n=5,294) from 10 states and 1999 data. Staffing thresholds:</p> <ul style="list-style-type: none"> • NA – 2.80 hrs for pressure ulcers and skin trauma • Licensed (RN + LPN) – 1.15 hrs for skin trauma • RN – 0.60 hrs for pressure ulcers. 		
Dehydration	<p>Anderson et al. (1998) Calculated a nursing home level score was calculated to indicate the percentage of residents in the home for whom the condition was present.</p> <p>Kayser-Jones et al. (1999) – Daily fluid intake of residents was compared to three established standards and found that fluid intake was inadequate for 39 of 40 residents. (Consumed less</p>	<p>Anderson, et al. 1998 - Homes in the group with the highest levels of RN staffing showed greater improvement in resident outcomes with the exception of verbal aggression, vest and wrist restraints, contractures, and dehydration.</p>	<p>Anderson, R. A. et al. (1998). Kayser-Jones et al. (1999). Rantz, M.J. et al. (in press).</p>

Table 3. Quality Measures

Resident Outcomes

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>than 1500 ml/day).</p> <p>Rantz, M.J. et al. (in press): Hydration was emphasized in facilities with good resident outcomes and they had fewer problems with dehydration.</p>		
Fractures	<p>Anderson et al. 1998 – A nursing home level score was calculated to indicate the percentage of residents in the home for whom the condition was present within the past 3 months. Homes in the group with the highest levels of RN staffing and highest expenses per day showed greater improvement in resident outcomes such as decubitus ulcers, fractures, and UTIs.</p> <p>Anderson et al. (2003) reported predictor variables accounted for 11% of the variance in the prevalence of fractures. Greater relationship-oriented leadership explained a lower prevalence of fractures.</p>	An MDS QI dependent upon the accurate reporting of facilities.	<p>Anderson, R. A., P. Hsieh, et al. (1998).</p> <p>Anderson, R.A. et al. (2003).</p> <p>Rantz, M.J. et al. (in press).</p>
Functional status/ functional ability/ ADL decline/ dressing/ transfer/ Katz score, Barthel Index	Functional abilities can be obtained from MDS, so are frequently used as quality measure.	Functional status measured in a number of ways, limiting the ability to compare studies. Risk factors to predict decline in	<p>Bliesmer, M. M. et al. (1998).</p> <p>Bostick, J.E. (in press).</p> <p>Castle, N. G. and B. Fogel</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>Shaughnessy et al., (1995). An evaluation study of the Teaching Nursing Home (TNH) program revealed significant increases in stabilization of bathing (p<.001) and ambulation (p<.001) and improvement in transferring (p<.001) in an admission sample. In a sample of longer-stay residents, stabilization in dressing and transferring were higher, but less significant (p=.013)</p> <p>Large, well-designed, multi-state studies using current longitudinal data have shown relationships between functional improvement and staffing measures.</p> <p>Hicks et al. (in press): Found that as ADL declines, costs of providing services accelerate (c-statistic 0.68). While each individual quality of care measure does not make a large contribution to the costs, when considered collectively, they can have a substantial financial impact on the operations of the home.</p> <p>Linn et al. (1977) reported a positive relationship between RN</p>	<p>physical function have not been established.</p> <p>Cross-sectional measurement, used in most studies, fails to capture improvement or decline that might be impacted by staff. Annual data collection does not differentiate between benefits from professional nursing that occur immediately after admission from benefits occurring later (Bliesmer et al., 1998)</p> <p>Hutt et al. (2000) and Kramer & Fish (2001) used modified Barthel index so data could be drawn from MDS. Instrument developed for use in community; not tested in modified form. Validated against an independent assessment of functional performed by a research nurse.</p> <p>Bostick (in press) found a significant positive association among LPN staffing hours and the prevalence of decubitus ulcers (OR=1.03, p=.02) and</p>	<p>(1998).</p> <p>Cohen, J. W. and W. D. Spector (1996).</p> <p>Felton, B. B. (1993).</p> <p>Hicks, L.L. et al. (in press).</p> <p>Hutt, E. et al. (2000).</p> <p>Intrator, O. et al. (1999).</p> <p>Kramer, A. M. and R. Fish (2001).</p> <p>Linn, M. W. et al. (1977).</p> <p>Martau, J. et al. (2000).</p> <p>Mezey, M. and J. Lynaugh (1991).</p> <p>Mukamel, D. B. and W. D. Spector (2000).</p> <p>Porell, F. and F.G. Caro (1998).</p> <p>Rantz, M.J. et al. (in press).</p> <p>Shaughnessy, P. W. et al. (1995).</p> <p>Spector, W. D. and H. A. Takada (1991).</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>hours per resident and improved function ($p < .05$) ($n = 1000$ residents in 40 nursing homes). Hutt et al (2000)</p> <ul style="list-style-type: none"> • In Ohio, facilities in lowest decile for RN staffing were 2.58 times as likely to be in the worst decile for facilities for functional improvement. • Facilities in the lowest 20% of licensed nurse staffing (RN + LPN) were 2.62 times as likely to have low rates of functional improvement. <p>Kramer & Fish (2001) identified staffing thresholds (hours per resident day below which a facility is significantly more likely to be in the lowest decile for functional improvement and above which there are no additional improvements in quality).</p> <ul style="list-style-type: none"> • NA – 2.4. hrs • Licensed (RN + LPN) – 1.55 hrs • RN – 0.80 hrs 	<p>late loss ADL decline (OR=1.02, $p = .03$).</p>	
Minimum Data Set (MDS)	At present the Zimmerman and colleagues (1995) Quality	Some would argue the reliability of MDS data due to	Fries, B. E. (1994). Rantz, M.J. et al. (in press)

Table 3. Quality Measures

Resident Outcomes

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	<p>Indicators (QI) based on data from the Resident Assessment Instrument are the best available measurement of quality of care (Kovner et al., 2000). The MDS has the advantage of a common set of assessment items that are routinely obtained for all nursing home residents upon admission, at times of significant change in condition, and annually.</p> <p>Rantz, M.J. et al. (in press): Used MDS QI scores to classify homes into groups of good, average, or poor quality of care. No statistically significant differences were found across any of the groups in staffing HRPD for total hours or for patient-related hours. Contract hours were also compared and were not significantly different.</p>	<p>inconsistencies in staff reporting and coding of information on the Resident Assessment Instrument. However, there is growing evidence in the literature of the validity and reliability of MDS data as well as foundational evidence of validity and reliability for the QI's derived from MDS data.</p> <p>Rantz, M.J. et al. (in press): Raised the question about the stability of the MDS QI. Frequent instability of MDS QI scores as measures to classify facilities according to quality of care requires a consecutive 6-month period before classifying homes into "good", "average", or "poor" homes. Continuous resident turnover within facilities may affect overall classification of homes according to quality of care.</p>	
Quality of Life	In a study of Iowa nursing homes (n=247), quality of life was related to nursing hours (p=.05) but not to	Poorly defined measure - defined by "satisfaction score" obtained from interviews with	Nyman, J.A. (1988)

Table 3. Quality Measures

Resident Outcomes			
Variable	Strengths	Weaknesses	Reference
	NA hours.	residents – validity not established and only 10 randomly selected residents in each facility interviewed.	
Resident Care (grooming, hygiene, availability of water)	A significant relationship between grooming and RN staffing has been shown. Of the 247 facilities studied, those below the average for RN hours per resident day (0.49 hours) were more than eight times more likely to have a high rate of ungroomed residents than those above the average (p<0.003). (Nyman, 1988)	Measure cannot be obtained from MDS; data related to resident care must be collected through direct observation. Martau et al. (2000) found no difference in grooming and hygiene between facilities with high and low NA staffing. Nyman (1988) acknowledged that data for “ungroomed resident” measure was ambiguous; some of the care categories used were not applicable to all residents.	Martau, J. et al. (2000). Nyman, J.A. (1988).
Resident Care (grooming, hygiene, availability of water)	Martau et al. (2000) collected data collected by direct observation. Hygiene and grooming measures case adjusted for psychiatric diagnoses and resident self-reports on ability to dress themselves. Nyman (1988) ; Relatively large (N=247 facilities) RN staffing significant; facilities below	Martau et al. (2000) : Small samples size (N=54 facilities) make it difficult to reach statistical significance No difference in grooming and hygiene between facilities with high and low aide staffing. Nyman (1988) ; Author acknowledged that data for this	Martau, J. et al. (2000). Nyman, J.A. (1988).

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	average for RN hours per resident day (0.49) are more than 8 times more likely to have a high rate of ungroomed residents (p<0.003)	measure was ambiguous; some of care categories may not have been applicable to all residents.	
Resisting assistance with ADL's (as measure of personal relationship between residents and staff)	<p>Has logical potential to elucidate relationship between residents and staff. Used as a longitudinal measure to identify improvement (a resident who does not resist assistance at second assessment if resistance had been noted at the first). Dichotomous quality measure, making analysis more robust.</p> <p>Two current, large, well-designed studies identified relationships.</p> <p>Hutt et al. (2000)</p> <ul style="list-style-type: none"> • In Ohio, facilities with <0.21 RN hours per resident day were significantly more likely to be in the lowest quality decile for resisting ADL care improvement (p=0.003). • LPN staffing below 0.47 hours per resident day (p=0.054), and total licensed (RN + LPN) staffing below 1.81 hours per resident day (p=0.061) were 	<p>This quality measure not previously studied; no established validity.</p> <p>Risk factors predicting resisting assistance with ADLs are not clear.</p>	<p>Hutt, E. et al. (2000). Kramer, A. M. and R. Fish (2001).</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>associated with the likelihood of being in the lowest quality decile for resisting care improvement.</p> <p>Kramer & Fish (2001) identified staffing thresholds (hours per resident day below which a facility is significantly more likely to be in the lowest decile for resisting ADL improvement and above which there are no additional improvements in quality).</p> <ul style="list-style-type: none"> ▪ NA – 2.8. hrs ▪ Licensed (RN + LPN) – 1.35 hrs ▪ RN – 0.75 hrs 		
Tube feedings/ Intubated residents	<p>Graber & Sloane (1995) report the coefficient for the proportion of intubated residents was positive (p=0.10), which may indicate that restraint compliance for intubated patients proved problematic for many facilities. These results were at the 0.10 level of significance, so they should be interpreted cautiously.</p> <p>Rantz, M.J. et al. (in press): Reported that in facilities with good outcomes, there were fewer</p>	<p>A process measure of nursing home quality, which is not in itself a measure of health status but may indicate with a high likelihood if substandard care is provided. Use of tube feedings can result in complications including self-extubation, infections, aspiration, unintended misplacement of tube, and pain.</p>	<p>Graber, D.R. and P.D. Sloane (1995).</p> <p>Rantz, M.J. et al. (in press).</p> <p>Zinn, J. S. (1993).</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	residents with tube feedings.		
Urinary tract infections	<p>Anderson, et al. 1998 – A nursing home level score was calculated to indicate the percentage of residents in the home for whom the condition was present. Homes in the group with the highest levels of RN staffing and highest expenses per day showed greater improvement in resident outcomes such as decubitus ulcers, fractures, and UTIs.</p> <p>Anderson, R.A. et al. (2003) reported predictor variables accounted for 15% of the variance in the prevalence of complications of immobility (decubitus ulcers, contractures, UTIs). Employing a DON with more experience, greater relationship-oriented leadership, and less formalization explained a lower prevalence of complications of immobility.</p> <p>Cherry (1991) found that higher RN hours were positively associated with a composite of good outcome measures (fewer decubitus ulcers, fewer</p>	An MDS QI dependent upon the accurate reporting of facilities.	<p>Anderson, R. A. et al. (1998).</p> <p>Anderson, R.A. et al. (2003).</p> <p>Cherry, R. L. (1991).</p> <p>Rantz, M.J. et al. (in press).</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	catheterized residents and UTI's, and less antibiotic use.		
Physical restraint use	<p>Anderson, et al. 1998 – A nursing home level score was calculated to indicate the percentage of residents in the home for whom the condition was present. Following implementation of Teaching Nursing Home (TNH) programs, “no restraint use” and “restraints checked every 30 minutes” were significantly higher in the TNH sample (n=6) than matched comparison nursing homes (p=.005 and p=.007 respectively, when adjusted for case-mix) in a sample of confused longer-stay residents. (Shaughnessy et al., 1995). The TNH programs focus on staffing changes and staff education might explain this finding. Anderson et al. (2003) reported predictor variables accounted for 21% of the variance in the prevalence of restraint use. Having more beds, a more experienced DON with longer</p>	<p>A process measure of nursing home quality, which is not in itself a measure of health status but may indicate with a high likelihood if substandard care is provided. Prevalence of restraint use has declined secondary to regulatory mandates. There are inconsistencies with restraint reporting and coding on MDS, especially in the use of side-rails.</p> <p>Anderson, et al. 1998 - Homes in the group with the highest levels of RN staffing showed greater improvement in resident outcomes with the exception of verbal aggression, vest and wrist restraints, contractures, and dehydration.</p> <p>Bostick (in press) found no significant associations between RN, LPN, or NA staffing hours and the prevalence of physical</p>	<p>Aaronson, W. E. et al. (1994). Anderson, R. A. et al. (1998). Anderson, R.A. et al. (2003). Bostick, J.E. (in press). Castle, N. G. and B. Fogel (1998). Graber, D.R. and P.D. Sloane (1995). Intrator, O. et al. (1999). Mezey, M. and J. Lynaugh (1991). Nyman, J.A. et al. (1990). Porell, F. and F.G. Caro (1998). Rantz, M.J. et al. (in press). Shaughnessy, P. W. et al. (1995). Sullivan-Marx, E.M. et al. (1999). Zinn, J. S. (1993). Zinn, J. S. (1994).</p>

Table 3. Quality Measures

Resident Outcomes

<i>Variable</i>	<i>Strengths</i>	<i>Weaknesses</i>	<i>Reference</i>
	tenure, and greater levels of communication openness explained lower use of resident restraints.	restraints, weight loss, problem behavioral symptoms toward others, and bowel or bladder incontinence.	
Use of antibiotics	Cherry (1991) found that higher RN hours were positively associated with a composite of good outcome measures (fewer decubitus ulcers, fewer catheterized residents and UTI's, and less antibiotic use.	No other studies that we reviewed used this variable.	Cherry, R. L. (1991).
Use of psychoactive drugs	Hicks et al. (in press): Found that when use of psychotropic medications increases, costs of providing services accelerate (c-statistic 0.68). While each individual quality of care measure does not make a large contribution to the costs, when considered collectively, they can have a substantial financial impact on the operations of the home. Shaughnessy et al. (1995) Significant increases in "no excess mean daily dose of neuroleptics" (p=.031) and "no long-acting Benzodiazepines" (p=.027) were found in an	A process measure of nursing home quality, which is not in itself a measure of health status but may indicate with a high likelihood if substandard care is provided. Prescription of psychotropic medications requires a physician's order. Nursing home staff input into prescribing decisions is often dependent upon individual physicians.	Castle, N. G. and B. Fogel (1998). Graber, D.R., Sloane, P.D. (1995). Hicks, L.L. et al. (in press). Rantz, M.J. et al. (in press). Shaughnessy, P. W et al. (1995). Shorr, R. I. et al. (1994). Svarstad, B. L. and J. K. Mount (1991).

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	evaluation study of six Teaching Nursing Homes (TNH) when compared to a matched sample of comparison nursing homes.		
Verbal aggression, physical aggression, disruptive behavior, behavioral problems	<p>Anderson, et al. 1998 – A nursing home level score was calculated to indicate the percentage of residents in the home for whom the condition was present.</p> <p>Anderson, et al. (2003) reported predictor variables accounted for 15% of the variance in the prevalence of aggressive /disruptive behavior problems. Having more beds and greater levels of RN participation in decision-making explained lower prevalence of behavior problems. This was inconsistent with prior research by Zinn et al., 1993.</p> <p>Harrington et al. (2000): Higher percentages of behavioral problems, urinary incontinence, and pressure sores were positively associated with quality of life deficiencies.</p>	<p>Anderson, et al. 1998 - Homes in the group with the highest levels of RN staffing showed greater improvement in resident outcomes with the exception of verbal aggression, vest and wrist restraints, contractures, and dehydration.</p> <p>Bostick (in press) found no significant associations between RN, LPN, or NA staffing hours and the prevalence of physical restraints, weight loss, problem behavioral symptoms toward others, and bowel or bladder incontinence.</p>	<p>Anderson, R. A. et al. (1998). Anderson, R.A. et al. (2003). Harrington, C. et al. (2000). Bostick, J.E. (in press). Rantz, M.J. et al. (in press).</p>
Weight change/weight loss	Inappropriate weight loss may be a sign of malnutrition and, is a	There is a disincentive for nursing homes to report weight	Bostick, J.E. (in press).

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>prevalent problem in nursing homes, and is frequently used as an indicator of poor care. Significant weight loss is documented on the MDS> Significant relationships between weight and staffing have been shown.</p> <p>Hicks et al. (in press): Found that with weight loss, costs of providing services accelerate (c-statistic 0.68). While each individual quality of care measure does not make a large contribution to the costs, when considered collectively, they can have a substantial financial impact on the operations of the home.</p> <p>Kramer & Fish (2001) identified staffing thresholds (hours per resident day below which a facility is significantly more likely to be in the lowest decile for weight loss and above which there are no additional improvements in quality).</p> <ul style="list-style-type: none"> ▪ NA - 3.1 hrs ▪ Licensed (RN + LPN) – 0.95 hrs 	<p>loss on the MDS, as there is a mandate to alter resident care plans to reflect measure taken to prevent further decline.</p> <p>Martau et al. (2000) used a small sample (N=54 facilities) in order to collect quality data through chart review and observation. This sample size made it difficult to reach statistical significance.</p> <p>Bostick (in press) found no significant associations between RN, LPN, or NA staffing hours and the prevalence of physical restraints, weight loss, problem behavioral symptoms toward others, and bowel or bladder incontinence.</p>	<p>Hicks, L.L. et al. (in press). Kramer, A. M. and R. Fish (2001). Martau, J., M. et al. (2000). Porell, F., Caro, F.G. (1998). Rantz, M.J. et al. (in press).</p>

Table 3. Quality Measures

Resident Outcomes

Variable	Strengths	Weaknesses	Reference
	<p>Martau et al (2000) related significant weight loss with licensed staff hours per resident day (RN + LPN) and with NA hours per resident day.</p> <ul style="list-style-type: none"> • Facilities in the lowest quartile for aide hours (< 1.55 hours per resident day) were almost 2 ½ times more likely than those in top 3 quartiles to be among facilities with above average rates of significant weight loss (p< 0.231)). • Facilities below the mean staffing for aides (1.99 hrs) were more than 3 times as likely than those above 1.99 hrs to have high rates of significant weight loss (p<0.080). • For licensed staff (RN + LPN), Facilities below mean staffing for licensed staff (1.11 hrs) were almost 5 times more likely than those above 1.11 hrs to have high rates of significant weight loss (p<0.026). 		

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
Average length of stay (ALOS)	In the regression analysis of ALOS, only the ownership variable had a significant coefficient. ALOS in for-profit facilities was shorter than in non-profit facilities.	The influence of year and PPS were not evident, probably because the ALOS was calculated from data including both ICF and SNF residents.	Kanda, K. and M. Mezey (1991).
Death/ mortality rates/ Survival rate	<p>Linn et al. (1977) reported a relationship between mortality and RN hours per resident in a longitudinal study of 1000 residents in 40 community nursing homes (p<.05).</p> <p>Cohen & Spector (1996) found that higher ratios of RNs to residents, adjusted for resident case-mix, reduced the likelihood of death and that a higher ratio of LPNs to residents significantly improved resident functional outcomes.</p> <p>Bliesmer et al. (1998) found that licensed nursing hours</p>	Death is often an expected outcome for nursing home residents. The problem in using death as a quality indicator is that the nature of the death is not always apparent in records. In addition, it is not always known whether the death was for reasons of poor care or because of clinical conditions that were not amenable to treatment (Anderson et al., 1998)	<p>Bliesmer, M. M. et al. (1998).</p> <p>Braun, B. I. (1991).</p> <p>Cohen, J. W. and W. D. Spector (1996).</p> <p>Halbur, B. T. and N. Fears (1986).</p> <p>Intrator, O. et al. (1999).</p> <p>Kanda, K. and M. Mezey (1991).</p> <p>Linn M.W. et al. (1977).</p> <p>Mukamel, D. B. and W. D. Spector (2000).</p> <p>Porell, F. and F.G. Caro (1998).</p> <p>Spector, W. D. and H. A. Takada (1991).</p>

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	(but not non-licensed) were significantly related to residents' improved functional ability, increased probability of discharge home, and decreased probability of death.		
Deficiencies/ Code violations/ Complaint data	<p>Deficiency data reported on OSCAR are recorded by state surveyors and are considered accurate because they are carefully reviewed by HCFA and subject to challenges by nursing facilities (Harrington & Carillo, 1999). Survey process was revised in 1999, requiring surveyors to investigate lack of sufficient staff as causes of identified care deficiencies (Cullen et al., 2000). Harrington et al. (2000) found that nursing staff and other direct care staffing levels had a consistent, significant negative relationship with</p>	<p>Questionable as to whether deficiencies are an accurate reflection of quality in facilities. There may be additional problems that are not reflected in deficiencies. Possible false negatives in surveyors' identification of deficiencies or false positives with deficiencies that are undetected by surveyors (Harrington et al., 2000)</p> <p>Deficiencies represent discrete problems identified by state surveyors. Types of deficiencies vary; They are not of equal importance and there are variations in surveyor procedures and practices across and within states. Dummit (2002)</p>	<p>Cullen et al. (2000). Cullen et al. (2000) Dummit, L. A. (2002). Graber, D.R. and P.D. Sloane (1995). Harrington, C. et al. (2000). Harrington, C. et al. (2001). Harrington, C. and H. Carrillo (1999). Johnson-Pawlson, J. and D. L. Infeld (1996). Munroe, D. J. (1990). Riportella-Muller, R. and D. P. Slesinger (1982). U. S. General Accounting Office (2002). Wan, T. T. (2003).</p>

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	<p>deficiencies, although overall staffing levels did not explain as much of the variation in deficiencies as did facility characteristics. Staffing hours alone predicted less than 1% of the total variance in deficiencies.</p> <p>Graber & Sloane, 1995: Nurse staffing levels were not found to be significant predictors of the restraint violation Higher levels of LVN and NA staffing are associated with lower proportions of restrained patients, resulting in the facility having a lower probability of being cited for improper use of restraints.</p> <p>Johnson-Pawlson & Infeld, 1996: Facilities staffing at or close to a minimum level of required nursing staff are more likely to provide a poorer quality of care based on deficiency citations than those that staff at higher</p>	<p>found “more than a five-fold difference across states in the percentage of homes found by state surveyors to have actual harm and immediate jeopardy deficiencies” (p.4). In a statewide study of California Medicare-certified nursing homes (N=820), staff turnover explained only 8.6% of the variance for health related deficiencies (Munroe, 1990).</p> <p>Johnson-Pawlson & Infeld (1996): A limitation is the use of survey deficiencies as a measure of quality of care. Concerns about reliability and validity of state survey data; the validity of the individual indices reflecting different dimensions of care have not been validated.</p>	

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	levels.		
Discharge rates	<p>Shaughnessy, Kramer, et al. (1995) noted a significant increase in the percentage of residents discharge to the hospital ($p < .001$) and to the community within three ($p = .001$), six ($p = .002$) and 12 ($p = .003$) months following implementation of the Teaching Nursing Home program in six facilities. Lin et al. (1977) identified relationships between discharge from the nursing home and more RN hours per resident ($p < .05$) and between discharge and Professional staff to resident ratio ($p < .01$) ($n = 1000$ residents in 40 nursing homes).</p> <p>Bliesmer et al. (1998) found that licensed nursing hours (but not non-licensed) were significantly related to residents' improved functional ability and increased probability of</p>	<p>Discharge rates are a dubious indicator because there are "good" reasons for discharge (e.g., return to home), and "bad" reasons for discharge (e.g., transfer to another nursing home for financial reasons</p> <p>(Anderson, R. A. et al., 1998).</p>	<p>Aaronson, W. E. et al. (1994). Bliesmer, M. M. et al. (1998). Braun, B. I. (1991). Halbur, B. T. and N. Fears (1986). Intrator, O. et al. (1999). Linn, M. W. et al. (1977). Shaughnessy, P. W. et al. (1995).</p>

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	discharge home. Braun (1991) found that discharge from the facility was inversely associated with the diagnosis of cancer and directly related to the index of nursing process.		
End of life care	Inadequate staffing and Lack of supervision were most significant factors that influenced care (Bathing, oral hygiene, adequate food and fluid and repositioning) 54% of the residents who died during the study period (n=117) developed pressure ulcers.	One facility, participant observations of 35 residents.	Kayser-Jones, J. et al. (2003)
Hospital admissions /re-hospitalization rates	Braun (1991) reported that re-hospitalization was associated with the patient factors of heart disease, hypertension, race and level of care with the size of the nursing home. Kayser-Jones et al. (1989) – Of 215 residents studied in two facilities, 37% were hospitalized and 48% of transfers to the hospital	Without risk adjustment, higher rates of hospital admission are likely to reflect case mix instead of staffing. Some causes of hospital admission are unavoidable; only selected admissions are care related. Intrator (1999) pooled all types of hospitalizations and found no association between staffing and	Aaronson, W. E. et al. (1994). Braun, B. I. (1991). Intrator, O. et al. (1999). Kanda, K. and M. Mezey (1991). Kramer, A. M., et al. (2000a). Kayser-Jones, J. et al. (1989) Kramer, A. M. and R. Fish (2001). Louwe, H. and A. M. Kramer (2001). Mezey, M. and J. Lynaugh (1991).

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	<p>were not warranted. Large, well-designed, multi-state studies have shown relationships between hospital admission and staffing levels. Considered selected diagnoses based on prevalence and potential to avoid hospitalization with appropriate care. Kramer et al. (2000a) found that (for 4 of 5 diagnoses:</p> <ul style="list-style-type: none"> • NA staffing at 2.00 hours per resident day associated with 4 X likelihood of high hospitalization rates (45% of facilities below this level). • Licensed (RN + LPN) staffing strongly associated with increased hospitalization for all five measures. <p>Staffing thresholds set; these were nursing staff hours below which residents at substantial risk of hospitalization for potentially</p>	<p>hospitalization at the resident level. Shaughnessy et al. (1995) also pooled all types of admission and findings were based on a small number of facilities (6 matched pairs). The authors acknowledge that Teaching Nursing Home Programs implemented in each home differed, making it difficult to determine aspects of the interventions that resulted in positive effects. Re-hospitalization may be a useful quality indicator, but only when it is known whether or not is was preventable (Anderson et al., 1998).</p>	<p>Shaughnessy, P. W. et al. (1995).</p>

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	<p>preventable causes</p> <ul style="list-style-type: none"> • 2.0 hrs for NA ▪ 0.75 to 1.0 hrs for RN + LPN ▪ 0.20 to 0.45 RN (portion of licensed staff hours) <p>Kramer & Fish (2001) Identified points (hours per resident day) at which no further detectable benefit from additional staffing. And below which facilities were at increased likelihood for being in worst 10% of facilities (n=3,632) for quality measure:</p> <ul style="list-style-type: none"> • NA 2.3 hrs for electrolyte imbalance and 2.4 hrs for other causes (2.37 average) • Licensed (RN + LPN) 1.05 hrs for respiratory infection up to 1.3 hrs for sepsis (1.14 average) • RN threshold 0.55 hrs for all measures <p>Louwe & Kramer (2001) identified recognition, accurate interpretation and a</p>		

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	<p>timely response to early symptoms (good nursing assessment skills and knowledge) as significant to quality measures related to hospitalization. Conclusions came from a qualitative study of nursing homes (N=17) from three states.</p> <p>Shaughnessy et al (1995) found that hospitalization rates within three months of admission declined by 7% (p = 0.015) after implementation of the Teaching Nursing Home (TNH) program (in 5 of 6 facilities in sample) when compared to a 4.9% increase in five of the six matched comparison nursing homes (CNH). Significance increased following adjustment for case mix (p.005 for 3 months; p=.073 for 6 months; p=.061 for 12 months).</p>		
Hospital days	Following implementation of	Findings were based on a	Shaughnessy, P. W. et al. (1995).

Table 3. Quality Measures

Facility Outcomes			
Variable	Strengths	Weaknesses	Reference
	the Teaching Nursing Home (TNH) program, a significant decrease in hospital days was seen in six TNHs after three (p=.009), six (p=.006) and 12 (p=.003) months. Following adjustment for case mix, decreases had increased significance (3 months, p<.001; 6 months, p=.002; 12 months, p=.013)	small number of facilities (6 matched pairs) and Teaching Nursing Home Programs implemented in each study home differed, making it difficult to determine aspects of the interventions that resulted in positive effects.	

Table 3. Quality Measures