Nursing Home Profit Status and Quality of Care: Is there any evidence of an association?

Authors

Michael P. Hillmer, MSc^{1,2,4}; Walter P. Wodchis, PhD^{1,2,3}; Sudeep S. Gill, MD^{1,2,4}; Geoffrey M. Anderson, MD, PhD^{1,2}; Paula A. Rochon, MD, MPH^{1,2,4}

Institutions

¹ Department of Health Policy, Management, and Evaluation, University of Toronto, Toronto, Ontario

² Institute for Clinical Evaluative Sciences, Toronto, Ontario

³ Toronto Rehabilitation Institute, Toronto, Ontario

⁴ Kunin-Lunenfeld Applied Research Unit, Baycrest Centre for Geriatric Care, Toronto, Ontario

Corresponding author

Michael P. Hillmer, MSc, Institute for Clinical Evaluative Sciences, Room G106,
2075 Bayview Avenue, Toronto, ON, Canada, M4N 3M5
email: michael.hillmer@utoronto.ca

Alternate corresponding author

Paula A. Rochon, MD, email: paula.rochon@utoronto.ca

Acknowledgements:

MPH is supported by a doctoral research grant from the Canadian Institutes of Health Research (CIHR). WPW and SSG are supported by post-doctoral fellowships from CIHR. PAR was supported by a CIHR Investigator Award. This work was supported by a CIHR Chronic Disease New Emerging Team (NET) program grant (NET 54010). The NET program receives joint sponsorship from the Canadian Diabetes Association, the Kidney Foundation of Canada, the Heart and Stroke Foundation of Canada, and the CIHR Institutes of Nutrition, Metabolism & Diabetes, and Circulatory & Respiratory Health.

Word count: 3362

Running head: A comparison of for-profit and not-for-profit nursing homes: Quality of Care

Keywords: Quality of care, Nursing homes, Ownership status, Systematic review

Abstract

Objective: To perform a systematic review examining the association between the profit status of North American nursing homes and the quality of care.

Data Sources: Studies were identified by searching MEDLINE (January 1990 – October 2002), reference lists, letters, commentaries, and editorials.

Data Extraction: The quality indicator(s) used to measure quality of care, and its relationship to profit status was extracted from each publication. The study design and risk-adjustment methodologies utilized were also extracted. The inter-rater reliability for these three items was determined to be 1.0, 0.6, and 0.8, respectively.

Data Synthesis: A qualitative systematic review was performed using Donabedian's framework of structure, process and outcome for analyzing medical quality of care.

Conclusions: Empirical research in the past 12 years has found that systematic differences exist between for-profit and not-for-profit nursing homes. For-profit nursing homes appear to provide lower quality of care in many important areas of process and outcome.

Word Count: 149

Introduction

There are more than 1.5 million Americans living in nursing homes and two-thirds of these residents are located in for-profit (FP) facilities (Harrington and Carrillo 1999). FP nursing homes have been criticized for favoring financial returns at the expense of ensuring quality of care (Harrington et al. 2001; Mendelson 1974; Vladeck 1980). FP nursing homes are thought to provide a lower standard of care because their managerial objective is to provide returns to investors (Mendelson, 1974). Quality of care deficiencies occur in not-for-profit (NFP) facilities as well. However, these facilities are not bound by the requirement of profit distribution. Managers who value high quality of care can therefore use net revenues to improve the quality of life and medical care for residents. Managerial behavior is particularly important for frail elderly nursing home residents who may not have the resources to advocate sufficiently well for themselves. Thus, the focus on ownership status is an important consideration in examining nursing home quality of care.

New Contribution

Most studies that have examined the importance of ownership focused on specific indicators of quality such as pressure ulcers, use of restraints, and mortality. While these studies provide indications of the relationship between ownership and quality, the specificity of the findings precludes generalizations of whether quality ultimately differs substantially between FP and NFP nursing homes. The present systematic review synthesizes the accumulated evidence.

Systematic reviews are a powerful means to provide more general conclusions than individual studies permit. O'Brien *et al* surveyed the nursing home ownership literature and concluded that

quality was similar across different types of ownership{O'Brien, 1983 674 /id}. Hawes and Phillips found that NFP nursing homes were providing higher quality of care. The last published literature review to summarize nursing home quality studies was conducted by Davis and is now twelve years old (Davis 1991). Davis' 1991 review found that many studies supported higher quality of care being provided in NFP homes. However, weaknesses in the methodological design of these studies led Davis to conclude that, "it would be premature to conclude that nonprofit nursing homes provide higher quality care".

The purpose of the present systematic review is to determine if the studies published since Davis' review permit a further elucidation of the true nature of the relationship between ownership status and quality of care in nursing homes.

Conceptual Framework

The literature provides a wide variety of study designs, quality measures, and risk-adjustment strategies. Several studies also examined multiple measures of quality within the same study. Quality is a multi-dimensional construct and its summary requires a systematic approach. A broad framework is important to capture the diverse approaches employed in this field of empirical research. We systematically employ two conceptual dimensions to describe and summarize the findings of past research: first the dimension of quality measured; and second the empirical methods used to study quality. We employ Donabedian's framework for analyzing quality in the health care setting wherein quality is composed of three interacting elements: structure, process, and outcome (Donabedian 1966). This framework has been widely applied in the medical literature. Structure specific indicators of quality refer to institutional characteristics

such as the amount and nature of the staff and other facilities available to the health service. The most common example of a structure quality indicator is staffing. Process quality indicators refer to what is done to and for the patient. For example, the inappropriate use of restraints, catheters, and psychoactive drugs are process quality indicators of nursing home care. Outcome specific indicators of quality are the end result, i.e., what actually happens to the patient. Examples of these outcome quality indicators include the development of pressure ulcers, frequency of falls, and mortality rates.

The interrelationship of structure and process, as well as individual patient characteristics dictate the final outcome. There is often no direct or obvious relationship between structure and process and the eventual outcome. However, it is implied in Donabedian's framework that when good structural inputs are in place, better outcomes will be produced. While these inputs may be necessary, they may not be sufficient to ensure better resident outcomes. On the other hand, process measures reflect the quality of care provided to patients and are the most commonly used indicators of nursing home quality.

The second broad dimension used to summarize the empirical literature is the empirical research method used. While no studies in this field employ the gold-standard randomized controlled trial, there are several different approaches used to analyze observational data. Although longitudinal studies are required to identify temporal, causal effects, they are also the most costly to conduct. Cross-sectional study designs are easier to execute but are only able to identify associations rather than true causal effects. Prospective designs provide greater assurances that potentially confounding factors will be accounted for and addressed, while retrospective designs are able only to use the data that were available from the specified data source and may involve

considerable biases from unmeasured factors that may affect the likelihood of observed quality differences. The specificity of risk-adjustment procedures is also critical (cite Berg et al., 2001). Inadequate risk-adjustment may lead to erroneous identification of association between certain environments and higher quality problems when the true cause is differences in underlying patient risk for adverse events. More comprehensive risk-adjustment procedures identify a greater array of important measures of underlying risk. Broad patient characteristics (demographics, age, sex, etc) are important but less satisfactory than detailed clinical information (diagnostics), level of functional dependence (activities of daily living (ADLs), number of nursing minutes per resident, case-mix index, etc), and treatments or medications. Thus we classify research methods in this review according to the research design (cross-sectional, retrospective longitudinal, prospective longitudinal) and the level of risk-adjustment specificity.

Methods

Search Strategy

An initial search was conducted using MEDLINE. The electronic search used the following exploded medical subject heading terms: “nursing homes” or “homes for the aged” or “long-term care” AND “health services for the aged” or “quality of health care” “exp delivery of health care” AND “*health facilities, proprietary/” or “ownership/” or “organizations” or “organizations, non-profit/”. The search was restricted to the English language and aged 65 or over and publication dates between January, 1990 through October, 2002. Additional articles

were identified through searches of the reference lists of the initial set of articles, as well as editorials, letters, comments, reports, and books.

Study Selection

The MEDLINE search identified 365 articles. The abstracts of all articles were retrieved and reviewed for relevance. The inclusion criteria were: 1) publications based on original and quantitative data; 2) nursing homes located in North America; and 3) a comparison of the quality of care in FP and NFP nursing homes. Studies that examined structural indicators were restricted to those that included staffing variables because staffing has been found to be one of the only structural indicators that is a significant predictor of nursing home quality (Bliesmer et al. 1998; Castle and Fogel 1998; Harrington et al. 2000).

Of the 365 articles identified through Medline, 13 met the inclusion criteria. An iterative process of searching reference lists was undertaken until all relevant articles that met the selection criteria were identified. An additional 24 articles were identified. A total of 38 publications were included for review in this study. It is worth noting that only 37 of the 38 studies were based on U.S. data and the remaining study was based on Canadian data.

Data Extraction

The following information was extracted from each study: the number and location of nursing homes, proportion of FP nursing homes, data source, study design, and risk-adjustment methodologies utilized. Inter-rater reliability for the classification was assessed by the

consistency of data extracted by two of the authors (MPH and SSG) from 10 randomly selected studies.

Synthesis of Evidence

The heterogeneity of study designs, risk adjustment techniques, and measurement, precluded a statistical combination of results through meta-analytic techniques. Instead, relationships between each quality indicator and ownership status were identified from the empirical studies and summarized by significance and direction. In order to summarize empirical results within Donabedian's framework, quality indicators were sub-divided into four categories: structure, process, outcome, and combined process and outcome. Quality results are also examined stratified by study design and risk-adjustment methods employed. Unless otherwise noted, results were identified as significant if a p-value less than 0.05 was reported. Since many studies provided results for multiple quality indicators, several studies appear in multiple categories.

Results

Summary of Studies A summary of the studies included in the present review is presented in Table 1. Inter-rater reliability for study design, risk-adjustment methodologies, and quality measures were 1.0, 0.6, and 0.8, respectively. Minor differences were resolved by consensus. There were three general study designs utilized in the reviewed publications; cross-sectional (28 studies), retrospective longitudinal (7 studies), and prospective longitudinal (2 studies).

Only three studies employed a risk-adjustment strategy based on all criteria (Garrard et al. 1995; Intrator et al. 1999; Spector and Takada 1991). Four studies employed only one method of risk-adjustment (Cherry 1991; Davis 1993; Johnson-Pawlson and Infeld 1996; Zinn 1993). Two studies did not employ resident-level risk-adjustment (Aaronson et al. 1995a; Walshe and Harrington 2002). The majority of the studies utilized two (13 studies) or three (15 studies) methods of risk-adjustment.

Summary of Quality Indicators

Table 2 summarizes 81 results that were reported in the 38 studies. Each quality measure in the left column identifies an indicator of poor quality. The studies reported beside each indicator are placed in the column identifying which ownership status was associated with the negative indicator of quality. For example, Aaronson et al. (1994) found for profit facilities had lower staffing (worse quality).

Structure Quality Indicators

Two measures of staffing, nursing aide turnover and number of staff were used in the reviewed publications. Cross-sectional studies with aggregate data found that nursing aide turnover was higher and nursing staff levels were lower in FP facilities. One cross-sectional study found that FP facilities had higher levels of licensed practical nurses, although total staff and RN staff were not significantly different between ownership types. Five staffing results were not statistically significant.

Process Quality Indicators

Seven different process-based indicators were used in the reviewed publications: Inappropriate use of restraints; federal audit deficiencies for the use of restraints; rate of catheterization; rate of tube feeding; inappropriate use of psychoactive medications; percentage of residents who are not toileted; and the percentage of residents with advance directives. The majority of the results were from studies using cross-sectional designs with aggregate data. The results that attained statistical significance nearly all indicated that NFP nursing homes were more likely to provide higher quality of care when judged by process-based measures. In fact, only one cross-sectional study found NFP facilities had lower quality.

The use of physical restraints was the most commonly studied process measure. This indicator was usually identified in cross-sectional studies with aggregated data, with the exception of a longitudinal patient-level study by Porell and Caro (1998). Nursing homes receive federal audit deficiency citations if they are found to be using restraints inappropriately. Three studies identified deficiency citations for restraint use as opposed to observed restraint use. Of the 11 studies (including 3 studies of deficiency citations), 6 showed increased use of restraints in FP homes, 5 were not significant, and only one indicated higher use of restraints in NFP facilities homes.

Three cross-sectional indicators using aggregate data showed increased use of psychoactive drugs in FP homes. Two longitudinal studies with patient-level data and one cross-sectional study with aggregate data found no difference in psychoactive drug use.

Outcome Quality Indicators

Eight outcome quality indicators were identified in the reviewed publications: mortality; infections; pressure ulcers; hospitalizations; functional ability; incontinence; dehydration; accidents; weight change; and contractures. With the exception of mortality, the pattern again suggests higher quality of care in NFP homes.

Mortality was the most common outcome-based measure of quality of care. However, fewer than half the studies observed a statistically significant result. Significant results indicated no clear distinction between FP and NFP nursing homes. Increased mortality was associated with FP facilities in one cross-sectional study and one longitudinal study. NFP homes were similarly found to have increased mortality in one cross-sectional and one longitudinal study. Chou's study demonstrated that mortality was significantly higher in FP facilities only when the resident did not have any family visitors within the first month of admission (Chou 2002).

Pressure ulcers were also a common outcome indicator of quality. The rate of pressure ulcers was found to be higher in FP homes in two cross-sectional and one longitudinal study. Only one cross-sectional study found NFP homes with a higher rate ($p < 0.1$). Four studies (1 cross-sectional and 3 patient-level longitudinal) found no significant difference.

The rate of infections was found to be higher in FP homes by one cross-sectional study. Chou's (2002) longitudinal study found FP homes to have more infections only when residents had no visitors. (Chou found similar results for dehydration.) The rate of hospitalization was higher in FP homes according to a cross-sectional analysis, while a longitudinal study found no statistically significant relationship. One patient-level longitudinal study found an increased rate

of resident functional decline in NFP residents. However, the findings were not significant in all years and five other studies identified no difference between FP and NFP homes.

Combined Process and Outcome Indicators

Several studies utilized quality measures that combined elements of process and outcome. Total federal audit deficiencies were used to measure overall quality in six studies. The latter studies used cross-sectional aggregate data sources. Three demonstrated that FP homes were more likely to receive federal audit deficiencies and three found no statistical differences between FP and NFP homes.

Composite quality scores were used in three studies. Bravo et al. (1999) employed a multi-dimensional quality scale encompassing several aspects of care. Using a hierarchical linear model, their results demonstrated that the quality was lower in FP nursing homes. In separate studies, Davis (1993) and Cherry (1991) utilized a combined measure of quality which included aspects of process and outcome (such as pressure sores, catheterizations, urinary tract infections, and antibiotic use) and a cross-sectional study design. Davis found that FP homes delivered lower quality of care, yet Cherry was unable to find a significant relationship.

Study Design Results

Stratifying the association between quality and ownership according to study design provides qualitatively similar results as the combined study results. Figure 1 shows the percentage of studies within each study design that indicated a significant relationship between ownership status and poor quality or no significant relationship. Cross-sectional studies resulted in the

highest percentage of study results indicating worse quality in NFP homes. Retrospective longitudinal studies indicated more quality problems in FP homes but also had the highest percentage of non-significant findings. Of the four prospective study results, one indicated lower quality in NFP homes, one indicated lower quality in FP homes, and two results were not significant.

Figure 2 shows the percentage distribution of study results stratified by risk-adjustment method (one method, two methods, three methods, four methods, or no adjustment). Both studies without risk-adjustment provided non-significant results. In all studies employing risk-adjustment procedures at least twice as many results indicated that NFP ownership was associated with fewer quality problems than FP ownership. The proportion of studies indicating poor quality in NFP homes was largest when four methods of risk-adjustment were employed.

Discussion

Our systematic review of the literature since 1990 suggests that FP ownership appears to be associated with quality deficiencies in many important areas of resident care. Overall, 38 studies yielded 81 results on the relationship between ownership and quality. Only 6 of the 81 results demonstrated that NFP nursing homes were delivering lower quality of care; 33 results indicated that quality of care in FP facilities was worse. Regardless of the study design, better quality was reported at least as often in NFP homes compared to FP homes.

The studies included in this review are more robust compared to the studies published before 1991, contained in Davis' review. Researchers have largely abandoned the use of structural

indicators (with the exception of staffing variables) as an effective means of measuring quality in the nursing home. The use of process and outcome measures has become more prominent. The use of longitudinal study designs and more thorough risk-adjustment has also become more common.

The results found by the present review are important because the quality indicators that are more prevalent in NFP facilities are important measures of resident quality of care and may have a substantial impact on resident quality of life. Results of structural quality indicate that NFP homes had a higher staff skill mixture and lower nursing aide turnover rate relative to FP ownership. An increased percentage of RNs and a decreased RN turnover rate have been linked with improved resident functional outcomes (Spector and Takada 1991). However, less skilled staff may have little impact on resident outcomes (Davis 1991), therefore, it remains to be determined whether a lower turnover rate of nursing aides has the same impact on functional outcomes.

All but one significant process quality result indicated that NFP providers had higher levels of quality than FP providers. These process indicators are associated with deleterious resident outcomes. For example, the inappropriate use of restraints has been linked with increases in both morbidity and mortality (Burton et al. 1992; Dube and Mittmann 1986; Phillips et al. 2003). The use of catheters can lead to an increased risk of urinary tract infection and decreases in the quality of life for residents (Ouslander and Kane 2003). Excessive and inappropriate use of psychoactive medications has been connected with an increased risk of falling and hip fractures in the elderly which leads to decreased quality of life and an increased rate of mortality

(Bernabei and Carbonin 1997; Liu et al. 1998; Ray et al. 2000; Rubenstein et al. 2001).

Weisbrod's work suggests that FP homes may substitute medications for adequate staffing levels (Weisbrod 1996). The same dynamic might exist for the increased use of catheters and restraints since these processes reduce the intensity of staffing that is required.

Most significant results from the outcome quality indicators indicate FP homes had more quality problems. This was most apparent for pressure ulcers. Pressure ulcers are an excellent marker of quality of care because very few residents receiving proper care should develop this condition.

Ulcers also seriously affect a resident's quality of life and have been linked to increased morbidity and mortality (Berlowitz et al. 2000; Brandeis et al. 1990). The higher rate of pressure ulcers observed in FP homes might be reflective of the decreased staffing intensity compared to NFP homes; it is also possible that FP homes admit more residents with pressure sores. The latter scenario is unlikely since care for such residents is more expensive.

Most other outcome measures of quality provided ambiguous results with the majority of studies unable to find any significant difference. Sample size and power may be an issue for some studies while the relative crudity of the outcome measures may also have been problematic. It is difficult to establish the quality of a nursing home based on rates of mortality because most elderly residents are expected to die and it is often difficult to attribute their death to the facility. Some facilities might send their residents to hospitals when they are about to die. A more important issue may be how their deaths occur. Similarly, nearly all nursing home residents decline in function and measuring differences in the rate of functional decline is challenging. It is important to explore such research further using robust risk-adjustment and longitudinal study designs.

It is difficult to capture all aspects of nursing home quality using a single measure. Nonetheless, composite quality scores and federal facility audits are advantageous because they often include a wider range of quality of care and quality of life combined into a single score. Without exception, these multi-faceted quality scores indicated that FP homes were providing lower quality of care. A significant challenge in developing composite scores is arriving at some means of attaching weight or importance to different aspects of care. Weights could be equal, but undoubtedly different residents and policymakers all have their own set of preferences. Davis notes that stakeholder values and preferences may conflict (cite Davis 1991).

Using single indicators also presents challenges. Each quality indicator summarized in this study taps into a slightly different component of care. The validity and reliability of each measure may vary considerably. Recent developments have pushed this issue to the forefront as the Centers for Medicare and Medicaid Services (CMS) has implemented an on-line tool to provide direct-to-consumer reporting of nursing home quality indicators including the prevalence of pressure sores, physical restraints, etc. CMS has also enlisted the assistance of field experts to develop sophisticated analyses of quality indicators (cite {Berg, 2001 670 /id} {Morris, 2003 690 /id} {Morris, 2003 691 /id} NOTE MIKE THAT I DON'T SEE THE MORRIS CITATIONS IN THE REFERENCE LIST). The reports arising from this research do much to identify problems associated with ascertainment and censoring biases, stability problems for rare events, as well as regional, facility, and patient-level variation. The CMS report identifies 24 indicators considered robust enough to support further research including (indicators summarized in this study) restraints, indwelling catheters, feeding tubes, psychoactive medication use, infections,

functional decline, incontinence, and dehydration. Additional indicators such as pain management are considered increasingly important for maintaining minimum standards of quality of care and quality of life for nursing home residents.

Simple statements about the association of quality with facility ownership still do not provide sufficient information about the nature of the relationship between ownership and quality. What about NFP facilities enables them to provide higher quality? The issue of price mix within a nursing home also has important potential implications on the quality differences between nursing homes{Hirth, 1999 568 /id} – ???does he talk about this much in that paper???. For example, FP homes may offer lower quality compared to NFP homes because they serve clientele with less ability to pay higher prices. Perhaps there would be no observable difference in quality if FP homes had a similar price mix as compared to NFP homes. Moreover without assessing patient preferences and considering market dynamics it is difficult to conclude that there is a welfare loss associated with lower quality in particular facilities. If facilities with lower quality also charge lower prices for care, and if the low-price lower-quality care is that demanded by consumers in those facilities, it is merely a characteristic of a differentiated health care product allowing consumers to sort according to quality preferences. A key omitted variable in all studies reviewed in the present study is thus price.

On the other hand, an efficient trade-off between quality and price relies on informed and able decision-makers while surrogate decision makers (sometimes the nursing homes themselves) are common in the nursing home market. Chou's study suggests that FP nursing homes take

advantage of residents who lack advocates for their care (Chou 2002). The rate of mortality, infections, and dehydration were higher in FP homes when residents had no family visitors within a month of admission. Residents receiving regular visits might experience an increased quality of life, which in turn improves the likelihood of favorable outcomes. NFP homes might also be more successful in creating a social support network for residents who do not have regular visits from family and friends. Greater understanding is needed regarding the relationship between actual quality of care, the resident's ability to assess and demand quality, and the facility's interest in the resident's well-being. The presence of suitable advocates for quality of care is an important factor that plays a critical role in the usefulness of new policies such as nursing home report cards and performance monitoring.

The issues of competition between ownership types in markets and price within a nursing home has received little attention in the empirical literature. If taken into account, these factors have the potential to confound many of the results in the published literature. Most reviewed studies controlled for overall competition, but not the differential impact of differing proportions of FP and NFP in particular markets.

The effects of NFP nursing homes may not be limited to the provision of care within their facilities. Work by Hirth (use the MCR&R Hirth Citation – I can't see from below which you have tried to use) and Grabowski and Hirth (2003 JHE) has emphasized the role of competition between FP and NFP nursing homes in the same market. The latter research proposes a broader conceptual model where consumers treat NFP ownership as a signal or indicator of quality and the mere presence of NFP facilities in a market forces FP facilities to compete on quality as well

as price. Such dynamics, not addressed in the quality literature reviewed here, infer that observed quality differences represent a lower bound of the true impact of NFP ownership on overall nursing home quality.

Future quality of care research must use patient-level longitudinal data to provide protection against ecological fallacy (Hulley et al. 2001). The recent implementation of the Minimum Data Set (MDS), a longitudinal comprehensive set of elements that describe the functional status of each resident, will be beneficial for future research studies. The broad array of functional status variables and clinical detail will allow for the construction of robust risk-adjustment methodologies and indicators that reflect the multi-factorial nature of quality in the health care setting (Berg et al. 2001; Berg et al. 2003).

There are, however, potential constraints to performing studies using high-quality data sources and well-validated, standardized indicators. Access to data is a key constraint. There are several large datasets with rich clinical contents that are only available through one particular institution or researcher. Continued data liberation efforts will help to ensure that high quality data is widely available. A second key constraint is research funding. Many researchers lack the funds to carry out the extensive and exhaustive literature reviews and important validity and reliability studies similar to those being carried out for CMS. The availability of quality longitudinal data and the completion of extensive work surrounding the selection of quality indicators are prerequisites to nursing home studies that are robust and methodologically sound.

A crucial question in observational research is whether the results are valid. Often, findings are artifacts caused by unadjusted biases and poorly matched comparison groups. Further improvements in empirical techniques are needed. Advanced statistical techniques such as hierarchical, Bayesian modeling, and propensity score adjustment have the potential to explain more variation and provide more balanced groups than traditional regression techniques. Combining these statistical methodologies with robust study design and adequate data sources should aid in determining the validity of the trends identified in this review. However, these regression techniques are unable to account for unknown confounders that might be unequally distributed between groups. The use of instrumental variables is becoming more popular in the field of health services research{McMahon, 2003 677 /id}. This powerful technique acts in the same fashion as randomization does in a clinical trial. The result is two groups that on average have an equal distribution of known and unknown confounders. These variables are factors that are only related to the assignment of people into groups and not the outcome being studied. Finding variables that are responsible for a resident entering a particular home that is not related to the studied outcome, however, is challenging.

Future research should strive to account for the complex interactions between characteristics within the nursing home (such as resident case-mix, payer mix, price, and structural and organizational factors) and the characteristics of the market, such as overall competition and the composition of the individual market. Ideally, when these factors are taken into account combined with the use of valid and reliable quality indicators, robust risk-adjustment, and

adequate data sources, we will be able to provide additional insights and go beyond simply asking the question: Are FP or NFP facilities providing higher quality of care compared to one another?

Limitations

The major limitation of this review is the qualitative nature of data synthesis, which does not allow for a single estimate of risk for a particular event. The extent of risk-adjustment utilized by the reviewed studies was variable. Many studies did not include important covariates such as age, gender, and functional ability in the analysis; whereas other studies had extensive methodologies to ensure that the comparison groups were equally balanced. The choice of risk-adjustment can have a profound impact on the study results. Relative nursing home quality rankings may change substantially depending on which risk-adjustment strategy is used (Mukamel and Brower 1998). The trends identified in this review should be verified using robust methodological designs and advanced statistical analyses to ensure their validity.

Conclusions

The methodological rigour of the nursing home ownership literature has improved since Davis published his review. The pattern of quality indicators indicates that NFP homes are less likely to have poor quality of care practices and outcomes. FP nursing homes were found to have provided lower quality of care when judged by structure, process, and outcome criteria.

This review suggests that in spite of increased awareness and numerous high-profile government reports and publications, residents of FP nursing homes were more likely to be the recipients of poor quality compared to similar residents in NFP facilities.

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Table 1: Publications meeting the inclusion criteria (38 Studies)

Source	Study Sample	Data Source	Study Design	Risk-Adjustment Methods*			
				Demographics	Clinical Information	Level of Function	No. of Medications
(Aaronson et al. 1994)	449 NHs in PA 60% FP	National + State Data (1987)	Cross-sectional secondary data analysis	•	•	•	
(Aaronson et al. 1995a)	519 NHs in PA 52%	State Data (1987, 1989)	Cross-sectional secondary data analysis	No resident-level risk-adjustment			
(Banaszak-Holl and Hines 1996)	254 NHs in 10 states 72% FP	National Data + Survey Data (1993)	Cross-sectional secondary data analysis		•	•	
(Bell and Krivich 1990)	503 SNFs in IL 58% FP	State Data (1986-87)	Cross-sectional secondary data analysis	•	•		
(Bliesmer et al. 1998)	440 NHs in MN 40% FP	State Data (1988 / 1989 / 1990)	Retrospective longitudinal cohort – secondary data	•		•	
(Brannon et al. 2002)	288 NHs in 8 states 59% FP	National + Survey Data (1995)	Cross-sectional secondary data analysis + Survey		•	•	
(Bravo et al. 1999)	87 NHs in QC, Canada 80% FP	Survey + Primary data collection 1996-97)	Cross-sectional primary data analysis + cross-sectional survey	•	•	•	
(Castle and Fogel 1998)	15, 074 NHs 66% FP	National Data (1995)	Cross-sectional secondary data analysis		•	•	•
(Castle and Mor 1998)	268 NHs in 10 states 69% FP	National Data (1990 and 1993)	Cross-sectional secondary data analysis	•	•	•	
(Castle et al. 1997)	268 NHs in 10 states 69% FP	National Data (1990 and 1993)	Cross-sectional secondary data analysis	•	•	•	
(Castle 1999)	268 NHs in 10 states 69% FP	National Data (1990 and 1993)	Cross-sectional secondary data analysis	•	•	•	

Source	Study Sample	Data Source	Study Design	Risk-Adjustment Methods*			
				Demographics	Clinical Information	Level of Function	No. of Medications
(Castle 2000b)	12,193 NHs 67% FP	National Data (1992 and 1997)	Cross-sectional secondary data analysis		•	•	•
(Castle 2000a)	17, 024 NHs 67% FP	National Data (1997)	Cross-sectional secondary data analysis		•	•	
(Castle 2001)	420 NHs in 5 states 64% FP	National + Survey Data (1999)	Cross-sectional secondary data analysis + cross-sectional survey		•	•	
(Castle 2002)	14,042 NHs 68% FP	National Data (1996, 1997, 1998, and 1999)	Cross-sectional secondary data analysis		•	•	•
(Cherry 1991)	134 NHs in MO 70% FP	State data (1984)	Cross-sectional secondary data analysis		•		
(Chou 2002)	1887 NHs 65% FP	National Data (1984, 1989, 1994)	Retrospective longitudinal cohort – Secondary data analysis	•	•	•	
{Cohen, 1990 529 /id}	1020 NHs 32% FP	National Data (1981)	Cross-sectional secondary data analysis		•	•	
(Cohen and Spector 1996)	658 NHs 79% FP	National Data (1987)	Retrospective longitudinal cohort – Secondary data analysis	•	•	•	
(Davis 1993)	178 in KY 72% FP	State Data (1989)	Cross-sectional secondary data analysis			•	
(Garrard et al. 1995)	372 NHs in MN 41%	State Data (1987, 1988, 1989, 1990)	Cross-sectional secondary data analysis	•	•	•	•
(Graber and Sloane 1995)	195 NHs in NC 86% FP	National + State Data (1991)	Cross-sectional secondary data analysis		•	•	•
(Grabowski 2001)	1981: 13,346 70% FP 1996: 15,463 69% FP	National Data (1981,1996)	Cross-sectional secondary data analysis		•	•	

Source	Study Sample	Data Source	Study Design	Risk-Adjustment Methods*			
				Demographics	Clinical Information	Level of Function	No. of Medications
(Harrington et al. 2000)	13,770 NHs 68% FP	National Data (1996)	Cross-sectional secondary data analysis		•	•	
(Harrington et al. 2001)	13,693 NHs 66% FP	National Data (1998)	Cross-sectional secondary data analysis		•	•	
(Hughes et al. 2000)	14,631 NHs 73% FP	National Data (1997)	Cross-sectional secondary data analysis		•		•
(Intrator et al. 1999)	253 NHs in 10 States 72% FP	National Data (1993)	Cross-sectional – Secondary data analysis	•	•	•	•
(Johnson-Pawlson and Infeld 1996)	198 NHs in MD 72.2% FP	National Data (1991-92)	Cross-sectional secondary data analysis			•	
(Munroe 1990)	455 NHs in CA 92% FP	National + State Data (1986)	Cross-sectional secondary data analysis		•	•	
(Porell and Caro 1998)	566 NHs in MA 76%	State Data (1991-1994)	Retrospective longitudinal cohort – Secondary data analysis	•	•	•	
(Porell et al. 1998)	566 NHs in MA 76%	State Data (1991-1994)	Retrospective longitudinal cohort – Secondary data analysis	•	•	•	
(Shorr et al. 1994)	172 NHs in TN 79% FP	National + State Data (1989-1991)	Retrospective longitudinal cohort – Secondary data analysis	•			•
(Spector and Takada 1991)	80 NHs in RI 81% FP	National + State + Primary Data Collection (1984-86)	Prospective longitudinal cohort – Primary data collection + Secondary data	•	•	•	•
(Spector et al. 1998)	** 76% FP	National Data (1987)	Retrospective longitudinal cohort – Secondary data analysis	•	•	•	

Source	Study Sample	Data Source	Study Design	Risk-Adjustment Methods*			
				Demographics	Clinical Information	Level of Function	No. of Medications
(Svarstad and Mount 2001)	16 NHs in WI 50% FP	Primary data collection (1990, 1993)	Prospective primary data collection + Secondary data	•	•		
(Walshe and Harrington 2002)	15,086 NHs 60% FP	National Data + Survey (1999)	Cross-sectional secondary data analysis + Survey	No resident-level risk-adjustment			
(Zinn et al. 1993)	438 NHs 52% FP	National + State Data (1987)	Cross-sectional secondary data analysis	•	•	•	
(Zinn 1993)	≈ 14,000 NHs 66% FP	National Data + Survey Data (1987)	Cross-sectional secondary data analysis			•	

* - Risk-Adjustment Methods

1 – Patient characteristics (demographics, age, sex, etc)

2 – Clinical information (diagnostics)

3 – Level of function (Activities of Daily Living (ADLs), case-mix index, catheterized, # of nursing minutes, etc)

4 – # of medications

** - Unable to determine the number of nursing homes

Table 2: The relationship between quality indicators (structure, process, outcome) and ownership status (The relevant references appear to the right of each quality indicator)

	For-Profit	Not-For-Profit	No Significant Difference between FP or NFP
Structure			
↓ staff	(Aaronson et al. 1994), (Grabowski 2001)	(Cohen and Spector 1996)*	(Cohen and Dubay 1990), { Aaronson, 1995 559 /id}, (Cohen and Spector 1996) [†] , (Cohen and Spector 1996) [‡] , (Davis 1993)
↑ nursing aide turnover	(Brannon et al. 2002), (Banaszak-Holl and Hines 1996)		
Process			
↑ use of restraints	(Castle and Fogel 1998), (Castle et al. 1997), (Castle 2000b), (Zinn 1993)		(Graber and Sloane 1995), (Aaronson et al. 1994), (Castle 2001), (Zinn et al. 1993), (Porell and Caro 1998)
↑ deficiency citations for restraints	(Castle 2000a), (Graber and Sloane 1995)	(Castle 2002)	
↑ use of catheters	(Zinn 1993), (Castle 2001)		(Zinn et al. 1993)
↑ tube fed rate			(Zinn 1993)
↑ use of psychoactive medications	(Hughes et al. 2000), (Castle 2001), (Garrard et al. 1995)		(Castle 1999), (Shorr et al. 1994), (Svarstad and Mount 2001)
↑ % of residents who are not toileted	(Zinn 1993)		
↓ % of residents with do not resuscitate orders	(Castle and Mor 1998) [§] ,		
↓ % of residents with do not hospitalize orders			(Castle and Mor 1998)
↓ % of residents with living wills	(Castle and Mor 1998)		

* LPNs

[†] Total Staff

[‡] RNs

[§] Finding not significant in all years

	For-Profit	Not-For-Profit	No Significant Difference between FP or NFP
Outcomes			
↑ mortality	(Chou 2002) ^{**} , (Spector et al. 1998),	(Spector and Takada 1991), (Zinn et al. 1993)	(Porell et al. 1998), (Chou 2002), (Intrator et al. 1999), (Bell and Krivich 1990), (Cohen and Spector 1996), (Porell and Caro 1998)
↑ pressure ulcers	(Grabowski 2001), (Castle 2001), (Porell and Caro 1998)	(Aaronson et al. 1994)	(Spector et al. 1998), (Chou 2002), (Cohen and Spector 1996), (Zinn et al. 1993),
↑ infections	(Spector et al. 1998) (Chou 2002)		(Chou 2002)
↑ hospitalizations	(Intrator et al. 1999) ^{††}		(Spector et al. 1998)
↓ functional ability (mental status, activities of daily living, etc.)		(Bliesmer et al. 1998)	(Spector et al. 1998), (Porell et al. 1998), (Spector and Takada 1991), (Cohen and Spector 1996), (Porell and Caro 1998)
↑ incontinence	(Porell and Caro 1998)		(Porell et al. 1998)
↑ dehydration	(Chou 2002)		(Chou 2002)
↑ accidents			(Porell and Caro 1998)
↑ weight change			(Porell and Caro 1998)
↑ contractures			(Porell and Caro 1998)
Combined Process and Outcome			
↓ composite quality score	(Davis 1993), (Bravo et al. 1999)		(Cherry 1991)
↑ total federal audit deficiencies	(Harrington et al. 2000), (Harrington et al. 2001), (Castle 2001)		(Johnson-Pawlson and Infeld 1996), (Walshe and Harrington 2002), (Munroe 1990)

The far-left column represents indicators of poor quality. If an indicator of poor quality favored a FP facility, then the reference number for that study will appear in the FP column. Similarly, reference numbers for indicators of poor quality favoring NFP facilities appear in the NFP column. If a study found that there was no difference between NFP and FP, it appears in the far-right column.

^{**} Only in situations where there was no child or spouse visit within the first month of admission

^{††} p < 0.1

Figure 1: Study results stratified by study design

Figure 2: Study results stratified by risk-adjustment method