

Quality of care in for-profit and not-for-profit nursing homes: systematic review and meta-analysis

Vikram R Comondore, resident,¹ P J Devereaux, associate professor,² Qi Zhou, statistician,² Samuel B Stone, resident,³ Jason W Busse, research associate,² scientist,⁴ Nikila C Ravindran, resident,⁵ Karen E Burns, staff physician,^{6,7} Ted Haines, associate professor,² Bernadette Stringer, assistant professor,² Deborah J Cook, professor,² Stephen D Walter, professor,² Terrence Sullivan, president and CEO,⁸ Otavio Berwanger, professor,⁹ Mohit Bhandari, associate professor,² Sarfaraz Banglawala, resident,³ John N Lavis, associate professor,² Brad Petrisor, assistant professor,³ Holger Schünemann, professor,^{2,10} Katie Walsh, summer research assistant,² Neera Bhatnagar, reference librarian,¹¹ Gordon H Guyatt, professor²

¹Department of Medicine, University of British Columbia, Vancouver, BC, Canada V5Z 1M9

²Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, ON, Canada L8N 3Z5

³Department of Surgery, McMaster University

⁴The Institute for Work and Health, Toronto, ON, Canada M5G 2E9

⁵Department of Medicine, Division of Gastroenterology, University of Toronto, Toronto, M5T 2S8

⁶St Michael's Hospital, Toronto, M5B 1W8

⁷Keenan Research Centre and Li Ka Shing Knowledge Institute, Toronto, M5B 1W8

⁸Cancer Care Ontario, Toronto, M5G 2L7

⁹Department of Clinical Epidemiology, Federal University of Rio Grande do Sul, Porto Alegre-RS, Brazil

¹⁰Italian National Cancer Institute Regina Elena, Rome, 00144, Italy

¹¹Health Sciences Library, McMaster University

Correspondence to: P J Devereaux phlipj@mcmaster.ca

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ABSTRACT

Objective To compare quality of care in for-profit and not-for-profit nursing homes.

Design Systematic review and meta-analysis of observational studies and randomised controlled trials investigating quality of care in for-profit versus not-for-profit nursing homes.

Results A comprehensive search yielded 8827 citations, of which 956 were judged appropriate for full text review. Study characteristics and results of 82 articles that met inclusion criteria were summarised, and results for the four most frequently reported quality measures were pooled. Included studies reported results dating from 1965 to 2003. In 40 studies, all statistically significant comparisons ($P < 0.05$) favoured not-for-profit facilities; in three studies, all statistically significant comparisons favoured for-profit facilities, and the remaining studies had less consistent findings. Meta-analyses suggested that not-for-profit facilities delivered higher quality care than did for-profit facilities for two of the four most frequently reported quality measures: more or higher quality staffing (ratio of effect 1.11, 95% confidence interval 1.07 to 1.14, $P < 0.001$) and lower pressure ulcer prevalence (odds ratio 0.91, 95% confidence interval 0.83 to 0.98, $P = 0.02$). Non-significant results favouring not-for-profit homes were found for the two other most frequently used measures: physical restraint use (odds ratio 0.93, 0.82 to 1.05, $P = 0.25$) and fewer deficiencies in governmental regulatory assessments (ratio of effect 0.90, 0.78 to 1.04, $P = 0.17$).

Conclusions This systematic review and meta-analysis of the evidence suggests that, on average, not-for-profit nursing homes deliver higher quality care than do for-profit nursing homes. Many factors may, however, influence this relation in the case of individual institutions.

INTRODUCTION

Nursing homes provide long term housing, support, and 24 hour nursing care for people who are unable

to function independently. Conservative forecasts from the European Union suggest that the need for nursing home care will double in the next 40 years as the population ages.¹ Many nursing home residents are bound to the routines, diets, and treatments prescribed by the home where they reside. In addition, many of them are unable to advocate for themselves because of physical, medical, cognitive, or financial limitations.

Concerns about quality of care in nursing homes are widespread among academic investigators,²⁻⁵ the lay press,⁶⁻¹¹ and policy makers.¹² Whether a facility is owned by a for-profit or a not-for-profit organisation may affect structure, process, and outcome determinants of quality of care. In the United States, for example, two thirds of nursing homes are investor owned, for-profit institutions; in the United Kingdom, more than half of healthcare beds belong to independent nursing homes for older people, most of which are operated by for-profit institutions.¹³ The type of ownership of nursing homes in Europe varies; countries with previously dominant public healthcare systems (such as Poland) now seek privatisation.¹⁴ In Canada, 52% of nursing homes are in for-profit ownership, and not-for-profit care is evenly split between charitable or privately owned not-for-profit facilities and government or publicly owned not-for-profit facilities.¹⁵ Both for-profit and not-for-profit nursing homes may have both public and private funding.

Several investigators have assessed the relation between for-profit/not-for-profit status and quality of care.¹⁶ If quality or appropriateness of care varies significantly by ownership, this should influence government policies related to regulatory assessments and the use of public funds for nursing homes. The objective of this systematic review and meta-analysis was to examine the quality of care in for-profit and not-for-profit (privately and publicly owned) nursing homes to enhance the evidence base for public policy. This work is part of our series of systematic reviews

Evaluation of quality of studies used in meta-analyses: appropriate and inappropriate adjustments

Appropriate adjustments (0-5)

One point for each of:

- Having an adjusted analysis
- Adjusting for age
- Adjusting for severity of illness (comorbidities)
- Adjusting for presence or absence or severity of dementia
- Adjusting for payment status of residents (government funded v privately funded)

Inappropriate adjustments (yes/no)

Yes for adjusting for potential quality of care measures (that is, elements used to assess quality of care in a different study, such as pressure ulcer, restraint use, urinary catheterisation, staffing, or regulatory agency citations)

comparing health outcomes, quality and appropriateness of care, and payment for care in for-profit and not-for-profit care delivery institutions.¹⁷⁻¹⁹

METHODS

Search strategy

We used a multimodal search strategy focused on 18 bibliographical databases, personal files, consultation with experts, reviews of references of eligible articles, and searches of PubMed (for related articles) and SciSearch (for articles citing key publications).

A medical librarian (NB) used medical subject heading terms and keywords from a preliminary search to develop database search strategies. In each database, the librarian used an iterative process to refine the search strategy through testing several search terms and incorporating new search terms as new relevant citations were identified. The search included the following databases from inception to April 2006: Medline, Embase, HealthSTAR, CINAHL, Cochrane

Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Cochrane Central Database of Controlled Trials, NHS Economic Evaluation Database, AgeLine, Web of Science, Proquest Dissertations and Theses, ABI/INFORM Global, CB CA Reference, EconLit, Proquest European Business, PAIS International, and Worldwide Political Science Abstracts. Search terms included nursing home specific terms (such as nursing homes, homes for the aged, long-term care) combined with ownership terms (such as proprietary, investor, for-profit, and competition). The web appendix gives a complete description of our database search strategies.

Study selection

Eligibility criteria

Our inclusion criteria were as follows: patients—those residing in nursing homes in any jurisdiction; intervention—for-profit status of the institutions; comparator—not-for-profit status; and outcomes—measures of quality of care in for-profit and not-for-profit nursing homes.

Definition of quality of care

As described by the American Medical Association, quality of care is “care that consistently contributes to the improvement or maintenance of quality and/or duration of life.”²⁰ Quality of care was conceptualised by Donebedian as having inter-related structure, process, and outcome components.²¹ Structure pertains to resources used in care (such as staffing). Process refers to action on the patient (such as use of restraint and urethral catheterisation). Outcome indicators assess the patient’s end result (such as pressure ulcers). Many quality of care instruments have been proposed, although none has been universally accepted.²² Consequently, we used measures that authors defined as representing “quality of care” or “appropriateness of care,” provided that they defined a priori what constituted “good” or “poor” quality of care. The most frequently used quality measures were as follows.

Number of staff per resident or level of training of staff—The US Medicare/Medicaid nursing home regulations emphasise the importance of this measure of structure.²³ Studies have consistently shown a positive association between staffing and measures of both process and outcome quality.²⁴⁻²⁶

Physical restraints—Although use of physical restraints can prevent patients from injuring themselves, restraints diminish a patient’s self esteem and dignity. By restricting mobility, they lead to both physical deterioration and the formation of painful pressure ulcers.^{24,27} An Institute of Medicine report emphasised use of restraints as an important process measure.²³

Pressure ulcers—The importance of this outcome quality measure was also stressed by the Institute of Medicine. Pressure ulcers are preventable and are associated with pain and infection risk.²³

Regulatory (government survey) deficiencies—Deficiency citations by a regulatory body cover many aspects of

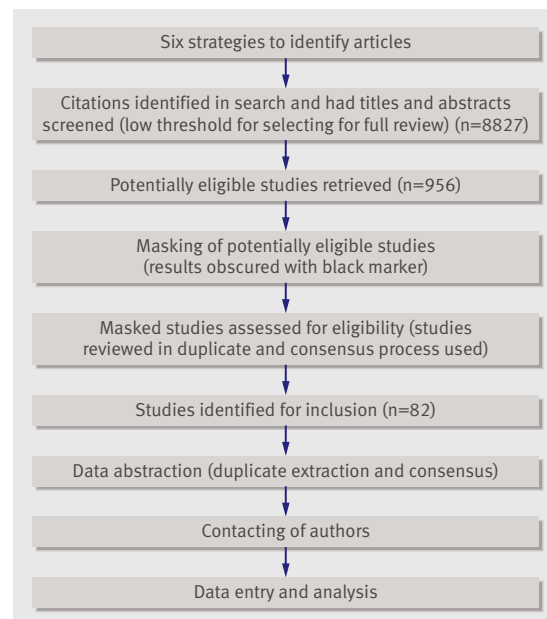


Fig 1 | Flow chart of steps in systematic review

Table 1 | Number of studies with quality of care comparisons favouring particular ownerships*: overall and staffing results

Quality of care measure	Summary of study characteristics	All statistically significant comparisons favoured NFP	Most statistically significant comparisons favoured NFP	Mixed results or direction unclear	Most statistically significant comparisons favoured FP	All statistically significant comparisons favoured FP
Quality overall with any quality of care measure (FP v NFP)	82 studies with data from 1965-2003 (1 from Australia, 5 from Canada, 1 from Taiwan, 74 from United States); 15 collected primary data, and 1 supplemented primary data with government survey data	40	2	37	0	3
Quality overall with any quality of care measure (FP v private NFP)	34 studies with data from 1965-2003 (1 from Australia, 1 from Canada, 38 from United States); 3 collected primary data, and 1 supplemented primary data with government survey data	16	2	16	0	0
More, or more extensively trained, staff	23 comparisons with data from 1965-2003 (2 from Canada, 21 from United States)	16	0	7	0	0

FP=for-profit; NFP=not-for-profit.

*Studies were classified into three categories: "all significant differences favour one ownership type" (at least one outcome with $P<0.05$ favoured either FP or NFP and all outcomes with $P<0.05$ favoured the same ownership—that is, all favoured NFP or all favoured FP); "most, but not all, significant differences favoured one ownership type" (at least four quality measures with $P<0.05$ and three times as many outcomes with $P<0.05$ favoured one ownership than favoured the other); "mixed results" (all other results).

nursing home care. Their strength lies in providing an overall measure of quality. Considerable work has gone into developing valid overall deficiency measures.⁴

Definition of nursing home

In keeping with other definitions,²⁸ we defined a nursing home as a home for elderly people in which most residents require daily nursing care. We included all long term care facilities that met this definition, including those studies that specifically evaluated "skilled nursing facilities" and special care facilities such as those for patients with Alzheimer's disease.

Assessment of study eligibility

Teams of two reviewers independently screened the titles and abstracts of all citations identified in our search, and if either reviewer thought that a citation might be eligible we retrieved the study for full text review. Research personnel who were not involved in

the screening or data abstraction process masked the study results from the text and tables of potentially eligible articles by using a black marker. Teams of two reviewers independently evaluated each masked article to determine eligibility. All disagreements were resolved by consensus, with discussions with the project lead (VRC) about eligibility criteria as required. In the event of ambiguity about whether the outcome was a measure of quality of care, we erred on the side of being inclusive.

Data extraction and study quality evaluation

Multiple teams of two reviewers independently abstracted data from included articles. We collected data on geographical area, year, data source, unit of measurement (number of residents or nursing homes), and quality of care measure. We developed and applied a 0-5 scale for evaluating appropriate adjustments and a yes/no scale for inappropriate adjustments (box). We explored whether appropriate and inappropriate

Table 2 | Number of studies with quality of care comparisons favouring particular ownerships: other results*

Quality of care measure	Summary of study characteristics	Favoured NFP (P<0.05)	Non-significantly favoured NFP	Direction unclear	Non-significantly favoured FP	Favoured FP (P<0.05)
Lower pressure ulcer prevalence	24 comparisons with data from 1984-2003 (1 from Canada, 23 from United States)	7	10	3	3	1
Lower physical restraint prevalence	21 comparisons with data from 1987-2003 (all from United States)	10	4	0	3	4
Fewer deficiencies on government surveys	19 comparisons with data from 1976-2003 (all from United States)	10	5	2	2	0
Lower urethral catheterisation prevalence	10 comparisons with data from 1984-2003 (all from United States)	4	2	3	0	1
Lower mortality	4 comparisons with data from 1984-99 (1 from Canada, 3 from United States)	1	2	1	0	0
Lower psychoactive drug use prevalence	4 comparisons with data from 1997-2003 (all from United States)	3	1	0	0	0
More feeding tubes	3 comparisons with data from 1990-9 (all from United States)	3	0	0	0	0
Lower hospital admission rate	3 comparisons with data from 1994-9 (1 from Canada, 2 from United States)	1	1	0	1	0

FP=for-profit; NFP=not-for-profit.

*Single overall comparisons were made for each of pressure ulcer, physical restraint, and deficiency outcomes, rather than multiple comparisons being made within the same study.

Table 3 | Characteristics of studies comparing private for-profit and private not-for-profit nursing home quality of care

Study	Place; year; data source*; No of residents or nursing homes	Factors controlled or adjusted for	
		Appropriate: age, severity of illness, severity of dementia, and payment status adjustments	Inappropriate: quality measures used in other studies; measures of intensity of care
Levey et al 1973 ^{w1}	Massachusetts; 1965 and 1969; state public health department; 129 homes in each year	Payment status	None
Cohen and Dubay 1990 ^{w2}	United States; 1981; MMACS; 694 FP and 235 private NFP homes	Severity of illness (long term care index of function), dementia (% confused or disoriented), payment status (% of Medicare patients in facility)	None
Elwell 1984 ^{w3}	New York state; 1976; Residential Health Care Facilities Report (NY); 258 FP and 130 private NFP homes	Severity of illness (ADLs), dementia (proportion of residents with totally impaired alertness), payment status (proportion of days paid for by Medicaid)	None
Lee 1984 ^{w4}	Iowa; 1980-1; Iowa Department of Health; 254 FP and 103 private NFP homes	Unadjusted analysis	Unadjusted analysis
Wiesbrod and Schlesinger 1986 ^{w5}	Wisconsin; 1976; State Division of Health; 220 FP and 134 private NFP homes	Adjusted analysis but none of 4 selected appropriate factors included	None
Lemke and Moos 1989 ^{w6}	United States; year not listed; research nurses; 44 FP and 44 private NFP homes	Unadjusted analysis	Unadjusted analysis
Pearson et al 1992 ^{w7}	Australia; 1988-90; authors collected data; 120 FP and 80 private NFP homes	Severity of illness (% of high need residents)	Staffing (% of nurses who were RNs)
Graber 1993 ^{w8}	North Carolina; 1991; OSCAR; 167 FP and 14 private NFP homes	Unadjusted analysis	Unadjusted analysis
Aaronson et al 1994 ^{w9}	Pennsylvania; 1987; MMACS; 269 FP and 180 private NFP homes	Varied by analysis: staffing—severity of illness (long term care index of resident function), payment status; pressure sores—age (% aged ≥85), severity of illness (long term care index of resident function), payment status; restraint use—dementia (proportion of confused patients per 100 beds), payment status (Medicaid use rate)	Varied by analysis: staffing—none; pressure sores—restraint use; restraint use—RN to resident ratio
Moseley 1994 ^{w10}	Virginia; 1983-5; state medical assistance services using long-term care information system; 174 homes with 2362 FP and 787 private NFP residents	Age, severity of illness (ADLs), dementia (oriented/disoriented)	None
Sainfort et al 1995 ^{w11}	Wisconsin; 1982; research teams; 44 FP and 46 private NFP homes	Unadjusted analysis	Unadjusted analysis
Holmes 1996 ^{w12}	Michigan; 1989; MMACS; 275 FP and 60 private NFP homes	Severity of illness (ADLs), payment status (% Medicaid patient days), dementia (% of residents with cognitive deficiencies)	None
Johnson-Pawlson and Infeld 1996 ^{w13}	Maryland; 1991-2; OSCAR; 137 FP and 55 private NFP homes	Severity of illness (ADLs), payment status (% of residents covered by Medicare)	Staffing (RN and full time equivalent nurse positions/patient)
Spector and Fortinsky 1998 ^{w14}	Ohio; 1994; MDS; 843 homes	Age, dementia (cognitive performance)	None
Spector et al 1998 ^{w15}	United States; 1987; NMES; 1695 FP and 535 private NFP homes	Age, dementia, payment status (Medicaid coverage %)	None
Hughes et al 2000 ^{w16}	Continental United States; 1997; OSCAR; 10 666 FP and 3342 private NFP homes	Dementia, payment status	Staffing (in facility model), antidepressant drug use
Troyer 2001 ^{w17}	Florida; 1994-6; OSCAR; unclear	Payment status (private pay/Medicaid/Medicare funding)	None
Chou 2002 ^{w18}	United States; 1984-94; NLTCs; 1770 FP and 1044 private NFP residents	Age, severity of illness (ADLs, before admission), dementia (cognitive score on admission)	None
Harrington et al 2002 ^{w19}	United States; 1997-8; OSCAR; 9009 FP and 3789 private NFP homes	Severity of illness (ADLs), dementia (in secondary analysis only), payment status (% Medicaid residents)	None
Grabowski and Hirth 2003 ^{w20}	United States; 1995; OSCAR; 11 174 FP and 4688 private NFP homes	Severity of illness (ADLs), payment status	None
Berta et al 2004 ^{w21}	Ontario; 1996-2002; RCFS; not clear	Unadjusted analysis	Unadjusted analysis
Grabowski and Angelelli 2004 ^{w22}	United States; 1998-2000; OSCAR and MDS; 9478 FP and 3434 private NFP homes	Adjusted analysis but none of 4 selected appropriate factors included	None
Grabowski and Castle 2004 ^{w23}	United States; 1991-9; OSCAR; 18 432 homes, selecting those with 5 consecutive yearly assessments with upper and lower quartile scores for each quality measure	Unadjusted analysis	Unadjusted analysis
Grabowski 2004 ^{w24}	Continental United States; 1996; MEPS and OSCAR; 815 homes, with 1856 FP and 673 private NFP residents	Age, severity of illness (ADLs), dementia, payment status	None
Grabowski et al 2004 ^{w25}	United States; 1998-9; MDS and OSCAR; 15 128 homes (13 819 for daily pain information, 13 169 for pressure ulcer information, 13 859 for physical restraint information)	Adjusted analysis but none of 4 selected appropriate factors included	None
Konetzka et al 2004 ^{w26}	United States; 1996-2000; OSCAR; 11 968 FP and 5077 private NFP homes	Severity of illness (ADLs), dementia (% with), payment status (% private pay)	None
Konetzka et al 2004 ^{w27}	United States; 1996; MEPS; 529 FP and 192 private NFP residents	Severity of illness (ADL dependence), dementia (cognitive performance), payment status (payer source)	Staffing (RNs and LPNs/100 residents, nursing assistants/100 residents)

Study	Place; year; data source*; No of residents or nursing homes	Factors controlled or adjusted for	
		Appropriate: age, severity of illness, severity of dementia, and payment status adjustments	Inappropriate: quality measures used in other studies; measures of intensity of care
Lapane and Hughes 2004 ^{w28}	Ohio; 1997 and 2000; MDS; 390 FP and 109 private NFP in 1997; 391 FP and 114 private NFP homes in 2000	Age, dementia, payment status (% of residents with Medicaid/Medicare)	None
Lapane and Hughes 2004 ^{w29}	IL, MA, MS, NY, OH, and SD; 2000; MDS and OSCAR; 1560 FP and 494 private NFP homes	Age, dementia (cognitive functioning), payment status (% of residents being paid for by Medicare/Medicaid)	Staffing (RN and LPN full time equivalents, and nursing assistants per 100 beds)
Rantz et al 2004 ^{w30}	Missouri; 2000-1; MDS and research nurses; 60 FP and 26 private NFP homes	Unadjusted analysis	Unadjusted analysis
Zhang and Grabowski 2004 ^{w31}	United States; 1987—MMACS, 1993—OSCAR; 5092 facilities for matched analysis between the 2 years	Severity of illness (ADL score), payment status (proportion Medicare funded)	None
Akinci and Krolkowski 2005 ^{w32}	Northeastern Pennsylvania; 2000-2; OSCAR; 46 FP homes and 38 private NFP homes	Unadjusted analysis	Unadjusted analysis
Bardenheier et al 2005 ^{w33}	United States; 1995, 1997, and 1999; NNHS; 1409 homes in 1995, 1488 in 1997, and 1423 in 1999	Age, payment status (payment source)	None
Zinn et al 2005 ^{w34}	United States; 2002-3; MDS; 10 763 FP, 4802 private NFP, 994 public	Adjusted analysis but none of 4 selected appropriate factors included	None

ADLs=activities of daily living; LPN=licensed practical nurse; FP=for-profit; NFP=not-for-profit; RN=registered nurse.

*MDS (minimum data set): quarterly survey of residents in US Medicaid certified facilities (resident level quality assessed); MMACS (Medicare and Medicaid Automated Certification System)/OSCAR (Online Survey, Certification and Reporting): facility level survey completed every 9-15 months for US Medicare/Medicaid certification (OSCAR replaced MMACS in 1991); MEPS (Medical Expenditure Panel Survey): see NMES; NMES (National (US) Medical Expenditure Survey): survey of nationally representative sample of people in nursing and personal care homes and facilities for mentally challenged people (collects information on health expenditures); NLTC (National (US) Long Term Care Survey): survey of nationally representative sample of elderly, disabled, Medicaid beneficiaries in community or institutional settings (tracks expenditures, family caregiving, and Medicaid service use); NNHS (National (US) Nursing Home Survey): survey of nationwide sample of nursing homes conducted by the National Center for Health Statistics (includes non-Medicare/Medicaid facilities; tracks service use and costs); OSCAR: see MMACS; RCFS (Residential Care Facilities Survey): Statistics Canada census of residential care facilities.

adjustment explained heterogeneity. Disagreements were resolved by consensus, with consultation of a third investigator when resolution could not be achieved.

Statistical analysis

Many studies had for-profit versus not-for-profit comparisons including multiple measures of quality of care. When summarising results, we classified studies into three categories. (1) "All statistically significant differences favoured one ownership type"—studies fulfilled two requirements: at least one outcome with $P < 0.05$ favoured either for-profit or not-for-profit and all outcomes with $P < 0.05$ favoured the same funding structure (that is, all favour not-for-profit or all favour for-profit). (2) "Most but not all significant differences favoured one ownership type"—studies fulfilled two requirements: at least four quality measures had $P < 0.05$ and three times as many outcomes with $P < 0.05$ favour one ownership as favour the other. (3) "Mixed results"—all other results.

We pooled outcomes by using random effects models separately for the most frequently used quality of care measures: number of staff or level of training of staff, pressure ulcers, physical restraints, and regulatory (government survey) deficiencies. We considered $P < 0.05$ to be statistically significant.

We used prevalence, rather than incidence, in reporting physical restraint use and pressure ulcers based on authors' reporting of study outcomes. We report the odds ratios and 95% confidence intervals for these outcomes. When necessary, we converted other effect measures to odds ratios by using available data. For example, if the study reported a relative risk (RR) and the event proportion in for-profit nursing homes (P_{fp}), the odds ratios was calculated as $(RR \times (1 - P_{fp})) / (1 - P_{fp} \times RR)$. Similarly, when the studies

presented a β coefficient (an adjusted result representing difference in event proportions in for-profit and not-for-profit nursing homes, $P_{fp} - P_{nfp}$), if the event proportion (P_c) in the study population and sample sizes (N_{fp} and N_{nfp}) of the nursing homes in for-profit and not-for-profit were provided, solving the following two equations for P_{nfp} and P_{fp} , we computed the odds ratio: $P_{fp} - P_{nfp} = \beta$ and $(P_{fp} \times N_{fp} + P_{nfp} \times N_{nfp}) / (N_{fp} + N_{nfp}) = P_c$. For the outcomes of deficiencies and staffing, we used the ratio of the effect from not-for-profit to for-profit nursing homes in pooling studies.

We avoided repetition of data on the same resident from different studies by preferentially using data from the larger dataset when necessary. One author (GHG) made these decisions by using blinded copies of articles while unaware of study outcomes. We requested supplemental data when available data was insufficient for analysis. We evaluated heterogeneity with both a χ^2 test and the I^2 statistic, interpreting a low I^2 as 25% or lower and a high I^2 as 75% or higher.²⁹ We examined funnel plots for evidence of publication bias. We applied a univariate meta-regression random effects model to each pooled outcome to evaluate potential sources of heterogeneity.

Hypotheses to explain heterogeneity

Our a priori hypotheses for sources of potential heterogeneity included analysis of privately owned and publicly owned nursing facilities in the same category, appropriate and inappropriate adjustments, the year of data collection, geography and political environment, and primary compared with secondary data collection. We did univariate meta-regression for each potential cause of heterogeneity. We present subgroup results if the likelihood of the differences between subgroups being due to chance was $P < 0.10$. Our a priori

Table 4 | Quality of care measures and outcomes of studies comparing private for-profit and private not-for-profit nursing homes (favoured directions represent those with higher quality care)

Study	Quality measure	Outcome
Levey et al 1973 ^{w1}	Dietary options; doctor's order book showing activity; nursing kardex showing activity; activities for patients' availability (religious, recreation); patients' records being complete; personal care availability; physical plant utilities; restorative services availability; staffing—No of nursing shifts not covered per week, licensed nursing hours, total nursing hours	Mixed results: not significant for all measures (direction not noted)
Cohen and Dubay 1990 ^{w2}	Staffing: RNs, LPNs per bed	Mixed results: non-significantly favoured private NFP
Elwell 1984 ^{w3}	Multi-bed rooms (proportion of patients in them); staffing—allied health hours/resident/day, nursing hours/resident/day, physician hours/resident/week, RN hours/resident/day	Most significant comparisons favoured private NFP: having fewer multi-bed rooms favoured FP (P<0.001); all other measures favoured private NFP (P<0.025)
Lee 1984 ^{w4}	Nursing and personal care delivery index (by inspection and resident interviews on 17 items); quarterly care review completion; residents' satisfaction by interview; room conditions ratings by inspection; staffing—staff/resident ratio	Mixed results: resident satisfaction by interview and room conditions by inspection favoured FP (P<0.05); favoured private NFP for quarterly care review completion and staffing; non-significantly favoured private NFP for nursing and personal care delivery (P=0.077)
Wiesbrod and Schlesinger 1986 ^{w5}	Deficiencies in Wisconsin licensing survey	Mixed results: non-significantly favoured private NFP for church owned homes; non-significantly favoured FP for non-church owned (P<0.1)
Lemke and Moos 1989 ^{w6}	Service availability; staff richness; staffing—No of full time equivalent staff members/resident; subjective comfort; subjective control; subjective rapport; subjective resident autonomy; subjective security	All significant (P<0.05) comparisons favoured private NFP: only significant difference was for subjective rapport, which favoured private NFP; private NFP also offered more comfortable physical environment and more health services
Pearson et al 1992 ^{w7}	Freedom of choice; healthcare treatment; home-like environment; privacy and dignity; social independence; variety of experience	All significant (P<0.05) comparisons favoured private NFP: non-significantly favoured private NFP for having healthcare treatment, privacy, and dignity; favoured private NFP for all others
Graber 1993 ^{w8}	Deficiencies in OSCAR; ombudsman office complaints	All significant (P<0.05) comparisons favoured private NFP: non-significantly favoured private NFP overall; non-significantly favoured private NFP for deficiencies, but significantly favoured private NFP for complaints (P<0.01)
Aaronson et al 1994 ^{w9}	Pressure ulcer prevalence; restraint use prevalence; staffing—RNs, LPNs, and aides per 100 beds	Mixed results: favoured FP for pressure ulcer (P<0.05); favoured private NFP for staffing (P<0.05); non-significantly favoured private NFP for restraint use
Moseley 1994 ^{w10}	Composite measure of inappropriate care (underprovision of routine medical care, skilled nursing care, and physical therapy or overprovision of psychotropic drugs, physical restraints, or urinary catheterisation); functional improvement over 9 months	All significant (P<0.05) comparisons favoured private NFP: favoured private NFP (P<0.001) for composite measure; non-significantly favoured private NFP for functional improvement
Sainfort et al 1995 ^{w11}	Outcome based quality such as grooming, mood, awareness of condition, physical condition, promotion of family ties, continuity of lifestyle; process based quality such as plan of care, medical records, planning and evaluation, admission/transfer, residents' influence, staff's attitudes to residents, staff communication, communication between residents, variety/adequacy of activities, match of residents to activities, volunteer programme, meal variety/presentation, nutrition/diet	Mixed results: non-significantly favoured private NFP for outcome measures; difference not stated for process measures
Holmes 1996 ^{w12}	Deficiencies in MMACS per facility	Favoured private NFP (P value not stated)
Johnson-Pawlson and Infeld 1996 ^{w13}	Deficiencies in Long-Term Care Survey	Non-significantly favoured private NFP
Spector and Fortinsky 1998 ^{w14}	Pressure ulcer prevalence	Non-significantly favoured private NFP
Spector et al 1998 ^{w15}	Functional disability at year end; hospital admission incidence; infection prevalence; mortality during 1987; pressure ulcer prevalence	All significant (P<0.05) comparisons favoured private NFP: non-significantly favoured FP for functional disability and hospital admission incidence; non-significantly favoured private NFP for pressure ulcer prevalence; favoured private NFP for infection prevalence (P<0.05); non-significantly favoured private NFP for mortality (P<0.1)
Hughes et al 2000 ^{w16}	Psychotropic drug use (use is poorer quality than no use); deficiencies in OSCAR per resident day; staffing—No of RN hours/day, total No of nursing hours per patient day	Favoured private NFP (for all measures) (P<0.001)
Troyer 2001 ^{w17}	Deficiencies in OSCAR per resident day	Favoured private NFP (P<0.05)
Chou 2002 ^{w18}	Mortality; prevalence of dehydration, pressure ulcers, and urinary tract infection	Mixed results: non-significantly favoured private NFP for all measures except pressure ulcer prevalence, which non-significantly favoured FP
Harrington et al 2002 ^{w19}	Deficiencies in OSCAR (quality care)*; staffing—(RN + LVN/LPN hours)/resident day and nursing assistant hours/resident day	Favoured private NFP for all three measures
Grabowski and Hirth 2003 ^{w20}	Prevalence of feeding tube, pressure ulcers, restraint use, and urinary catheterisation; staffing—proportion of total staff who are RNs, total nurse staff/resident/day	Most significant comparisons favoured private NFP: favoured private NFP (P<0.01) for all measures except urinary catheterisation prevalence, which favoured FP (P<0.01)
Berta et al 2004 ^{w21}	Staffing—RN + nursing assistant hours/resident/day, other direct care staff hours/resident/day	Favoured private NFP (P<0.05) in comparison of FP and (private NFP + public + FP) for all measures
Grabowski and Angelelli 2004 ^{w22}	Pain reported by residents; pressure ulcer prevalence; restraint use prevalence	Mixed results: favoured FP (P<0.05) for pain reported by residents and restraint use prevalence; favoured private NFP for pressure ulcer prevalence
Grabowski and Castle 2004 ^{w23}	Prevalence of feeding tube, pressure ulcers, restraint use, and urinary catheterisation	Mixed results: favoured private NFP (P<0.001) for consistently poor quality homes for each measure; favoured FP (P<0.001) for consistently good quality homes for each quality measure
Grabowski 2004 ^{w24}	Deficiencies in health/quality of care in OSCAR	Non-significantly favoured FP

Study	Quality measure	Outcome
Grabowski et al 2004 ^{w25}	Pressure ulcer prevalence	Favoured private NFP (P<0.05)
Konetzka et al 2004 ^{w26}	Deficiencies in OSCAR; staffing—nursing assistant hours/resident day, RN hours/resident day, RN + LPN hours/resident day	All significant (P<0.05) comparisons favoured private NFP
Konetzka et al 2004 ^{w27}	Transfer to hospital rate for patients with pneumonia	Favoured private NFP (P<0.01)
Lapane and Hughes 2004 ^{w28}	Depression treatment prevalence—assessed by antidepressant use and specifically by SSRI use	Non-significantly favoured FP for both measures
Lapane and Hughes 2004 ^{w29}	Depression treatment prevalence—assessed by antidepressant use and specifically by use of antidepressants other than tricyclic antidepressants	All significant (P<0.05) comparisons favoured private NFP: favoured private NFP (P<0.05) for antidepressant use, and non-significantly favoured private NFP for not using tricyclic antidepressants
Rantz et al 2004 ^{w30}	Performance on MDS quality indicators, confirmed by research nurses	Non-significantly favoured private NFP
Zhang and Grabowski 2004 ^{w31}	Prevalence of pressure ulcers, restraint use, and urinary catheterisation	All significant (P<0.05) comparisons favoured private NFP: favoured private NFP for all measures (P<0.001) except restraint use prevalence, which non-significantly favoured private NFP
Akinci and Krolikowski 2005 ^{w32}	Deficiencies in quality of care in Pennsylvania database; staffing—certified nursing assistant hours/day, LPN/LVN hours/day, RN hours/day, total staff hours/day	All significant (P<0.05) comparisons favoured private NFP: non-significantly favoured private NFP (P<0.05) for deficiencies, certified nursing assistant hours, and LPN/LVN hours; favoured private NFP for RN hours and total staff hours
Bardenheier et al 2005 ^{w33}	Vaccination for pneumococcus (% of homes)	Non-significantly favoured private NFP
Zinn et al 2005 ^{w34}	Prevalence of infection, pain, pressure ulcers, pressure ulcers adjusted for facility admission profile or loss of ADLs, and restraint use	Mixed results: favoured private NFP (P<0.1) for all measures except pain prevalence, which favoured FP (P<0.01)

ADLs=activities of daily living; FP=for profit; LPN=licensed practical nurse; LVN=licensed vocational nurse; MDS=minimum data set survey; NFP=not for profit; OSCAR=Online Survey Certification and Reporting; RN=registered nurse; SSRI=selective serotonin reuptake inhibitor.

*Related to resident assessment, quality of nursing services, dietary services, physician services, rehabilitative services, dental services, pharmacy services, and infection control.

hypotheses to explain heterogeneity are detailed below.

Analysing privately and publicly-owned not-for-profit facilities in the same category—We hypothesised that privately owned not-for-profit facilities may deliver superior care compared with publicly owned facilities, and thus comparisons between not-for-profit and for-profit facilities may yield different results if publicly owned facilities are included, as seen in previous studies.¹⁹ We decided, a priori, to present the result of a for-profit versus privately owned not-for-profit meta-analysis separately from a for-profit versus not-for-profit meta-analysis regardless of whether privately or publicly owned not-for-profit status explained heterogeneity of the pooled estimate.

Extent of appropriate and inappropriate adjustment—We have defined concepts of appropriate and inappropriate adjustment in the data extraction section above. We compared studies with above median scores against those with scores below the median for assessment of appropriateness. Similarly, we compared studies with inappropriate adjustment against those without inappropriate adjustment, excluding studies that did not have an adjusted analysis.

Year of data collection—Legislation on quality of care in nursing homes was introduced in the United States under the Federal Nursing Home Reform Act (part of Omnibus Budget Reconciliation, 1987). Most of the studies we reviewed were from the United States. As a result, we compared data collected before and during 1987 versus after 1987.

Geography—We compared data collected inside and outside the United States, as geography and political environment are potential sources of heterogeneity.

Primary versus secondary data collection—We compared data acquired by primary (direct) data collection with those acquired by secondary (administrative agency) data collection.

RESULTS

Of the 8827 articles screened, we selected 956 for blinded full text review. Figure 1 details the steps in this review. Our agreement on the eligibility of studies was very good ($\kappa=0.73$ on the basis of two questions: does the study evaluate nursing homes, and does the study compare quality of care in for-profit and not-for-profit facilities?). Disagreements stemmed from implied but not stated definitions in the articles regarding good and poor quality and implied but not stated quality of care measures. We requested supplementary data from 36 authors; 25 responded, of whom three did new analyses in response to our queries.

We found 82 studies, spanning 1965 to 2003, comparing for-profit and not-for-profit nursing homes.^{w1-w82} We found 40 studies in which all statistically significant analyses (P<0.05) favoured not-for-profit homes and three in which all statistically significant analyses favoured for-profit homes. Similarly, 34 studies compared for-profit and privately owned not-for-profit nursing homes. In 16 of these, all statistically significant comparisons favoured higher quality in privately owned not-for-profit homes; none had all statistically significant analyses favouring higher quality in for-profit homes.

Tables 1 and 2 present a summary of the characteristics and outcomes of all studies included in this review and summarise the results of comparisons for quality measures evaluated by three or more studies. Tables 3 and 4 present the detailed study characteristics and

Table 5 Characteristics of studies comparing for-profit and not-for-profit nursing home quality of care (public and private NFP homes)

Study	Place; year; data source*; No of residents or nursing homes	Factors controlled or adjusted for	
		Appropriate: age, severity of illness, severity of dementia, and payment status adjustments	Inappropriate: quality measures used in other studies; measures of intensity of care
Winn 1974 ^{w35}	Washington state; 1971; mailed questionnaire to administrators; 24 FP, 24 NFP	Unadjusted analysis	Unadjusted analysis
Riporttella-Muller and Slesinger 1982 ^{w36}	Wisconsin; July 1977-June 1978; Wisconsin Department of Health and Wisconsin Nursing Homes Ombudsman Program; 462 homes	Adjusted analysis but none of 4 selected appropriate factors included	None
Nyman 1984 ^{w37}	Wisconsin; 1978-9; 1979 Wisconsin Nursing Home Survey, Quality Assurance Project Pre-test, and Cost-Quality Study dataset; 88 cases of nursing home violations (No of nursing homes not indicated)	Payment source; severity of illness (need for intermediate, personal, or residential care by payment source)	None
Brunetti et al 1990 ^{w38}	North Carolina; 1987; surveys to nursing home administrators; 236 nursing homes (164 FP, 40 NFP)	Certification (Medicare only, Medicaid only, or Medicare and Medicaid)	None
Munroe 1990 ^{w39}	California; 3 December 1985 to 30 December 1986; Office of Statewide Health Planning and Development of California; 455 homes	Illness severity (ADLs/IADLs); payment status	Proportions of residents with catheters and decubiti; ratio of RN to LVN hours per resident day
Cherry 1991 ^{w40}	Missouri; 1984; Missouri State Board of Health; 134 homes	Payment status	RN, LPN, aide hours per resident
Kanda and Mezey 1991 ^{w41}	Pennsylvania; 1980, 1982, 1985, 1987; Long Term Care Facilities Survey conducted by State Health Data Center, Pennsylvania Department of Health; 407 homes for 1980, 395 for 1982, 395 for 1985, 461 for 1987	Age of residents (in RN staffing comparison, when each year was analysed separately)	None
Cherry 1993 ^{w42}	Missouri; 1984; Missouri Division of Aging Routine Inspections and Missouri State Board of Health; 210 nursing homes	Adjusted analysis but none of 4 selected appropriate factors included	Nurse ratio
Zinn et al 1993 ^{w43}	Pennsylvania; 1987; MMACS, Pennsylvania Long Term Care Facility Questionnaire; 438 homes	Payment status	RNs per resident
Zinn 1993 ^{w44}	46 continental US states; 1987; AHCA and MMACS; approximately 14 000 homes	% private pay; % confused; % Medicare; functional severity index	RN, LPN, aide staffing; rate of catheter use, restraint use, and tube feeding
Graber and Sloane 1995 ^{w45}	North Carolina; 1991; OSCAR, North Carolina Division of Medical Assistance, Office of State Health Planning; 195 homes	Illness severity (% intubated patients, facility disability level, % with incontinent residents)	RN ratio; LVN/nursing assistant ratio; % of residents on psychotropic drugs
Christensen and Beaver 1996 ^{w46}	Oregon; 1991-4; Oregon Board of Examiners of Nursing Home Administrators and State surveyors reports; 147 nursing homes (37 NFP or government and 110 FP)	Unadjusted analysis	Unadjusted analysis
Mukamel 1997 ^{w47}	New York (excluding New York City); 1986-90; New York State Department of Health; approximately 550 homes, 42.3% of residents in proprietary homes, 39.9% of residents in voluntary NFP homes, 17.8% in public homes	Unadjusted analysis	Unadjusted analysis
Anderson et al 1998 ^{w48}	Texas; 1990; Texas Medicare Nursing Facility Cost Reports and Client Assessment, Review, and Evaluation form; 494 nursing homes	% of private pay	RN, LPN, aide staffing
Bliesmer et al 1998 ^{w49}	Minnesota; 1988-91; Minnesota Department of Human Services Long-Term Care Division facility profiles and assessments of residents by RNs; 4103 residents in 1988, 4676 residents in 1989, and 4672 residents in 1990	Age	Compliance with regulations
Castle and Fogel 1998 ^{w50}	United States; 1995; OSCAR, ARF; 15 074 homes	Illness severity (ADLs, incontinent bladder/bowel); payment status	Psychotropic drug use; staffing (high/medium/low RNs, LPNs, nursing assistants per resident)
Anderson and Lawhome 1999 ^{w51}	Advance care directive prevalence; feeding tube prevalence; drug errors noted on survey; pressure ulcer prevalence; restraint use prevalence; staffing—direct care hours per resident per day; urinary catheterisation prevalence	All significant (P<0.05) comparisons favoured NFP: non-significantly favoured NFP for drug errors, non-significantly favoured FP for restraint use prevalence; favoured NFP for all other comparisons	None
Bravo et al 1999 ^{w52}	Eastern townships of Quebec (Canada); 1996; resident interviews; 301 residents from 88 nursing homes	Age; cognitive functioning (MMMS score); functional autonomy (SMAF score)	Staff to resident ratio
Castle 1999 ^{w53}	CA, CT, IA, MD, MA, OH OR, TN, TX, and VA: 1990 and 1993, Resident Assessment Instrument and OSCAR; 268 facilities (90% in each cohort FP)	Age; ADLs; severity of illness; severity of dementia; payment status	Staffing levels
Ballou 2000 ^{w54}	Wisconsin; 1987-95; Wisconsin Centre for Health Statistics and Wisconsin Bureau of Quality Assurance	Unadjusted analysis	Unadjusted analysis
Castle 2000 ^{w55}	United States; 1997; OSCAR; 17 024 homes	Dementia; ADLs	Staffing (RNs, LPNs, nurse aides, specialists per resident and nurse aide training); pressure ulcer incidence; urinary catheterisation; use of psychoactive drugs
Castle 2000 ^{w56}	United States; 1992 and 1997; OSCAR; 15 455 homes in 1992; 16 533 homes in 1997	ADLs; payment status	Staffing (RNs, LPNs, nurse aides, rehabilitation assistants per 100 beds); antipsychotic drug use; residents with psychiatric problems
Castle 2001 ^{w57}	United States; 1999; OSCAR; 420 nursing facilities and OSCAR 1999 (~16 000 homes)	ADLs; dementia; payment status	Catheterisation; psychoactive drug use; physical restraint use; pressure ulcers; psychological disorders
Castle 2001 ^{w58}	United States; 1997; OSCAR; 16 871 homes	Age; ADLs	None

Study	Place; year; data source*; No of residents or nursing homes	Factors controlled or adjusted for	
		Appropriate: age, severity of illness, severity of dementia, and payment status adjustments	Inappropriate: quality measures used in other studies; measures of intensity of care
Castle 2001 ^{w59}	United States; 1992-7 and 1999; OSCAR (1992-7); 13 162 nursing homes	ADLs; private pay occupancy	Nurse staffing
Dubois et al 2001 ^{w60}	Eastern townships of Quebec (Canada); 1996; resident interviews; 88 nursing homes	Age	Staff to resident ratio; percentages of professionals among staff
Keith 2001 ^{w61}	A "Midwestern state"; 2 year period (year not specified); primary mail questionnaire and Area Agencies on Aging; questionnaire data from 633 volunteers and 1886 records	Adjusted analysis but none of 4 selected appropriate factors included	None
O'Neill et al 2001 ^{w62}	United States; 1999; OSCAR; 1098 homes	ADLs; dementia	Staffing (administration, medical director, RNs and LPNs, nurse aides per 10 residents)
Castle 2002 ^{w63}	United States; 1996-9; OSCAR; 14 042 homes	ADLs; payment status	Psychiatric problems
Lee et al 2002 ^{w64}	Taiwan; 1999; Quality Assessment Index; 28 homes (12 chain/FP, 12 independent/FP, and 4 NFP)	Adjusted analysis but none of 4 selected appropriate factors included	Ratio of nurses to average number of daily residents
Allen et al 2003 ^{w65}	Connecticut; 1998-2000; Connecticut Ombudsman Reporting System; 3443 complaints combined with related data from state's 261 nursing homes	Medicaid percentage	Nurse/resident ratio
Allen et al 2003 ^{w66}	Connecticut; 1998-2000; Long-Term Care Ombudsman Program complaint data; 3360 complaints from 261 nursing homes	Medicaid occupancy	Staffing (full time employee ratio of RNs, LPNs, and certified nursing assistants to total number of beds/facility)
Anderson et al 2003 ^{w67}	Texas; date of survey administration not provided (secondary data from 1995); survey data from nursing home staff and 1995 Texas MDS; 164 nursing homes	Adjusted analysis but none of 4 selected appropriate factors included	None
Castle and Banaszak-Holl 2003 ^{w68}	United States; 1999; OSCAR; 15 834 homes	Dementia; severity of illness (ADLs)	None
Harrington and Swan 2003 ^{w69}	California; 1999; state cost reports; 1155 homes	Payment status	None
Weech-Maldonado et al 2003 ^{w70}	NY, KS, VT, ME, and SD; 1996; Health Care Financing Administration Investment Analyst Nursing Home Database (MDS+, OSCAR)	Adjusted analysis but none of 4 selected appropriate factors included	None
Baumgarten et al 2004 ^{w71}	Maryland; 1992-5; interviews with significant others or MDS+; 59 homes (1938 residents)	Unadjusted analysis	Unadjusted analysis
Lau et al 2004 ^{w72}	United States; 1996; MEPS NHC, 3372 residents	Age; Medicaid coverage; mental status; ADL limitations	RN to non-RN ratio; RN to resident ratio; influenza vaccination percentage
Castle and Engberg 2005 ^{w73}	MO, TX, CT, and NJ; 2003; primary data on staff turnover from mailed survey, OSCAR for remaining information; 526 homes	Illness severity (ADLs, incontinent bladder/bowel); dementia	Staffing (full time equivalent RNs, LPNs, nursing assistants/100 beds)
Chesteen et al 2005 ^{w74}	Utah; 1999; survey of certified nursing assistants, Utah Medicare/Medicaid certification program, and operational data reported to the state of Utah; 890 certified nursing assistants at 42 nursing homes	% Medicaid	None
Gruber-Baldini et al 2005 ^{w75}	4 US states; year of data acquisition unclear; survey of resident care supervisors; 347 residents with dementia in 10 homes and 35 residential care/assisted living facilities	Cognitive status	% of supervisory staff trained; % of direct care providers trained
Intrator et al 2005 ^{w76}	United States (minus Alaska, District of Columbia, Hawaii, and Puerto Rico); 1993 to 2002; OSCAR and recent survey done by authors; 137 190 surveys from 17 635 distinct nursing facilities	Residents not paid for by Medicare or Medicaid (%), Medicare residents (%)	Total nurse hours per patient day ^{4.55}
McGregor et al 2005 ^{w77}	British Columbia; 2001; British Columbia Labour Relations Board; 167 homes	Severity of illness (levels of care)	None
Starkey et al 2005 ^{w78}	NY, ME, VT, and SD; 1996; MDS+, OSCAR; 1121 homes	Payment status	None
Stevenson 2005 ^{w79}	Massachusetts; 1998-2002; nursing home complaints received by Massachusetts DPH, OSCAR, and MDS QI; 539 nursing homes	ADLs	Survey deficiencies; staffing (nurse, aide); indwelling catheter; pressure sores
White 2005 ^{w80}	United States; 1997, 2001; OSCAR; ~10 000 homes in each year (unclear from article)	Payment status	None
Williams et al 2005 ^{w81}	4 US states; year of data acquisition unclear; primary survey of resident care supervisors; 331 residents with dementia in 10 homes and 35 residential care/assisted living facilities	Cognitive status	Staffing
McGregor et al 2006 ^{w82}	British Columbia; 1 April-1 August 1999; British Columbia Linked Health Database; 43 065 residents	None for crude analysis	None for crude analysis

ADLs=activities of daily living; DON=director of nursing; FP=for profit; IADLs=instrumental activities of daily living; LPN=licensed practical nurse; LVN= licensed vocational nurse; MMMS=modified mini-mental state examination; NFP=not for profit; RN=registered nurse; SMAF=functional autonomy measurement system.

*AHCA=American Health Care Association; ARF=Area Resource File; DPH=Department of Public Health; HCFA=Health Care Financing Administration; SAGE=Systematic Assessment of Geriatric Drug Use via Epidemiology; see table 3 for others.

Table 6 | Quality of care measures and outcomes of studies comparing for-profit and not-for-profit nursing homes (public and private NFP homes): favoured directions represent those with higher quality care

Study	Quality measure	Outcome
Winn, 1974 ^{w35}	Staffing—No of equivalent hours per patient day (1 RN hour=1 h; other employees' hours in proportion to 1 as their salary is to that of an RN), aide/orderly hours per patient day, LPN hours per patient day RN hours per patient day, total nursing care hours per patient day	Non-significantly favoured NFP for all comparisons
Riporttella-Muller and Slesinger 1982 ^{w36}	Complaints to Wisconsin Nursing Homes Ombudsman Program; deficiencies in Wisconsin Office of Quality Compliance survey	All significant (P<0.05) comparisons favoured NFP: favoured NFP (P<0.001) for complaints; not significant (direction unclear) for deficiencies
Nyman 1984 ^{w37}	No of Medicaid violations weighted by severity in 1979, and composite variable for Wisconsin's Quality Assurance Project; each quality measure examined with 2 models	All significant (P<0.05) comparisons favoured FP: for violations, one model significantly favoured FP (P<0.05) and the other non-significantly favoured FP; for the composite variable, non-significantly favoured FP and NFP in two different models
Brunetti et al 1990 ^{w38}	Cardiopulmonary resuscitation policy prevalence and quality of policy compared with 10 model criteria	Mixed results: presence of policy, non-significantly favoured FP; quality of policy, difference not noted
Munroe 1990 ^{w39}	Deficiencies at California state licensing "276 health deficiencies," assessed for licensing (state) and certification (Medicare and Medicaid); staffing (turnover)	All significant (P<0.05) comparisons favoured NFP: non-significantly favoured FP for deficiencies; favoured NFP for staffing (P<0.001)
Cherry 1991 ^{w40}	Aggregate measure of staffing hours, pressure ulcer prevalence, urethral catheterisation, urinary tract infections/resident, and antibiotic use (poorly explained)	Non-significantly favoured NFP (only one aggregate outcome reported)
Kanda and Mezey 1991 ^{w41}	Staffing: RN staffing—No of full time RNs/100 beds, No of part time RNs/100 beds, total No of nursing staff/100 beds, proportion of part time and full time RNs to total nursing staff	All significant (P<0.05) comparisons favoured NFP: favoured NFP for part time RNs/100 beds (P<0.001), total nursing staff/100 beds (P<0.001); non-significantly favoured NFP for full time RNs/100 beds, proportion of full time and part time RNs to total nursing staff
Cherry 1993 ^{w42}	Poor nursing care (composed of four items) and non-compliance (defined as infraction in any of eight federally established categories of inspection)	All significant (P<0.05) comparisons favoured NFP; FP showed non-significantly more poor care and significantly greater non-compliance (P<0.01)
Zinn et al 1993 ^{w43}	Mortality—deaths per 100 residents; prevalence of pressure ulcers, restraint use, and urethral catheterisation	Non-significantly favoured NFP for all measures
Zinn 1993 ^{w44}	Staffing (RNs per resident, LPNs per resident, NAs per resident); catheter use rate; restraint use rate; tube fed rate; % not toileted	Mixed results: FP significantly associated with fewer RNs per resident, more LPNs per resident, higher catheter use rate, higher restraint use rate, and higher % not toileted; FP non-significantly associated with more NAs per resident and higher tube fed rate
Graber and Sloane 1995 ^{w45}	Restraint use prevalence at 1991 North Carolina Annual Survey	Non-significantly favoured NFP
Christensen and Beaver 1996 ^{w46}	Surveys of health and safety deficiencies and life safety code deficiencies	Significantly favoured NFP (P<0.005), meaning FP had more deficiencies
Mukamel 1997 ^{w47}	Deterioration of decubitus ulcers; physical restraint use prevalence; dehydration rates; deterioration in ADLs	Mixed results: FP associated with worse outcomes for deterioration in decubitus ulcers (P=0.004) and physical restraints (P=0.0001) and better outcomes for dehydration rates (P=0.0001); no significant difference for accident rates and No of deficiencies
Anderson et al 1998 ^{w48}	Average resident outcomes concerning verbal/physical aggression; other disruptive behaviour; geriatric-chair, wrist-mitten or vest-belt restraints; contracture; pressure ulcer; dehydration; urinary tract infection; fracture within preceding 3 months; and percentage improvements in resident outcomes between two time points	Not significant (direction not noted)
Bliesmer et al 1998 ^{w49}	Change in total dependence score (TDS) based on sum of eight ADLs: dressing, grooming, bathing, eating, bed mobility, transferring, walking and toileting	Mixed results: when deaths and discharges were excluded from the TDS scores, ownership status was no longer significant; FP status was significantly associated with higher chances of discharge in 2 of the 3 years examined (1990 (P<0.001) and 1991 (P<0.01)); NFP status was significantly associated with higher chances of death in 2 of the 3 years examined (1990 and 1991, P<0.001 for both)
Castle and Fogel 1998 ^{w50}	Restraint use prevalence	Significantly favoured FP (P<0.001)
Anderson and Lawhorne 1999 ^{w51}	Advance care directive prevalence; feeding tube prevalence; drug errors noted on survey; pressure ulcer prevalence; restraint use prevalence; staffing—direct care hours per resident per day; urinary catheterisation prevalence	All significant (P<0.05) comparisons favoured NFP: non-significantly favoured NFP for drug errors, non-significantly favoured FP for restraint use prevalence; favoured NFP for all other comparisons
Bravo et al 1999 ^{w52}	QUALCARE scale*	Not significant (direction not noted)
Castle 1999 ^{w53}	Psychoactive drug use prevalence	Non-significantly favoured FP
Ballou 2000 ^{w54}	Deficiencies (federal violations—definition unclear); staffing—RNs + LPNs per bed, total nursing staff per bed	Favoured NFP (unclear if significant)
Castle 2000 ^{w55}	Restraint use (changes with legislation)	Mixed results: favoured NFP (P<0.001) for not increasing restraint use with legislation; favoured FP (P<0.05) for decreasing restraint use with legislation
Castle 2000 ^{w56}	Restraint use citations	Favoured NFP (P<0.05)
Castle 2001 ^{w57}	Deficiencies in OSCAR† for 19 quality of care items; prevalence of pressure ulcers, psychoactive drug use, restraint use, and urethral catheterisation	All significant (P<0.05) comparisons favoured NFP; favoured NFP for deficiencies, psychoactive drug use, restraint use prevalence; not significant (direction unclear) for deficiencies, urethral catheterisation
Castle 2001 ^{w58}	Deficiency citations in OSCAR, subdivided into provision of appropriate services, training provisions and resident assessments	Favoured NFP (P<0.001)
Castle 2001 ^{w59}	Early adoptors of innovation (as measured through 13 special care units or subacute services)	Non-significantly favoured FP

Study	Quality measure	Outcome
Dubois et al 2001 ^{w60}	QUALCARE scale*	Not significant (direction not noted)
Keith 2001 ^{w61}	Ombudsman program complaints	Favoured NFP (P=0.001)
O'Neill et al 2001 ^{w62}	Deficiencies in OSCAR† (total deficiencies and severe deficiencies rated F and higher, where maximum No of deficiencies was 85 to reduce outlier effects); staffing—average total nursing hours per resident day	Favoured NFP (P<0.01) for all comparisons
Castle 2002 ^{w63}	Restraint use prevalence	Favoured FP: 1 citation (P<0.05); 2 consecutive yearly citations (P<0.01); 3 consecutive yearly citations (P<0.01)
Lee et al 2002 ^{w64}	QAI	Significantly favoured NFP for 3/5 categories and for total QAI score (P<0.05)
Allen et al 2003 ^{w65}	Ombudsman program complaints	Mixed results: non-significantly favoured NFP for both care complaints (P=0.79) and abuse complaints (P=0.20)
Allen et al 2003 ^{w66}	Ombudsman complaints	Significantly favoured NFP (P=0.021)
Anderson et al 2003 ^{w67}	Residents' behaviour (verbal or physical aggressiveness or other disruptive behaviour); restraint use; complication of immobility; or sustaining a fracture in previous 3 months	Mixed results: non-significantly favoured FP for resident behaviours and higher restraint use; non-significantly favoured NFP for complications of immobility and fractures
Castle and Banaszak-Holl 2003 ^{w68}	Prevalence of pressure ulcers, psychoactive drug use, restraint use, and urinary catheterisation	Favoured NFP for each comparison (chains and non-chain owned nursing homes analysed separately)
Harrington and Swan 2003 ^{w69}	Staffing—total nurse and RN hours per resident day	Favoured NFP (P<0.01)
Weech-Maldonado et al 2003 ^{w70}	Outcome quality (cognitive decline, mood decline, pressure ulcer prevalence); process quality (restraint use prevalence, urinary catheterisation prevalence); staffing (ratio of RN hours to total nursing hours)	Mixed results: non-significantly favoured FP for outcome quality; nearly significantly favoured NFP (P<0.10) for process quality; non-significantly favoured NFP for staffing
Baumgarten et al 2004 ^{w71}	Pressure ulcer incidence	Favoured NFP
Lau et al 2004 ^{w72}	Inappropriate medical prescriptions by Beer's criteria	Non-significantly favoured NFP
Castle and Engberg 2005 ^{w73}	Contracture prevalence; deficiencies in OSCAR†—focused on quality deficiencies (19/185 assessed); restraint use prevalence; pressure ulcer prevalence; psychoactive drug use prevalence (% of residents given anti-anxiety, sedative/hypnotic, and antipsychotic drugs); quality index—normalised measure of other indices (physical restraint prevalence, urethral catheterisation prevalence, contracture prevalence, pressure ulcer prevalence, psychoactive drugs use, and deficiency data)	All significant (P<0.05) comparisons favoured NFP: non-significantly favoured NFP for all comparisons except for restraint prevalence, which favoured NFP (P<0.01)
Chesteen et al 2005 ^{w74}	Health deficiency, severity of deficiency, and frequency of deficiency	Mixed results: non-significantly favoured NFP for all 3 measures, meaning that FP had worse deficiencies
Gruber-Baldini et al 2005 ^{w75}	Depression (of resident) prevalence, measured by modified Cornell scale for depression in dementia	Significantly favoured NFP (odds ratio 2.53 FP/NFP, 95% CI 1.29 to 4.98)
Intrator et al 2005 ^{w76}	Employment of nurse practitioners or physician assistants on staff	Non-significantly favoured FP
McGregor et al 2005 ^{w77}	Staffing: mean (dietary, housekeeping and laundry staff) hours per resident day; mean (RN, LPN and NA) hours per resident day; mean activity aide hours per resident day; mean dietary staff hours per resident day; mean housekeeping staff hours per resident day; mean laundry staff hours per resident day; mean LPN hours per resident day; mean NA hours per resident day; mean RN hours per resident day (each measure assessed in intermediate care, intermediate/extended care, and multilevel nursing home care settings)	All significant (P<0.05) comparisons favoured NFP—favoured NFP for all comparisons except: non-significantly favoured NFP for intermediate/extended care mean activity aide hours per resident day, multilevel care mean dietary staff hours per resident day, multilevel care mean laundry staff hours per resident day, intermediate care or intermediate/extended care mean LPN hours per resident day, mean NA hours per resident day in all three care settings, mean RN hours per resident day in intermediate and multilevel care settings; no direction to relation for multilevel care mean LPN hours per resident day; non-significantly favoured FP for mean laundry staff hours per resident day in all three care settings
Starkey et al 2005 ^{w78}	Cognitive decline between OSCAR assessments; mood decline between OSCAR assessments; prevalence of pressure ulcers, restraint use, and urinary catheterisation	All significant (P<0.05) comparisons favoured NFP: non-significantly favoured NFP for all measures except restraint use prevalence, which non-significantly favoured FP, and urethral catheterisation prevalence, which significantly favoured NFP
Stevenson 2005 ^{w79}	Ombudsman office complaints	Significantly favoured NFP (P<0.05)
White 2005 ^{w80}	Deficiencies in OSCAR†; pressure ulcer incidence (OSCAR); restraint use incidence (OSCAR)‡	All significant (P<0.05) comparisons favoured NFP: significantly favoured NFP (P<0.05) in all measures except pressure ulcer incidence, which non-significantly favoured FP
Williams et al 2005 ^{w81}	Resident self reported pain using Philadelphia Geriatric Centre pain intensity scale	Significantly favoured NFP (odds ratio 2.99 FP/NFP, 95% CI 1.40 to 6.39)
McGregor et al 2006 ^{w82}	Hospital admission rate for anaemia, dehydration, falls, pneumonia, urinary tract infection, and pressure ulcers/gangrene; mortality	All significant (P<0.05) comparisons favoured NFP: favoured NFP for all measures except falls, urinary tract infection, and pressure ulcer admissions (non-significantly favoured NFP) and mortality (no direction)

ADL=activities of daily living; FP=for-profit; NFP=not-for-profit; LPN=licensed practical nurse; OSCAR=Online Survey Certification and Reporting; QAI=quality assessment index (composite measure of staff presentation, operational efficiency, resident care quality, and institutional care plan); RN=registered nurse.

*54 items grouped into 7 subscales: older person's room, residence, physical care, medical maintenance, psychosocial care, human rights, and financial.

†OSCAR includes results of independent site surveys done every 9-15 months by auditors under contract from the Center for Medicare and Medicaid Services. The surveys detail compliance with each of 185 separate measures of quality that consider nursing home structure, processes, and outcomes. As a measure of quality, deficiency data has some limitations. Also, under-detection and under-reporting of deficiencies may occur. Deficiencies are categorised according to severity from A to L. F and higher denotes care that has potential to cause harm or immediate jeopardy to patients. In some years, deficiencies assessed varied from state to state.

‡Use of vests, belts, mittens, or wrist or ankle restraints. Chairs with locking trays (Geri-trays) are also included, whereas bed rails are not. Specifically, restraints imposed for discipline or convenience, and not needed to treat the resident's medical symptoms were objectionable. Variable for restraint use is dichotomous—the home either did or did not receive this deficiency. Restraint use was verified by surveyors during the day for OSCAR.

Table 7 | Results of testing of a priori hypotheses to explain heterogeneity

Outcome	Summary study characteristics	FP-NFP v FP-private NFP	Interaction P value		
			Above median v below median appropriate adjustment score	Presence v absence of inappropriate adjustment, among studies with adjusted analysis	Data collection before or during 1987 v after 1987
More extensively trained staff or more staff	13 studies had poolable data, from 1971-2002; 3 removed for data overlap; 10 meta-analysed—4 collected data after 1987, 1 used primary data, 1 had data from Canada (remainder from United States)	0.64 for FP-private NFP; ratio of effect sizes 1.09 (95% CI 1.07 to 1.12, P<0.001, I ² =0%)	0.15	0.99	0.66
Lower pressure ulcer prevalence	16 studies had poolable data, from 1987-2003; 5 removed for data overlap; 11 meta-analysed—2 used primary data, 1 had data from Canada (remainder from United States)	0.76 for FP-private NFP comparison; ratio of effect sizes 0.89 (0.82 to 0.98, P=0.02, I ² =39.3%)	0.42	0.54	All meta-analysed data collected after 1987
Lower physical restraint prevalence	13 studies had poolable data from 1987-2003; 5 removed for data overlap; 8 meta-analysed—1 used primary data	0.84 for FP-private NFP comparison; ratio of effect sizes 0.94 (0.78 to 1.14, P=0.53, I ² =84.9%)	0.86	0.13	All meta-analysed data collected after 1987
Fewer deficiencies on government surveys	13 studies had poolable data from 1976-2003; 6 removed for data overlap; 7 meta-analysed—2 collected data before 1987	0.56 for FP-private NFP comparison; ratio of effect sizes 0.92 (0.79 to 1.06, P=0.25, I ² =63.1%)	0.80	0.54	0.11; for data collected after 1987, pooled effect size 0.73 (95% CI 0.54 to 0.97, P=0.03, I ² =67.9%) favouring NFP homes; for data collected before or during 1987, pooled effect size 1.09 (0.94 to 1.25, P=0.25, I ² =0%)

FP=for-profit; NFP=not-for-profit.

outcomes of those studies that compared for-profit and privately owned not-for-profit facilities. Similarly, tables 5 and 6 present the detailed study characteristics and outcomes of studies that compared for-profit and not-for-profit (publicly and privately owned) facilities.

We meta-analysed data for the four most commonly used quality measures. Table 7 presents a summary of the characteristics of studies meta-analysed, along with the results of sensitivity analyses to explain heterogeneity among studies in each meta-analysis. Two meta-analyses showed statistically significant results favouring higher quality care in not-for-profit nursing homes.

We found more or higher quality staffing in not-for-profit homes (ratio of effect 1.11, 95% confidence

interval 1.07 to 1.14, P<0.001, I²=91.6%) (fig 2). We found a similar result favouring not-for-profit homes when assessing staffing hours alone, with a ratio of effect of 1.11 (1.08 to 1.14, P<0.001, I²=70.3%), an absolute hours increase of 0.42 (0.31 to 0.53) hours/resident/bed/day, and a relative hours increase of 11% (8% to 14%). When the only non-US study was excluded, we arrived at a similar ratio of effect for more or higher quality staffing in not-for-profit homes of 1.11 (1.07 to 1.15, P<0.001, I²=92.4%).

We found a lower prevalence of pressure ulcers in not-for-profit homes (odds ratio 0.91, 95% confidence interval 0.83 to 0.98, P=0.02, I²=52.1%), with an absolute risk reduction of 0.59% (0.13% to 1.12%) and a relative risk reduction of 8.4% (1.9% to 16%) (fig 3). When the only non-US study was excluded, we arrived at a similar odds ratio favouring lower pressure ulcer prevalence in not-for-profit homes of 0.89 (0.82 to 0.97, P=0.007, I²=50.2%).

The remaining two meta-analyses showed non-statistically significant differences. We found less use of physical restraints in not-for-profit homes (odds ratio 0.93, 0.82 to 1.05, P=0.25, I²=74.6%) (fig 4) and fewer deficiencies in governmental regulatory assessments in not-for-profit homes (ratio of effect 0.90, 0.78 to 1.04, P=0.17, I²=59.8) (fig 5).

Funnel plots for the four meta-analyses did not suggest publication bias. A priori hypotheses did not explain the observed heterogeneity (table 7).

DISCUSSION

Our systematic review identified 82 studies comparing quality of care in for-profit and not-for-profit nursing homes. More studies had all statistically significant analyses showing higher quality in not-for-profit

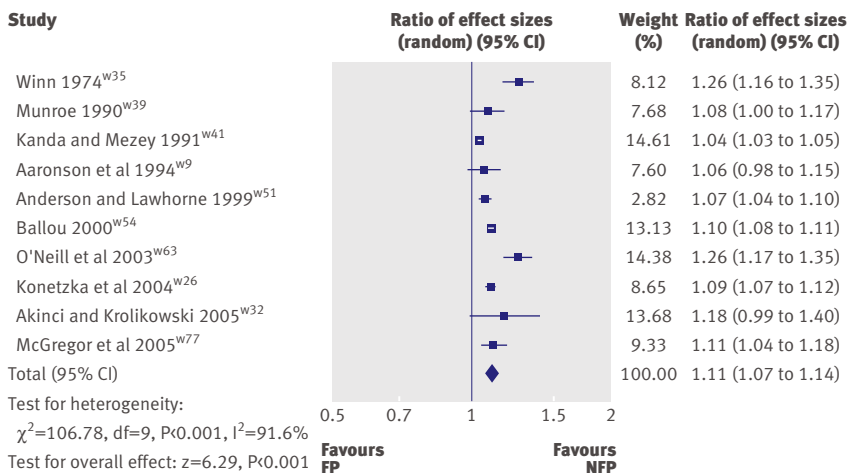


Fig 2 | Ratio of effect sizes for staffing quality in for-profit (FP) and not-for-profit (NFP) nursing homes. Ratios listed represent effect size in NFP homes compared with that in FP homes. Ratio >1 indicates that NFP homes had more, or higher quality, staffing (that is, favours NFP)

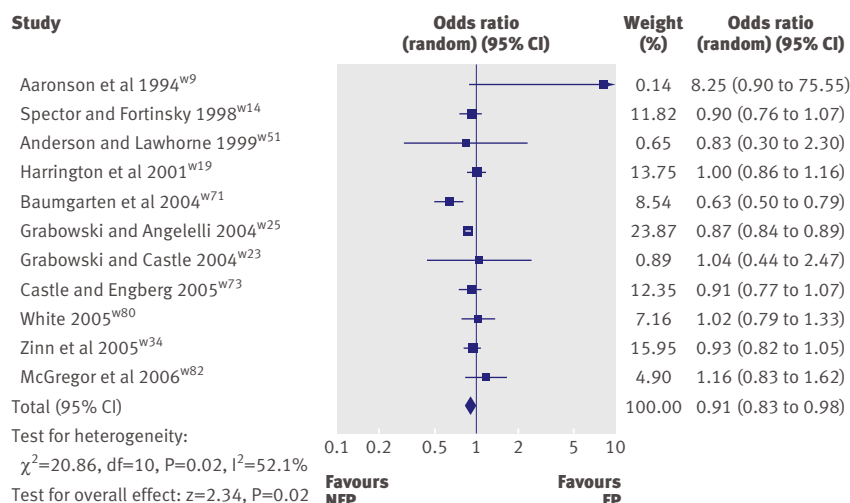


Fig 3 | Odds ratios (OR) comparing pressure ulcer prevalence in for-profit (FP) and not-for-profit (NFP) nursing homes. OR <1 indicates lower risk of pressure ulcers in NFP facilities than in FP facilities, suggesting that NFP facilities deliver higher quality care

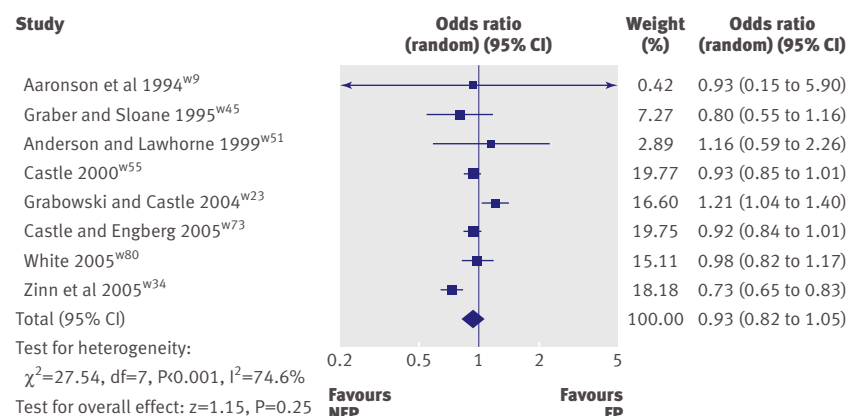


Fig 4 | Odds ratios (OR) comparing physical restraint prevalence in for-profit (FP) and not-for-profit (NFP) nursing homes. OR <1 represents less physical restraint use in NFP facilities than in FP facilities, suggesting that NFP facilities deliver higher quality care

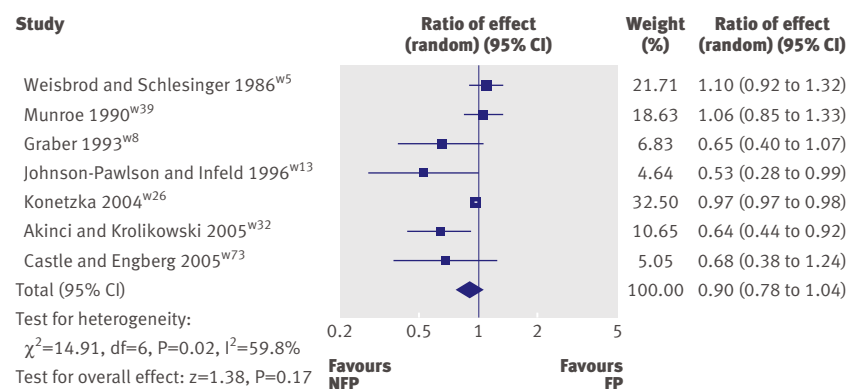


Fig 5 | Ratio of effect sizes for regulatory deficiencies in for-profit (FP) and not-for-profit (NFP) nursing homes. Ratios listed represent effect size in NFP facilities compared with that in FP facilities. Ratio <1 represents fewer deficiencies in NFP homes, suggesting that NFP homes deliver higher quality care

nursing homes than in for-profit nursing homes. Many studies, however, showed no significant differences in quality by ownership, and a small number showed statistically significant differences in favour of for-profit homes. This pattern held true when we compared for-profit homes with both privately owned and publicly owned not-for-profit facilities. Pooled analyses of the four most commonly used quality measures showed statistically significant results favouring higher quality care in not-for-profit homes for staffing and prevalence of pressure ulcers and non-statistically significant differences favouring not-for-profit homes in physical restraint use and regulatory agency deficiencies. The large observed heterogeneity was not explained by our a priori hypotheses.

Previous systematic reviews

Two previous systematic reviews have compared quality of care in for-profit and not-for-profit nursing homes. In 1991 Davis and colleagues found that many studies showed that higher quality of care was provided in not-for-profit nursing homes; however, weaknesses in the methodological design of the included studies limited the conclusions that could be drawn.³⁰ In 2002 Hillmer and colleagues did a systematic review comparing for-profit and not-for-profit facilities (including publicly owned facilities), focusing on studies in North America completed after the previous review.³¹ This study also concluded that not-for-profit facilities provided better quality care than for-profit facilities.

Strengths and weaknesses of this review

We did a comprehensive search, which identified 60 studies not included in previous reviews. We assessed studies spanning four decades and published in any language. We masked study results before determining eligibility and did duplicate citation screening, data abstraction, and quality assessment. We contacted authors for missing data and received responses from most of them. We compared quality of care in both for-profit versus not-for-profit nursing homes and for-profit versus privately owned not-for-profit nursing homes, did pooled analyses of quality of care measures, and found largely consistent results.

Our review has limitations resulting from the characteristics of the studies included. No randomised trials have compared quality of care across nursing home ownership, and no such trials are ever likely to be done. Furthermore, most studies are from the United States, which raises questions of generalisability to other jurisdictions.

Studies are also limited in that no standard definition of quality of care exists. The result is that studies used a very wide variety of alternative measures of quality. Even when the same measures were used, standardised approaches to the application of those measures were lacking. For example, meta-analysis for number and qualifications of staff fails to take into account staff turnover, the use of agency staff, and the professional mix of staff.²⁵

WHAT IS ALREADY KNOWN ON THIS TOPIC

The quality and appropriateness of care delivered in nursing homes is a major concern for the public, policy makers, and media

Controversy exists about whether for-profit compared with not-for-profit ownership affects quality of care

WHAT THIS STUDY ADDS

Most studies suggest a trend towards higher quality care in not-for-profit facilities than in for-profit homes, but a large proportion of studies show no significant trend

Moreover, several eligible studies used administrative databases, which further limits the comprehensiveness and quality of the data. For example, the American Online Survey Certification and Reporting (OSCAR) database comprises self reported data from nursing home administrators; surveyors verify only a sample. Careful duplicate abstraction of data from patients' charts with a priori definitions or, ideally, direct assessment of care provision would be preferable.

Our meta-analyses are limited in that many authors could not remove publicly owned facilities from their datasets for our for-profit versus privately owned not-for-profit analysis. However, in our sensitivity analyses, results comparing for-profit and not-for-profit facilities were not significantly different from those in which we restricted the not-for-profit facilities to those for which we could confirm ownership.

Heterogeneity

On the one hand, one might see our results as compellingly favouring not-for-profit facilities. The gradient between studies in which all significant measures favoured not-for-profit (40 studies) and those in which all measures favoured for-profit (3) is large (table 1). All four meta-analyses favoured not-for-profit institutions, and two reached statistical significance.

On the other hand, 37 studies had mixed results (some measures favoured for-profit, some not-for-profit) and considerable heterogeneity was present in the results of the meta-analyses. This suggests that although the average effect is clear, that effect probably varies substantially across situations. The variability is probably explained, in part, by a variety of factors that vary within categories of for-profit and not-for-profit homes, including management styles, motivations, and organisational behaviour. For example, for-profit facilities owned and operated by investor owned corporations may have different motivations than facilities owned by small private businesses or single proprietors. Not-for-profit facilities run by charities might differ in structure and process from those run by municipalities; not-for-profit facilities that are managed by for-profit nursing home companies may function differently from those that are not.

We have partially mitigated this problem with our a priori hypotheses (extent of appropriate adjustments, year of data collection, geography and political

environment, primary compared with secondary data collection, and, in particular, public versus private ownership of not-for-profit facilities). None of these variables, however, explained the substantial heterogeneity of our results. The studies failed to specify characteristics of individual nursing homes in sufficient detail to allow analyses exploring factors such as those listed above (ownership by corporation, small business, charitable organisation of municipality; management of not-for-profit homes by for-profit providers).

Significance of this study

Most of the studies in our systematic review showed lower quality of care in for-profit nursing homes than in not-for-profit nursing homes. However, a large proportion of studies showed no significant difference in quality of care by ownership. In the long term care market, in which funding is often provided by the government at fixed rates, both for-profit and not-for-profit facilities face an economic challenge that may affect staffing and other determinants of quality of care. In the for-profit context, however, shareholders expect 10-15% returns on their investments,³² taxes may account for 5-6% of expenses, and facilities tend to have higher executive salaries and bonuses, so for-profit facilities have a strong incentive to minimise expenditures.³³ Minimising expenditures may lead to lower quality staffing and higher rates of adverse events (such as pressure ulcers), which may be reflected in citations for deficiency.

Proving causality by using observational studies is difficult. Furthermore, given their variability, the results do not imply a blanket judgment of all institutions. Some for-profit institutions may provide excellent quality care, whereas some not-for-profit institutions may provide inferior quality of care.

Our findings are, however, consistent with findings of higher risk adjusted death rates in for-profit hospitals and dialysis facilities as shown in previous reviews,^{18 19} as well as providing insight into average effects. Given the absolute risk reduction in pressure ulcers of 0.59%, we can estimate that pressure ulcers in 600 of 7000 residents with pressure ulcers in Canada and 7000 of 80 000 residents with pressure ulcers in the United States are attributable to for-profit ownership. Similarly, given an absolute increase in nursing hours of 0.42 hours per resident per bed per day, we can estimate that residents in Canada would receive roughly 42 000 more hours of nursing care a day and those in the United States would receive 500 000 more hours of nursing care a day if not-for-profit institutions provided all nursing home care. These estimates are based on the 2006 census from Canada showing that 100 740 of 252 561 nursing home residents resided in for-profit nursing homes and the 2000 census from the United States showing a total of 1 720 500 nursing home residents.^{34 35} These estimates assume that two thirds of US nursing home residents live in for-profit facilities.

Further research and conclusions

Although this review has fully assessed the data available comparing for-profit and not-for-profit nursing home care, additional work is needed to compare the costs between these types of facilities and to evaluate the consistency of these findings outside of the United States and Canada. Although we have extensively evaluated the literature comparing quality of care in for-profit, charitable organisation owned, and government owned nursing homes, the available studies did not allow comparison of the possible impact of factors such as sub-category of for-profit ownership (for example, chain *v* non-chain, investor *v* small business ownership, municipality *v* federal government ownership). Nursing home management companies further complicate the relation between ownership and quality of care. These are all important areas that warrant further research.

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- European Commission. Long-term care in the European Union. 2008. http://ec.europa.eu/employment_social/spssi/docs/social_protection/2008/hc_ltc_en.pdf.
- Georgiades S. Quality nursing home care in Cyprus: are elder residents content with their treatment? *J Gerontol Soc Work* 2008;50(3-4):3-24.
- Konetzka RT, Stearns SC, Park J. The staffing-outcomes relationship in nursing homes. *Health Serv Res* 2008;43:1025-42.
- Mukamel DB, Glance LG, Li Y, Weimer DL, Spector WD, Zinn JS, et al. Does risk adjustment of the CMS quality measures for nursing homes matter? *Med Care* 2008;46:532-41.
- Castle NG, Liu D, Engberg J. The association of Nursing Home Compare quality measures with competition and occupancy rates. *J Healthc Qual* 2008;30(2):4-14.
- BBC News. Nursing home residents 'in pain'. 2007. <http://news.bbc.co.uk/2/hi/health/6471485.stm>.
- Welsh M, Benzie R. No minimum standard for nursing care. 2008. www.thestar.com/News/Ontario/article/445152.
- The Toronto Star. Troubling report on nursing homes. 2008. www.thestar.com/article/453994.
- Covello L. Nursing home quality: more hype than hazard? 2008. www.foxbusiness.com/portal/site/fb/menuitem.5b2f8f9bb693bd972f08aa8738d48a0c/?vgnnextoid=ac387b770dbba110VgnVCM10000086c1a8c0RCRD&directed=true.
- Duhigg C. At many homes, more profit and less nursing. 2007. www.nytimes.com/2007/09/23/business/23nursing.html?_r=1&pagewanted=all&oref=slogin#.
- CBC News. Another seniors home in B.C. not up to standard, NDP says. 2007. www.cbc.ca/canada/british-columbia/story/2007/10/04/bc-senior.html.
- US Department of Health and Human Services. Nursing home compare. www.medicare.gov/NHCompare.
- Kerrison SH, Pollock AM. Care for older people in the private sector in England. *BMJ* 2001;323:566-9.
- Tyszko P, Wierzba WM, Kanecki K, Ziolkowska A. Transformation of the ownership structure in Polish healthcare and its effects. *Cent Eur J Med* 2007;2:528-38.
- Statistics Canada. Residential care facilities 2003/2004. Ottawa, ON: Statistics Canada, 2006 (available at <http://www.statcan.gc.ca/pub/83-237-x/83-237-x2006001-eng.pdf>).
- Shapiro E, Tate RB. Monitoring the outcomes of quality of care in nursing homes using administrative data. *Can J Aging* 1995;14:755-68.
- Devereaux PJ, Choi PT, Lacchetti C, Weaver B, Schünemann HJ, Haines T, et al. A systematic review and meta-analysis of studies comparing mortality rates of private for-profit and private not-for-profit hospitals. *CMAJ* 2002;166:1399-406.
- Devereaux PJ, Schunemann HJ, Ravindran N, Bhandari M, Garg AX, Choi PT, et al. Comparison of mortality between private for-profit and private not-for-profit hemodialysis centres: a systematic review and meta-analysis. *JAMA* 2002;288:2449-57.
- Devereaux PJ, Heels-Ansdell D, Lacchetti C. Payments for care at private for-profit and private not-for-profit hospitals. *CMAJ* 2004;170:1817-24.
- American Medical Association. Quality of Care Council on Medical Service. *JAMA* 1986;256:1032-4.
- Donabedian A. The quality of care: how can it be assessed? *JAMA* 1988;260:1743-8.
- Mukamel DB. Risk-adjusted outcome measures and quality of care in nursing homes. *Medical Care* 1997;35(4):367-85.
- Institute of Medicine. *Improving the quality of care in nursing homes*. Washington, DC: National Academy Press, 1986.
- Abt Associates. *Appropriateness of minimum nurse staffing ratios in nursing homes: report to Congress*. (Phase II final, volume 1.) Baltimore, MD: Centres for Medicare and Medicaid Services, 2001 (available from [www.allhealth.org/BriefingMaterials/Abt-NurseStaffingRatios\(12-01\)-999.pdf](http://www.allhealth.org/BriefingMaterials/Abt-NurseStaffingRatios(12-01)-999.pdf)).
- Castle NG, Engberg J. The influence of staffing characteristics on quality of care in nursing homes. *Health Serv Res* 2007;42:1822-47.
- Hutt E, Radcliffe TA, Liebrecht D, Fish R, McNulty M, Kramer AM. Associations among nurse and certified nursing assistant hours per resident per day and adherence to guidelines for treating nursing home acquired-pneumonia. *J Gerontol A Biol Sci Med Sci* 2008;63:1105-11.
- Goodson J, Jang W, Rantz M. Nursing home care quality: insights from a bayesian network approach. *Gerontologist* 2008;48:338-48.
- National Cancer Institute. Dictionary of cancer terms. http://cancernet.nci.nih.gov/Templates/db_alpha.aspx?CdrID=441254.
- Identifying and measuring heterogeneity. In: Higgins JPT, Green S, eds. *Cochrane handbook for systematic reviews of interventions* Version 5.0.0 [updated February 2008]. The Cochrane Collaboration, 2008 (available at www.mrc-bsu.cam.ac.uk/cochrane/handbook/chapter_9/9_5_2_identifying_and_measuring_heterogeneity.htm).
- Davis MA. On nursing home quality: a review and analysis. *Med Care Rev* 1991;48:129-68.
- Hillmer MP, Wodchis WP, Gill SS, Anderson GM, Rochon PA. Nursing home profit status and quality of care: is there any evidence of an association? *Med Care Res Rev* 2005;62:139-66.
- Nudelman PM, Andrews LM. The "values added" of not-for-profit health plans. *N Engl J Med* 1996;334:1057-9.
- Friedman BS, Hattis PA, Bogue RJ. Tax exemption and community benefits of not for-profit hospitals. *Adv Health Econ Health Serv Res* 1990;11:131-58.
- Statistics Canada. *Residential care facilities 2006/2007*. Ottawa, ON: Statistics Canada, 2008 (available at www.statcan.ca/english/freepub/83-237-XIE/83-237-XIE2009001.pdf).
- United States Census Bureau. Census 2000 PHC-T-26. Population in group quarters by type, sex and age, for the United States: 1990 and 2000. 2003. www.census.gov/population/www/cen2000/briefs/phc-t26/tables/tab01.pdf.

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