Quality management systems and clinical outcomes in Dutch nursing homes

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ABSTRACT

The objective of the article is to explore the impact quality management systems and quality assurance activities in nursing homes have on clinical outcomes. The results are based on a cross-sectional study in 65 Dutch nursing homes. The management of the nursing homes as well as the residents (N= 12,377) participated in the study. Primary survey-data about the implementation of quality management systems and quality assurance activities were collected in 1994/1995 and in 1998, and were combined with information on resident characteristics and the prevalence of undesirable clinical outcomes. The results demonstrate that there are differences between nursing homes in the prevalence of undesirable clinical outcomes. In the nursing homes with the lowest scores, undesirable outcomes occur approximately 10 times less often than in nursing homes with the highest scores. The multi-level analysis has demonstrated that the differences in outcomes are mainly caused by differences between residents and, to some extent, also by differences between nursing homes. Resident characteristics explain 48% of the differences between residents and 72% of the differences between nursing homes. The size of the nursing home, the involvement of a client council and the implementation of a quality management system could explain a small part of the remaining variation in the number of undesirable outcomes. It seems that the implementation of a quality management system and the involvement of a client council had significant influence on the number of undesirable outcomes. Approximately 50% of the undesirable outcomes cannot be explained by the selected resident characteristics, the size of the nursing home and the implementation of quality management systems or quality assurance activities.

1. INTRODUCTION

This article explores the impact quality management systems (QMS) and quality assurance (QA) activities in nursing homes have on clinical outcomes. During the past 10 years, nursing homes in various countries

have made a start with the systematic implementation and evaluation of care planning [1–4], practice guidelines [5–9], quality indicators [10,11], client councils and quality management systems [12–15] to improve the quality of care provided [16,17] and adapt to the changing needs of nursing home residents [18]. In several countries, the government has also imposed legal requirements to improve the quality of nursing home care. The American Congress, for example, introduced the Omnibus Budget Reconciliation Act (OBRA) in 1987. This contains specific guidelines regulating the use of psychotropic drugs and physical restraints in long-term care facilities [19,20], and mandates the use of the Resident Assessment Instrument (RAI) for care planning. Moreover, nursing homes are obliged by

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this act to create a quality improvement team. In Canada and Iceland, for instance, the government has also mandated the use of the RAI to improve the process of care planning and to monitor the quality of care [11]. In The Netherlands, the Dutch parliament introduced the Care Institutions Quality Act in 1996 (http://www.minvws.nl). The aim of this Quality Act is to ensure that the care provided is of a high standard.

Nursing homes and other health care organizations must therefore, develop a quality management system and implement QA-activities. A quality management system comprises the entire process of formulating requirements, collecting information, assessing outcomes and adjusting policies at all levels of an organization [15]. In The Netherlands, the first nursing homes started in 1990 with the development and implementation of more systematic QA-activities, such as systematic care planning, practice guidelines and a quality policy for the entire nursing home. In 1995 and 2000 still only 5% of the health care organizations had fully implemented a quality management systems, others were still working on the implementation and the systematic improvement of their care processes [21].

The basic assumption underlying the implementation of quality management systems is that effective and efficient care processes will lead to appropriate care and positive outcomes. However, in nursing homes it is not always possible to improve or maintain the health status of elderly residents. Therefore, the quality of life of nursing home residents could be an important outcome measure, but, until now there have been no relevant health-related quality of life measures that could indicate appropriate care [22]. In earlier research undesirable clinical outcomes, such as mortality, pressure sores, incontinence or indwelling catheters, have been used to assess the quality of nursing home care [10,11,23–27]. These clinical outcomes are undesirable because of their negative influence on the health status of residents. In other research, the relationship between quality of care and organizational determinants have been investigated [28–34]. Over the years, research results have shown that differences in clinical outcomes could partly be explained by organizational determinants, such as economic status, size, bed-occupancy, nursing home staffing and environmental determinants, such as per capita income, bed supply and competition [28,33–37].

Quality management systems and QA-activities are designed to improve clinical outcomes for residents by improving the process of health care provision. Studies which have examined the impact of the implementation of specific QA-activities on the process and outcomes of care have found some evidence that specific further training of professionals, practice guidelines and individual care planning have a positive impact on resident-related outcomes [1,3,38] or staff work satisfaction [39]. To date, however there is scarce evidence that quality management system improve clinical outcomes in nursing home residents to any great extent.

In this article is studied the relationship between quality management systems and the prevalence of undesirable clinical outcomes. The central research question was: Do nursing homes with a quality management system have less undesirable clinical outcomes than nursing homes without a quality management system?

2. METHOD

2.1. Sample

Sixty-eight nursing homes, representing 20% of all nursing homes in The Netherlands, participated in the study. The sampling process consisted of two steps. In 1994/1995, we took a random sample of 50% (N= 159) of all Dutch nursing homes to investigate the development of quality management systems in nursing homes; the response rate was 75% (N= 120). For the study in 1998, we started with the respondents of the 1994/1995 sample, which would allow us to measure changes in the development of quality management systems and quality assurance activities over time. An additional selection criterion was the availability of standardized patient data from the SIG Nursing Home Information System (SIVIS). Out of the 120 nursing homes 101 met the additional criterion; they received a postal questionnaire on quality management systems and were asked to give permission to use anonymous patient data from SIVIS. Finally, full data were obtained from 65 nursing homes (response 64%). There were no differences found in the average amount of QA-activities that had been implemented in 1994/1995 between respondents and non-respondents.

2.2. Quality management systems

To measure the implementation of quality management systems and the amount of QA-activities a postal questionnaire was sent to the medical director of the nursing home, asking for the implementation of QAactivities (Appendix A). These activities are indicators of a quality management system. All activities together represent a quality management system. The QAactivities were measured in 1994/1995 and 1998. For this study,we have used two measures: the total amount of QA-activities of an organisation in 1994/1995 and the increase of QA-activities between 1994/1995 and 1998. The Pearson correlation coefficient between these two measures is 0.58 (p = 0.00).

2.3. Nursing home characteristics

A nursing home or a long-term care facility is an institution providing nursing care 24 h a day, assistance with activities of daily living and mobility, psychosocial and personal care, paramedical care, as well as room and board [40].

To control for nursing home characteristics that could influence residents' outcomes (besides the quality management system), we have included organisation size (total bed capacity) and occupancy rate [18,19].

2.4. Resident characteristics and case mix

Data were obtained on all permanent residents living in the nursing homes between September 1997 and February 1998 from the SIG Nursing Homes Information System. The Nursing Homes Information System is a national registry that registers resident characteristics and some clinical outcomes. The sample included 12,377 residents. Resident characteristics included age, sex, somatic or psychogeriatric diagnosis and functional status. The functional status was obtained by creating a severity-index by summing an ADLscore and active communication, bed transferring, bladder and bowel continence, walking and wheelchair dependency. A score of 0 indicated no functional disabilities and a score of 12 indicated great functional disabilities. The 12 items of the severity-index form a strong hierarchical scale [41]. The ADL-score was obtained by summing the amount of help (0=can do alone or can do with help; 1=must be done for) required in five areas (eating, bathing upper or lower part of the body, dressing and toileting). A score of 0 indicated independent performance in these areas, and a score of 5 indicated total dependence. The resident characteristics and the functional status have been used for case-mix adjustment. Earlier research has shown that case-mix adjustment is sometimes necessary to better understand the results of quality indicators [42–45].

2.5. Undesirable outcomes

In this study, five undesirable clinical outcome measures, e.g. the prevalence of bladder incontinence, pressure ulcers, urethral catheterization, restricted mobility and behavioural problems were used. These outcome measures have been selected in earlier research as quality indicators for nursing homes [10,42,45–47]. In The Netherlands no standardized registration of health outcomes is obliged, therefore only some outcome measures can be used for research purposes.

In addition, the outcome variable 'combination of undesirable outcomes'was constructed by summing up the five separate clinical outcome measures. Thereby, we counted the prevalence of bladder incontinence or the prevalence of indwelling catheterization. From a care perspective it is easier to treat incontinence by catheterization than by a toileting plan, but from a quality and client-centred perspective catheterization is less desirable. Therefore, catheterization was weighted for two points, the other outcomes for one point.

2.6. Data analyses

We have used descriptive statistics and multi-levelanalysis to describe the data. The relationship between quality management systems and clinical outcomes have been examined by multi-level analyses with two levels: nursing home level and resident level [48]. Separate logistic multi-level analyses were run on the individual (dichotomous) outcome variables to examine the predictive effects of nursing homes that have developed a quality management system, while controlling for differences in case mix. Linear regression multilevel analyses were run on the variable 'combination of undesirable outcomes', based on the linear association between the number of quality assurance activities and the number of undesirable outcomes. For all tests the significance level was set to 0.05. Analyses were performed using spss-X and MLn.

3. RESULTS

3.1. Resident characteristics and clinical outcomes

Approximately 74% of all 12,377 residents were women. The average age of residents was 81 years. Of all residents 56% had a psychogeriatric diagnosis such as dementia. The overall level of dependency was 7.5 on a 12-point-scale. There were only small differences in the demographic characteristics and the severity index of residents in nursing homes that have participated in this study and other Dutch nursing homes [49] (Table 1).

Most of the residents in the study homes received nursing care, 20% received treatment from an allied health care professional and 7% received specific attention because of their dementia. Furthermore, 45% of the residents was incontinent, 27% was restricted in their mobility, 13% showed disturbing behavioural problems and 10% had pressure ulcers or indwelling catheters. Of the 12,377 residents 38% had none of the selected undesirable outcomes, 30% had one undesirable outcome, 22% had two and 10% of the residents suffered from three or four undesirable outcomes (Table 2).

[TABLE 1]
[TABLE 2]

3.2. Implementation of quality management systems and QA-activities

In 1994/1995 the average amount of QA-activities in nursing homes was 21 out of 52 (S.D. = 8). Three years later, the participating nursing homes had implemented 27 QA-activities (S.D. = 8). None of the nursing homes had yet implemented all QA-activities that are conditional for a quality management system. The number of QA-activities has increased over the past 3 years with an average of six activities.

The most common QA-activity in nursing homes was the systematic use of care planning (91%). Nearly two-third of the nursing homes had implemented quality documents, such as a quality policy, quality action plans, an annual quality report and a quality handbook (62%). A client council was active in 63% of the nursing homes. Less often, nursing homes had implemented continuous education for professionals and systematic feedback of results as means for quality improvement (37%). Finally, 37% of the nursing homes had implemented several practice guidelines, such as guidelines for specific diagnostic groups, guidelines for medical interventions by nurses and the utilisation of medical equipment.

3.3. Differences in undesirable outcomes between nursing homes

Table 3 displays the percentile scores for five undesirable outcomes. The score of a nursing home is the percentage of residents that had, for example, bladder incontinence. The first row shows that 13% of the residents in the best nursing homes (0th percentile) had bladder incontinence. A nursing home with a score of 27% would rank in the top 10%, and a nursing home with 62% would rank at the 90th percentile and belongs to the 10% nursing homes with a poor score. A nursing home may have scores at different percentiles for different outcomes. Table 3 illustrates that, in some nursing homes 2% of the residents had pressure ulcers, whereas in nursing homes scoring at the 90th percentile 17% of the residents reported pressure ulcers. Similarly, for catheterization, in homes scoring at the 10th percentile 3% of residents had an indwelling catheter, whereas in homes at the 90th percentile, 20% had. Nursing homes scoring at the 100th percentile, those scoring most poorly on this outcome, reported indwelling catheters for 38% of their residents.

Overall, for each of these outcomes, there are nursing homes doing very well and others doing very poorly. In the next section, we will try to explain the difference at resident level between nursing homes by accounting for variation in resident populations. In addition, we will examine the relationship between quality management systems c.q. QA-activities and undesirable outcomes.

[TABLE 3]

3.4. Multi-level analyses

In Table 4, regression coefficients are presented for each of the outcome variables included in the analyses. By including resident characteristics we can establish whether there are differences in the

resident population with respect to relevant characteristics, which possibly influence the nursing home scores on undesirable outcomes. Also included in the table are characteristics of nursing homes, such as the total bed capacity and the amount of QA-activities in 1994/1995 and the increase of QA-activities over the period 1994/1995 and 1998, representing the implementation of quality management systems The occupancy rate has not been included in the analyses because of the little difference in occupancy between nursing homes (mean = 99%, S.D. = 2.4). By including variables at the organisationlevel we can establish whether some of the differences found between residents and nursing homes can be explained by the implementation of quality management systems or the size of the nursing home.

Most of the variances (95%, not in Table 4) in all analysis have been found between residents. However, there were also significant differences between nursing homes (5%, not in Table 4). The resident characteristics included in the models used to explain differences in undesirable outcomes have an independent effect that exceeds the 0.05 significance level. An exception can be made for gender; no relationships were found between gender and incontinence, behavioural problems and pressure ulcers. Of the nursing home characteristics the number of beds has a relationship with the prevalence of pressure ulcers. Residents in larger nursing homes have less often pressure ulcers. The implementation of quality management systems in 1994/1995 and the increase of QA-activities over the last 3 years had no independent effect on the outcomes.

The variance coefficients illustrates that after including the independent variables, there remain significant differences between residents and nursing homes. These differences cannot be explained by the used resident and organisation characteristics.

Table 5 presents the effect of resident characteristics, organisation characteristics, the implementation of quality management systems and separate QAactivities on the amount of undesirable outcomes. Furthermore, Table 5 presents the estimated variances for the 'null' (no predictor variable) model and the applied (with stepwise inclusion of all predictor variables) models. If the variances of the null-model are entered in the formula for calculating the intraclass-correlation, the percentage of variance at level 2 (nursing home) is 4.7% of the total variance ($(0.05/0.05 + 1.01) \times 100$) [50]. So, 95.3% can be labelled as variance on level 1 (resident).

On the resident level, the applied A-model for resident characteristics, explained 48% of the 95% variance due to between resident differences. The 5% variance between nursing homes could, to a great extent (72%), be explained by differences between resident characteristics. In model B–D, the independent variables of the nursing home level are included. In model B, the size (number of beds) of the nursing homes is included. Size has an effect on the amount of undesirable outcomes. The reduction in variance compared to the A model is 0.3% at resident level and 9.5% at nursing home level. In model C, the implementation of quality management systems have an independent effect on the amount of undesirable outcomes. The variance at resident level was, additionally, reduced by 0.1%, whereby the variance at nursing home level was reduced by 5%. The implementation of separate QA-activities (model D), such as systematic use of care planning, a quality policy, further education of professionals and the use of practice guidelines, had no effect on the amount of undesirable outcomes. However, a relation was found between the involvement of client councils and the amount of undesirable outcomes. Thus, after including the independent variables there remain significant differences in the amount of undesirable outcomes between residents. The remaining differences between nursing homes are significant, but relative small.

[TABLE 4]
[TABLE 5]

4. DISCUSSION

The objective of this study was to determine the extent to which the differences found in outcomes can be explained by the existence of a quality management system in the nursing homes. Quality management systems were chosen as determinant because the objective of these systems is to systematically attune the policy of the organization and the care process to the needs of the residents. This implies that effective and efficient care processes should result in optimal care for residents, and thus, the best clinical outcomes as possible.

From the results of the study it is apparent that, of the 52 quality assurance activities studied, nursing homes had implemented an average of 21 in 1994/1995 and 27 in 1998. The number of activities per nursing home in 1998 varied from 11 to 48, indicating that only a few of the nursing homes had implemented an integral quality management system. This implies that the results of the study must be interpreted with caution, because a quality management system which has not been fully implemented could have less effect on the results. Moreover, there are certain shortcomings in using the number of activities as a measure for the implementation of a quality management system, because the existence, for instance, of a quality policy, a quality manual or practice guidelines is less important in the achievement of positive results than the implementation of the activities at all levels in the nursing home. In the present study, these limitations have been accounted for by asking about quality activities, which apply to various aspects of a quality management system (i.e. policy and strategy, personnel management, process management and client involvement). These aspects have been derived from the Baldrige Quality Award and the European Quality Award [15].

The results of this study clearly demonstrate that there are differences between nursing homes in the prevalence of undesirable outcomes. The differences can be seen in the five outcome measures studied. In the nursing homes with the lowest scores, undesirable outcomes occur approximately 10 times less often than in the nursing homes with the highest scores. In an American study, among 352 nursing homes even greater differences in the five undesirable outcomes have been found [24]. Nevertheless, based on these data, no foregone conclusion can be drawn that nursing homes with high scores provide sub-optimal care. Differences between residents, with regard to the intensity of care needed, could explain the differences in outcomes. These outcomes clearly demonstrate that it is important to carry out further research on the possible reasons for these differences.

The central research question addressed in this article was whether nursing homes with a quality management system have better clinical outcomes than nursing homes without a quality management system. The results of the multi-level analysis have demonstrated that the differences in outcomes are mainly caused by differences between residents and, to some extent, also by differences between nursing homes. At resident level, characteristics such as gender, psychogeriatric diagnoses and the dependence of the resident explain 48% of the differences between residents and 72% of the differences between nursing homes. On the other hand, this implies that approximately 50% of the differences in undesirable outcomes cannot be explained by the selected case-mix variables, and that there are therefore other underlying causes.

The size of the nursing home can explain a small part of the remaining variation in some undesirable outcomes. Residents in larger nursing homes have less undesirable outcomes. Finally, it seems that the implementation of a quality management system in 1994/1995 and the involvement of a client council had significant influence on the number of undesirable outcomes in 1998. There was a small reduction in the variance at resident and nursing home level. On the other hand, the increase in the number of activities themselves and individual quality assurance activities (i.e. care planning, quality policy, further education and practice guidelines) appeared to have no independent influence on the outcomes. This could indicate that quality management systems are not effective or that the results of quality management systems only become apparent in the long term, and that it takes some time before a quality management system influences the care process, the behaviour of the carers and the clinical outcomes. This could also imply that individual quality assurance activities have no influence on undesirable outcomes, whereas a 'system' is more advantageous for the quality of care provided for the residents. It is not the existence of quality activities, which leads to improvements, but the systematic application of these activities. A third possible explanation is that nursing homes, which already have effective care processes implement a quality management system to become even better. In this case, not the implementation of a quality management system determines whether nursing homes have less undesirable outcomes, but the already existing level of care provided. A longitudinal research design could give more insight, but is more expensive and time consuming. From the results of this study, it can be concluded that approximately 50% of the differences in outcomes between residents cannot be explained by differences in the resident population, the size of the nursing home, or the existence of a quality management system or individual quality assurance activities. Future research to investigate other possible explanations, possibly involving a more specific and comprehensive study of nursing home policies and the existing care processes, is of vital importance

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in order to identify the basic elements, which are of influence in preventing undesirable resident outcomes and improving the quality of care.

TABLES AND APPENDIX

Table 1
Resident characteristics of participating nursing homes and overall Dutch nursing homes

Resident characteristics	Residents participating nursing homes, $n = 12,377$	Residents Dutch nursing homes, $N = 45,645$
Diagnosis, % psychogeriatric	56	54
Sex, % female	74	73
Age female, mean years	82	82
Age male residents, mean years	77	77
Severity index (scale 0–12), mean	7.5	8

Table 2
Description of the dependent and independent variables used in 1998 to describe the implementation of quality systems and QA-activities ($N = 65$ nursing homes), and undesirable resident outcomes ($N = 12,377$)

Description	Characteristics
Quality system	
Amount of QA-activities in 1994/1995; (maximum 52)	Mean = 21; S.D. = 8
Increase of QA-activities between 1994/1995 and 1998;	Mean = 6; S.D. = 8
QA-activities	
Systematic use of care planning; dummy (%)	91
Systematic involvement of client council; dummy (%)	63
Quality policy; dummy (%)	62
Further education and feedback; dummy (%)	37
Use of practice guidelines; dummy (%)	37
Organization characteristics	
Number of beds	Mean = 193; S.D. = 77
Percentage full beds (occupation rate)	99%; S.D. = 2.4
Undesirable outcomes: prevalence of:	
Bladder incontinence, $n = 5551$ (%)	45
Restricted mobility, $n = 3302$ (%)	27
Behavioural problems, $n = 1579$ (%)	13
Indwelling catheter, $n = 1233$ (%)	10
Pressure ulcers, $n = 1229$ (%)	10
Sum of five undesirable outcomes; scale 0–5	
0 undesirable outcomes, $n = 4695$ (%)	38
1 undesirable outcome, $n = 3717$ (%)	30
2 undesirable outcomes, $n = 2730$ (%)	22
3 undesirable outcomes, $n = 955$ (%)	8
4 undesirable outcomes, $n = 169$ (%)	2
5 undesirable outcomes, $n = 9$ (%)	0

Table 3
Percentile scores for selected undesirable outcomes of 65 nursing homes

Clinical outcomes	0th percentile (minimum or best score) (%)	10th percentile (good score) (%)	50th percentile (average score) (%)	90th percentile (poor score) (%)	100th percentile (maximum or worst score) (%)
Bladder incontinence	13	27	46	62	65
Restricted mobility	5	17	28	39	51
Behaviour problems	2	5	12	21	29
Pressure ulcers	2	5	10	17	22
Indwelling catheter	1	3	9	20	38

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Table 4
The impact of resident characteristics and quality systems on various undesirable outcomes: regression and variance coefficients of logistic multi-level analyses

Characteristics	Bladder in-continence	Restricted mobility	Behaviour problems	Pressure ulcers	Indwelling catheter
Resident characteristics					
Age	$0.01^*(0.00)$	$-0.01^*(0.00)$	$-0.01^*(0.00)$	$0.01^*(0.00)$	$-0.01^*(0.00)$
Female	$0.06\,(0.07)$	$0.52^*(0.09)$	$-0.01\,(0.06)$	$-0.08\,(0.07)$	$-0.26^*(0.07)$
Psychogeriatric diagnoses	$1.00^*(0.07)$	$-1.67^*(0.09)$	$0.70^*(0.07)$	$-0.82^*(0.07)$	$-1.81^*(0.08)$
Severity-index	$1.01^*(0.02)$	$1.02^*(0.03)$	$0.18^*(0.01)$	$0.26^*(0.01)$	$0.25^*(0.01)$
Organization characteristics					
Number of beds	$-0.00\,(0.00)$	$-0.01\,(0.01)$	$-0.00\,(0.00)$	$-0.01^*(0.001)$	$-0.00\,(0.00)$
Implementation quality system					
Amount of QA-activities 1994/1995	$-0.00\,(0.01)$	$-0.01\,(0.01)$	$-0.02\,(0.01)$	$-0.001\,(0.008)$	$-0.003\,(0.01)$
Increase of QA-activities 1994/1995–1998	$-0.00\,(0.01)$	$-0.01\,(0.01)$	$0.01\,(0.01)$	$0.000\,(0.008)$	$-0.001\,(0.01)$
Variance coefficients					
Nursing home level	$0.10^*(0.03)$	$0.04^*(0.02)$	$0.23^*(0.05)$	$0.27^*(0.06)$	$0.30^*(0.07)$
Resident level	$0.96\,(0.01)$	$1.88\,(0.02)$	$0.97\,(0.01)$	$1.37\,(0.02)$	$0.93\,(0.01)$

Table 5
The effect of resident characteristics and quality systems on the amount of undesirable outcomes: regression and variance coefficients and explained variance of linear multi-level analyses

Risk factor	0 model	A model	B model	C model	D model
Intercept	$1.06(0.08)$	$-0.49\,(0.06)$	$-0.38\,(0.07)$	$-0.31\,(0.08)$	$-0.32\,(0.08)$
Resident characteristics					
Age		$-0.003^*(0.000)$	$-0.003^*(0.001)$	$-0.003^*(0.001)$	$-0.003^*(0.001)$
Female		$0.03^*\,(0.01)$	$0.03^*\,(0.01)$	$0.03^*\,(0.01)$	$0.03^*\,(0.01)$
Psychogeriatric care		$-0.13^*\,(0.02)$	$-0.13^*\,(0.02)$	$-0.13^*\,(0.02)$	$-0.13^*\,(0.02)$
Severity-index		$0.24^*\,(0.00)$	$0.24^*\,(0.00)$	$0.24^*\,(0.00)$	$0.24^*\,(0.00)$
Organization characteristics					
Number of beds			$-0.0005^*(0.0002)$	$-0.0004^*(0.0002)$	$-0.0004^*(0.0002)$
Implementation quality system					
Amount of QA-activities 1994/1995				$-0.005^*\,(0.002)$	
Increase QA-activities 1994/1995–1998				$-0.002\,(0.002)$	
QA-activities					
Systematic use of care planning				$-0.06\,(0.05)$	
Quality policy				$-0.02\,(0.03)$	
Further education and feedback					$-0.02\,(0.03)$
Use of practice guidelines					$0.05\,(0.04)$
Involvement of client council					$-0.06^*(0.03)$
Variance coefficients					
Nursing home	$0.05^*(0.01)$	$0.012^*(0.00)$	$0.0108^*(0.00)$	$0.0102^*(0.00)$	$0.009^*(0.00)$
Resident	$1.01(0.01)$	$0.54(0.01)$	$0.54\,(0.01)$	$0.54\,(0.01)$	$0.54\,(0.01)$
Reduction of variance					
Nursing home level (%)		72	9.5	5	12.5
Resident level (%)		48	0.3	0.1	0.3

* $p < 0.05$.

Appendix A

Quality assurance activities as indicators for the development stage of a quality management system.

Stages	Policy and strategy	Human resources policy	Process control by standardization	Process control by sub-systems	Participation of clients/patients
Orientation/consciousness	Mission product description	Encouraging professional development	Protocols for specific treatment	Testing single/multidisciplinary care plans	Patient is not involved
Preparation stage	Quality policy institutional quality working plan quality profiles	Training group leaders training staff participation during working hours indicated by management	Information specific target groups, unforeseen activity medical aids	Committees record of complaints client council job assessment interviews	Discussions of results assessment of the targets achieved
Implementation stage	Quality working plan for some departments quality working plan for all departments	Management tests management monitors selection of new staff	Critical moments cooperation with other institutions	Satisfaction research needs analysis	Participation in: committees projects the development of criteria/ protocols
Systematic approach/establishment	Annual quality report quality manual	Systematic feedback priorities relating to quality policy training new staff	Routing patient	Management information system internal audit interinstitutional testing	Systematic participation in commit-tees, projects and in the setting up of criteria/ protocols

REFERENCES

[1] Phillips CD, Zimmerman D, Bernabei R, Jonsson PV. Using the Resident Assessment Instrument for quality enhancement in nursing homes. Age and Ageing 1997;26-S2:77–81.

[2] Hawes C, Mor V, Phillips CD, Fries BE, Morris JN, Stelle- Friedlob E, et al. The OBRA-87 nursing home regulations and implementation of the Resident Assessment Instrument: effects on process quality. Journal of American Geriatrics Society 1997;45:977–85.

[3] Fries BE, Hawes C, Morris JN, Phillips CD, MorV, Park PS. Effect of the national Resident Assessment Instrument on selected health conditions and problems. Journal of American Geriatrics Society 1997;45:994–1001.

[4] Mor V, Intrator O, Fries BE, Phillips C, Teno J, Hiris J, et al. Changes in hospitalization associated with introducing the Resident Assessment Instrument. Journal of American Geriatrics Society 1997;45:1002–10.

[5] Levine JM, Totolos E. A quality-oriented approach to pressure ulcer management in a nursing facility. The Gerontologist 1994;34(3):413–7.

[6] Suntken G, Starr B, Ermer-Seltun J, Hopkins L, Preftakes D. Implementation of a comprehensive skin care program across care settings using the AHCPR pressure ulcer prevention and treatment guidelines. Ost/Wound Man 1996;42(2):20–32.

[7] Moseley CB. The impact of federal regulations on urethral catheterization in Virginia nursing homes. American Journal of Medical Quality 1996;11(4):222–6.

[8] Semla TP, Palla K, Poddig B, Brauner DJ. Effect of the Omnibus Reconciliation Act 1987 on antipsychotic prescribing in nursing home residents. Journal of American Geriatrics Society 1994;42:648–52.

[9] Shorr RI, Fought RL, Ray WA. Changes in antipsychotic drug use in nursing homes during impelementation of the OBRA- 87 regulations. Journal of the American Medical Association 1994;271(5):358–62.

[10] Zimmerman DR. Improving nursing home quality of care through outcomes data: the MDS quality indicators. International Journal of Geriatrics Psychiatry 2003;18(3):250–7.

[11] Jensdottir AB, Rantz M, Hjaltadottir I, Gudmundsdottir H, Rook M, Grando V. International comparison of quality indicators in United States. Icelandic and Canadian nursing facilities. International Nursing Review 2003;50(2):79–84.

[12] Wagner C, de Bakker DH, Sluijs EM. Kwaliteitssystemen in instellingen: de stand van zaken in 1995 (Quality management systems in health care organizations: state of the art 1995). Utrecht: NIVEL; 1995.

[13] Casparie AF, Sluijs EM, Wagner C, de Bakker DH. Quality management systems in Dutch health care institutions. Health Policy 1997;42:255–67.

[14] Zinn JS, Weech RJ, Brannon D. Resource dependence and institutional elements in nursing home TQM adoption. Health Services Research 1998;33(2):261–73.

[15] Wagner C, de Bakker DH, Groenewegen PP. A measuring instrument for evaluation of quality systems. International Journal for Quality in Health Care 1999;11(2):119–30.

[16] Rantz MJ, Zwygart-Stauffacher M. Back to the fundamentals of care: a roadmap to improve nursing home care quality. Journal of Nursing Care Quality 2004;19(2):92–4.

[17] Brazil K, Royle JA, Montemuro M, Blythe J, Church A.Moving to evidence-based practice in long-term care: the role of a Best Practise Resource Centre in two long-term care settings. Journal of Gerontological Nursing 2004;30(3):14–9.

[18] Bishop CE. Where are the missing elders? The decline in nursing home use, 1985 and 1995. Health Affaires 1999;18(4):146–55.

[19] Castle NG. Differences in nursing homes with increasing and decreasing use of physical restraints. Medical Care 2000;38(12):1154–63.

[20] Castle NG. Nursing homes with persistent deficiency citations for physical restraint use. Medical Care 2002;40(10):868–78.

[21] Sluijs EM, Wagner C. Progress in the implementation of quality management systems in health care: 1995–2000. International Journal for Quality in Health Care 2003;15(3):223–34.

[22] Treurniet HF, Essink-Bot ML, Mackenbach JP, vander Maas PJ. Health-related quality of life: an indicator of quality of care? Quality of Life Research 1997;6:363–9.

[23] Zinn JS, Aaronson WE, Rosko MD. The use of standardized indicators as quality improvement tools: an application in Pennsylvania nursing homes. American College of Medical Quality 1993;8(2):72–8.

[24] Rantz MJ, Mehr DR, Conn VS, Hicks LL, Porter R, Madson RW, et al. Assessing quality of nursing home care: the foundation for improving resident ourcomes. Journal of Nursing Care Quality 1996;10(4):1–9.

[25] Bates-Jenson BM, Cadogan M, Osterweil D, Levy-Storms L, Jorge J, Al-Samarrai N, et al. The minimum data set pressure ulcer indicator: does it reflect differences in care processes related to pressure ulcer prevention and treatment in nursing homes? Journal of American Geriatric Society 2003;51(9):1203–12.

[26] Wipke-Tevis DD, Williams DA, Rantz MJ, Popejoy LL, Madson RW, Petroski GF, et al. Nursing home quality and pressure ulcer prevention and management practices. Journal of American Geriatric Society 2004;52(4):583–8.

[27] Boyle VL, Roychoudhury C, Beniak R, Cohn L, Bayer A, Katz I. Recognition and management of depression in skillednursing and long-term care settings: evolving targets for quality improvement. American Journal of Geriatric Psychiatry 2004;12(3):288–95.

[28] Davis MA. On nursing home quality: a review and analysis. Medical Care Review 1991;48(2):129–66.

[29] Flood AB. The impact of organizational and managerial factors on the quality of care in health care organizations. Medical Care Review 1994;51(4):381–428.

[30] Steffen TM. Organizational determinants of service quality in nursing homes. Hospital and Health Services Administration 1997;42(2):179–91.

[31] Zinn JS, Mor V, Castle N, Intrator O, Brannon D. Organizational and environmental factors associated with nursing home participation in managed care. Health Services Research 1999;33(6):1753–67.

[32] Hughes CM, Lapane KL, Mor VM. Influence of facility characteristics on use of antipsychotic medications in nursing homes. Medical Care 2000;38(12):1164–73.

[33] Zinn JS, Mor V, Intrator O, Feng Z, Angelelli J, Davis JA. The impact of the prospective payment system for skilled nursing facilities on therapy service provision: a transaction cost approach. Health Services Research 2003;38(6):1467– 85.

[34] Bostick JE. Relationship of nursing personnel and nursing home care quality. Journal of Nursing Care Quality 2004;19(2):130–6.

[35] Zinn JS, Aaronson WE, Rosko MD. Variations in the outcomes of care provided in Pennsylvania nursing homes. Medical Care 1993;31(6):475–87.

[36] Brannon D, Zinn JS, Mor V, Davis J. An exploration of job, organizational, and environmental factors associated with high and low nursing assistant turnover. Gerontologist 2002;42(2):159–68.

[37] Schnelle JF, Simmons SF, Harrington C, Cadogan M, Garcia E, Bates-Jensen B. Relationship of nursing home staffing to quality of care. Health Services Research 2004;39(2):225– 50.

[38] Fitzgerald RP, Shiverick BN, Zimmerman D. Applying performance measures to long term care. Journal on Quality Improvement 1996;22(7):505–17.

[39] van Harten WH, Casparie AF, Fisscher OAM. The evaluation of the introduction of a quality management system: a processoriented case study in a large rehabilitation hospital. Health Policy 2002;60:17–37.

[40] Ribbe MW, Ljunggren G, Steel K, Topinkova E, Hawes C, Ikegami N, et al. Nursing homes in 10 nations: a comparison between countries and settings. Age and Ageing 1997;26- S2:3–12.

[41] Van Drunen PHC, Van Montfort APAW. Een analyse van de kostenstructuur van Nederlandse Verpleeghuizen (An analyses on the coststructure of nursing homes in The Netherlands).G&S 1981;2(4):246–61.

[42] Berlowitz DR, Bandeis GH, Morris JN, Ash AS, Anderson JJ, Kader B, et al. Deriving a risk-adjustment model for pressure ulcer development using the Minimum Data Set. Journal of American Geriatric Society 2001;49(7):866–71.

[43] Beck K, Spycher S, Holly A, Gardiol L. Risk adjustment in Switzerland. Health Policy 2003;65(1):63–74.

[44] Mukamel DB, Watson NM, Meng H, Spector WD. Development of a risk-adjusted urinary incontinence outcome measure of quality for nursing homes. Medical Care 2003;41(4):467– 78.

[45] Bours GJ, Halfens RJ, BergerMP, Huijer Abu-Saad H, Grol RT. Development of a model for case-mix adjustment of pressure ulcer prevalence rates. Medical Care 2003;41(1):45–55.

[46] Holroyd-Leduc JM, Mehta KM, Covinsky KE. Urinary incontinence and its association with death, nursing home admission, and functional decline. Journal of American Geriatric Society 2004;52(5):712–8.

[47] Bula CJ, Ghilardi G, Wietlisbach V, Petignat C, Francioli P. Infections and functional impairment in nursing home residents: a reciprocal relationship. Journal of American Geriatric Society 2004;52(5):700–6.

[48] Goldstein H. Multilevel statistical models. 2nd ed. New York: Haltsted Press; 1995.

[49] SIG Jaarboek verpleeghuizen (SIG Yearly Review of Nursing Homes). Utrecht: SIG: Dutch Center of Health Care Information; 1998.

[50] Snijders TAB, Bosker RJ. Modelled Variance in two-level models. Sociological Methods & Research 1994;22(3):342–63.