extended degree program in meeting both faculty and student goals. The report suggests that the program was effective, and that it is meeting an identified need in the community. It also links the university to the community it serves. In an era of apparent lack of understanding by the public of the need for government services, it appears that the extended degree program might also provide a necessary link between the school of public health and the public it serves, generating favorable publicity as well as a power base.

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Case Mix and Surrogate Indicators of Quality of Care Over Time in Freestanding and Hospital-Based Nursing Homes in Colorado

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SYNOPSIS ....

Broad case mix and surrogate indicators of quality of care were examined to assess (a) annual variations in these factors in Colorado's nursing homes over a 3-year period and (b) differences between hospital-based and freestanding nursing homes in the State. The findings pertain to 19 hospital-based and 138 freestanding nursing homes, and they are based largely on analyses of secondary data that were self-reported by nursing home staffs and collected through facility-level surveys conducted by the Colorado Professional Standards Review Organization and the Colorado Department of Health.

The results suggest that case mix and quality change little from one year to the next for nursing homes. Based on the relatively crude case mix and quality indicators analyzed, there appears to be some evidence to suggest that case mix may be more complex and quality of care better in hospital-based nursing homes than in freestanding nursing homes. Further verification of the results, however, requires more refined measures of case mix and quality of care.

T HE RATIONALE FOR EXAMINING CHANGES in nursing home case mix and quality over time rests with a number of issues that can be broadly divided into patient care, regulatory, and reimbursement topics.

First, the degree to which the needs of patients change over time, such as from one year to the next, has substantial implications for care planning, staffing, and facility characteristics. If it is likely for

a nursing home or groups of nursing homes to retain a relatively stable mix of patients in terms of their social and health care needs over time, the opportunity to develop a stable and effective program of health and social care is enhanced. If, however, the typical nursing home experiences relatively substantial changes in case mix and therefore patients needs over time, the opportunity to attain this type of stability and effectiveness is decreased. This instability clearly has serious ramifications for the quality of patient care and even the cost of patient care.

Second, regulatory programs targeted at assuring quality, ranging from broad certification or licensure programs to specific patient or medical review programs (including those which monitor patient needs), should be structured as efficiently as possible from the perspective of collecting a minimal amount of data. Considerable attention is now being devoted to sampling, sentinel events, regulation by exception, and administrative costs of such programs (1,2). One of the issues entailed is the frequency with which data should be collected—quarterly, semiannually, annually, and so forth. Such issues are largely dependent on the extent to which nursing home case mix and quality of care change over time.

Third, the increased interest in incorporating indicators, especially of case mix and possibly quality, into nursing home reimbursement perforce requires not only an investigation of the types of case mix and quality measures to use, but also a general awareness of how case mix and quality influence cost and, in turn, how they change over time and thereby induce cost changes over time (3,4). Thus, if case mix and quality data are to be collected for purposes of reimbursement, the issue of how frequently this information should be gathered is relevant.

Under Section 223 of Public Law 92-603, hospital-based nursing homes are reimbursed under Medicare at a higher maximum rate than freestanding nursing homes. This provision was repealed under the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA, Public Law 97-248) and subsequently reinstated through the Social Security Amendments of 1983 (Public Law 98-21). This provision is premised on the reasonably well-known fact that care provided in hospital-based nursing homes is more expensive than care provided in freestanding nursing homes. Nevertheless, the question of why this cost differential exists is largely unanswered. The differential could, in fact, be due to

'One of the issues entailed is the frequency with which data should be collected—quarterly, semiannually, annually, and so forth. Such issues are largely dependent on the extent to which nursing home case mix and quality of care change over time.'

practices of cost reporting and reimbursement, differences in case mix and quality, or some combination of all such factors.

The purpose of this paper is to present the results of an initial investigation into both case mix and quality changes over time and the potential case mix and quality differences between hospital-based and freestanding nursing homes. The results are part of a larger study to examine the interrelationships among nursing home case mix, quality, and cost (5). The scope of this paper is restricted to indicators of case mix and surrogate quality derived from secondary data, and it is not intended to analyze or address nursing home costs. The data and measures used have several limitations, and our intent is to present some preliminary evidence and, we hope, make some inroads into these two areas.

Sample, Data, and Methods

Sample. The nursing homes which form the sample analyzed in this paper consist of 157 facilities from the universe of 184 Medicaid-certified nursing homes in Colorado in 1978. Fifteen facilities from this universe were excluded because they were restricted primarily to the treatment of mentally detarded (MR) or developmentally disabled (DD) patients, or because their case mix indicated they were chiefly MR–DD facilities. An additional 11 facilities were dropped from the larger study on which this analysis is based due to the lack of availability of adequate Medicaid cost report data for the entire 3 study years from 1978 through 1980. One facility was dropped since it was an extreme outlier on a number of structural and cost variables. The remaining 157 nursing homes include 138 freestanding facilities and 19 hospital-based facilities.

Data sources. Data analyzed came from four sources: (a) a facility survey administered by the Colorado Professional Standards Review Organization (PSRO)

in 1979, (b) a facility-level case mix survey administered by the Colorado Department of Health in 1979 and in 1980, (c) Medicaid cost reports for 1978 through 1980, and (d) the Medicaid certification survey administered by the Colorado Department of Health in 1978 and 1979. The case mix indicators discussed in this paper are based on the PSRO survey and the health department case mix survey, while all but two types of surrogate quality measures are based on data from the Medicaid cost reports and Medicaid certification surveys. The exceptions pertain to the nursing staff turnover measures for 1979, which were defined as the ratio of the number of full-time equivalent nurses who left a given facility during the year over the total number of full-time equivalent positions for the year. These measures were based on PSRO survey data for 1979.

Both the health department case mix survey and the PSRO survey instruments were completed by the nursing home staff and returned to the respective agencies. The data from these sources, therefore, may be somewhat inaccurate due to self-reporting biases. The health department case mix surveys pertain to 6 quarter-year periods, the last 2 quarters of calendar year 1979 and all 4 quarters of 1980. These data were aggregated over the first 2 and last 4 quarters and, therefore, the 1979 data (presented in table 1 in the next section) pertain to the last 6 months of 1979 rather than the entire year.

The likelihood of any type of self-reporting bias is minimal for the Medicaid cost report and Medicaid certification survey data, since the cost reports were audited by the Medicaid program and underwent considerable scrutiny during data preparation for this study and the certification survey forms were completed by surveyors external to the nursing

homes. Nevertheless, the certification survey data should be qualified by the fact that certification surveys have come under criticism nationally due to their questionable relevance in some instances and the possible inconsistencies among different survey teams.

Measures. All case mix measures used were expressed as the percentage of patients in the facility with a given attribute such as independent in ambulation, decubiti, currently receiving special skin care, confused or disoriented, over 85 years of age, classified as a patient needing a skilled level of nursing, and so forth. The surrogate quality indicators pertained predominantly to characteristics of the nursing staff, with the exception of hours spent by volunteers per patient per week, and the number of violations of 36 certification requirements. The certification violations variable was obtained from the Medicaid certification survey. The surrogate quality variable called percent use of nursing pools was constructed from Medicaid cost report data by calculating the percentage of nursing and aide costs associated with temporary nursing staff hired through nursing pools. The remaining measures analyzed are either self-explanatory or discussed further in the next two sections.

Case Mix and Structural Quality Changes

Case mix. Case mix appeared to change very little between 1979 and 1980 in terms of the case mix variables of the Colorado Department of Health presented in table 1. The only significant differences between the 2 years pertain to the 2.08 percentage point decrease between 1979 and 1980 for the bowel and bladder training variable and the 2.61 percent

Table 1. Case mix changes between 1979 and 1980 for 157 nursing homes in Colorado

Patient attribute	1979		1980		t value	Significance [2]
	Percent [1]	S.D.	Percent [1]	S.D.		
Independent in ambulation	37.11	17.23	36.05	15.49	1.22	.225
Requires some assistance in eating	15.39	11.60	14.98	9.39	0.52	.603
Indwelling catheter	5.51	4.67	5.41	4.98	0.43	.668
Incontinent	28.06	12.17	28.55	10.49	0.58	.563
Decubiti	3.49	2.76	3.59	2.54	0.40	.686
On bowel and bladder training program	12.70	14.07	10.70	10.62	1.88	.063
Receives special skin care	20.81	16.09	21.71	15.87	0.74	.462
Confused or disoriented	46.14	18.88	43.53	16.08	2.09	.038
Receives intravenous therapy or blood transfusions [3]	.04	.24	.02	.09	0.94	.349

[1] Average of percentages for each of the 157 nursing homes.
[2] Matched pair t value and corresponding 2-tail significance level.

[3] Percentages available for only 155 facilities.
SOURCE: CDH case mix survey and CDH certification survey.

decrease in the confused or disoriented variable ($P = .063$ and $P = .038$, respectively). Matched-pair t tests were used in order to avoid the possibility that the overall means could remain relatively stable over the 2 years, despite the possibility that certain case mix percentages could vary considerably for individual facilities from one year to the next. Although the annual differences associated with bowel and bladder training and confusion or disorientation were statistically significant at the 0.10 level, the actual mean differences were small, suggesting relatively inconsequential changes from 1979 to 1980.

The results of table 1 were further substantiated by comparing the same case mix indicators over each of the six different quarters beginning with the third quarter of calendar 1979 and ending with the fourth quarter of 1980. A one-way analysis of variance was used to examine the six means (one per quarter) over time for each variable. The results were basically the same as those in table 1.

Surrogate quality. Six surrogate quality variables were analyzed for the 3-year period from 1978 through 1980. Five of the six variables measured nursing staff characteristics or availability, and the sixth, the number of violations of the 36 certification requirements, represents a structural quality indicator. The certification violations variable was available only for 1978 and 1979, and it did not change significantly over this period. As shown in table 2, changes in the surrogate quality indicators were statistically significant over the 3-year period. However, the actual magitude of the changes in the registered nurse (RN), licensed practical nurse (LPN), aide, orderly, and total staffing ratios (that is, hours per patient) was small relative to the ratios themselves. For example, although the change in

the total staffing ratio from 1979 (2.09) to 1980 (2.20) was 0.11, it represented only a 5 percent change over this period. The relative magnitude of the change was greater, however, for the other variable which changed significantly over this period, the percent use of nursing pools by the facilities. The change from 1978 (0.03, actually 0.025 before rounding) to 1980 (0.05), although only 0.025 in absolute terms, represented a 100 percent change over this period.

Under the assumption that higher values of this variable suggest lower quality of care owing to greater use of temporary nursing personnel, who are not as familiar with patients as full-time permanent nursing personnel, the upward trend over time suggests a decrease in quality of nursing care. The increased use of nursing pools is often due to the inability of nursing homes to pay wages necessary to minimize nursing and aide personnel turnover. Only anecdotal information is available to support this phenomenon. However, under a contract from the Health Care Financing Administration, Mathematica Policy Research is currently investigating the extent of nursing pool usage and its impact on quality of care, with preliminary findings expected in 1983.

Matched-pair t tests were used for the comparisons between each pair of years from 1978 to 1980 for the same reasons mentioned earlier. Also anologous to the table 1 results, one-way analyses of variance were conducted to compare simultaneously the means for all 3 years for each of the surrogate quality indicators in table 2. Again, the results essentially confirmed those of the matched pair t tests presented in table 2. Consequently, minimal changes in quality, as measured by the surrogate indicators of table 2, appear to take place over time, with the

Table 2. Annual changes in surrogate quality indicators from 1978 to 1980 for 157 nursing homes in Colorado

| Quality indicator | 1978 | | 1979 | | 1980 | | Significance [1] | | |
	Mean	S.D.	Mean	S.D.	Mean	S.D.	1978 vs. 1979	1978 vs. 1980	1979 vs. 1980
Number of violations [2]	5.71	3.29	6.11	3.79	...	...	.264	...	...
Percent of facilities using nursing pools [3]	0.03	0.04	0.04	0.05	0.05	0.08	< .001	< .001	< .003
RN hours per patient [3]	0.39	0.27	0.33	0.38	0.35	0.24	.020	.009	.309
LPN hours per patient [3]	0.31	0.20	0.30	0.17	0.33	0.19	.284	.056	.003
Aide, orderly hours per patient [3]	1.47	0.32	1.49	0.36	1.51	0.30	.483	.005	.105
Total nursing and aide hours per patient [4]	2.15	0.57	2.09	0.49	2.20	0.44	.012	< .001	< .001

[1] 2-tail significance levels for the matched pair t test.
[2] Number of violations of 36 certification requirements. For this variable, data were available for only 131 facilities for 1978 and 1979. No data were entered in computers for 1980.
[3] Data available for only 155 facilities for between-year comparisons.

[4] The means for total nursing and aide hours per patient differ slightly from the sum of the component means for each year due to rounding.
SOURCE: CDH certification survey, Medicaid cost reports, CDH case mix survey.

> *'Although the use of nursing pools was only 5 percent for freestanding facilities, this proportion was approximately five times as high as the pool-use indicator for hospital-based facilities. In general, these results suggest a potentially better care environment in hospital-based than in freestanding facilities, especially in terms of staffing.'*

exception of a statistically and substantively significant increase in the use of nursing pools between 1978 and 1980.

Hospital-Based and Freestanding Homes

Case mix. Hospital-based and freestanding nursing homes were compared on a number of case mix indicators for 1980, including all those in table 1, plus the percentages of patients in two different age categories, who were ambulatory with a device, in wheelchairs, completely bedfast, with alcohol or drug problems, with developmental disabilities, and classified as skilled nursing-level patients. Neither activities of daily living (ADLs) measured in the traditional sense (6,7) nor medical diagnoses (8) were available from the data sources used. Of the case mix indicators examined, those that were significantly different between freestanding and hospital-based nursing homes are presented in table 3. The ordinary rather than the matched-pair t test was used for the comparisons since there was no specific within-facility factor for which to compen-

sate, that is, the only question of interest was the between-facility (freestanding versus hospital-based) comparison.

Several differences between freestanding and hospital-based nursing homes were statistically significant and, further, the actual magnitudes of the mean differences were substantial (table 3). Overall, the results suggest that patients in hospital-based nursing homes tend to be older, more frequently classified as needing skilled nursing care, and less frequently characterized by incontinence, alcohol or drug problems, and the psychosocial problem of confusion or disorientation common in the long-term care field.

Surrogate quality. Of the 10 surrogate quality variables examined in the comparison of freestanding with hospital-based facilities, 7 yielded statistically significant differences between the two facility types (table 4). Hospital-based nursing homes were significantly lower users of nursing pools ($P = .06$), tended to have fewer violations of certification requirements ($P = .052$), had greater availability of LPNs per patient ($P < .001$), greater availability of aides and orderlies per patient ($P = .003$), more total nursing and aide resources in general per patient ($P = .001$), less LPN turnover ($P < .001$), and less aide or orderly turnover ($P < .001$). Although RN resources per patient were higher and RN turnover lower for hospital-based facilities, the differences were not significant.

Among the most pronounced differences were the substantially higher LPN and aide or orderly hours per patient, with hospital-based facilities averaging one-third hour more per patient day for each type of care than the freestanding facilities. The substantially higher turnover ratios for LPNs, aides, and

Table 3. Comparison of general case mix indicators for 138 freestanding and 19 hospital-based nursing homes in Colorado, 1980

Patient attribute	Freestanding facilities		Hospital-based facilities			
	Percent [1]	S.D.	Percent [1]	S.D.	t value [2]	Significance [2]
Incontinent	29.29	10.14	23.13	11.67	2.44	.016
Confused or disoriented	44.90	15.88	33.56	14.27	2.96	.044
85 years or older [3]	36.30	15.96	51.65	11.56	− 3.60	< .001
Between 21 and 44 years [3]	3.29	6.32	1.80	2.42	1.75	.085
Alcohol or drug problems [3]	4.28	6.99	1.09	1.47	4.34	< .001
Needs skilled level of nursing [3]	32.46	27.43	45.57	36.61	− 1.74	.085

[1] Average of percentages for freestanding and hospital-based facilities, respectively.
[2] Ordinary t value and corresponding 2-tail significance level for t test using pooled or distinct variance version, depending on results of an F test for variance homogeneity.

[3] For the patient attributes referenced with this footnote, statistics are based on fewer than 138 freestanding or fewer than 19 hospital-based nursing homes.
SOURCE: Colorado PSRO survey of facilities and CDH case mix survey.

Table 4. Comparison of surrogate quality indicators for 138 freestanding and 19 hospital-based nursing homes in Colorado, 1980

Quality indicator [1]	Freestanding		Hospital-based		t value	Significance [2]
	Mean	S.D.	Mean	S.D.		
Number of violations [3]	6.35	3.85	4.33	2.58	1.96	.052
Percent of facilities using nursing pools	0.05	0.08	0.01	0.05	1.89	.060
RN hours per patient	0.34	0.15	0.43	0.57	− 0.66	.517
LPN hours per patient	0.29	0.14	0.62	0.28	− 4.90	< .001
Aide, orderly hours per patient	1.48	0.26	1.81	0.41	− 3.37	.003
Total nursing, aide hours per patient	2.11	0.30	2.86	0.76	− 4.09	.001
Volunteer hours per week per patient [4]	0.57	0.56	0.56	0.56	0.04	.965
RN turnover [4,5]	0.63	0.57	0.47	0.57	1.05	.297
LPN turnover [4,5]	0.66	0.72	0.26	0.31	3.81	< .001
Aide, orderly turnover [4,5]	0.67	0.75	0.23	0.32	4.22	< .001

[1] Data for all quality indicators pertain to fewer than 138 freestanding or fewer than 19 hospital-based facilities, ranging from 116 to 136 freestanding and 13 to 18 hospital-based nursing homes.
[2] Ordinary t value and corresponding 2-tail significance level for t test using pooled- or distinct-variance version, depending on the results of an F test for variance homogeneity.
[3] Number of violations of 36 certification requirements.

[4] Data pertains to 1979 rather than 1980.
[5] The RN turnover variable represents the ratio of the number of RNs who left the facility during the year to the total number of full-time equivalent positions for the year. The LPN and aide or orderly turnover variables are defined analogously.
SOURCE: Medicaid cost reports, Medicaid certification survey, Colorado PSRO facility-level survey, and CDH case mix survey.

orderlies were pronounced, with turnover close to three times as high for the freestanding facilities as for the hospital-based homes. During this period, Colorado was experiencing the same general trend as the rest of the country with respect to increased turnover of nursing staff and greater use of nursing pools by nursing homes. Although the use of nursing pools was only 5 percent for freestanding facilities, this proportion was approximately five times as high as the pool-use indicator for hospital-based facilities. In general, these results suggest a potentially better care environment in hospital-based than in freestanding facilities, especially in terms of staffing.

Summary and Conclusions

The results listed in the preceding two sections have several implications.

1. Case mix seems to vary little from one year to the next for the average nursing home.

2. Quality, measured chiefly by surrogate indicators characterizing the nursing staff and a structural indicator characterizing the general care environment, does not vary substantially from one year to the next, except for an upward trend in the use of temporary nursing personnel.

3. Case mix appears to differ for hospital-based and freestanding facilities; hospital-based facilities tend to have more patients needing skilled levels of nursing, older patients, and fewer patients with problems of incontinence, alcohol or drug abuse, and confusion or disorientation.

4. Hospital-based facilities are characterized by a greater availability of nursing staff, less nursing turnover, a lower percentage of temporary personnel hired through nursing pools, and fewer violations of certification requirements than freestanding facilities.

These results should be considered in the context of several qualifications. First, no major policy changes took place in Colorado immediately before or during the 1979–80 period that would be likely to have a significant impact on changing the mix of cases in nursing homes. Although a preadmission and concurrent screening program was subsequently implemented for purposes of determining whether a patient might be eligible for Medicaid-financed noninstitutional care, this program was not in place during the study period. Therefore, the results suggest that nursing home case mix varies but little during time periods when financial and regulatory conditions remain stable.

Second, 84 percent of the hospital-based nursing homes in Colorado are located in non-Standard Metropolitan Statistical Areas. Thus, some of the observed differences, such as the difference in the age of the patients, are due partly to rural-urban differences. Although several characteristics, such as occupancy rate (92 percent for freestanding facilities and 93 percent for hospital-based facilities) do not necessarily point to specific reasons for some of the observed differences, no examination of the causes of such differences was undertaken as part of this analysis. Also, the results pertain only to Colo-

rado and should be verified using data from other States.

Finally, and most important, the case mix and quality data used only suggest the four conclusions listed previously. More detailed patient-specific data on activities of daily living scales, severity of patients' problems and diagnoses, and quality of services provided (even outcomes, if possible) are needed to make the implications of this paper conclusive.

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An Assessment of the Completeness of the Massachusetts Burn Registry

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SYNOPSIS ....

An opportunity to assess the completeness of reporting to the Massachusetts Burn Registry arose when data on the incidence of inpatient burns in Massachusetts became available from an independent source, the New England Regional Burn Program. The assessment showed that the level of reporting to the registry was approximately 20 percent and that substantial geographic variability existed. Other areas in which the registry is experiencing difficulties that bear on its potential usefulness include confusion about the type of burns that are reportable, lack of adequate control of data quality, and insufficient funds to support the registry's activities. Continuation of the present burn reporting system does not seem defensible in the absence of changes in either the reporting requirements or the reporting methods, because the level of reporting is low, the quality of the data is unknown, and the registry is not achieving goals of substantial public health importance.

BURN INJURIES IN THE UNITED STATES account for the deaths of approximately 6,300 persons each year; an additional 60,000 persons are hospitalized annually for the treatment of burns. Among the industrialized nations, the United States has the highest death rates and per capita property loss from fires (1). Our undesirable position has persisted for several decades notwithstanding improvements in medical care for burned patients and a greater recognition that burns are a largely preventable public health problem.

A fairly recent approach to the control of burn injuries has been the establishment of statewide and national registries of burns. One example is the Massachusetts Burn Registry, which was established by law in 1973 to provide a data base from which information on the incidence and epidemiology of burns statewide could be obtained (2). Reportable