A Comparison of the Level of Care Predictions of Six Long-Term Care Patient Assessment Systems

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Abstract: Six patient assessment systems that have explicit decision rules for replicating team judgments on level of care patient placement were selected for analysis. The six were selected because of their origin, logic or decision diversity, and their ability to be programmed on a computer (i.e., explicit decision rules).

Six hundred seventy-nine patient descriptor profiles were collected on patients currently in New York State nursing homes. These patients were then "placed" by level of care for each assessment system. The probability of agreement of placement between pairs of assessment systems ranges from 38 per cent to 91 per cent. Among SNF (skilled nursing facility) patients only, the level of agreement drops as low as 39 per cent. Uniformity of placement criteria is, in fact, the exception rather than the rule. A patient's placement is quite dependent on both his/her state of residence and his/her health status.

The effect of differences in placement decisions has major implications for the patients being placed and for the cost of LTC (long-term care). This analysis was confined to systems that had a well developed set of guidelines—the situation is likely to be even more variable where guidelines are vaguely stated. (*Am J Public Health* 1980; 70:1152-1161.)

Introduction

The planning and delivery of long-term care (LTC) is presently receiving much attention both in terms of resources and public concern. However, the long-term care delivery system is plagued by the same problems that affect most health care and social care delivery systems: the lack of well-defined missions and goals and, hence, a basis for judging how effectively the delivery system is performing. One basis for judging the effectiveness of the LTC system is the adequacy with which the needs of the LTC patient are assessed and the ability to relate these needs to an appropriate level of care.

The potentially negative consequences of an incorrect determination of an appropriate level of care include the following:

1. If more intensive care is provided than is needed, the patient may become more dependent.
2. If less intensive care is provided than is needed, the patient may suffer the consequences of inadequate care, and staff in the facilities may be overextended.
3. Most planning methodologies for LTC are demand-based methodologies. Thus, an inappropriate placement system tends to be self-perpetuating.
4. Placement in more intensive settings than is needed leads to unnecessary costs in the system.

One mechanism which has been proposed and tested with regard to patient assessment is a screening instrument with decision rules for replicating team judgments in the choice of an appropriate institutional setting for a patient or groups of patients. These algorithms for replicating clinical judgments are less costly and professionally less demanding than full interdisciplinary clinical team assessment mechanisms.

In order to gain some insight into the magnitude of the inappropriate placement problem, a study was performed which concentrated on evaluating—both individually and in a comparison framework—screening instruments that have explicit decision rules for replicating team judgments of level of care patient placement. Six screening instruments from diverse settings were selected for analysis. These six were selected because of their origin diversity, logic or decision rule diversity, and their ability to be programmed on a computer.

Materials and Methods

Descriptive Review of the Systems

A review of the classification systems (or algorithms) developed for patient placement in LTC showed there were three basic types of logical structures used in the systems:

- additive logic
- maximum need logic
- multiple contingency logic

In *additive* logic, the level of care for a patient is selected on the basis of a point total which has resulted from

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the addition of the points assigned to various patient descriptor statements. The decision rule for the level of care is made on selected threshold values for the point total.

The *maximum need* logic is a set of rules which selects the level of care on the basis of the maximum demonstrated or indicated level in some dimension of the patient's need.

Multiple contingency logic can best be characterized as "it depends" logic. This logic can be implemented in several ways including dual consideration of a total score and scores in patient need dimensions or through simultaneous consideration of two or more dimensions of need. The multiple contingency title is appropriate, since the decision on level of care is dependent upon more than one summary statement about the patient.

Additive Logic Classifications

Two additive logic screening instruments were analyzed and compared. The first system considered is from Colorado, and the second is from New York State.

Long-Term Care Program Placement Review Form, Colorado Foundation for Medical Care

Pre-admission review of potential long-term care patients in Colorado is a function of the Colorado Foundation for Medical Care (CHMC), the Professional Standards Review Organization (PSRO) for Colorado. As part of a demonstration project in long-term care review, an assessment instrument was designed for use in this review.[1] The patient dimensions measured in the determination of the level of care, and the points that are assigned to patient description statements under each dimension, are shown in Table 1.

The assigned points were developed by group consensus following review of efforts done by others and the points used in those efforts. The placement decision rules are based on the total point score. A score of 15 or more qualifies the patient for Skilled Nursing Facility (SNF) level, while a score of 8 to 14 qualifies the patient for Intermediate Care Facility (ICF) level. A score of 7 or less indicates a Residential Care Facility (RCF) level of care.

TABLE 1—Colorado Foundation for Medical Care LTC Placement Review

Dimension	Assigned Point Levels
I. Activities of Daily Living	
Dressing	0, 1, 2, 4
Bathing	0, 1, 2, 4
Continence of Bladder	0, 1, 3, 5
Continence of Bowel	0, 1, 3, 5
Personal Hygiene	0, 1, 1, 2
Eating and Feeding	0, 2, 3, 15
II. Mobility	0, 2, 3, 8
III. Nutrition	not scored
IV. Sensory Status	
Vision	0, 0, 2, 6
Hearing	0, 0, 2, 6
V. Communication	0, 1, 4, 12
VI. Skin Care	0, 1, 4, 12
VII. Medications	0, 1, 8, 15
VIII. Motivation	0, 1, 2, 8
IX. Behavior	0, 2, 7, 15
X. Ordered Therapies	0, 15, 30, 45, 60, 75

The point levels assigned to each ordered therapy are large enough to place the patient in SNF level of care. This includes tube, gastrostomy or IV feedings in addition to physical or speech therapy. The inability to make needs known and need for intensive skin care are also assigned large point scores. Tests on the placement system involved comparison of a point total predicted level with the level prediction of experts. These tests have led to a reevaluation of the points assigned, and work is now continuing on redeveloping the instrument.

New York State DMS-1 Patient Assessment Form

The New York State DMS-1 Patient Assessment Form was developed as an aid for the non-physician screener in performing continued stay reviews in SNFs and Health-Related Facilities (HRF). (The HRF level in New York conforms to the Medicaid definition of an ICF).

The DMS-1 assessment is required by regulation to be conducted in the following circumstances: discharge or transfer to any LTC facility from a hospital, admission from home to LTC facility to another LTC facility, admission from an LTC facility to a hospital, periodic utilization review, Medicaid review, or in the event of death.

The placement form contains objective and narrative sections which address many different areas for patient assessment (see Table 2). The placement decision of a patient as to level of care can be automatically certified through the scoring mechanism of the DMS-1 or by a physician's statement which certifies a level of care different from the scored level. A total predictor score equal to or greater than 180 indicates that the patient is medically eligible for SNF admission or continued stay; if the score is equal to or greater than 60, the patient is medically eligible for HRF admission or continued stay while those patients with scores less than 60 are not qualified (by the point total) for a health-related LTC facility.

The point values and the level of care threshold scores are constructed so that the presence or requirement for a single service does not alone qualify the patient for SNF level of care. Thus, in this additive logic system, combinations of required services and fractional limitations are needed to qualify a patient for the SNF level of care.

The numerical standards (or points) were developed using discriminant analysis, conditional probability, and Monte Carlo simulation of 5,982 SNF-placed patient assessments and 1,236 HRF-placed patient assessments. The overriding philosophy in the development was to mirror current practice, i.e., patients were to be assigned to the levels they required at the time of the study as determined by an interdisciplinary assessment team in the participating facility.

The final set of decision rules considered two factors:

- misplacements were more likely to be made to a higher level than needed than to a lower level than needed;
- advisory group input on the effect on facilities and patients the new decision rules would make.

Although the decision rules and point values were deter-

TABLE 2—New York State DMS-1 Patient Assessment

Dimension	Assigned Point Levels
Nursing Care and Therapy	
Parenteral Medications	0, 25, 60, 85, (subtract 15 if self care)
Inhalation Treatment	0, 37, 38, 75 (subtract 20 if self care)
Oxygen	0, 49, 49, 98 (subtract 4 if self care)
Suctioning	0, 50, 50, 100 (subtract 1 if self care)
Aseptic Dressing	0, 42, 48, 90
Lesion Irrigation	0, 49, 49, 98 (subtract 20 if self care)
Cath/Tube Irrigation	0, 35, 60, 85 (subtract 1 if self care)
Ostomy Care	no points assigned
Parenteral Fluids	0, 50, 50, 100
Tube Feeding	0, 50, 50, 100
Bowel/Bladder Rehabilitation	0, 48, 48, 96
Bedsore Treatment	0, 50, 50, 100
Other (Describe)	0
Incontinence	
Urine	0, 10, 15, 20
Stool	0, 20, 40
Function Status	
Walks with or w/o aids	0, 35, 70, 105
Transferring	0, 6, 12, 18
Wheeling	0, 1, 2, 3
Eating/Feeding	0, 25, 50
Toileting	0, 7, 14
Bathing	0, 17, 24
Dressing	0, 40, 80
Mental Status	
Alert	0, 20, 40
Impaired Judgment	0, 15, 30
Agitated (Nighttime)	0, 10, 20
Hallucinates	0, 1, 2
Severe Depression	Psychiatric evaluation required
Assaultive	0, 40, 80
Abusive	0, 25, 50
Restraint Order	0, 40, 80
Regressive Behavior	0, 30, 60
Wanders	no points assigned
Other (Specify)	no points assigned
Impairments	
Sight	0, 1, 2
Hearing	0, 1, 2
Speech	0, 10, 20
Communications	no points assigned
Other (Contractures, etc.)	no points assigned
Skilled Therapy	
Physical Therapy	0, 37
Occupational Therapy	0, 37
Speech Therapy	0, 37

mined from one set of data, tests of the validity of both were performed on an independent set of patient assessments.

These tests on the study sample demonstrated that the placement decision of an interdisciplinary team for SNF care were replicated 83 per cent of the time by the classification system. Decisions on HRF level were replicated 91 per cent of the time. In addition, the scoring and decision rules were compared to the placement recommendation of a team of two physicians and a nurse in a New York State county. In this comparison, the team assessments and the placement by use of the scores agreed in nearly 90 per cent of the cases.[3]

Maximum Need Logic Classifications

Two maximum need logic patient placement algorithms were analyzed and compared. The first one considered is titled the Sandoz Pharmaceuticals System.[4] The second is from the State of Massachusetts.[5, 6]

Evaluating Elderly Patients' Required Level of Care, Sandoz Pharmaceuticals

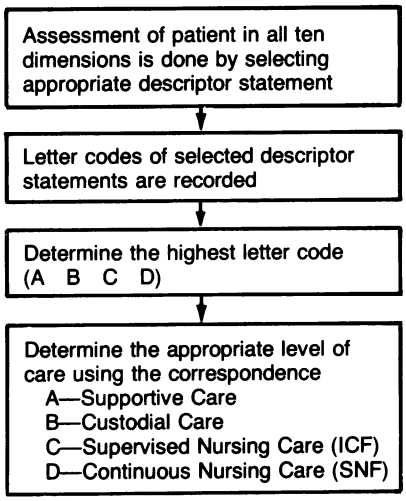
The Sandoz system is oriented to the physician as an aid to selecting alternative living arrangements for the elderly. However, the patient assessment and placement algorithm can be used by a nurse or trained administrator to determine the level of care and services needed by the elderly individual. A major reason for evaluating this system was to see how well this relatively simple system compares in placement decisions to the more complex systems.

The health-oriented levels of care included in the assessment system the SNF and ICF. Also included in the assessment algorithm are two non-health levels of care: 1) supportive care such as senior citizen residence, day care center, or home care; and 2) custodial care in homes for the aged. The evaluation guide is completed much as any multiple-choice form. Corresponding to the responses is the appropriate descriptor statement which defines the patient's ability or need in each of ten dimensions (see Table 3). Because the classification system is a guide to evaluation and is not a mandated system, some exceptions to the maximum need logic are suggested, e.g., use professional judgment on the appropriate level of care when only one dimension is at the highest level of need in contrast to the situation when a number of dimensions are at the higher level. The maximum need logic is also modified somewhat when considering the patients' special therapy requirements. With regard to therapy, only two descriptors are given and the level of care distinction between these descriptor statements is whether the services can be received at home or in a clinic, indicating a placement in a non-health, long-term care setting (responses A or B), or whether the intensity or frequency of services necessary is such that they can be more appropriately received at a health-oriented, long-term care facility (responses C or D). Thus, the contribution to the level of care decision that this dimension of need makes is limited to the choice of a health-oriented, long-term care facility or a non-health facility.

TABLE 3—Logic Flowchart of Evaluating Elderly Patients' Required Level of Care, Sandoz Pharmaceuticals

Patient Dimensions Assessed

1. Ability to attend to personal care
2. Ability to move about
3. Ability to think clearly and make decisions
4. Ability to perceive time and identify places and persons
5. Ability to initiate and complete task and routine duties
6. Ability to show proper emotional responses
7. Patient's ability to feed himself/special diets
8. Patient's behavior patterns
9. Patient's recent medical history
10. Patient's special therapy requirements



The Massachusetts Department of Public Health Long-Term Care Patient Surveys

As part of the planning efforts for long-term care in Massachusetts, the Massachusetts Office of Health Planning and Statistics conducted a survey of the residents residing in long-term care facilities. Included in the effort was the development of a statistical model which, on the basis of patient assessment data, replicated the placement decision made by a Periodic Medical Review Team.

The classification logic was developed using factor analysis, discriminant analysis, and intuitive model building which followed a pattern of systematically improving the model by studying the effects on the success of the model of adding additional conditions.

The classification is much more reliable in a statistical sense, i.e., in its ability to correctly identify the level of care distribution in a group of patients, than it is reliable as an indicator of the level of care need for an individual patient. When the classification is compared to Periodic Medical Review Team placement decisions, they both agree (replicate) approximately 75 per cent of the time. The classification system overpredicts in a group of patients the need for Chronic Hospital or Rehabilitation Hospital care (22.6 per cent), underpredicts the need for Level II care (10.4 per cent), and overpredicts Level III and IV care by less than 3 per cent.[7]

The levels of care in the survey and programmed into the placement model are:

Level I: Chronic Disease/Rehabilitation Hospital Care. Patients heading this level of care are those whose condition is medically unstable, who need the special services available only in a hospital, frequent physical visits, or who need intensive and multidisciplinary rehabilitation services for a relatively short period of time.

Level II: Patients needing this level of care are those whose needs can only be provided by licensed nursing personnel with regards to *type* of nursing care and not *amount* of nursing care required.

Level III: Patients at this level may require either some or a considerable amount of assistance in activities of daily living (ADL), and may, in addition, require some nursing services that can be provided by nurses aides or assistants under the supervision of licensed nursing personnel.

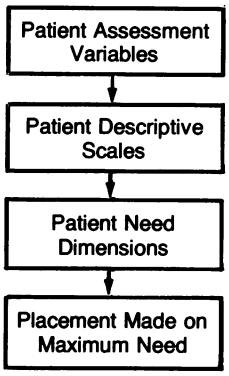
Level IV: Individuals at this level require some supervision in activities of daily living, or require, perhaps because of problems of orientation, supervision in taking medications.

Forty-nine patient descriptor variables were translated into 16 patient descriptive scales and, in turn, further refined into six dimensions of the patients (see Table 4). The final placement is based upon the maximum need in these six placement dimensions and is expressed as an index directly related to the four levels of care. The logic leading to the determination of an appropriate level of care for these dimensions is not, however, based on any single decision rule but includes additive mechanisms and contingency logic.

Because of the inclusion of the chronic disease/rehabilitation hospital level in the algorithm, several patient assessments items are directed to the medical stability of the patient. The presence of medical disabilities such as comatose,

TABLE 4—Massachusetts LTC Planning Algorithm

Patient Descriptive Scales	Final Placement Dimensions
1. Ambulation	1. Medical Instability
2. Personal Care	2. Rehabilitation
3. Bowel-Bladder Function	3. Skilled Nursing
4. Total Activities of Daily Living	4. Mental Status/Behavior
5. Mental Behavior	5. Activities of Daily Living
6. Mental Hospital Patient	6. Special Needs of Former Mental Hospital Patients
7. Medications	
8. IV or Clysis	
9. Skilled Nursing	
10. Intermediate Nursing	
11. IM Injection	
12. Frequency of Services	
13. Number of Services	
14. Physician Care Scale	
15. Special Procedures	
16. Comatose	



a diagnosis of stroke or liver failure, or the need for intense and/or frequent rehabilitation therapy indicates a need for the chronic disease/rehabilitation hospital level of care.

Multiple Contingency Logic Classifications

Multiple contingency logic classifications are characterized by a decision on placement which is made through the simultaneous consideration of two or more factors of the patient. In the first classification, Illinois Evaluation of Need for Care, this logic is implemented through the consideration of a point total, as well as which items contribute to that point total. In the second classification, the simultaneous consideration of three dimensions of the patient is used in the final placement decision.

Illinois Evaluation of Need for Care

The Illinois Evaluation of Need for Care[8] was jointly designed by the Illinois Department of Public Aid and Department of Public Health for use in an automated system for regulation and medical review of long-term care facilities and patients. The regulation aspect includes a reimbursement mechanism which relates the reimbursement for a patient in a nursing home to the disability level of that patient (which is reflected by the point score for that patient). A set of rules for appropriate placement are associated with the point score and the patient descriptors.

The levels of care in the system are SNF, ICF-1, and ICF-2, (a second intermediate care level which was defined as a health-oriented, long-term care facility for those requiring assistance in bathing, dressing, grooming, eating, mobility, incontinence and behavior, but not to the extent that would make the person eligible for the higher intermediate care level). This level of care has since been abolished, and patients previously placed in this level now are placed in the single intermediate care level or in a residential care facility (adult home) depending upon the amount and type of assistance needed.

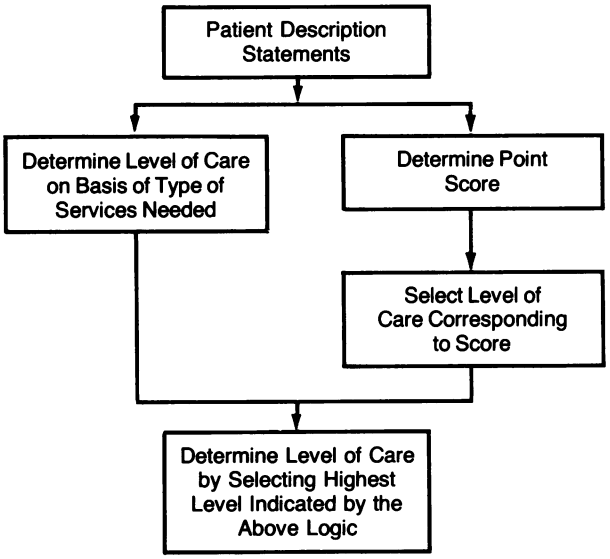
The system is shown in Table 5. A patient is qualified for skilled care level when the total score is 25 or more or when certain designated skilled care items are required; for intermediate care when the score is seven or more or when certain designated intermediate care services are required; and for residential care treatment when the patient does not qualify for either of these levels.

The points assigned to the patient descriptors were developed in the early 1960s. Steps used in the development were not documented. However, research now being initiated is aimed toward developing a new assessment instrument and point assignments.

The points assigned to the various services required were used in a regression analysis to determine the relationship between costs in a nursing home and the point scores of

TABLE 5—Illinois Evaluation of Need for Care

Dimension	Points
1. Eating	0, 1, 2, 4, 8
2. Mobility	1, 2, 3
3. Behavior and Mental Condition	0, 3, 8
4. Physical Rehabilitation Needs	0, 1, 8, 12
5. Catheterizations (including irrigations)	0, 4, 8
6. Incontinence (bladder and bowel)	0, 1, 2, 8, 6, 8
7. Douches, Enemas, or Colostomy Irrigations	0, 4, 5
8. Diet	0, 3
9. Medications (oral, ointments, drops, and suppositories	0, 1, 2
10. Injections (hypodermic and intramuscular)	0, 2, 4
11. Intravenous and Subcutaneous Fluids)	0, 2, 8
12. Suctioning	0, 3, 5, 8
13. Oxygen (includes positive pressure)	0, 4, 8
14. Dressings and Appliances	0, 4, 6, 8
15. Nursing Care Required for Acute Illness or Injuries	0
16. Bathing	0
17. Dressing	0
18. Grooming	0



residents. When all nursing homes are considered as a group, this regression analysis results in the determination of a reimbursement rate equation for the state which is used for reimbursement purposes.[9] Thus, the rate for a patient that a nursing home receives is based upon a fixed cost component and a variable cost component tied into the point score for that patient.

New York State Department of Mental Hygiene Level of Care Survey

As part of their planning activities, the New York State Department of Mental Hygiene conducted a study to determine the placement alternatives of their psychiatric hospital residents. This Level of Care Survey,[10] was a process by which data concerning each patient were gathered by a trained surveyor and were analyzed using a computerized algorithm which simulated criteria of service appropriateness within a variety of settings.

The levels of care in the algorithm included the LTC levels already established in New York with the imposition over these levels of psychiatric environment. Thus, the selection of an environment for a patient was based not only on the physical level of care but also on the appropriate psychiatric need level of the patient. The selection of appropriate environment along these two dimensions was based upon the premise that function is more relevant to level of care need than the presence of a symptom or its severity. Questions on the survey were stated in terms of degree of interference with functioning due to the particular condition being addressed.

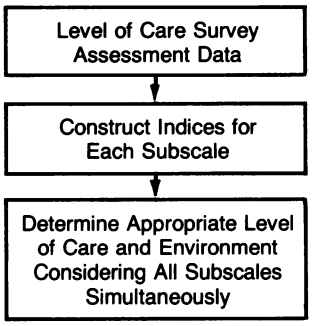
A total of 146 items of data regarding the patient were gathered both in terms of the physical level of care needed and the psychiatric level of need. These 146 items were reduced through the construction of five subscales or dimensions (Table 6). Several criteria were used in the development of these five subscales from the data, including: logical consistency, statistical coherence among items, a necessary place in the type of judgments made by clinicians, and some degree of independence from other subscales.

The subscales and the respective decisions on need levels within the five subscales were constructed using structured input from multidisciplinary clinical terms from mental hygiene facilities with subsequent balancing by central office staff to reflect average statewide conditions and also to reflect state and federal regulations. In subscales 1, 3, and 5, these groups were asked to determine the degree of disability of a single particular problem which would exclude an individual from a placement in a level of care and, further, what combinations of problems in an area would disqualify a patient for a particular level of care.

In the construction of subscales 2 and 4, groups were asked to weigh the responses on the following basis: for each

TABLE 6—New York State Department of Mental Hygiene, Level of Care Survey

Dimensions	Number of Levels
1. Self-care abilities in activities of daily living	7
2. Psycho-behavioral supervision and treatment level	3
3. Social behavior acceptability in community settings	2
4. Degree of supervision and treatment for current somatic illness and condition	3
5. Skilled nursing services needed	3



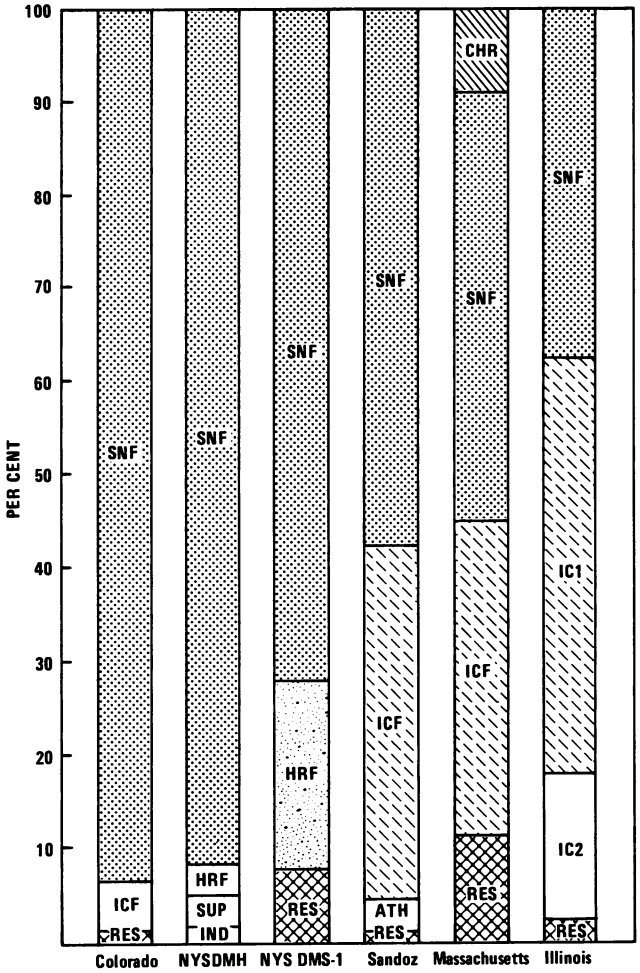


FIGURE 1—Overall Placement Distribution in Six Long-Term Patient Assessment Systems

condition at what level of impairment would need for inpatient treatment be indicated? And furthermore, in a cumulative framework, how would this condition contribute to the decision for a need for an inpatient environment?

The determination of the individual's appropriate level of care is made by simultaneously considering the subscales 1, 4, and 5. This type of multiple contingency logic is necessitated by the clinician's decision process of "it depends." The appropriate level of care is insensitive to scales 4 and 5 when the patient's self-care ability is such that total or a high level of physical assistance is required, but when less physical assistance is needed, the level of care becomes very sensitive to scale 4 and 5 levels of care.

The weights by the group were represented by numerical assignments. The numbers assigned ranged from 1 to 9. The value of 9 indicated high interference of the condition on the patient and a need for an inpatient environment. Values less than 9 indicated lesser interference, although the combined interference of several conditions with individual weights below 9 may indicate a need for an inpatient environment.

Comparison of Classification Systems

In most instances, the comparison of classification systems is a difficult task since the strengths and weaknesses of a classification can only be discerned on the basis of how well they function in the eyes of the user. Furthermore, a classification that functions well in one use may not function at all in another use, even though the items that are to be classified are equivalent.

In the classification systems reviewed in this article, however, these problems of comparison are somewhat alleviated by the common purpose of the classifications: the prediction of a level of care for an LTC patient or groups of patients. Using this commonality among the classification systems, an analysis of the logic of each classification system and the placement predictions of the classifications were performed by:

- defining the common patient descriptor data base;
- computerizing the decision rules for each placement algorithm;
- collecting patient descriptor data on actual patients;
- applying all placement algorithms to each patient; and
- maintaining statistics on the placement prediction.

The results presented in the next section, both descriptive and numerical, are based upon the 679 patient descriptor profiles collected specifically for this analysis in selected New York State nursing homes. Because of the diverse origin of the classification systems, 64 descriptor statements on each patient were necessary for the simultaneous application of each algorithm.

Results of Algorithm Application*

Figure 1 displays the overall patient placement distribution. The disparity of placement between the systems tested and the vast differences that exist among the algorithms are shown. The Colorado PSRO algorithm places the highest number of patients into the SNF level (94 per cent), while the Illinois algorithm places the least (37 per cent). The two New York State classifications also differ in the placement of patients; the DMH algorithm places 92 per cent of the patients in the SNF level, while the DMS-1 places less than 74 per cent into the SNF level.

*Numerical detail comparing placements of all six systems with each other on a pair-wise basis is available on request to author.

TABLE 7—Probability of Agreement

	DMH[1]	MASS[2]	DMS-1	COL	SANDOZ[3]	ILLINOIS[4]
DMH[1]		.5862	.7879	.9146	.6362	.3962
MASS[2]			.6598	.5567	.5994	.5243
DMS-1				.7467	.7143	.5376
COL					.6009	.4197
SANDOZ[3]						.6348
ILLINOIS[5]	.8483	.5758	.8203	.8733	.7040	
ILLINOIS[6]	.4153	.5508	.4934	.3770	.5493	

1. DMH categories of SUP LVG and IND LVG combined into category labeled residential for this analysis.
2. Massachusetts categories of CHR Hospital and SNF combined into category labeled SNF for this analysis.
3. Sandoz categories of ATH and RES combined into category labeled residential for this analysis.
4. Illinois categories of IC1 and IC2 combined into category labeled ICF for this analysis.
5. Illinois categories of IC1 and SNF combined into category labeled SNF for this analysis.
6. Illinois categories of IC2 and R&B combined into category labeled residential for this analysis.

Descriptive Results of Classification Comparison

In addition to numerical results generated, the comparison also served to illustrate how the logic of the algorithms work. The Illinois system places the least amount of emphasis on ADL as a contributing factor to the SNF level of care among the six systems. In more than one case, all other systems recommended SNF level, while the Illinois system recommended ICF-1 level due to this low emphasis on ADL. Of the two New York State systems, DMH and DMS-1, DMH places greater emphasis on ADL than DMS-1, and the higher levels of care are indicated more often in DMH due to ADL limitations than in the DMS-1.

The medical instability consideration in the New York State DMH classification is a contributing factor for recommending a higher level of care than the DMS-1 system. This is most apparent when the ADL capacity of the patient requires only minimal to moderate assistance. Medical instability is also a consideration in the Massachusetts classification but is used in a threshold type basis for recommending the chronic hospital level of care. High rehabilitation needs in Massachusetts will also serve as a mechanism for recommendation of the chronic hospital level of care. This medical instability consideration in Massachusetts results in some very diverse placement patterns. In some instances, the Massachusetts level will be chronic hospital while the other systems placement range from residential care to SNF level.

The need for nursing care is treated quite differently in the various systems and results in some divergent level of care recommendations. In the additive systems, the contribution is cumulative, while in maximum need systems and multiple contingency systems, the level of care is determined by skill level and frequency of services. Despite this similarity of treatment in the latter classification systems, the needs of a patient do not translate into equal need levels in the classification systems. The Massachusetts algorithm divides needs into "need for skilled nursing" and "need for intermediate nursing" and considers both in determining level of care determination due to nursing needs. The other systems do not make this distinction formally but handle it in other fashions. As a result, when the placement decision is heavily influenced by the need for nursing care, the various systems will recommend divergent levels of care.

The low consideration of the New York State DMH system of mental status and behavior in determining the level of care recommendation results in several cases where other systems recommend an ICF or SNF level, while DMH recommends a supervised living arrangement. This behavior is due to the design split in the DMH system between the need for mental and behavioral supervision and the physical level of care needed.

Numerical Comparisons of the Classification

Numerical measures of agreement from pair-wise comparison of the placement algorithm are presented in Tables 7 and 8. The measure of agreement is the proportion of the population which is classified by both algorithms in the same level of care for every level of care in the algorithms (i.e, it is the sum of the proportion of population categorized as needing SNF level, HRF level, or residential level, by both algorithms). In Table 7, the probability of agreement is presented under several aggregation assumptions for the levels of care in the respective algorithms. This grouping of levels of care is necessary since not all placement algorithms have the same number of levels of care. From Table 7, it is seen that the probability of agreement ranges from a low of 0.3770 (between Colorado and Illinois) to a high of 0.9146 (New York State DMH and Colorado). Between the New York State DMS-1 and the other systems, it ranges from a low of 0.4954 (Illinois) to a high of 0.7879 (New York State DMH). This latter high level of agreement was expected since both systems were designed for use in the same state, although the application population was different. The main source of difference between the two New York systems stems from

TABLE 8—Measure of Agreement for SNF Placement

		OMH	MASS	DMS-1	COLO	SANDOZ	ILLINOIS
	DMH		.580	.800	.979	.633	.397
	MASS	.981		.913	1.000	.739	.492
Given	DMS-1	1.000	.675		.998	.731	.478
Algorithm	COLORADO	.956	.578	.780		.617	.389
	SANDOZ	1.000	.690	.929	.997		.536
	ILLINOIS	.992	.727	.996	.996	.847	

TABLE 9—Maximum Number of Agreements

Maximum Number of Agreements	Random Assignments Frequency	Six Systems Observed Frequencies
2	.022	.026
3	.522	.201
4	.261	.257
5	.130	.293
6	.065	.223

the higher number of patients placed into the SNF level by the DMH algorithm as compared to the DMS-1 system.

Table 8 is a measure of agreement in placing SNF patients by the various algorithms. Agreement means the proportion of patients classified as SNF patients by a second algorithm. An agreement measure equal to one does *not* mean that placement algorithms agree completely on SNF placement. It *does* mean that all the patients that were classified in the SNF level by algorithm A were also predicted SNF by algorithm B, but algorithm B may also place other patients in the SNF level. In this case then, the measure of agreement between B and A would not equal one (i.e., the agreement between Massachusetts and Colorado equals 1.000, while between Colorado and Massachusetts it equals 0.578).

This agreement level ranges from a low of 0.389 (Colorado and Illinois) to a high of 1.000 (four different pairs). This low level of agreement, while perhaps not unexpected, is undesirable, since the SNF Medicare guidelines are nationally accepted and have been in place (with modification) since the start of the Medicare program. This nonagreement implies that despite the existence of regulatory placement guidelines and patient review regulations, uniformity is the exception rather than the rule, indicating the need for a new type of placement mechanism. At the macro level, one additional comparison which illustrates this point can be made as follows. For each patient profile, observe the placement decision by the six systems and select the most common placement. Then tally how many systems had the most common placement. Repeat this for each patient profile and compute the frequency of the maximum number of agreements. These placements, which are based on the algorithms and thus, hopefully, frequently match can then be compared to simply randomly assigning the patient placement six times and observing the maximum number of random agreements. Table 9 presents the results of this analysis. When compared to the random classification system using a Chi-square goodness-of-fit statistic, the observed distribution of agreements is rejected as being a random agreement pattern and, by a small margin, more agreements are observed than would be the case in a system of six random classifications.

The above shows that, while the agreement is better than random, it is certainly not high. Using the reported agreement proportion on placement by interdisciplinary terms of 0.9,[12] only two pairs of classifications can be said to agree at this level (DMH and Colorado; Illinois and Colorado). This low agreement level is also supported by computing the correlation coefficient for data in a bivariate frequency table by considering each classification in a pair-wise basis with the remaining classifications. In this analysis, the correlation coefficient ranged from a low of 0.1263 to a high of 0.6231, with a number of comparisons falling in the 0.4 to 0.5 range.

As a further step in the analysis of the agreement of the classification systems, the placement predictions of the classifications were tabulated by DMS-1 score. In this manner, for a given range of DMS-1 scores, the placement distribution of the remaining five classifications could be seen. In Table 10, the placement distribution for selected DMS-1 categories is shown. These categories were selected because of their significance in the DMS-1 classification. The category 61-75 was selected because DMS-1 threshold for HRF patients is 60. For this category, DMH and Colorado have predicted SNF placement for a high proportion of patients (0.60 and 0.90 respectively), while the other systems place a majority of patients into residential or ICF levels.

The category of DMS-1 scores 121-135 is the median score group between HRF and SNF thresholds (60 and 180 points respectively). Again, for this category, DMH and Colorado place a high proportion of patients into the SNF level. The category of scores 181-195 is significant to the DMS-1 system because of the SNF point threshold. For this category, Massachusetts, Sandoz, and Illinois predict placement in an ICF level for a majority of patients, while DMH and Colorado predict SNF placement for the vast majority. The mean DMS-1 score for the patients used in the analysis falls in the range of scores 361-390. For this category, all classifications except Illinois predict SNF level of care for a majority of patients. The Illinois predicted level of care favors the ICF level by a margin of 5 to 1 when compared to SNF place-

TABLE 10—Placement Prediction Distribution by DMS-1 Score: Selected Categories

	DMH			Massachusetts					Colorado			Sandoz				Illinois			
DMS-1 Score	IND	SUP	HRF	SNF	RES	ICF	SNF	CHR	RES	ICF	SNF	RES	ATH	ICF	SNF	R&B	IC2	ICI	SNF
60-75	.10	.10	.20	.60	.50	.20	.10	.20	.10		.90		.10	.80	.10	.10	.50	.30	.10
121-135		.05	.20	.75	.15	.60	.20	.05		1.00			.90	.10		.55	.45		
181-195				1.00		.75	.25			.04	.96			.63	.37		.17	.83	
361-390				1.00		.37	.58	.05			1.00			.37	.63			.74	.26

ment. Thus, although there is an association or agreement between the recommended levels of care, this agreement is not high, indicative of the ill-defined nature of the LTC delivery system and the placement decisions being made.

Conclusions

In this research, the number of unanswered questions is still high, especially in the area of determining the underlying causes of the demonstrated differences. Do the observed differences stem from the perceived roles that the LTC institutions are to play in the delivery of LTC; are they due to the built in limitations of the algorithms; or are they due to limitations in the available techniques for distinguishing between classes of patients, given descriptor data on patients?

Surprisingly, despite the differences in the various logics of the algorithms and the diversity of patient descriptors used in each, the agreement between algorithm placement recommendations is high when one looks at the diverse nature of the algorithms, but is low when one considers the implications for planning and regulation of LTC facilities and programs. On a national level, where there exist federal guidelines for levels of care, this non-agreement implies that regulations are being interpreted differently by various jurisdictional entities and that comparison across jurisdictional lines cannot be performed due to the definitional differences.

The effects of such implied differences in placement decisions have major implications for the patients being placed and for the cost of LTC. The analysis has demonstrated that a patient's placement level is quite dependent on his state of residence. This analysis was confined to systems that had a well-developed set of guidelines—the situation is likely to be even more variable where guidelines are vaguely stated.

This analysis has not concentrated on the cost impact of these placement guidelines, but some general observations of the effects of a more uniform method of utilization review for LTC are possible. For example, if both States had 9 million days in LTC and State 1 had 30 per cent more placements in SNFs and correspondingly fewer in ICFs, then State 1 is paying over $50 million more than it would be if it used the placement mechanism from State 2 (using cost differential between SNFs and ICFs from reference 13 trended to 1980).

The experience in New York State with a placement algorithm has highlighted the need for uniformity in placement practice in fairness to the patients, institutions, and paying agencies. The form of this uniformity structure is, however, a policy decision related to decisions on the future of the long-term care delivery system and its structure.

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EMS and Trauma Center Development Course Announced

The University of Maryland's Program of Continuing Education has announced a forthcoming continuing medical education course on "EMS Systems and Trauma Center Development," to be held January 12-17, 1981.

Sponsored by the Maryland Institute for Emergency Medical Services Systems, the course will be held at Frenchman's Reef Hotel Resort, St. Thomas U.S. Virgin Islands. For information contact: The Program of Continuing Education, University of Maryland School of Medicine, 10 S. Pine Street, Room 300 Baltimore, MD 21201; phone (301) 528-3956.