POTENTIAL AVOIDABILITY-A STATISTIC FOR CONTROLLING IN-PATENT UTILIZATION IN ACUTE CARE HOSPITALS

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Abstract: A patient-day of service is classified as potentially avoidable if the unique facilities and manpower of an acute care hospital are not essential to provide the services received. From a practical standpoint, not all potentially avoidable days are truly avoidable. However, norms can be established, specific to diagnosis, surgery, sex, and age, which specify an acceptable range for the percentage of potentially avoidable days. A procedure is developed for efficiently assessing potential avoidability making, if feasible, to measure this concept for every patient on a daily basis. The resultant data base can then be used in utilization review screening to detect abnormal patterns of utilization by case, physician, or hospital.

Keywords: Potential avoidability, Self-Care Capability, Routine Recording, Drip Solutions, Patient Conditions Affecting Care Level.

Introduction: Data for this study were derived from a survey of patient services delivered at three major hospitals of similar size Yashoda Hospitals, Global Hospitals and Care Hospital with a combined rated capacity of over 2,000beds. A unit of observation consisted of 24 hours of stay by a single patient. A non-proportionate stratified sample of patients was selected for observation each day over a 35 consecutive day period. The resultant sample size was slightly over 4,000 patient-days of service and represented approximately seven percent of all delivered in-patient services for the period. Exclusions from the survey consisted only of psychiatric patients and long-term care patients in one hospital where a separate facility existed.

The survey instrument consisted of a composite of several documents designed for level-of-care assessment and supplemented by suggestions from nursing direction and staff at the participating hospitals. There were 167 items on the instrument. Approximately 45 items identified the patient-day of service by hospital ward, patient demography, diagnosis, surgery and various important times, days and dates. The remaining 122 items characterized on patient's received service-conditions. Most of these service-condition items were then grouped into ten related categories.

A "true" acuity algorithm was specified, a prior, utilizing the service and condition item measurements to classify patients with respect to the potential for serving the patient in a non-acute environment. Details of this "true" algorithm are too lengthy to present here, but it's essential content can be summarized briefly. Each patient-day was scored unity or zero in each of the ten categories of service or condition, a unity score indicating the necessity of an acute care environment with respect to that service or condition. A count of the total number of unity-scored categories constituted an overall "true" measure of acuity. A patient-day scored as zero on this integer scale was considered to be potentially avoidable. The ten services / condition categories of concern and a crude description of their respective criteria are given below:

1. ***Self-Care Capability.*** Scored zero if patient was able to move about, dress, bathe, feed himself and take medication with at most a moderate amount of assistance
2. ***Routine Recording.*** Measurements of temperature, pulse, respiration and blood pressure taken less than 12 times per day resulted in zero score.
3. ***Non-routine Recording.*** One of a variety of observations such as intake/output, level of consciousness, electro-cardiac monitoring etc. would result in a unity score.
4. ***Critical Patient Conditions.*** One of a variety of severe conditions including an "other" category would yield a unity score.
5. ***Medications.*** More than one injected medication would yield a unity score.
6. ***Drip Solutions.*** Any form of drip solution would yield a unity score.
7. ***Patient Conditions Affecting Care Level.*** Any of a variety of conditions such as isolation, tracheotomy, unconscious, vital signs instability, etc., would yield a unity score.
8. ***Nursing Procedures.*** Any of a variety of nursing procedures such as drainage dialysis, irrigations, suction, oxygen, etc. would yield unity score.
9. ***Facilities.*** Use of operating or recovery room labor and delivery, ECG, EEG, etc. would yield a unity score.
10. ***Diet.*** Scored unity only if no oral feeding was permitted.

Many items, not included in the above categories were recorded but were not considered as being, by themselves, determinates of acuity. These were social and educational needs, radiology, laboratory, respiratory therapy, physical medicine and

rehabilitation.

To establish the validity of our "true" algorithm we must first rely heavily on the comprehensiveness of the instruments which contributed to our hybrid collection of items. These instruments have been used in various level-of-care studies. Secondly, we have examined the detailed item measurements on all 610 cases in one hospital rated as potentially avoidable by the "true" algorithm to assure ourselves that such a conclusion is not erroneous in the light of the objective evidence we have available.

The "true" acuity algorithm described above is much too costly and cumbersome to implement for control purpose. A simple model using a few item measurements as possible was desired, and our success in finding such a model hinged on the kind of interdependencies which existed between the items recorded in the survey. Both linear discriminate analysis and linear regression analysis were employed to find a small subset of measurements which, when introduced into a linear model, would accurately and precisely estimate the acuity measure given by the more complex, "true" algorithm. Discriminate analysis failed us dismally, but liner regression yield greater success than we could have hoped.Only the data from Yashoda hospitals were used in the formulation. Of course, the variables measured did not satisfy the necessary assumptions required for proper interpretation of the statistics usually associated with regression analysis. The resultant "best fit" utilizing a limited number of independent variables were accepted hypothetically and tested against data from Global hospitals. Patient-days were assessed by both the "true" algorithm and the approximating linear model. Errors of misclassification were examined in detail, and some modifications in the model were required to correct systematic errors. Finally we were prepared to state, a compact linear approximation to the "true" acuity algorithm.

RESULT AND ANALYSIS

The regression study shows that twelve binomial measurements or variables is the maximum number necessary in a

linear model to produce an excellent approximation to the "true" acuity algorithm.

As few as seven variables give satisfactory results. Three alternative linear models [**Table 1**] were tested against the "true" acuity algorithm in Care hospital using seven to twelve variables.

TABLE 1: LINEAR MODELS TO APPROXIMATE ACUITY, DERIVED FROM YASHODA AND GLOBAL HOSPITALS

Variables (Yes =1, No = 0)	Parameter Values		
	Model 1	Model 2	Model 3
Intake / Output recording	1.21	1.22	1.27
Drip solutions	1.36	1.40	1.62
Ambulation assistance required	0.91	0.90	1.04
Injected medications-more than 1	1.06	1.06	1.16
Cannot administer own medications	0.93	0.92	0.96
Vital signs instability or elevation	1.06	1.08	1.35
Drainage	1.14	1.18	1.17
Oxygen therapy	1.10	1.09	-
Use of operating room / recovery room	0.83	0.95	-
ECG	0.88	0.85	-
Wound (sterile) technique	0.83	-	-
Surgical preparation	0.88	-	-
Constant term	0.17	0.22	0.26

TABLE 2: GOODNESS-OF-FIT TESTS FOR APPROXIMATE MODELS, INDEPENDENT VARIABLE = TRUE MEASURE OF ACUITY OF CARE HOSPITAL

	Model 1	Model 2	Model 3
Sample size	1,515	1.515	1,515
Slope	1.026	1044	1.031
Intercept	-0.019	-0.045	-0.032
Coefficient of correlation	0.948	0.939	0.922
Coefficient of determination	0.899	0.881	0.850
Standard error of estimate	0.610	0.656	0.742

TABLE 3: POTENTIAL AVAILABILITY CLASSIFICATION TESTS FOR APPROXIMATE ACUITY MODELS OF CARE HOSPITAL

Approximate Models	True Model	
Model 1(12 vars) Mode 2 (10 vars) Model 3 (7 vars)	P.A (=0)	Not P.A (1, 2, 3...)
P.A. (<0.5)	610 610 610	56 (3.7%) 54 (5.5%) 143 (9.4%)
Not P.A (>0.5)	0 0 0	849 821 762

Two separate performance tests were applied. First, minimum squared error goodness-of-fit tests were applied with the "true" score given by the acuity algorithm as the independent variable and the score given by the linear model as the dependent variable. **Table 2** shows the result of these tests.

A second and more important test of the linear models is their capacity to classify cases as potentially avoidable. Using the integer-valued "true" algorithm, a score of zero was considered to be potentially avoidable. With the continuous-valued linear models, a score of less than 0.5 was taken to be potentially avoidable. Comparative classifications are shown in **Table 3.** It is incidental, though not altogether surprising, that all of the variables in the approximating models are also key variables in the "true" acuity algorithm. As a result, all cases classified as potentially avoidable with the "true" algorithm are also classified as such by the approximating models. Conversely, a number of cases classified as potentially avoidable by the approximating models are not classified so by the "true" algorithm. As the number of variables included in the approximation showing improvement by small increments as each variable is added to the model, it appears that, at most, ten or twelve variables are needed to produce 95 percent accuracy. Beyond twelve variables, successive additions of variable is added to the model, it appears that, at most, ten or twelve variable are needed to produce little improvement in classification. Detailed examination of misclassified cases does not show any systematic pattern which might suggest added terms of qualifications in the approximating model.

As a demonstration of one mode in which norms might be established for control of utilization, **Table 4** shows a number of surgery categories performed in each of the three hospitals with comparative percentages of potentially avoidable patient-days. Systematic differences can be seen between the types of surgery as well as between hospitals within surgery types. Similar profiles could be established for physicians, adjusted for case mix, thought individual physicians were not identified in this study. In addition to their use in control, data on potential avoidability can be applied to identification of hospital management problems. Using acuity profiles by day-since-admission, substandard performance of a hospital in treating a specific class of cases can be traced to the originating problems,

e.g facility or manpower shortages, turnaround of laboratory tests, or inefficient facility scheduling.

Table : POTENTIAL AVOIDABILITY NORMS FOR HOSPITALS SPECIFIC TO CERTAIN BROAD SURGICAL CATEGORIES

Surgery Category Percent P.A Sample Size	**Hospitals**			**Total**
Neurosurgery	25.0% 40	47.5% 40	28.5% 14	35.1% 94
Ophthalmology	34.9 63	48.4 64	70.58 17	45.1 144
Thoracic	41.0 39	26.4 34	56.2 16	38.2 89
Abdominal	28.7 73	43.2 67	29.4 34	34.4 174
Urological	30.2 86	31.8 91	38.3 86	33.4 263
Breast	69.5 42	17.3 23	6.6 15	37.5 80
Gynecological	44.6 56	34.4 90	55.5 81	44.4 227
Obstetrical Procedures	49.3 79	32.8 76	68.5 105	52.3 260
Orthopedic	50.0 186	54.6 260	41.9 136	50.1 582
All Categories	42.2% 915	42.4% 1,007	47.0% 615	43.4% 2,537

Conclusion: As we have demonstrated, a maximum of twelve variables need be reported on a daily basis for every in-patient. Examination of the variable list [Table 1] should convince the reader that all of the measurements can be conducted quickly from an attending nurse's knowledge of the patient and with only the most cursory reference to the patient's file. The measurement process can easily be incorporated into the routine midnight census. Note that all variables are binomial to facilitate ease in assessment and recording

Computation of the acuity score can be accomplished at the same time as measurements are recorded using a programmed pocket calculator. Alternatively, measurements can be recorded on custom mark sensed coding sheets and batch-processed after discharge. Periodic processing of the resultant data base can be done commercially at reasonable cost

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