What alters physicians' decisions to admit to the coronary care unit?

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BACKGROUND. A trial of a decision-support tool to modify utilization of the coronary care unit (CCU) failed because utilization improved after explanation of the tool but before its actual employment in the trial. We+ investigated this unexpected phenomenon in light of an emerging theory of decision-making under uncertainty.

METHODS. A prospective trial of the decision-support intervention was performed on the Family Practice service at a 1 00-bed rural hospital. Cards with probability charts from the acute ischemic Heart Disease Predictive Instrument (HDPI) were distributed to residents on the service and withdrawn on alternate weeks.

Residents were encouraged to consult the probability charts when making CCU placement decisions. The study decision was between placement in the CCU and in a monitored nursing bed. Analyses included ail patients admitted during the intervention trial year for suspected acute cardiac ischemia (n=89), plus patients admitted in two pretrial periods (n=108 and 50) and one posttrial period (n=45).

RESULTS. In the intervention trial, HDPI use did not affect CCU utilization (odds ratio 1.046, P [is greater than] .5). However, following the description of the instrument at a departmental clinical conference, CCU use markedly declined at least 6 months before the intervention trial (odds ratio 0.165, P [is less than] .001). Simply in learning about the instrument, residents achieved sensitivity and specificity equal to the instrument's optimum, whether or not they actually used it.

CONCLUSIONS. Physicians introduced to a decision-support tool achieved optimal CCU utilization without actually performing probability estimations. This may have resulted from improved focus on relevant clinical factors identified by the tool. Teaching simple decision-making strategies might effectively reduce unnecessary CCU utilization.

KEY WORDS. Medical decision making; chest pain; physicians' practice patterns; coronary care units. (J Fam Pract 1997, 45:219-226)

Decision-support tools to improve the appropriateness of the emergency department disposition of cases of suspected acute cardiac ischemia (myocardial infarction or unstable angina) have been heavily researched over the last two decades.[1-10] One of the motivations for the research on decision support is that educational interventions have generally not yielded significant lasting changes in physician behavior.[11-13]

Unfortunately, while there is extensive literature documenting the validity of decision-support tools for heart disease, they have fared little better than education in effectively changing clinical practice.[14] In two trials that provided decision-support tools for physicians to use or not as they chose, the tools were found to be ineffective; physicians tended not to use them.[15,16] One recent trial providing probability information without human interaction also failed to change behavior.[17] Two trials have demonstrated physician behavior change[2,18]; these trials failed, however, to adequately exclude bias due to nonspecific Hawthorne[19] and sentinel[20,21] effects inherent in how the interventions were applied.

We report a dramatic change in CCU utilization by a family practice teaching service at a small community hospital. We discovered this change while considering the failure of a trial that aimed to influence physician use of coronary care unit (CCU) services by applying the acute ischemic Heart Disease Predictive Instrument (HDPI).[2] Our findings suggest a potential educational strategy for changing physician decision behavior and emphasize the importance of considering nonspecific effects in interpreting decision-support trials.

METHODS

Setting and Patients

We studied patients with suspected acute ischemic heart disease (AIHD) admitted to the inpatient family Practice (FP) service at a 100-bed community hospital. Located in a town of 4000 population, the hospital serves a surrounding community of about 20,000. The population is 98% white, and 68% of local residents are blue-collar workers. For patients with suspected AIHD, an emergency physician (or occasionally an FP outpatient-clinic physician) initially decides on hospitalization; the senior resident on service, with the approval of the attending physician, then decides whether the patient should be placed in the CCU or in a regular nursing bed with ECG telemetry. No administrative incentives, sanctions, or other activities aimed at reducing CCU utilization were initiated at this hospital during any of the study periods.

A retrospective review of all AIHD admissions to the FP service between January 1984 and September 1985 demonstrated very high CCU utilization.[9] In November of 1987, the lead author presented his findings along with a description of the HDPI at a departmental conference. The HDPI is a logistic formula for calculating the probability that a patient has acute ischemic heart disease.[2] It generates a probability score from seven historical and ECG findings, scored dichotomously as present or absent. Subsequently, the appropriateness of CCU utilization was often questioned at department morbidity and mortality conferences.

Intervention Procedure

The week before July 1, 1988, the lead author sent to all FP residents a memorandum explaining the study, presenting the literature in support of the HDPI, and outlining the dimensions of the problem of inappropriate CCU utilization. Beginning July 1 and continuing for 1 year, we used an ABAB reversal design: pocket-sized plastic-laminated cards bearing tables the HDPI's probabilities[22] (Figures 1 and 2) were alternately distributed and withdrawn weekly. As residents rotated through the service and the call schedule, all were exposed to the cards for 2 of their 4 weeks on service, and on one half of their call nights.

DATA COLLECTION

The intervention was carried out between July 1, 1988, and June 30, 1989. The medical records of all FP patients aged 35 and older admitted to the hospital during this period were examined, and those admitted for suspected AIHD were collected. Subsequently, we also identically abstracted records for the 6 months preceding and the 6 months following the intervention. A graduate research assistant abstracted each record for demographic information, admission and discharge diagnoses, CCU utilization, peak creatine kinase (CK) level and MB fraction, complications (sustained ventricular arrhythmias, high-grade block, congestive failure, and reinfarction), and HDPI score. All residents who admitted patients during the intervention trial also took part in an unstructured interview designed to assess the instrument's adoptability potential.[23]

Analysis

In reporting our results, we refer to four periods in chronological order of admission dates: period 1 comprises the original retrospective data[9]; period 2 encompasses admissions during the 6 months preceding the intervention; period 3 is made up of admissions during the intervention; and period 4 constitutes admissions during the 6 months following the intervention.

Univariate statistical comparisons were performed, using one-way analysis of variance for interval data and chi-square testing for categorical data. Likelihood-ratio chi-square tests were used when 2x2 comparisons were made. The Kolmogorov-Smirnov statistic was used to compare distributions. Logistic regression was used for all multivariable analyses.

Considering only intervention trial (period 3) patients, we tested the intervention study hypothesis by determining whether the reversal phase (the week using the HDPI, as compared with the week not using the HDPI) was a significant predictor of CCU placement in a logistic regression model. Other independent variables in the model were age, patient sex, physician sex, and HDPI score.

The results of the intervention trial suggested that CCU utilization behavior was much different from the behavior previously experienced at this hospital. To elucidate this, we analyzed CCU utilization in a logistic regression model as a function of time, using as independent variables patient age, sex, HDPI score, and dummy variables for periods 1 through 4. We also plotted the sensitivity and specificity of residents' admission decisions against the HDPI's receiver operating characteristic (ROC) curve. The ROC curve graphically displays the tradeoff between sensitivity and specificity when different cutoff points (in this case, HDPI score) are used to denote a positive test. For the resident placement in the CCU was considered a positive test. We designated the occurrence of myocardial infarction (defined as an elevation of CK above 150 IU/L with MB fraction more than 5% of total CK) as true disease. The HDPI predicts acute ischemic heart disease, not just myocardial infarction (MI); however, for consideration of the need for CCU admission, MI serves as a reasonable proxy.

RESULTS

Patients

The numbers and characteristics of patients admitted during each of the four periods are displayed in Table 1. Patients did not differ significantly over the periods by HDPI score (F(3) = 1.90, P [is greater than] .2; Kolmogorov-Smirnov D for period 1 compared with periods 2 through 4 = 0.125, P [is greater than] .2), sex [Chi.sup.2](3) = 5.92, P [is greater than] .1), or occurrence of MI [Chi.sup.2](3) = 1.50, P [is greater than] .6). The periods did differ by age (F(3) = 3.61, P=.014). Subsequent analyses used multivariate logistic regression models to control for the age difference between periods.

Logistic Regression Results in Analysis of CCU Utilization

Variable	Weight	Odds Ratio (95% CI)
Age	0.012	1.128(*) (0.923-1.38)
Male sex	0.81	2.25 (1.26-4.02)
HDPI score	2.66	1.95(dagger) (1.39-2.73)
Period 2[double dagger]	-1.80	0.165(dagger) (0.069-0.398)
Period 3$	-1.93	0.145 (0.066-0.316)
Period 4$	-1.74	0.175 (0.069-0.443)

Could our introduction of the HDPI have been sufficient to bring about this major behavioral change? Although much of the literature on changing physician behaviors has been disappointing, individual or small group sessions to influence drug-prescribing behavior have had significant impact in some settings.(28) Soumerai and Avorn(29) identified 11 important components of successful drug detailing and academic counter-detailing: (1) defining specific problems and objectives; (2) identifying physician motivations for use of a product; (3) establishing credibility; (4) targeting high-potential physicians; (5) involving opinion leaders; (6) two-sided communication; (7) promoting active learner involvement; (8) repetition and reinforcement; (9) use of brief graphic print materials; (10) offering practical alternatives; and (11) selection and training. Introducing the HDPI at a departmental conference and mentioning the appropriateness of CCU admissions in subsequent conferences arguably met many of these criteria (specifically 1, 3 through 8, and 10). Residents had been very high utilizers of CCU services, and a workable alternative (telemetry monitoring outside the CCU) was available. Department conferences were small and relatively interactive in the late 1980s, and the small number of faculty had high credibility with residents. The HDPI's introduction and the conferences appear to have "detailed" the cues of genuine predictive utility.

The unstructured interviews with the FP residents after completion of their time on service lend support to this belief. While the residents could not recall actual probability scores from the chart of predictive instrument probabilities (Figures 1 and 2) they could accurately recall the factors on which the probabilities were based, even several months following completion of the project.

Could a simple cognitive strategy such as a PMM, used by a resident with the correct cues, provide such impressive results? In addition to the residents' performance, Figure 3 is marked with points for the performance of two examples of PMMs: simple tallying, and "take the best." The simple tally is positive if more than two of the HDPI factors are present, negative if not. "Take the best" is positive if the patient has: (1) ST segment changes, or (2) a chief complaint of chest pain plus any one other factor. From the ROC curve, it is apparent that both these simple PMMs performed as well as the HDPI and as well as the residents. More important, both simple PMMs provide examples of how a physician could make decisions equal in accuracy to the HDPI after simply seeing it, ie, without actually calculating probabilities.

These findings are potentially very useful to the primary care physician and to the primary care teacher. The medical decision-making literature contains the unspoken presumption that the human decision process is flawed,(30) and hence must be supplemented by or replaced with decision-analytic or regression-derived decision-support models. Our unexpected findings suggest, on the contrary, that the physician's decision process may perform as well as the best available logistic regression model in at least some situations. The key to such performance is selection of the correct cues. A validated decision-support tool can identify those cues, and a simple intervention can communicate them effectively.

Unexpected findings are seldom unequivocally interpretable, as the experiments in which they were discovered were not designed with them in mind. Our results are no exception. Although we can show the educational hypothesis to be plausible, we cannot exclude all other possible explanations. Our data make it more likely than other possibilities. This study was performed in a small community hospital, the study problem is well defined and circumscribed, and there is a good decision-support tool correctly identifying the important clinical data. To what extent our findings would hold in other settings remains unclear.

CONCLUSIONS

In a setting where a pattern of excessive use existed previously, we found that optimal use of the CCU was achieved following education about, but without the actual use of, a decision-support tool. Explicit probability calculation was not necessary in order to change decision-making.

Existing decision-making research tends to consider typical clinical decision-making inherently defective, and seeks to replace or reform it. These results suggest the possibility of developing strategies, based on the latest judgment and decision-making theory, that could build on the strengths of, rather than seek to replace, clinicians' reasoning. Such strategies could be taught quickly and at low cost. How broadly this technique might be applied remains to be determined.

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