

THE ANATOMY OF DEFENSIVE MEDICINE:
A SYSTEM DYNAMICS ANALYSIS

by

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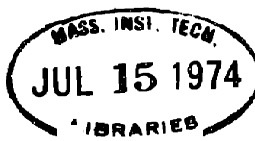
TECHNOLOGY

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Submitted to the Alfred P. Sloan School of Management on May 10, 1974 in partial fulfillment of the requirements for the degree of Master of Science.

ABSTRACT

Defensive medicine is characterized by those acts which a physician performs to protect himself from liability and not primarily to benefit the patient. Previous research has shown that defensive medicine consumes significant resources and therefore contributes to the rising cost of health care. Furthermore, the cost of this defensive medicine far exceeds the legal liability threat to the physician. Moreover, the practice of defensive medicine is operating as a positive feedback system. That is, the increasing use of defensive medicine results in an ever increasing need to use it.

A better understanding of the interactions in this complex system is a prerequisite for improvement. Toward this end, a system dynamics model of defensive medicine is developed. The system dynamics approach is appropriate because of the complex feedback structure of the system. The model is then used to simulate the consequences of following the present policies and to test other policies designed to control the problem. From the simulations we conclude that many proposed solutions such as reducing the lawyer's share of a successful claimant's award or educating patients as to the costs, risks, and limitations of medicine are not powerful enough to control the growing number of malpractice claims. However, the problem is quickly brought under control by the immediate enactment of a health security act which includes a section prohibiting double recovery in malpractice litigation accompanied by a patient education program. Finally it is noted that delaying this legislation will increase the time required to control the problem.

Thesis Supervisor: Edward B. Roberts

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CHAPTER ONE: PROBLEM DEFINITION AND RESEARCH METHODOLOGY

America is in the midst of a health care crisis. This crisis has many facets, but the one which every American knows well is the crisis in costs. Hospital costs have risen, doctors' fees have risen, and insurance premiums have risen in a seemingly hopeless attempt to keep pace with these rising costs. The average wage earner now works one month out of every year just to pay his health care and health insurance bills, and there is no end in sight (15, p.1).

Climbing at more than twice the rate of the cost of living indicators, the health care industry is the most rapidly growing segment of the economy (3). The allocation of the GNP for health expenditures increased from 4.6 per cent to 7.0 per cent between 1950 and 1970 (17). If the current rate of growth continues, the 1970 expenditure of \$67 billion will be dwarfed by an annual expenditure of \$200 billion in the early 1980's. Some 40 per cent of the nation's health bill is now paid by the government through health programs for government employees, veterans, and servicemen and their dependents, as well as Medicare and Medicaid. Blue Cross, Blue Shield, and other commercial insurers pay 20 per cent of the nation's medical bill, and individuals pay the remaining 40 per cent directly (3). Ultimately, however, the consumer foots the entire bill through direct payments, insurance payments, or taxes.

One of the many contributors to the increased health

care bill is the cost of physicians' malpractice insurance which is, of course, passed on to the patient. Indeed, the years 1966-1970 showed more than a threefold increase in medical malpractice insurance coverage, with 1970 malpractice insurance costs in the \$200 million to \$350 million range (10, p.31).

The threat of a malpractice suit has more significant implications on the cost of health care than merely through the cost of malpractice insurance. The entire health care delivery system is affected by the malpractice threat. The Secretary of Health, Education, and Welfare's Committee on Medical Malpractice, hereafter referred to as SCMM, observed that "the fear of being sued permeates the entire health care community" (10, p.5). Physicians now practice defensive medicine to protect themselves from the malpractice threat. Defensive medicine can be defined as

the alteration of modes of medical practice, induced by the threat of liability, for the principal purposes of forestalling the possibility of lawsuits by patients as well as providing defense in the event such lawsuits are instituted (10, p.34).

In essence defensive medicine is characterized by those acts which a physician performs to protect himself from liability and not primarily to benefit the patient.

An analysis of defensive medicine was recently carried out at M.I.T. by E. Twine, a lawyer, and E. J. Potchen, a radiologist (13). Twine and Potchen developed a descrip-

tive model of the system in which defensive medicine is practiced based on a series of interviews with physicians, lawyers, and insurance company representatives and on data supplied by the SCMM. Key variables in the system are described and their relationship to other variables is discussed and illustrated in individual causal diagrams. Twine and Potchen show that defensive medicine consumes significant resources and thereby contributes to the rising cost of health care. Furthermore, they demonstrate that the cost of this defensive medicine far exceeds the legal liability threat to the physician. The limitation of Twine and Potchen's work is that a mathematical model was not developed. A robust model of the system of defensive medicine is useful if appropriate strategies for intervention are to be established. This thesis proposes such a model and uses it to test various strategies for controlling the problem. For reasons which will be discussed shortly, a system dynamics approach seemed suitable for adoption as the primary analytical tool.

System dynamics is both a philosophy of the nature of socioeconomic systems and a methodology to aid in the quantitative study of such systems. The philosophy's primary tenet is that complex, non-linear feedback processes form the important structure of socioeconomic systems. The methodology is a simulation technique with a computer program called DYNAMO which allows the analyst to model the system under study and test assumptions about the correspondence between

structure and behavior.

Complex industrial and social systems are closed loop feedback systems. The framework of such a system implies that an action ultimately affects the environment that caused the action. It is precisely the closed loop structure that causes the observed behavior of the system, and it is therefore imperative that models of such systems preserve this structure. Examination of the separate parts of the system does not give an adequate understanding of its behavior. The interconnection of the various parts, the delays in perception and action, and the distortion in information flows compose the structure and determine the growth and stability of the system.

DYNAMO (9) is a computer program which compiles and executes continuous simulation models written in a language specially designed for the representation of these models. Whereas discrete simulations are useful when individual events are important, continuous simulations are valuable when system behavior depends more on aggregate flows. DYNAMO was originally written for application to the study of industrial systems but now is used to analyze social, economic, and biological systems as well.

The system dynamics approach was adopted for this study for several reasons:

1. The problem of defensive medicine is complex and an examination of the system shows it to have the multiloop feedback

structure which forms the backbone of a system dynamics analysis.

2. The mind's ability to comprehend and visualize the behavior resulting from the interactions of the separate parts of a complex system is less reliable than its ability to understand the interactions occurring within isolated sectors of the system.

3. Empirical data are not sufficiently available to develop all model relationships precisely and with certainty, especially the psychological ones. Given these uncertainties, system dynamics offers the advantage of providing easy sensitivity analysis of these parameters thus indicating which relationships should be carefully researched because of the sensitivity of the model to them.

The problem has been identified: defensive medicine consumes significant resources and contributes to the rising cost of medical care, yet it does not benefit the patient. Furthermore, Twine and Potchen demonstrate that the physician is reacting disproportionately to the threat. Yet malpractice claims and malpractice insurance increase each year.

The next step in a system dynamics analysis is to determine the boundary of the system. The objective is to define a closed system with the minimum number of factors which will produce the observed behavior. To aid in determining the boundary a causal loop diagram is constructed

(Chapter Two). A causal loop diagram shows the important variables of the system and the causal relationships existing between them. Major feedback loops are thus identified and classified as positive (giving rise to exponential growth or decay) or negative (goal-seeking).

The causal loop diagram forms the base for development of a DYNAMO flow diagram and the accompanying model equations (Chapter Three). Validation of the model is achieved in several ways. The ability of the model to be initialized several years in the past and simulate to the present gives an indication, but not proof, that the model is reasonable. Verification of each model equation by experts in the field makes a strong case for validity.

After validation, the model is used to simulate the consequences of following the present policies and to test other policies designed to control the problem (Chapter Four). Sensitive areas for intervention are first discovered on the model and then can be implemented on the real system.

CHAPTER TWO: A DESCRIPTION OF DEFENSIVE MEDICINE:
DEVELOPMENT OF THE CAUSAL LOOP DIAGRAM

Eli P. Bernzweig, special assistant for malpractice research and prevention in the office of the Director of the Community Health Service commented on malpractice claims as follows:

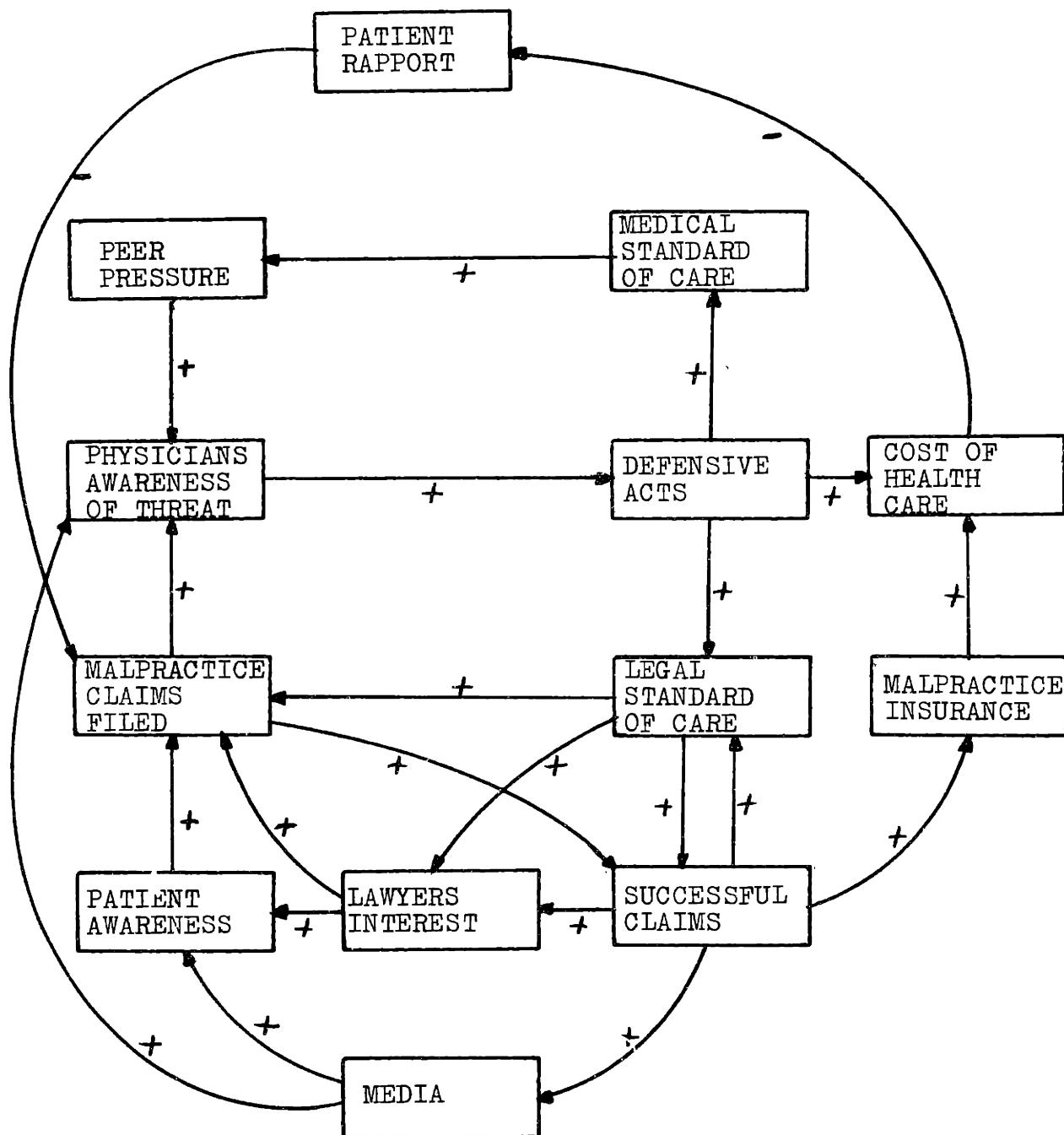
Critical analysis generally reveals that a combination of medical, sociological, and psychological factors lies behind most malpractice claims, and in our opinion little progress will be made until the interplay between these various elements is more fully recognized and comprehended. Failure to come to grips with the true causes of malpractice claims will inevitably result in misdirected efforts to alleviate the situation' (12, p. 16).

The first attempt to understand the interplay among the many factors involved in defensive medicine and medical liability was a study carried out by Twine and Potchen at the M.I.T. Sloan School of Management (13). Their descriptive model identified many causal relationships which they visualized individually in causal diagrams in their thesis report. The causal diagram which follows is a synthesis of the salient features of their descriptive model.

We will discuss each of the variables in the diagram and offer evidence supporting the causal links shown. After the descriptive model is complete there will be a brief discussion of its implications, followed by the development of the DYNAMO model.

The physician of today, unlike the family doctor of

FIGURE 1: CAUSAL DIAGRAM OF DEFENSIVE MEDICINE



SOURCE: Synthesized from Twine and Potchen, A Dynamic Systems Analysis of Defensive Medicine

many years ago, is acutely aware of the threat which a malpractice suit represents. One physician told the SCMM: "It may be hard to believe that we are a frightened profession. The doctor feels put upon. He feels nude in the corner of the main street of life" (10, p.57).

When one looks at the figures for malpractice claims filed and awards for successful claims it is not so hard to believe the extent of the fear which pervades the medical profession. A Cleveland lawyer who defends physicians said the number of malpractice suits with which he has been involved has increased 400 per cent between 1955 and 1966 (12, p.446). Aetna Life and Casualty, which provides malpractice insurance to the medical community, said the number of claims have increased 43 per cent and the average cost per claim has jumped 200 per cent in the last five years (12, p.1009). The Nettleship Company of Los Angeles reports that the average cost per claim will rise from \$2468 in 1957 to an estimated \$13,325 in 1970, which the company believes is a conservative estimate. The Nettleship Company also reports:

We incurred one claim for every twenty doctors insured during 1957. It is now a statistically proven figure that we are incurring one claim for every ten doctors insured during one year. Hence, with a doctor population of approximately 11,000 physicians, 1969 will produce 1100 claims (12, p. 1044).

The 250,000 practicing physicians in the United States were defendants in approximately 12,000 malpractice suits in 1970. (10, p.23). Computations based on SCMM data show that awards

totalled over sixty five million dollars (10, pp.19,20,23).

The perceived threat of legal liability is not the only root of a physician's awareness of threat. The fear of unfavorable peer review, the seemingly omnipresent eyes of nurses, pharmacists, colleagues, and the death committee, may be even more significant than the legal liability threat. The physician is worried about his reputation and the damage which his reputation would suffer due to unfavorable peer review. He may be less worried about the financial implications of a malpractice suit since liability insurance will protect his financial position. Finally there is the Fourth Estate, faithfully reporting the largest malpractice awards of the year, infecting the medical profession with fear and, as we shall see later, also affecting the legal profession and the patient.

Defensive acts are the manifestation of a physician's awareness of threat. They are performed by the physician to protect himself from liability and not to benefit the patient. Defensive acts may be active or passive. An active act is something the physician does for the patient which is not designed to benefit the patient, but rather to protect the physician from potential liability. A passive defensive act occurs when a physician fails to take action, such as refusing to perform a high risk operation, because of the fear of liability. Twine and Potchen find that most of the defensive acts are of an active nature and

take the form of a physician covering himself by superfluous consultation from other physicians or by ordering additional diagnostic tests which the physician does not believe will necessarily help the patient (13, p.46).

The American College of Surgeons Survey showed that approximately sixty per cent of surgeons who were surveyed admitted that they practiced positive defensive medicine in response to a perceived legal threat (1). This indicates that the severity of the threat is enough to cause significant alterations in medical practice.

The practice of medicine, including both nondefensive and defensive medicine, gives rise to a medical standard of care. Medical standards are the physician's perception of the norm and therefore are not universally held or well defined. Twine and Potchen postulate a scenario for the genesis of these standards as follows:

A physician may become aware of a diagnostic procedure when told by a colleague that it has helped in a specific patient's problem. He may then feel that if he doesn't use it when faced with a similar clinical problem, he would not 'be doing everything he could for the patient.' Once used, the application of the procedure may become habitual even though the physician finds it only occasionally or even rarely useful (13, p.91).

The effect of peer pressure on the physician's awareness of threat has been discussed. Now the loop from awareness of threat through defensive acts to medical standards of care will be closed by establishing the causal link between medical standards of care and peer pressure. Medical stand-

ards form the basis for peer review; a physician can expect to be held by his peers to a standard of practice which is considered normal. Medical practice committees have long been a part of most hospitals. Informal and away from the public eye, they are very real to the physician. Currently, due to the enactment of HR1, Professional Standards Review Organizations are being established and will aggravate the physician's perceived threat.

The standard of care that the law requires of the physician is determined by what a reasonable physician would do if confronted with the case. In substance,

the law requires a physician at all times to apply the skill and knowledge of the ordinary practitioner in his field. As long as he uses ordinary skill and care, he is not liable if his diagnosis proves to be incorrect or his treatment unsuccessful (12, p.99).

This appears to be a simple rule, but is easily misunderstood. Although the law demands only ordinary skill, the average or even superior physician is subject to human fallibility and will sometimes perform services of less than standard quality. The law, however, demands a standard of ordinary skill at all times and holds the physician accountable for any substandard services.

The current legal standards of care form the base for all malpractice litigations. As legal standards increase, a lawyer will be more likely to consider a patient's complaint to be malpractice and worthy of developing as a tort case.

This consideration is important because the Legal Survey of the SCMM finds that in 1970 lawyers accepted only ten per cent of the complaining patients as malpractice plaintiffs (18). The underlying motivation for this is economic; malpractice lawyers are paid on a contingent fee basis. Therefore, a lawyer will accept only those cases he feels will succeed, and higher legal standards imply a greater chance of success.

Legal standards affect the percentage of malpractice claims which are successful. This is the very heart of the legal process: law is based on precedent. A precedent is set, the legal standard is changed, and subsequent cases can rely on the precedent as a standard. Furthermore, the mechanism just described shows that the causality goes both ways: legal standards affect the successful claims and successful claims in turn affect the legal standards. This is a small but powerful positive feedback loop.

The legal standards of care also affect the legal profession's interest in malpractice litigations. A study of the medical malpractice legal system revealed that from January 1970 to September 1972 only 27 per cent of the lawyers in private practice handled malpractice claims (18, pp.27-31). As legal standards rise and the potential remuneration increases, there will be a tendency for more lawyers to handle medical malpractice suits.

As mentioned previously, the media play a role in the

system. Describing the largest awards, the media emphasize the extremes of the malpractice suits. Referring to the diagram, the content of the media is determined by the successful claims and affects the lawyers' interest, the physicians' awareness of threat, and the patients' awareness.

Patient awareness is the consumer's knowledge of a physician's legal responsibilities. Few people have a complete understanding of the concepts of medical malpractice, but the Consumer Survey (4) found that up to 50 per cent show substantial knowledge and understanding. This awareness is affected by the media, by lawyers' interest, and by consumer rights groups. Furthermore, increased patient awareness raises the probability that a patient will recognize improper medical treatment and thus increases the number of malpractice claims filed.

The rising cost of health care is felt by every American. Sixty seven billion dollars, seven per cent of the Gross National Product, was spent on health care in 1970 (17). Of interest here is the amount of resources consumed by defensive acts and malpractice insurance. The SCMM reports that physicians paid approximately \$300 million in 1970 for malpractice insurance (10, p.31). The cost of malpractice insurance is increasing far more rapidly than medical costs as a whole. Indeed, the index for medical malpractice insurance coverage from 1966 to 1970 more than tripled, while the index for total medical services rose 16 per cent (10,

p.31).

Insurance companies cite several reasons for the steadily increasing premiums. The most obvious reason is the burgeoning of payments for claims which the patient wins. Computations on SCMM data show that in 1970 approximately \$65 million was paid out for lost suits (10, pp.19,20,23). Furthermore, the time spent in preparing a defense and the cost of expert witness must be valued. Moreover, the time lag is substantially longer for medical malpractice claims than for other types of tort claims. Only six per cent of all claims are filed during the year of the negative medical experience: 48 per cent are filed by the second year, 80 per cent by the fourth year, and 95 per cent by the sixth year. The remaining five per cent are filed an average of ten years from the date of the alleged injury (12, p.9). Furthermore, insurance companies know that each case will take an average of two years to process, and therefore, they must set their premiums on predictions of the future number of awards, the amount of the awards and inflation.

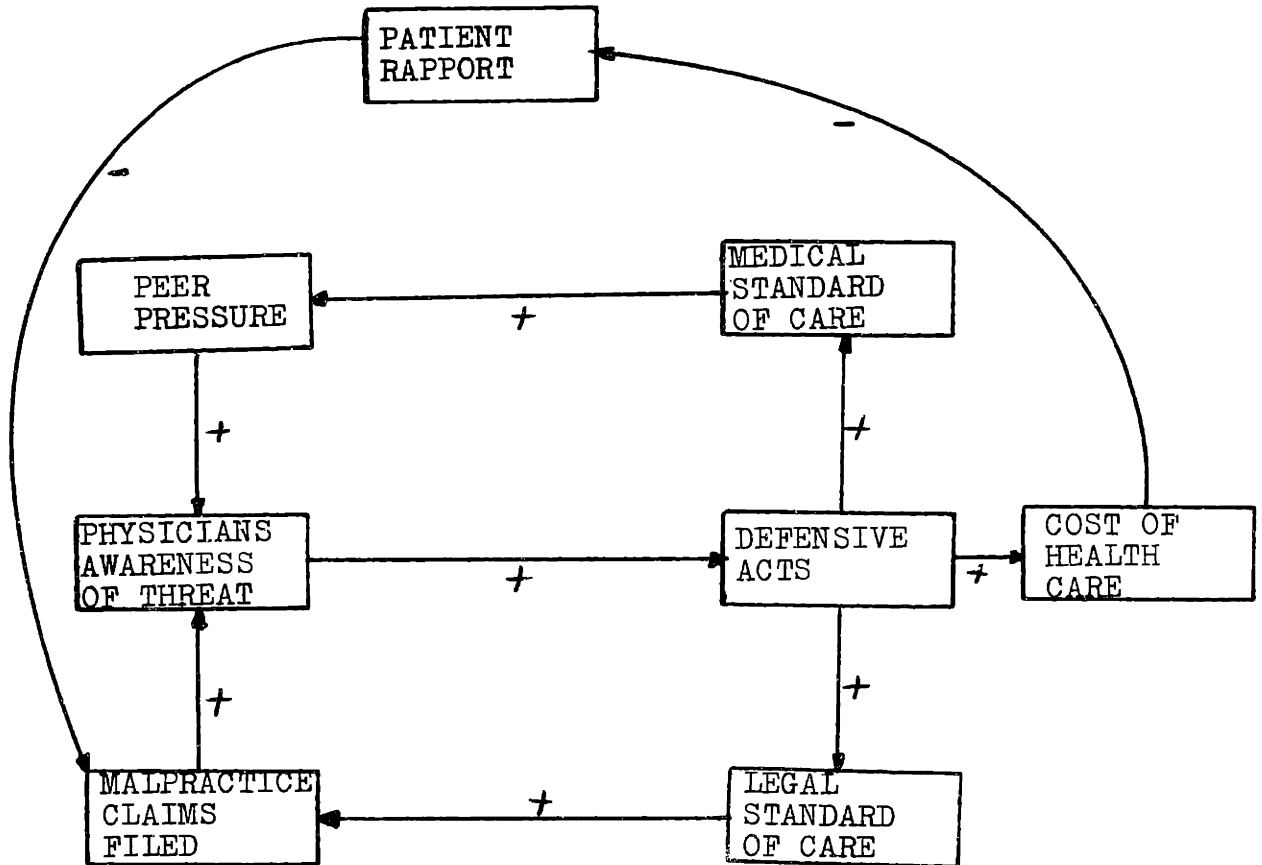
The cost of defensive acts is much harder to estimate, but Twine and Potchen conclude that in the use of diagnostic radiology alone more than \$1 billion per year is consumed by defensive acts. This represents one third of all x-rays (13, p.49). Recognizing that defensive acts may not consume such a high percentage of resources in fields other than radiology, consider the following estimate for the cost of

defensive medicine: Dr. Michael Halberstam of Washington, D.C., another physician who has studied the problem, recently said that hospital tests ordered primarily for doctors' protection may account for as much as fifteen per cent of a patient's bill (6). Even if Dr. Halberstam's figure is high, it seems proper to conclude that the total cost of defensive medicine is a significant percentage of the total health care budget.

The high cost of health care is a significant factor contributing to the deterioration of the physician-patient relationship. Another factor adversely affecting patient rapport with the physician is the increasing specialization of medicine and the resulting impersonal treatment. Of significance to this discussion is the effect of patient rapport on malpractice claims filed. As patient rapport decreases, the patient is more likely to find fault with the physician's treatment. He is less likely to be dealing with his family doctor and less likely to have the confidence in or warm feeling for the unknown specialist as he has for his family doctor. Thus the decreasing patient rapport due to increasing costs and increasing specialization tends to increase the number of malpractice claims filed.

The core of the system of defensive medicine and medical liability is shown in the next diagram. This simplification of the complete causal loop diagram is intended to emphasize the three major positive feedback loops of the sys-

FIGURE 2: THE CORE OF THE SYSTEM OF DEFENSIVE MEDICINE



tem. Positive feedback loops, unlike negative feedback loops, are not goal-seeking; instead, positive loops characteristically exhibit exponential growth. In positive feedback situations, the level to which the system has risen determines the rate of increase: the more there is, the faster it grows.

An examination of these three loops will confirm that they are all positive. An increase in physicians' awareness of threat increases the amount of defensive medicine he practices which raises the medical standards of care and increases the threat which the physician feels through peer pressure. Similarly, an increase in threat leads to an increase in the legal standards of care which results in more malpractice claims filed and a consequently greater threat perceived by the physician. Finally, the increased defensive acts resulting from the increased threat leads to a higher cost for medical care which lowers patient rapport and increases the number of malpractice claims filed, again resulting in even more perceived threat. Thus all three loops are positive. Once malpractice claims are initiated the positive feedback effects result in increased defensive acts, increased medical and legal standards, increasing cost of care, and ultimately increased malpractice claims. Thus, rather than reducing the number of malpractice claims, the system has caused an increase. This is the core of the system of defensive medicine and medical malpractice today. The result is increasing allocation of resources to protect the physician from

liability and not to benefit the patient.

Among the physicians interviewed by Twine and Potchen there was no awareness of the type of feedback just described. In fact, even when the positive loops were explained to the physicians, many felt that such behavior was counterintuitive (13, p.93).

CHAPTER THREE: A DETAILED ANALYSIS OF SYSTEM STRUCTURE:
DEVELOPMENT OF DYNAMO MODEL

A formal mathematical model will now be developed which conforms to the verbal description of the system and its causal loops. The model will be developed in several sections:

1. The physician
2. Medical and legal standards of care
3. The patient
4. The media
5. Cash flow
6. Understanding
7. The lawyer

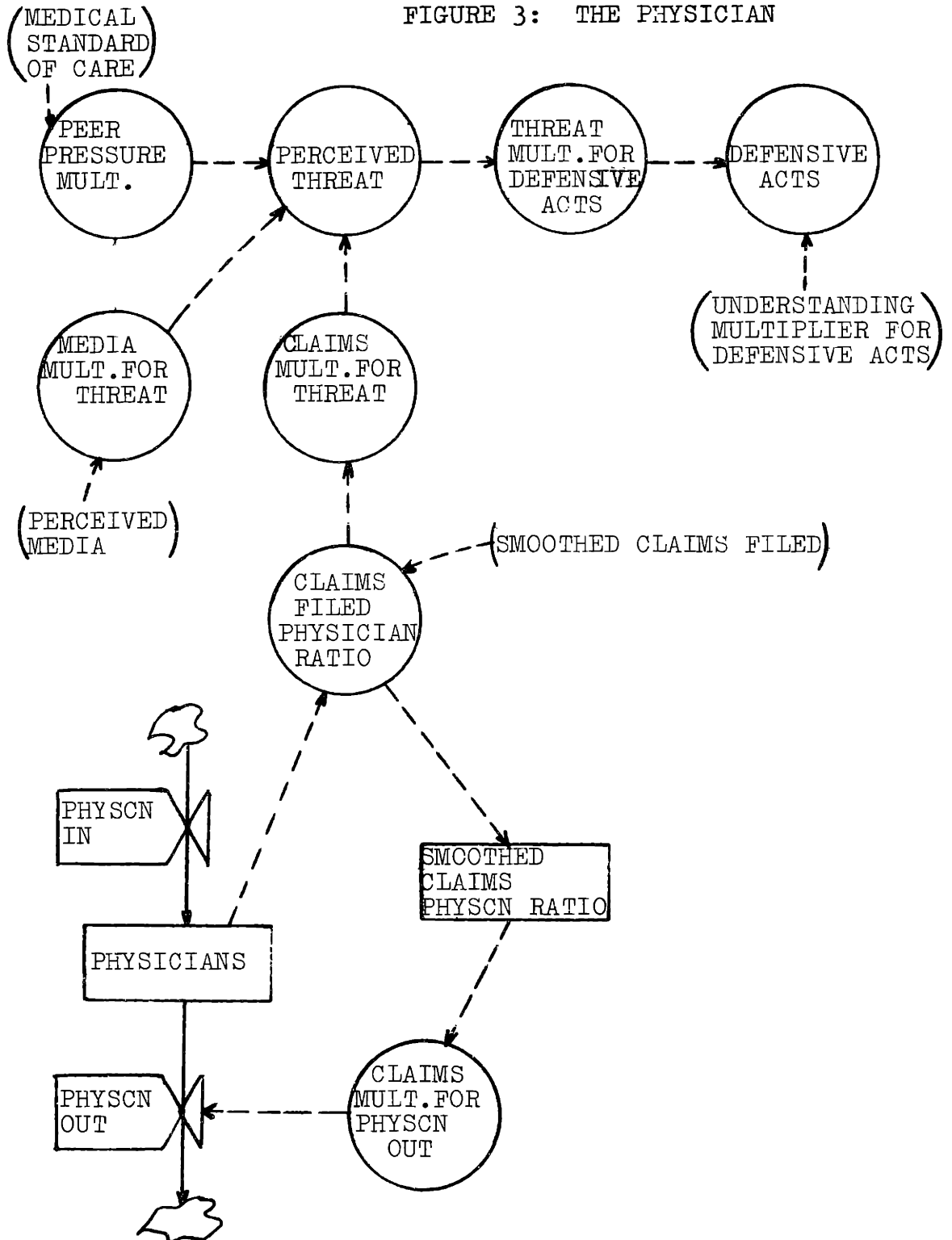
A flow diagram of each sector accompanies the description.

A documented list of the model equations can be found in the appendix.

The Physician

We have established that physicians today feel acutely threatened by the prospect of being sued for malpractice. There are three sources of this threat: Peer pressure, actual malpractice claims filed, and the media's picture of a physician's potential liability. The physician's awareness of threat is formulated as a multiplicative separable function. Separable formulations of multivariate causality are

FIGURE 3: THE PHYSICIAN



widely used in modeling dynamic systems, and Senge concludes that such separable formulations "can probably be used to adequately represent much of the causality encountered in social systems model building" (11).

Graphical relationships of the effect on threat of changes in each of the three sources of threat provide the basis for the formulation of the variable PTHR (perceived threat). Since a physician does not instantaneously recognize changes in his environment, the three multipliers in the perceived threat formulation are averages of recent events or perceptions of the situation. DYNAMO allows the user to express an arbitrary relationship between two variables by using a table function. The graphs which follow are the relationships which were incorporated into the model using table functions.

The peer pressure multiplier explains the relationship between the medical standard of care and the physician's perceived threat. The positive first derivative indicates that the causal link between the two variables is a positive one. The normal point of the peer pressure multiplier curve is the point where medical standard of care of 1.0; at this point the peer pressure multiplier has a value of 1.0. Later it will be explained that a standard of care of 1.0 means that a physician is doing everything possible for his patients, but is not practicing defensive medicine. A standard of care above 1.0 means that defensive medicine is being practiced.

As medical standard of care rises above 1.0, the physician feels increased pressure from his peers to practice defensive medicine in response to the perceived threat. A standard of care less than 1.0 means that physicians are not doing everything possible for the patient.

The media multiplier for threat shows the relationship between the perceived media and the physician's perceived threat. The 1970 media coverage is assigned the value 1.0 and other measurements are made relative to this value. The positive first derivative shows the positive relationship between perceived media and perceived threat. Furthermore, the negative second derivative at high values of perceived media shows the saturation effect which occurs; after a point the reporting of malpractice awards in the media will become so commonplace that the physician will no longer feel more threatened upon exposure to an even higher level of reported awards.

The malpractice claims multiplier for threat indicates the relationship between actual malpractice claims filed per physician and the physician's perceived threat. As contrasted to reporting in newspapers, magazines, radio and television, the sources of malpractice claims filed physician ratio are the professional journals, physician surveys, and Federal studies. The normal point for the function is the 1970 figure of .048 claims filed per physician per year which is based on 12,000 claims and 250,000 practicing

TABLE FUNCTION 1: PEER PRESSURE MULTIPLIER

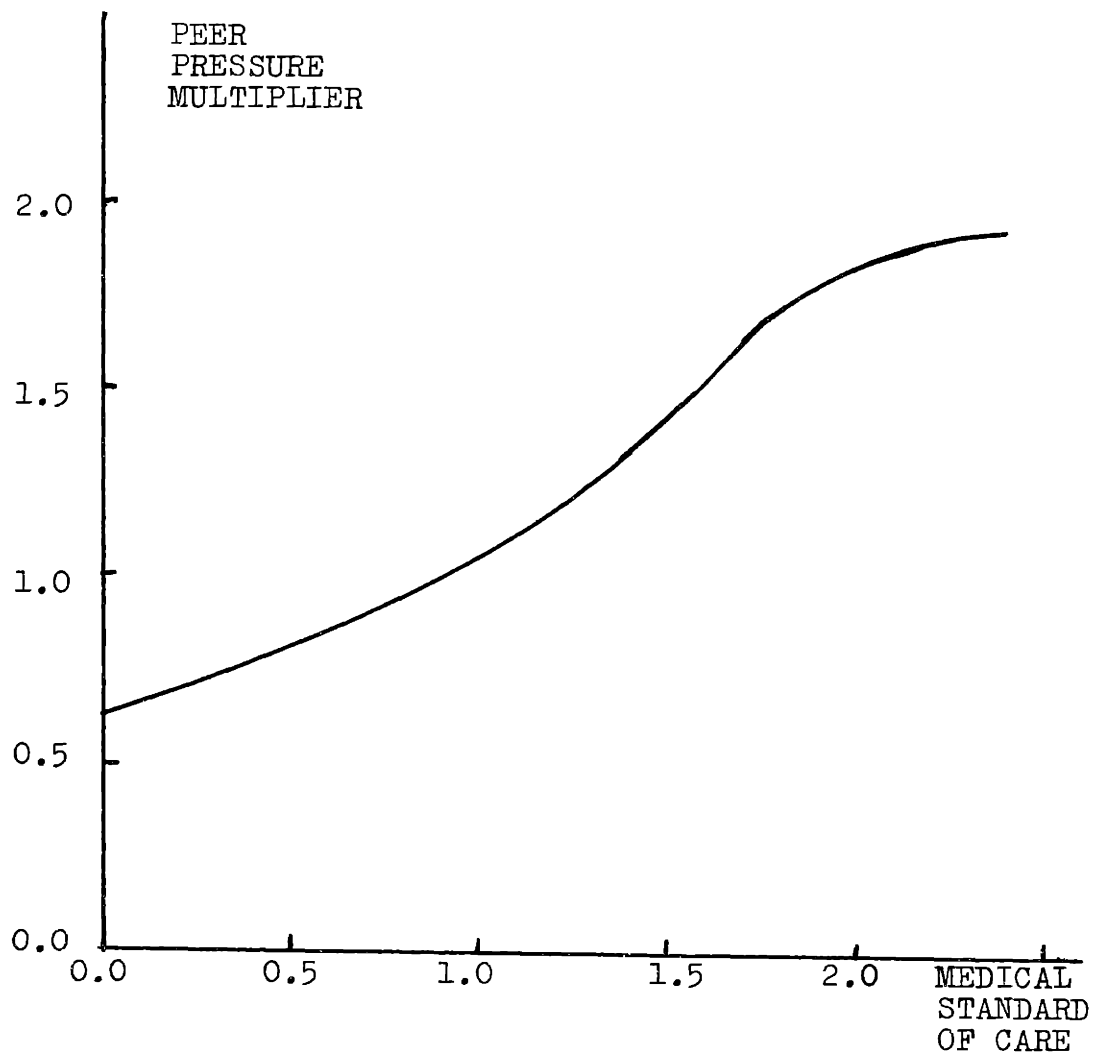


TABLE FUNCTION 2: MEDIA MULTIPLIER FOR THREAT

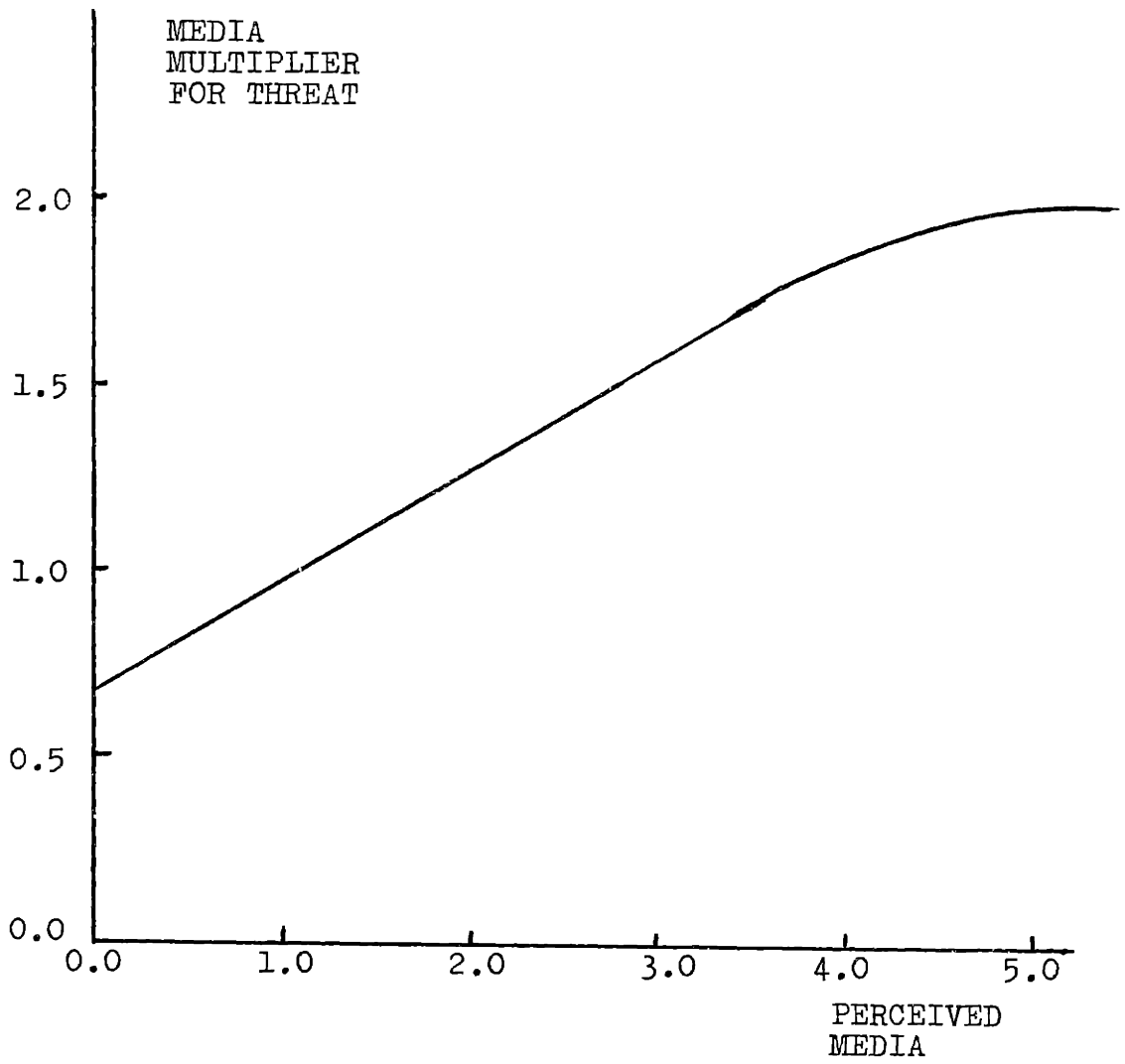
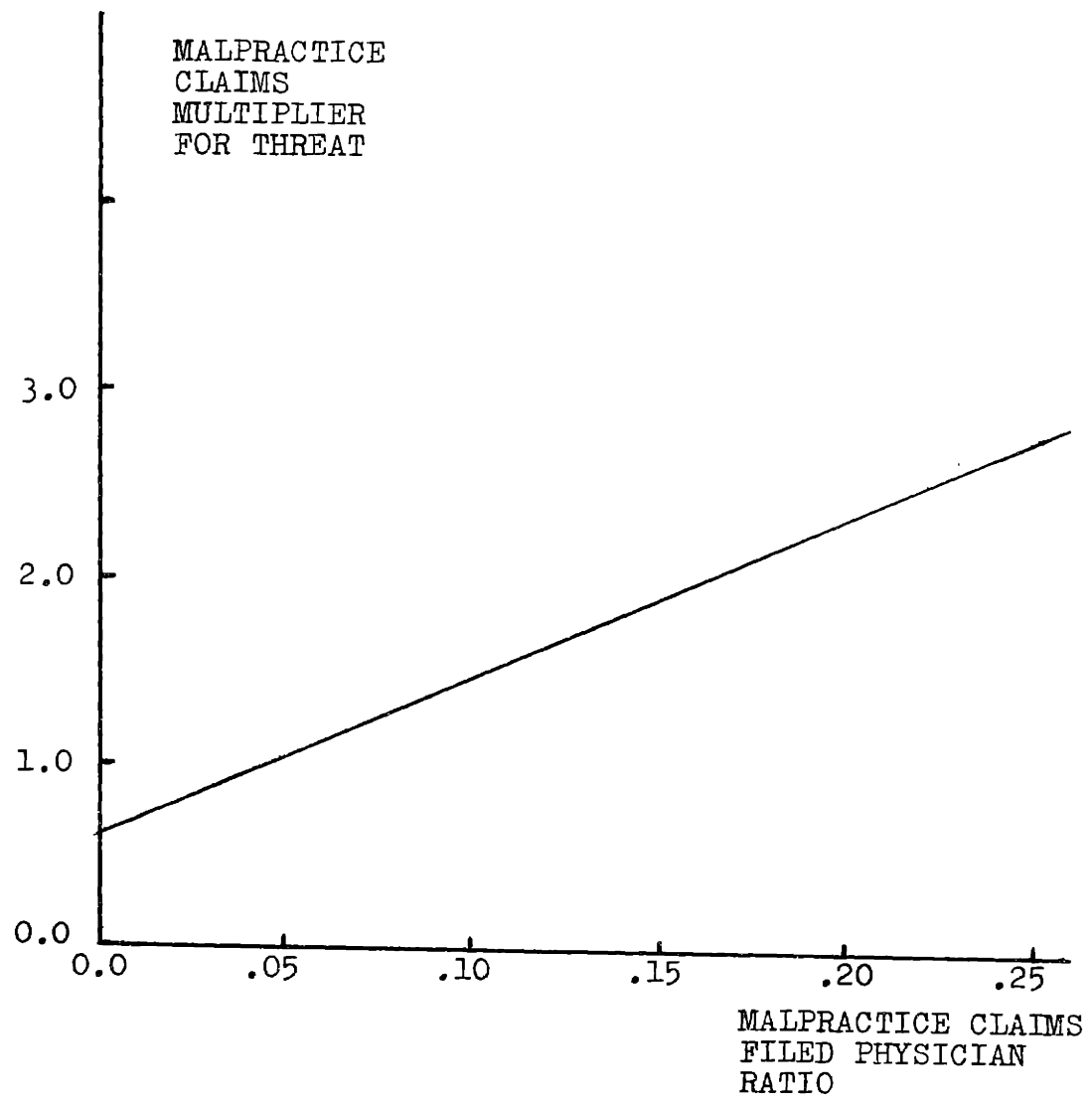


TABLE FUNCTION 3: MALPRACTICE CLAIMS MULTIPLIER FOR THREAT



physicians. Again the positive slope shows that positive causal relationship which exists between malpractice claims filed per physician and the physician's perceived threat.

The magnitude of the defensive acts resulting from the perceived threat is discussed by Bernzweig:

It has become commonplace for physicians to order complete x-ray studies of an injured limb even without the slightest indication of a fracture. Needless to say, these x-rays can add \$20 to \$30 to the patient's bill even though they may be unwarranted in 99 out of 100 cases.

In addition to x-rays, physicians now frequently recommend medical consultations even when there are no positive medical grounds for such specialized services. In still other cases physicians are ordering additional laboratory tests, additional hospitalization, and additional nursing care, both to minimize the chances of being sued for malpractice and to guarantee the successful defense of any suit which might be instituted. To our knowledge no study has yet been undertaken with respect to these matters, but we believe that the additional procedures being ordered are adding significantly to the overall costs of medical care (12, p.22).

Physicians will spend their time and their patient's money for defensive acts according to the threat which they perceive. The physician's knowledge and understanding of the counterintuitive results of defensive medicine will also affect the number of defensive acts he commits. The total number of defensive acts obviously will depend on the number of practicing physicians. Here again, and frequently throughout this model, a multiplicative separable approximation is used: defensive acts is modeled as the product of a normal value, the number of physicians, the 'threat

multiplier', and the 'understanding multiplier.' The normal value of defensive acts per physician is based on 1970 data and is calculated by DYNAMO from other information such as the average cost of a defensive act, the percentage of total medical costs consumed by defensive medicine, and the number of physicians. The understanding multiplier will be explained more fully in the understanding section.

The threat multiplier for defensive acts is a table function input showing the relationship between the physician's perceived threat and the number of defensive acts which he performs. The 1970 values of perceived threat was assigned as 1.0 and this point is the normal point of the function. The lower end point indicates that there would be no defensive acts if there was no perceived threat. The function is linear and increasing over most of its range, indicating the positive nature of the relationship. Saturation occurs at extreme limits of threat: the physician is practicing an inordinate amount of defensive medicine, but there is a limit.

The number of practicing physicians is an important variable in the model. Although medical schools are granting degrees to more graduates each year, there is still a shortage of physicians. This shortage is compounded by early retirements caused, in part, by the growing threat of litigation. According to the Subcommittee on Executive Organization, older semi-retired physicians are retiring from practice

TABLE FUNCTION 4: THREAT MULTIPLIER FOR DEFENSIVE ACTS

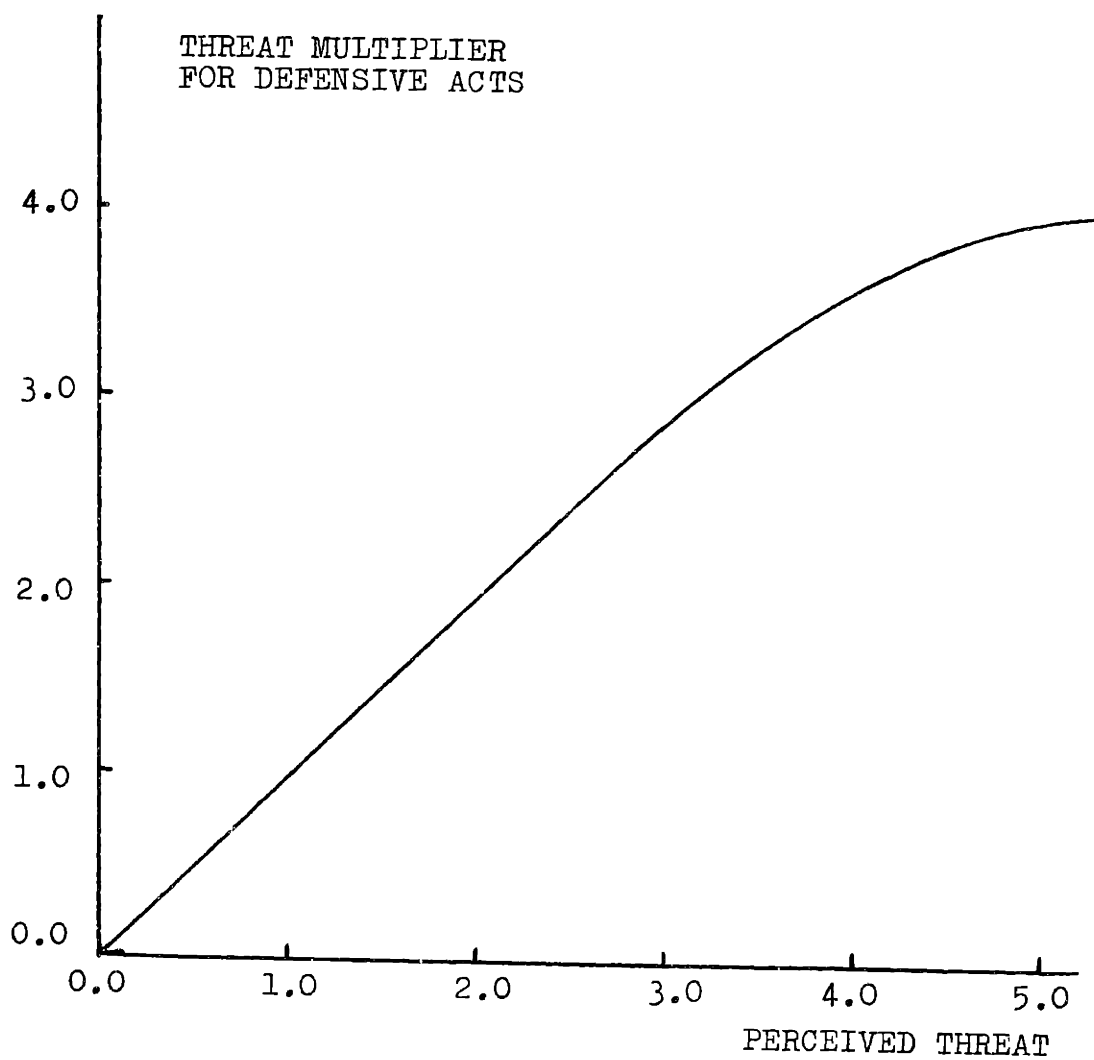
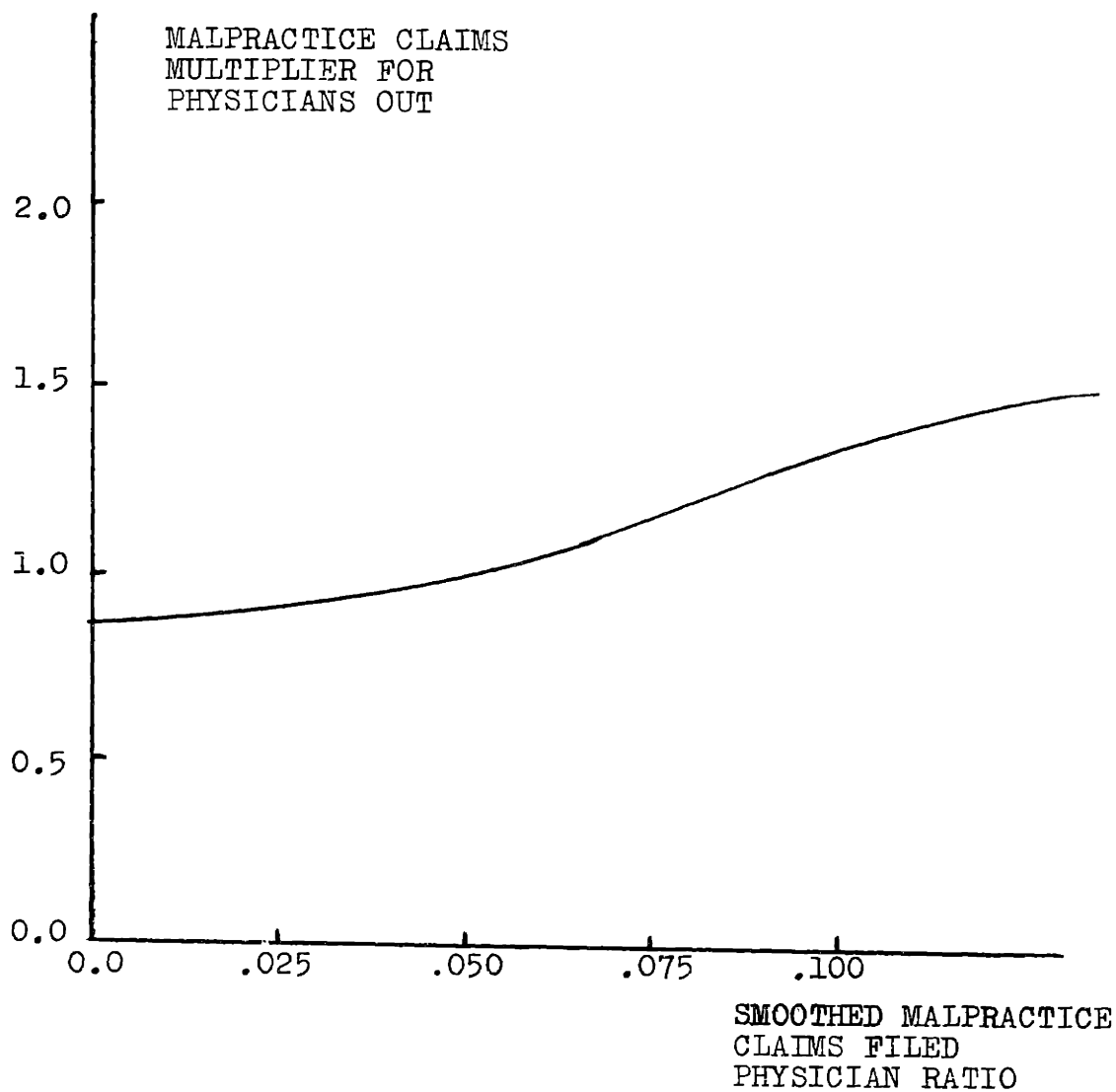


TABLE FUNCTION 5: MALPRACTICE CLAIMS MULTIPLIER
FOR PHYSICIANS OUT



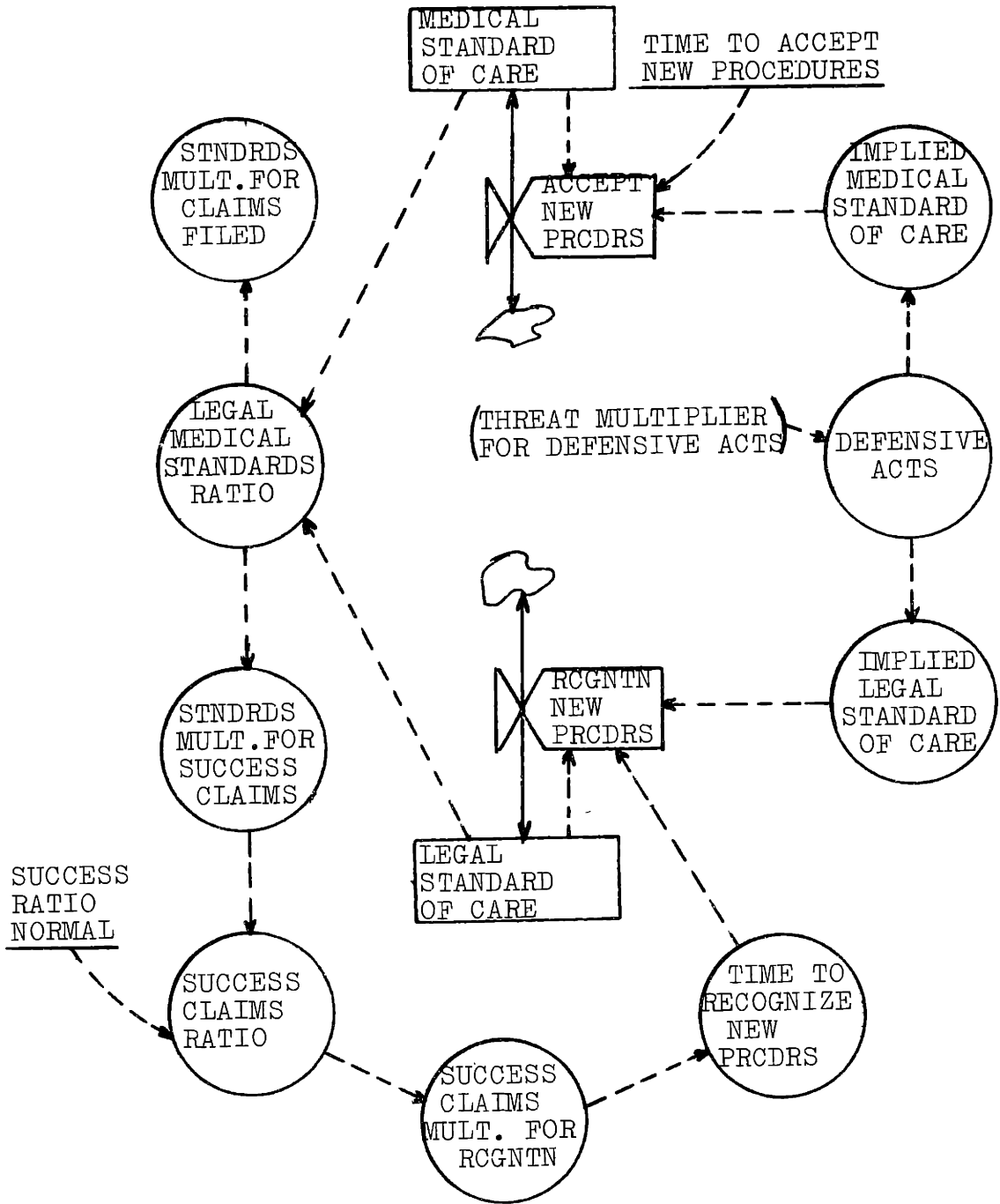
completely because of the growing threat and the prohibitive cost of insurance. Furthermore, the Subcommittee reports that some 350 physicians in California have quit medical practice because of rising insurance costs. (12, p.10).

The malpractice claims multiplier for physicians leaving medical practice models the effect of the litigation threat on early retirements. The independent variable for this table function is the smoothed malpractice claims filed per physician ratio. The smoothing time is five years because of the importance of the decision involved and the resultant length of time over which it is considered. The function is quite flat in the neighborhood of the operating point indicating the relatively small effect a change in smoothed malpractice claims filed would have on physician retirements. The first derivative is positive, however, and the effect becomes more severe as malpractice claims filed reach a level several times as high as at present.

Medical and Legal Standards of Care

A medical standard of care is implied by the everyday acts of practicing physicians. Both non-defensive and defensive acts contribute to the standard. There is a delay involved because medical standards are a physician's perception of the norm: acceptance of new procedures takes time, time to learn of their existence, time to evaluate

FIGURE 4: MEDICAL AND LEGAL STANDARDS OF CARE



them, and more time to incorporate them into regular practice. We shall use a medical standard of care of 1.0 to mean that a physician is doing everything possible for his patients, but is not practicing any defensive medicine. As the medical standard rises above 1.0 this will mean that defensive medicine is being used. A standard of 1.10 means that ten per cent of the resources consumed are for defensive purposes and not primarily to benefit the patient.

The legal standard of care is similarly determined. The actual practice of the medical profession, including defensive and non-defensive medicine, yields and implied legal standard of care. The actual legal standard of care is a delayed form of the implied standard due to the time required for the legal profession to recognize new medical practices. Law is based on precedent, and previous cases, therefore, set the standard for current litigation; a high ratio of successful claims to claims filed will reduce the time to recognize new procedures.

The medical and legal standards of care will be very similar, but not identical. This is due to the manner in which they are determined: medical standards are a physician's perception of the norm while legal standards are influenced by legal precedents. The ratio of the legal standard to the medical standard will affect the percentage of cases accepted by lawyers and the percentage of claims that result in payment. When the legal-medical standards ratio

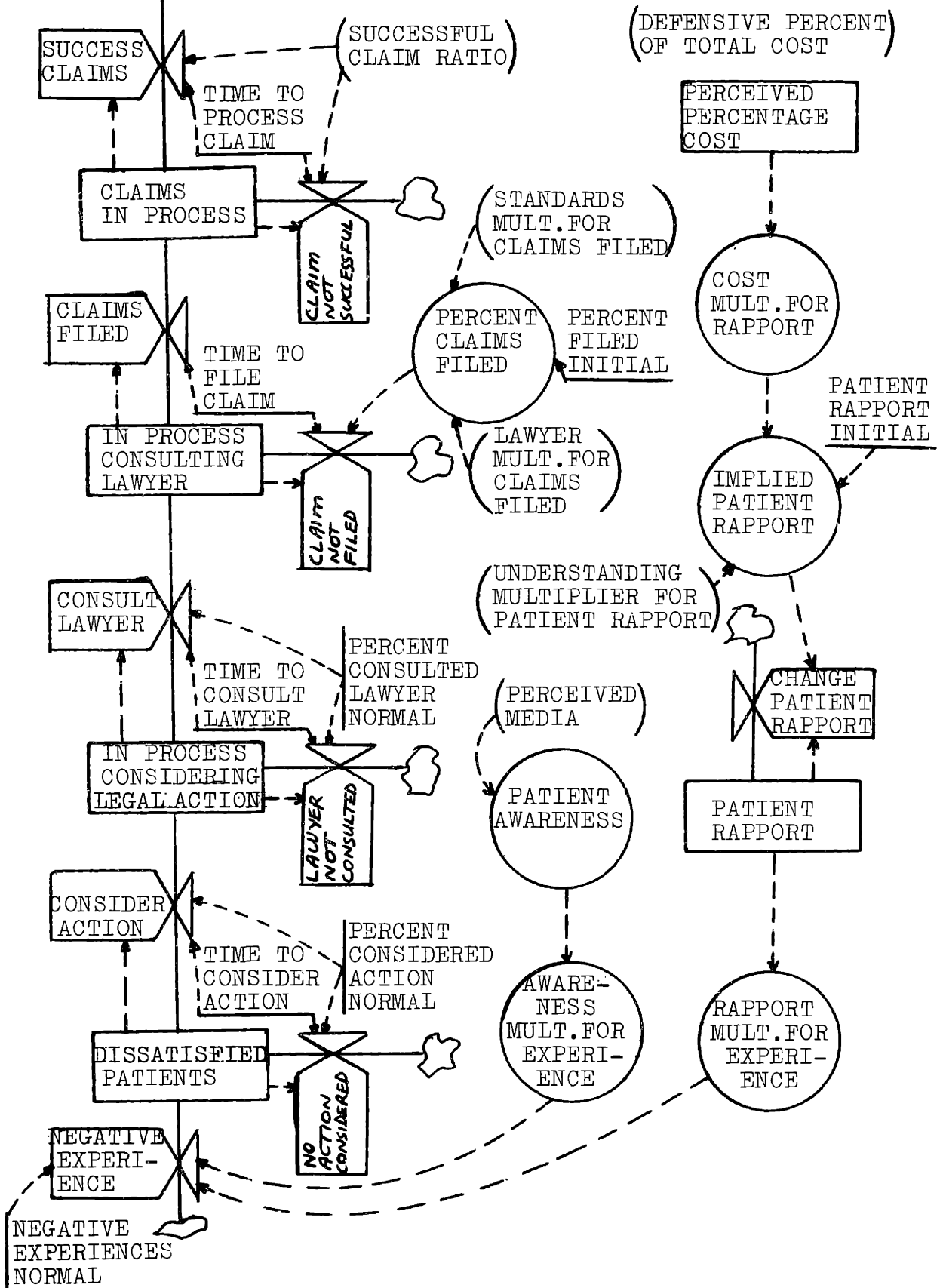
is greater than one, the patient has an advantage in filing suit. On the other hand, when the ratio is less than one, the physician is less likely to be sued and if sued, more likely to emerge the winner.

The Patient

All malpractice claims originate with a dissatisfied patient, a patient who perceives that he has had a negative medical experience. There are two factors modulating patient's ability and desire to perceive a negative medical experience; patient awareness and patient rapport. Patient awareness is the patient's knowledge of a physician's legal responsibilities, his understanding of medicine, and his knowledge of physicians' liability insurance. Patient rapport is the subjective impression of the quality of the patient-physician relationship.

The level of patient awareness has a positive causal influence on malpractice claims filed. There are three components of patient awareness: medical, legal, and insurance. As a patient's knowledge of medicine, his medical awareness, increases it is more likely that he will recognize improper medical treatment. As a patient becomes more aware of a physician's legal obligations and legal procedures it is more likely he will consult a lawyer after a perceived negative medical experience. Finally, as a patient's understand-

FIGURE 5: THE PATIENT



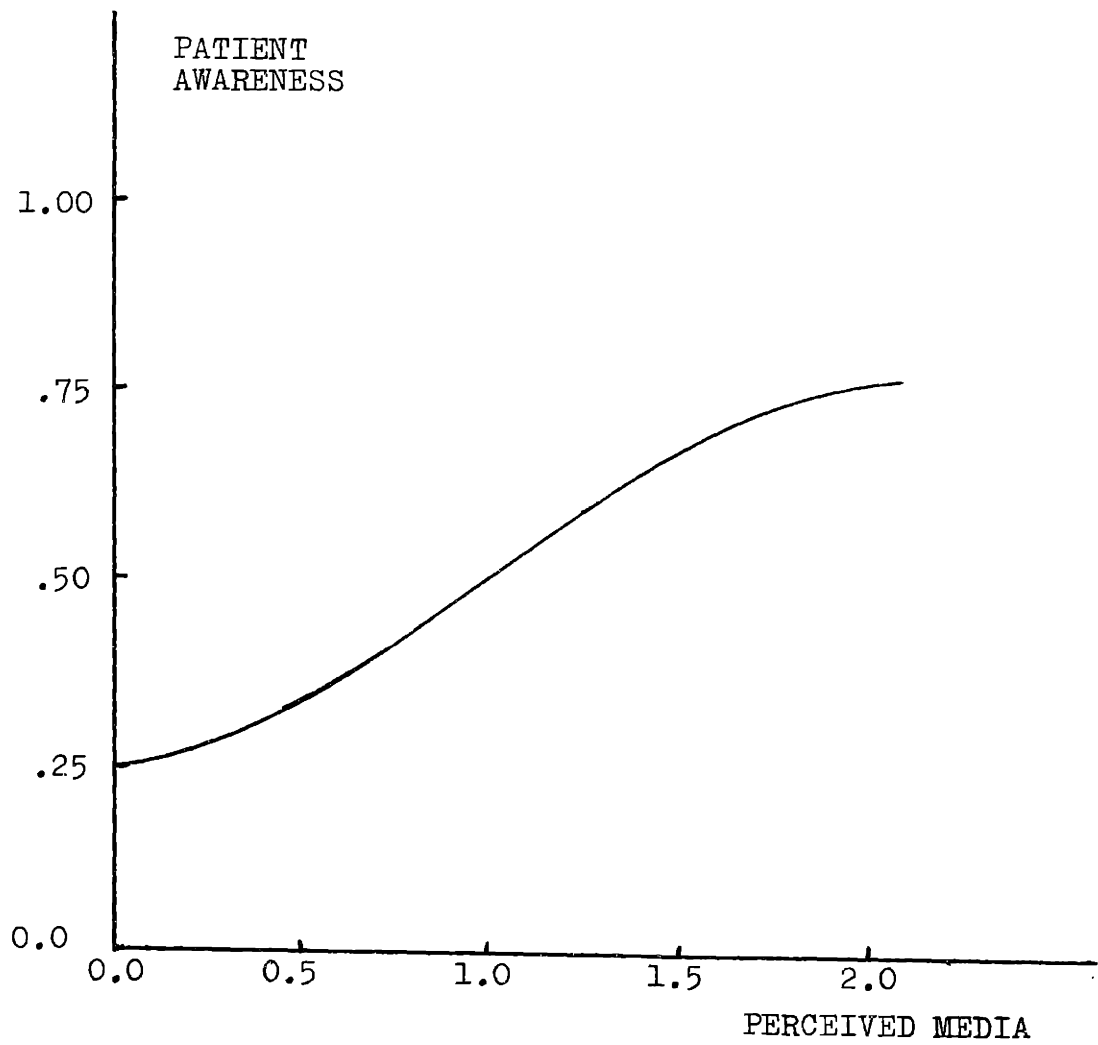
ing of medical liability insurance increases and he realizes that a suit will not directly affect the physician's financial position, the probability of filing a claim increases. The SCMM's Consumer Survey supports these conclusions with the following data:

1. There is a definite positive correlation between understanding the basic elements of medical malpractice and probability of considering legal action after a negative medical experience. (4, p.79).
2. Exposure to the legal system is positively correlated with consideration of legal action. Furthermore, the degree of correlation depends on the depth of exposure. (4, p.78).
3. Forty six per cent of the sample either did not know or thought that malpractice insurance was not available to physicians (4, p.17).

The major influence on patient awareness is the media. The media's coverage of the malpractice problem affects the patient's medical, legal, and insurance awareness. A table function is used to express this relationship. The flattening out of the curve as perceived media decreases from 1.0 indicates that the media is not the only source of patient awareness, and the saturation that occurs at levels of perceived media greater than 1.5 shows that there is an upper limit on the effect that the media can have on patient awareness.

We will now examine and quantify the determinants of

TABLE FUNCTION 6: PATIENT AWARENESS

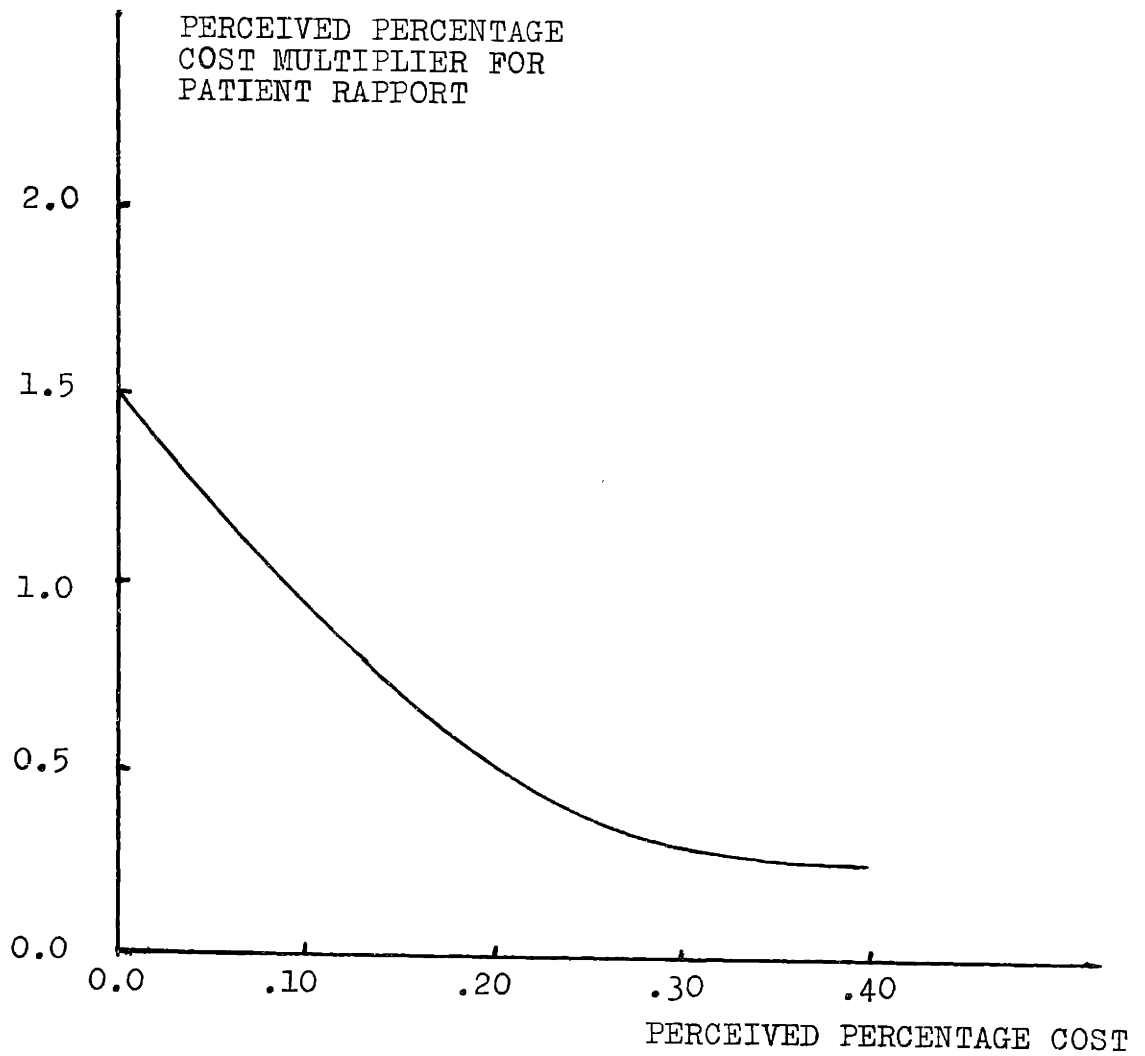


patient rapport. From the Consumer Survey it is apparent that many people feel that the costs of medicine outweigh the benefits. Insurance companies interviewed by Twine and Potchen feel that a prime reason for low rapport in those who had a perceived negative medical experience was the fact that they had to pay for this treatment. Furthermore, Twine and Potchen found that many such patients would not have considered filing a suit after a perceived negative medical experience if they were not repeatedly billed for the treatment (13, p.56). Thus the cost of health care, and in particular the cost of non-beneficial health care, is a major factor affecting patient rapport. One measure of non-beneficial health care is the cost of defensive medicine, and this will be used to formulate patient rapport.

The table function relating perceived percentage cost of the defensive medicine, to patient rapport has a negative slope which indicates the negative causal link between the variables; that is an increase in perceived cost causes a decrease in rapport and a decrease in perceived cost causes an increase in rapport. The normal point is perceived percentage cost equals 0.10. The function is linear in the operating region around the normal point, but saturation occurs as the perceived cost increases beyond twenty per cent.

Patient rapport has changed as the traditional physician-patient relationship has changed. Eli Berzweig,

TABLE FUNCTION 7: PERCEIVED PERCENTAGE COST MULTIPLIER
FOR PATIENT RAPPORT



Special Assistant for Malpractice Research and Prevention
for the Department of Health, Education, and Welfare, discusses the changing relationship:

Perhaps the most significant sociological factor influencing the increase in malpractice claims over the past decade has been the changing nature of the physician-patient relationship, and particularly the increasingly impersonal way in which health care services are provided under our existing health care system. There is little doubt that the increasing demands for health services, coupled with the chronic manpower shortages, have depersonalized the delivery of health services, but it does not seem that the consequences thereof have been fully appreciated. Everyone knows that the family doctor has given way to the busy specialist, who generally sees the patient on a referral basis and seldom gets to know him intimately, but not everyone appreciates the results of this change in medical practice (12, p.20).

Louisell and Williams describe the implications of unsatisfactory patient rapport:

If (rapport) between physician and patient is not commensurate with the necessary diagnostic and therapeutic activities, there is a strong possibility of a failure of treatment, the collapse of the relationship, or both. If both occur at about the same time, chances for a lawsuit are strong. (5, p.137).

The essential prerequisite for a liability claim is the perceived negative medical experience. We have just given evidence supporting the hypothesis that patient awareness and patient rapport are the primary determinants of perceived negative medical experiences. The formulation relating these variables is similar to the formulation of perceived threat:

multipliers are defined, showing the separate effect of awareness and rapport on perceived negative medical experience, and a multiplicative separable formulation is assumed. The accompanying graphs depict the table functions which comprise the multipliers. The negative slope of the rapport multiplier expresses the negative causal link between patient rapport and perceived negative medical experience. On the other hand, the positive slope of the awareness multiplier indicates the positive causal link which exists between patient awareness and perceived negative medical experience.

We have discussed the factors affecting the frequency of perceived negative medical experiences. Now we will follow the path from perceived negative medical experience to malpractice claims filed. This is not a simple procedure for the dissatisfied patient; the road is long and hard, and fortunately for the courts and the physicians, only a small percentage of negative medical experiences evolve into malpractice claims. Furthermore, formal litigation represents only a relatively small proportion of all malpractice claims. We shall use the term malpractice claim to include all types, whether or not they materialize as lawsuits.

In 1970 the 204 million Americans made almost one billion visits to physicians (7) (14). According to the Consumer Survey approximately 1.67 per cent, or 3.4 million people, believed they had a negative medical experience in a twelve month period in 1971-72 (4, p.31). A patient's

TABLE FUNCTION 8: RAPPOR MULTIPLIER FOR PERCEIVED
NEGATIVE MEDICAL EXPERIENCE

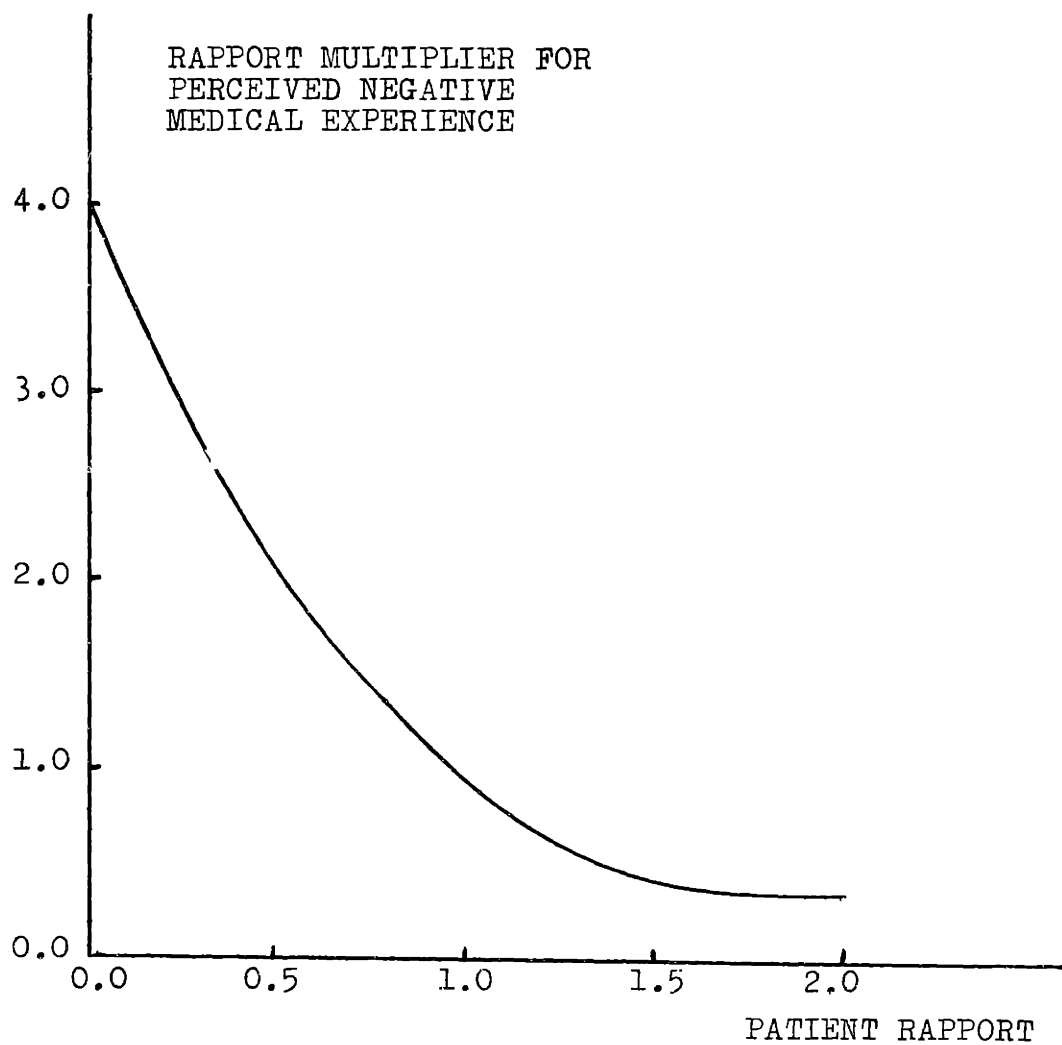
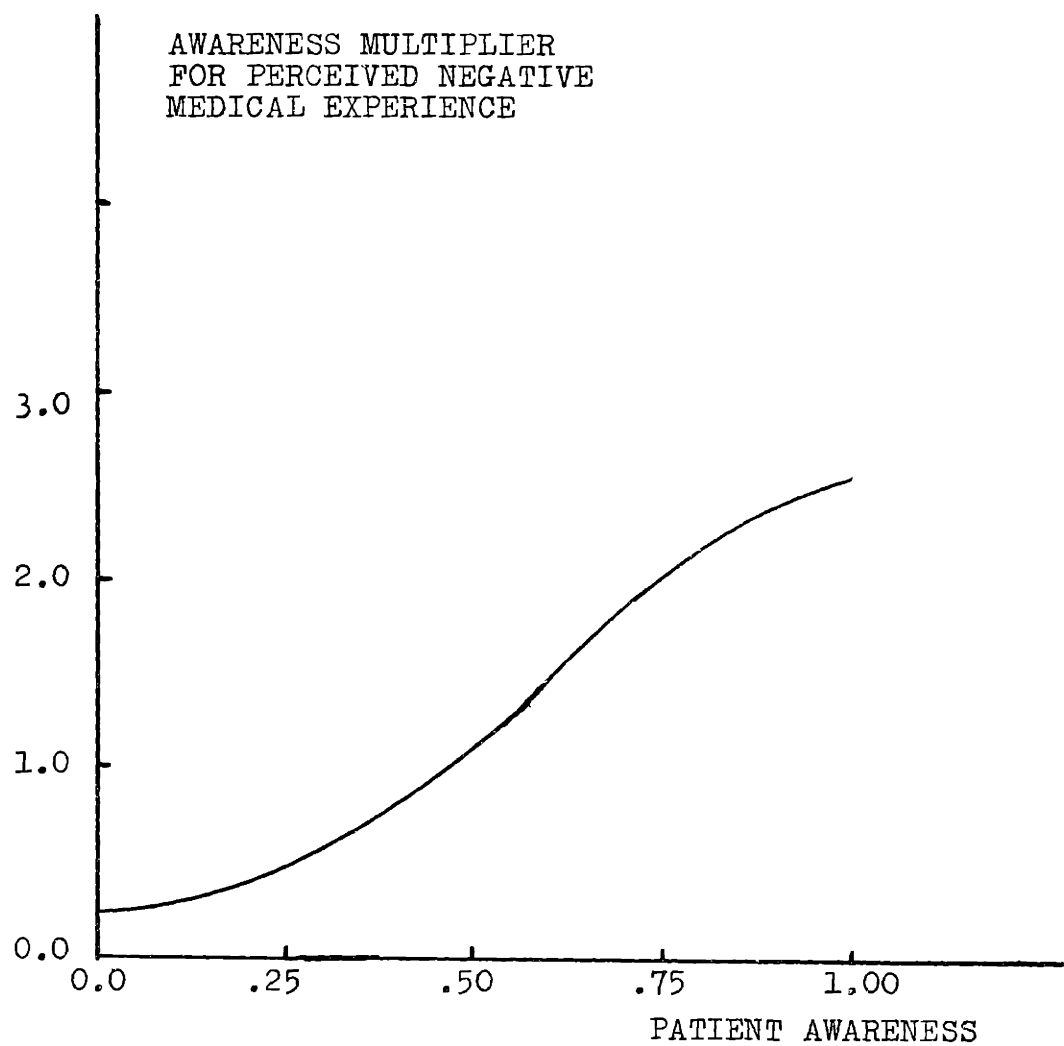


TABLE FUNCTION 9: AWARENESS MULTIPLIER FOR PERCEIVED
NEGATIVE MEDICAL EXPERIENCE



perception that something went wrong with his medical care is the first step towards a malpractice claim.

Most patients who perceive a negative medical experience will not even consider legal action for several reasons:

1. Patients unaware of the contingent fee system are unwilling to pay the high cost of legal assistance.
2. Patients doubt that they could win a case because of the difficulty of obtaining medical records and expert testimony.
3. The delay involved and the time which must be spent reduce the potential benefit.
4. The patient does not want to hurt the physician. Thus the Consumer Survey indicates that only eight per cent of the sample who had a negative medical experience even considered legal action. (4, p.43).

The next step toward filing a claim is to consult a lawyer. The Consumer Survey showed that only 38 per cent of the patients who considered legal action actually talked to a lawyer (4).

The legal profession does considerable screening of prospective malpractice claimants. Both the Legal Survey prepared for the SCMM and the earlier study by the California Medical Association reveal that lawyers accept only ten to twelve per cent of the cases which patients bring to them (18). The lawyers perform an initial evaluation of the liability of the physician and the damages to the patient, and only if there appears to be sufficient damage and probability

of negligence will the case be accepted by the lawyer.

Thus, of the 3.4 million perceived negative medical experiences in 1970 only $(.08)(.38)(.12) = .0036$ finally manifest themselves as malpractice claims. This is 12,000 malpractice claims per year and agrees with the SCMM's data that in 1970 malpractice claims were filed for approximately 12,000 incidents (10, p.23).

It is important to remember the time lag between the actual negative medical experience and its perception and also from the time of perception to the time the malpractice claim is filed. The statute of limitations for medical liability begins to run only when the patient actually perceives or should perceive that something went wrong in the course of his medical care. Thus only forty-eight per cent of all claims are filed within two years of the negative medical experience (12, p.9).

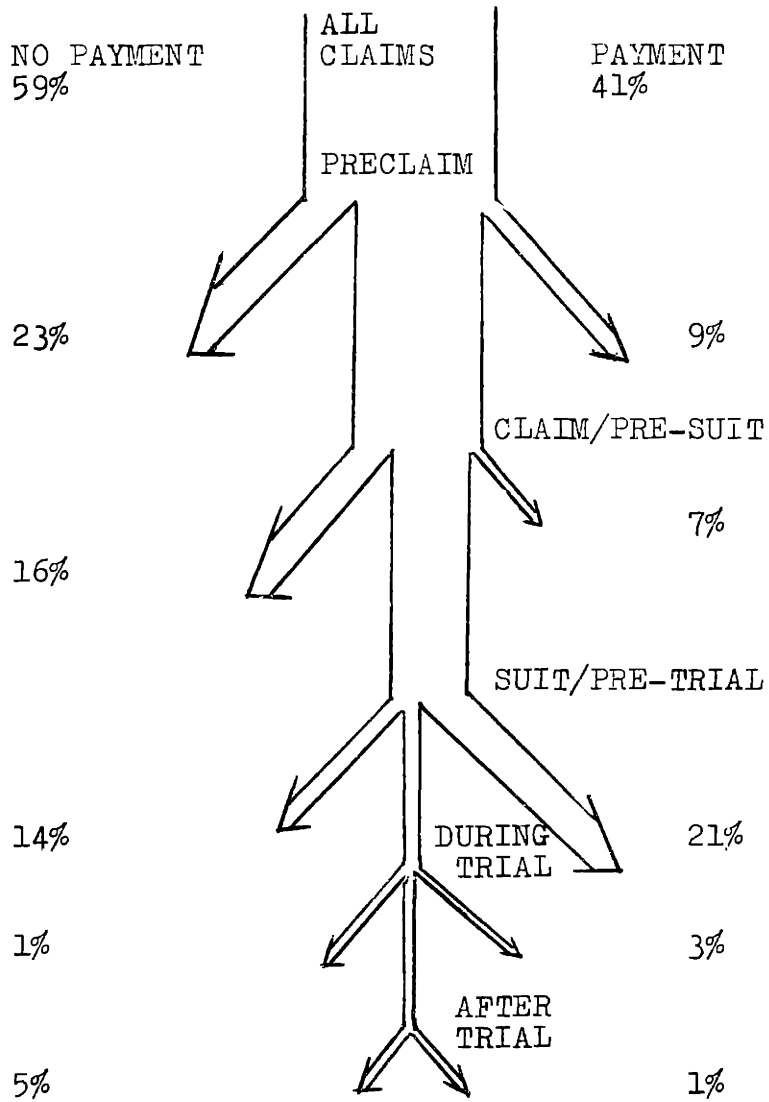
All malpractice claims filed, however, do not go to trial. Many are resolved before a suit is filed, some after a suit is filed but before trial; others are settled during the trial and only a few depend on a trial verdict or appeal. Each case takes an average of two years to process (12, p.9). It is useful to think of the root structure of a tree: as the roots go further into the ground seeking water, so the malpractice claims proceeds further into the legal system in search of resolution. The further down the structure one descends, the smaller are the roots. The illustration on the

next page depicts the disposition of claims using the root structure analogy. Overall, forty-one per cent of claims filed result in payments to claimants or heirs, while fifty-nine per cent are settled in favor of the defendants.

Referring to the flow diagram of the patient sector, one can follow the flow of patients just described. Patients who have a negative medical experience enter the pool of dissatisfied patients. After an average stay of six months, eight per cent of the dissatisfied patients considered legal action and ninety-two per cent leave the pool of dissatisfied patients. Those patients who considered legal action enter a group called dissatisfied patients considering legal action. They remain in this group approximately six months; thirty-eight per cent consult a lawyer while sixty-two per cent decided not to bother. People who actually consult a lawyer first enter the level called dissatisfied patients in process of consulting lawyer. After an average of six months, the lawyer accepts ten per cent of the patients as malpractice claimants. If a malpractice claim is filed, the patient enters the level called malpractice claims filed in process. Since each claim takes an average of two years to process, the average length of time in the level is two years. After this delay the patient leaves the system, forty-one per cent as successful claimants and fifty-nine per cent as unsuccessful claimants.

The median payment for those claims closed with

FIGURE 6: DISPOSITION OF MEDICAL MALPRACTICE CLAIM FILES CLOSED IN 1970



SOURCE: (10, p. 17)

payment in 1970 was \$3000. Only 4.2 per cent of the successful claims settled for over \$50,000, but it is these large settlements that alarm the physicians the most. Less than one tenth of one per cent of successful claims result in payments in excess of \$1 million (10, p.18).

The Media

The media play a dual role in affecting patient's perception of medicine. They describe both the largest cases of malpractice litigation and the foremost medical breakthroughs and 'miracles'. Thus the media raise the patients' expectations and inform them of methods of legal recourse in the event that medical miracles are not performed on them. Besides increasing the probability of a patient filing a malpractice claim, the media's description of the largest, even though infrequent, awards increases the physician's perceived threat.

The SCMM evaluated 1200 articles published in general and professional press. The vast majority of stories dealt with lawsuits. Human interest factors such as huge sums of money and severely injured persons carried great weight. There is, on the other hand, a relative lack of coverage where lawsuits were won by the defendant. Furthermore, the SCMM finds that

there is a growing recognition among pro-

FIGURE 7: THE MEDIA

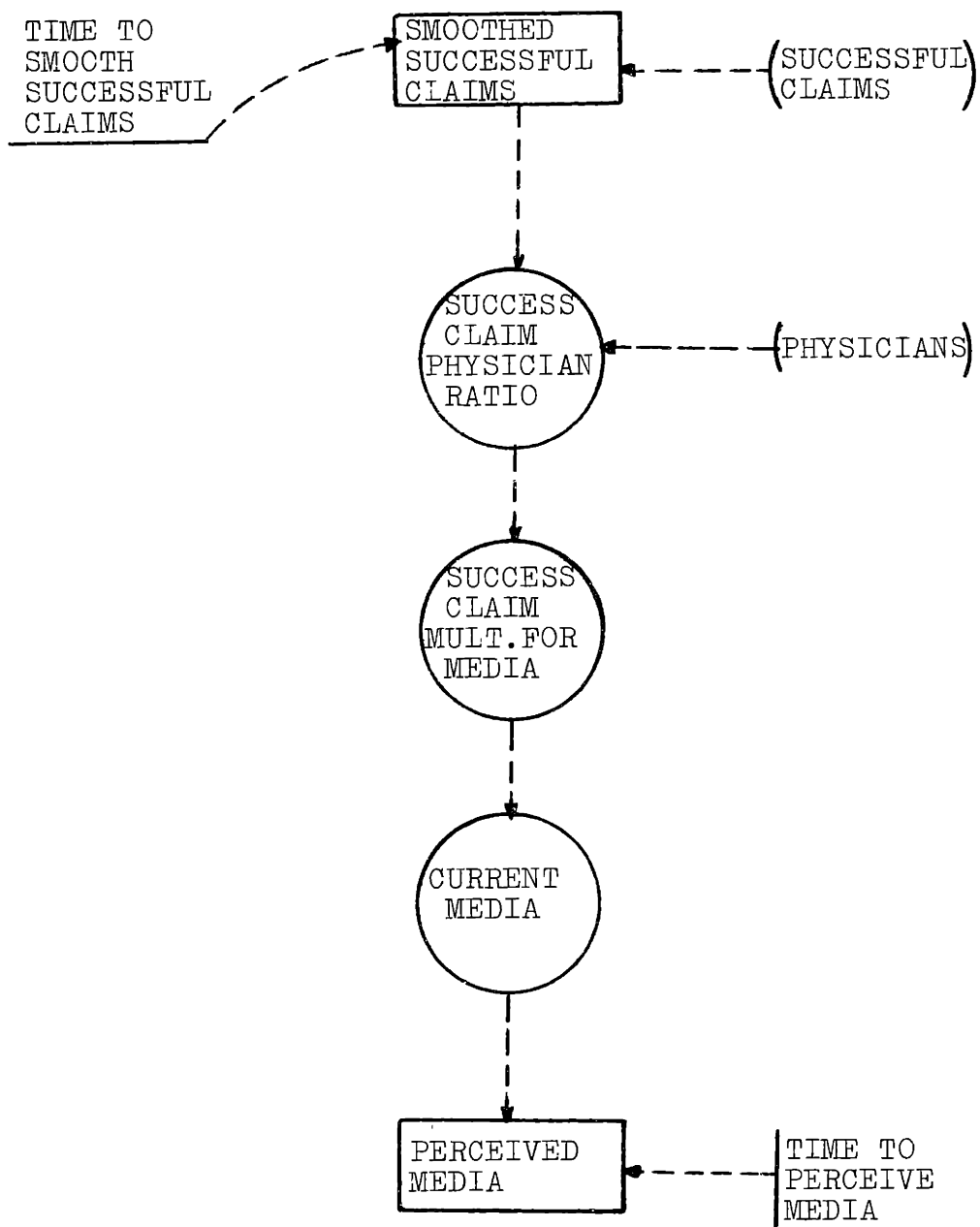
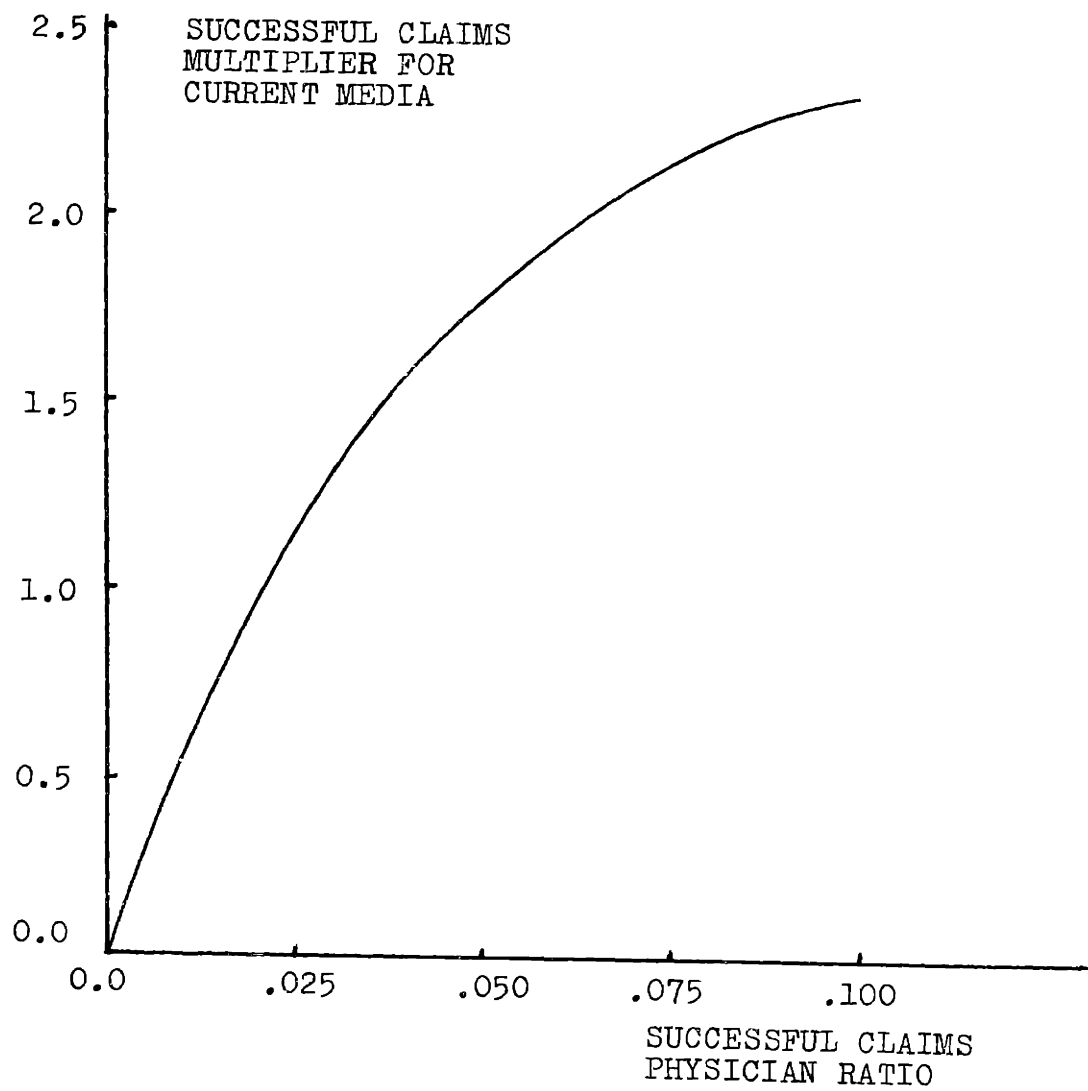


TABLE FUNCTION 10: SUCCESSFUL CLAIMS MULTIPLIER FOR CURRENT MEDIA



professionals, newsmen and the general public that the mass media, particularly television, by portraying medical 'miracles' and failing to properly inform audiences of ever present limitations, raises expectations that the medical profession can cure everyone (10, p.52).

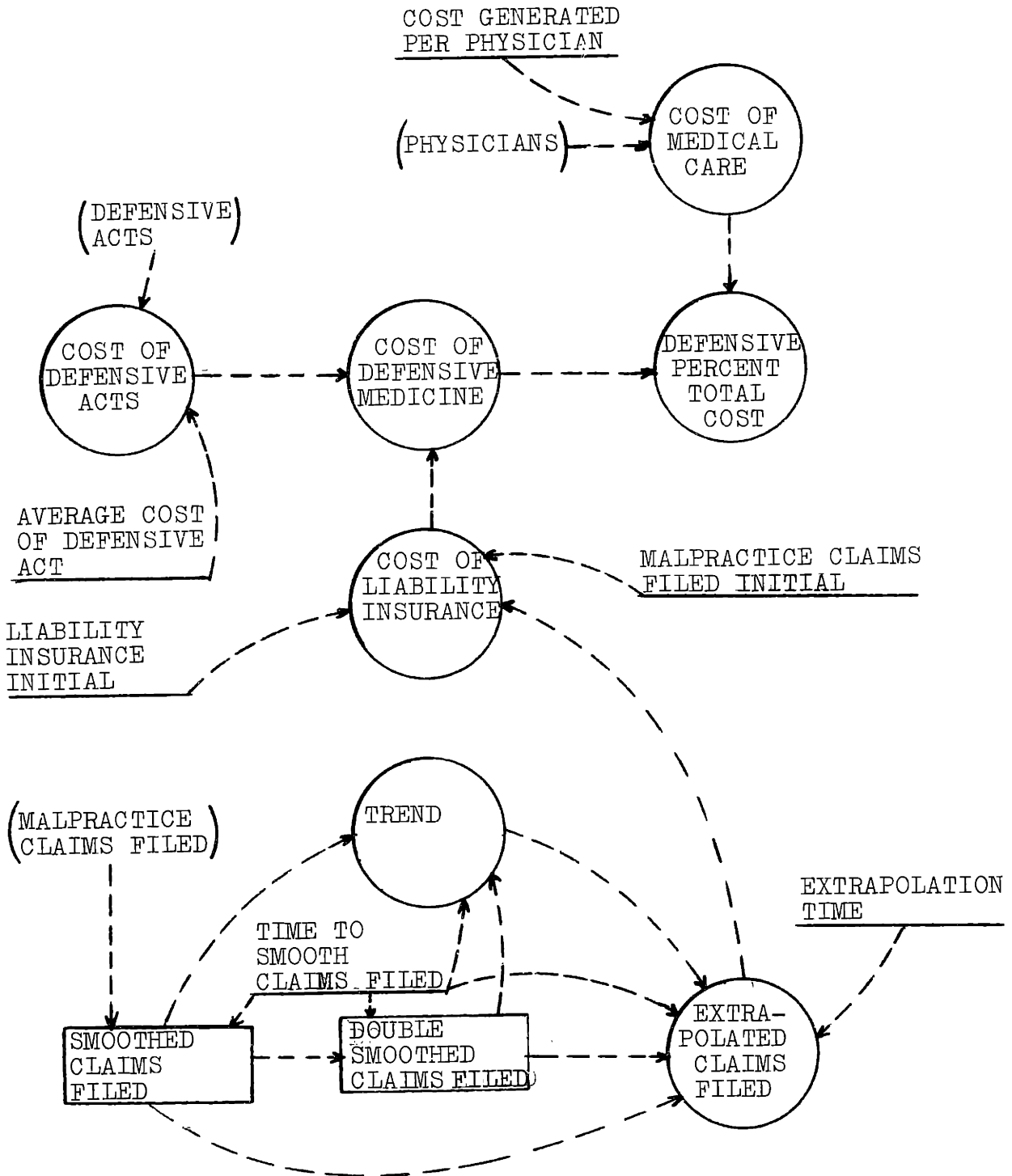
Specifically, the value of the current media is determined by the ratio of the level of successful claims to the number of physicians. This is an acceptable surrogate for the small fraction of extremely high payment claims since they differ only by a constant factor. The table function relating the two variables illustrates the positive nature of the relationship. It also shows that no coverage would result if there were no successful claims, and, at the other extreme, coverage saturates as successful claims reach extraordinary levels.

The media is an information channel, and the current content of an information channel does not instantaneously affect people's awareness. As in most information channels, there is a delay before the information reaches and is absorbed by the receiver. Thus the variable perceived media is established and used as input to patient awareness.

Cash Flow

Many members of the SCMM concluded that the quantity and cost of defensive medicine may not be measurable, but the Commission believes that defensive medicine "in whatever way

FIGURE 8: CASH FLOW



defined or how extensively practiced, adds to health care costs" (10, p.36). In this section we will attempt a rough measure of the cost of defensive medicine and the implications of this cost on the structure of the system. There are two aspects of the cost of defensive medicine: cost of defensive acts and the cost of malpractice insurance.

There have been several estimates of the quantity and cost of defensive medicine. A recent American Medical Association study (2) found that more than seventy per cent of the physicians interviewed order extra tests to protect themselves against malpractice suits. Twine and Potchen conclude that one out of every three x-rays is not needed for treatment, but is a protective measure for the physician. (13, p.48). Dr. Michael Halberstam of Washington, D.C., who has studied the problem, recently said that hospital tests ordered primarily for doctors' protection may account for as much as fifteen per cent of a patient's bill (6). None of these estimates include the cost of consultations initiated on a defensive basis. For simulation purposes a conservative initial value of ten per cent was chosen as the percentage cost of defensive medicine.

The cost of malpractice insurance for physicians in 1970 was approximately \$300 million (10, p.31). This cost is rising even faster than medical costs in general. Between 1960 and 1970 malpractice insurance premiums rose 115 per cent for dentists, 263 per cent for hospitals, 540 per cent for

physicians other than surgeons, and 949 per cent for surgeons (10,p.32). Even with this tremendous growth in premiums, most medical liability insurers sustained operating losses. For example, the National Bureau of Casualty Underwriters reports that for the five year period 1959 to 1963 losses and company operating expenses amounted to \$140 for every \$100 in premiums received from physicians during the period. For surgeons the underwriting loss was even greater (8, p.4).

The reasons for the losses sustained by the insurance companies are simple; the solution is complex. The average malpractice claim is filed two years after the negative medical experience and takes still more time to be resolved (12, p.9). This is significantly longer than for other types of tort claims. Thus insurance companies must set their premiums on predictions of future claims' awards. The unusual growth of malpractice awards during the last twenty years has made prediction difficult if not impossible. A typical method for determining premiums is to use exponential smoothing to determine the trend and predict future cash requirements.

The cost of malpractice insurance is ultimately passed on to the patient in the form of higher fees and charges. The estimated \$300 million paid in liability insurance premiums in 1970 resulted in an additional twenty to fifty cents for every ten dollar doctor fee and an addition of approximately fifty cents to the daily cost of hospital care (10,

p.33). Thus the total cost of defensive medicine is the sum of the cost of defensive acts and the cost of malpractice insurance.

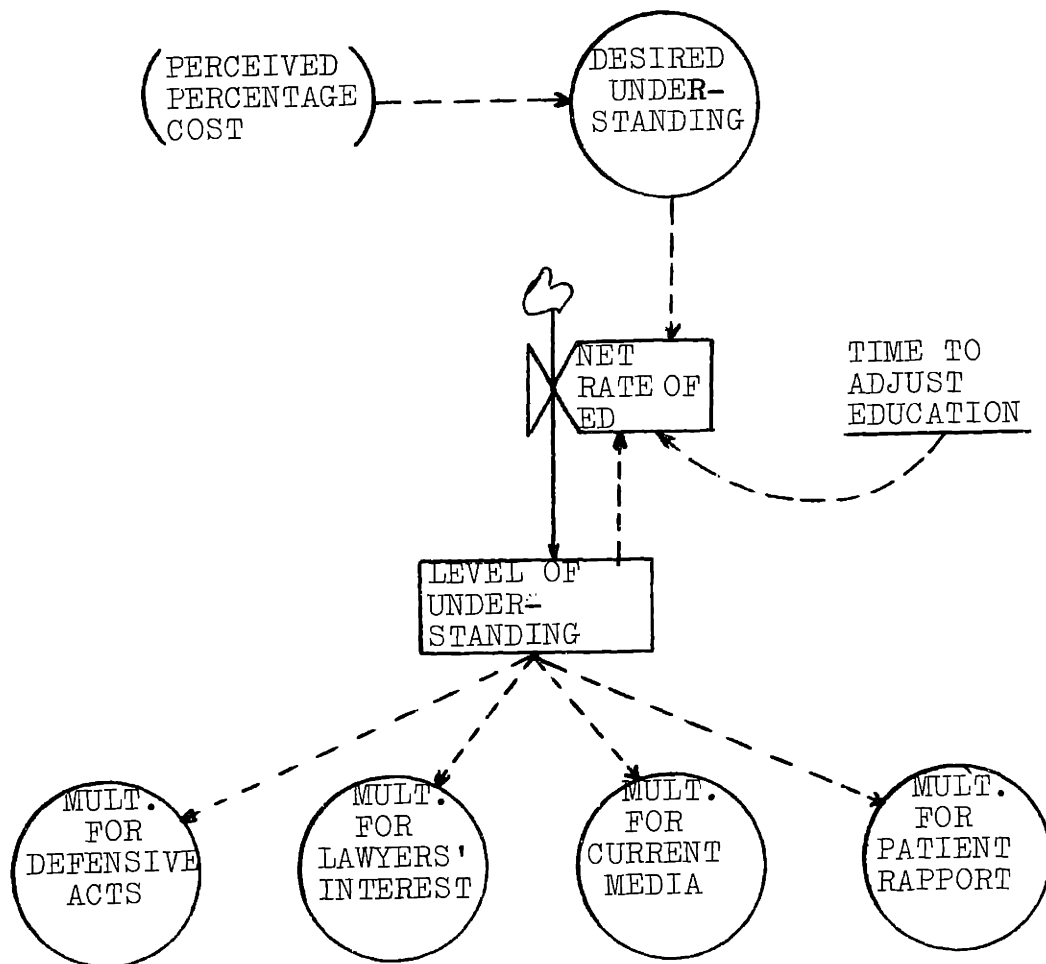
The total expenditure for medical care in 1970 was \$67 billion. This sum was generated by the practices of 250,000 physicians. The total cost can be modeled as the average cost generated per physician multiplied by the number of practicing physicians. The value for the average cost generated per physician is based on the 1970 data.

Finally the percentage of the total cost of medical care which is consumed by defensive acts and liability insurance is calculated as the ratio of the cost of defensive medicine to the total cost of medical care.

Understanding

The problem of defensive medicine and medical liability is of recent origin and is not well understood. The increasing severity of the problem during the past few years has motivated much study in the area, including a 1969 study by the Subcommittee on Executive Organization (12), a 1973 study by the Secretary of Health, Education and Welfare's Commission on Medical Malpractice (10), Twine and Potchen's descriptive analysis of defensive medicine (13), and this thesis, and numerous books, surveys, and journal articles. An understanding of the problem is necessary in order to

FIGURE 9: UNDERSTANDING



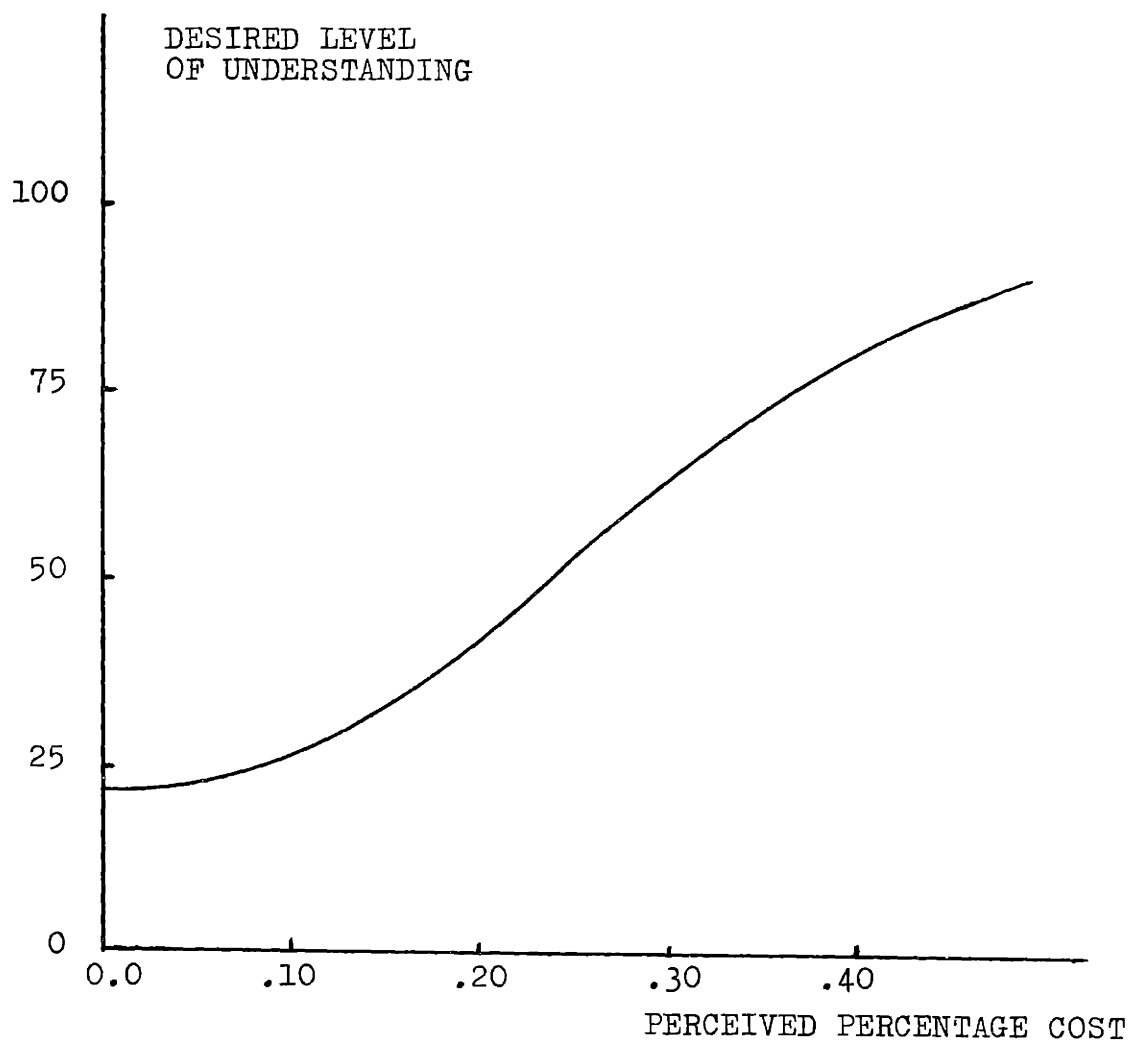
take action to remedy the situation. The studies mentioned above were prompted by the increasing severity of the problem, and undoubtedly, others will follow. Each study will contribute to the physicians', lawyers', or public's understanding of the situation and possibly tend to stabilize the system.

The desired level of understanding increases as the magnitude of the problem increases. Thus the perceived percentage cost of defensive medicine is used to determine the desired level of understanding. The non-linear relationship is shown in the table function. At very low levels of perceived percentage cost the problem is small and the desired level of understanding is low and level. As the cost of defensive medicine increases the problem receives more widespread attention and the desired level of understanding increases rapidly.

The level of understanding impinges upon the system in four places: the physician, the lawyer, the media, and the patient. Each of these effects is modeled as a multiplier and a graph showing the shape and relative magnitude of each function follows.

As mentioned previously, the physicians interviewed by Twine and Potchen found the positive feedback nature of the defensive medical system to be counterintuitive (13, p. 93). Physicians are reacting out of proportion to the threat

TABLE FUNCTION 11: DESIRED LEVEL OF UNDERSTANDING



by ordering defensive acts conservatively estimated to cost more than \$5 billion in response to a threat of \$65 million in current malpractice awards and simultaneously paying \$300 million in insurance premiums. Furthermore, Twine and Potchen find that most successful malpractice claims are due to rather serious acts of negligence such as removing the wrong leg or leaving a surgical instrument in the body during an operation, and few of these actions could have been prevented by defensive acts. Based on their survey, Twine and Potchen estimate that less than twenty per cent of malpractice awards could have been averted by a diagnostic defensive act (13, p. 73). Therefore, defensive acts costing in excess of \$5 billion were made in an attempt to prevent less than \$15 million in liability awards. If physicians understood these facts and the nature of the system's behavior they would probably alter their mode of practice. The understanding multiplier for defensive acts models the effect of physicians' understanding on the amount of defensive medicine practiced.

The level of understanding will also affect lawyers' interest in malpractice cases, the media's treatment of malpractice suits, and patient rapport. Since lawyers already perform a significant screening function with respect to potential malpractice claimants, the effect of increased understanding will not be great. Furthermore, many lawyers depend upon malpractice cases for their income and would be reluctant to change their practice.

TABLE FUNCTION 12: UNDERSTANDING MULTIPLIER FOR DEFENSIVE ACTS

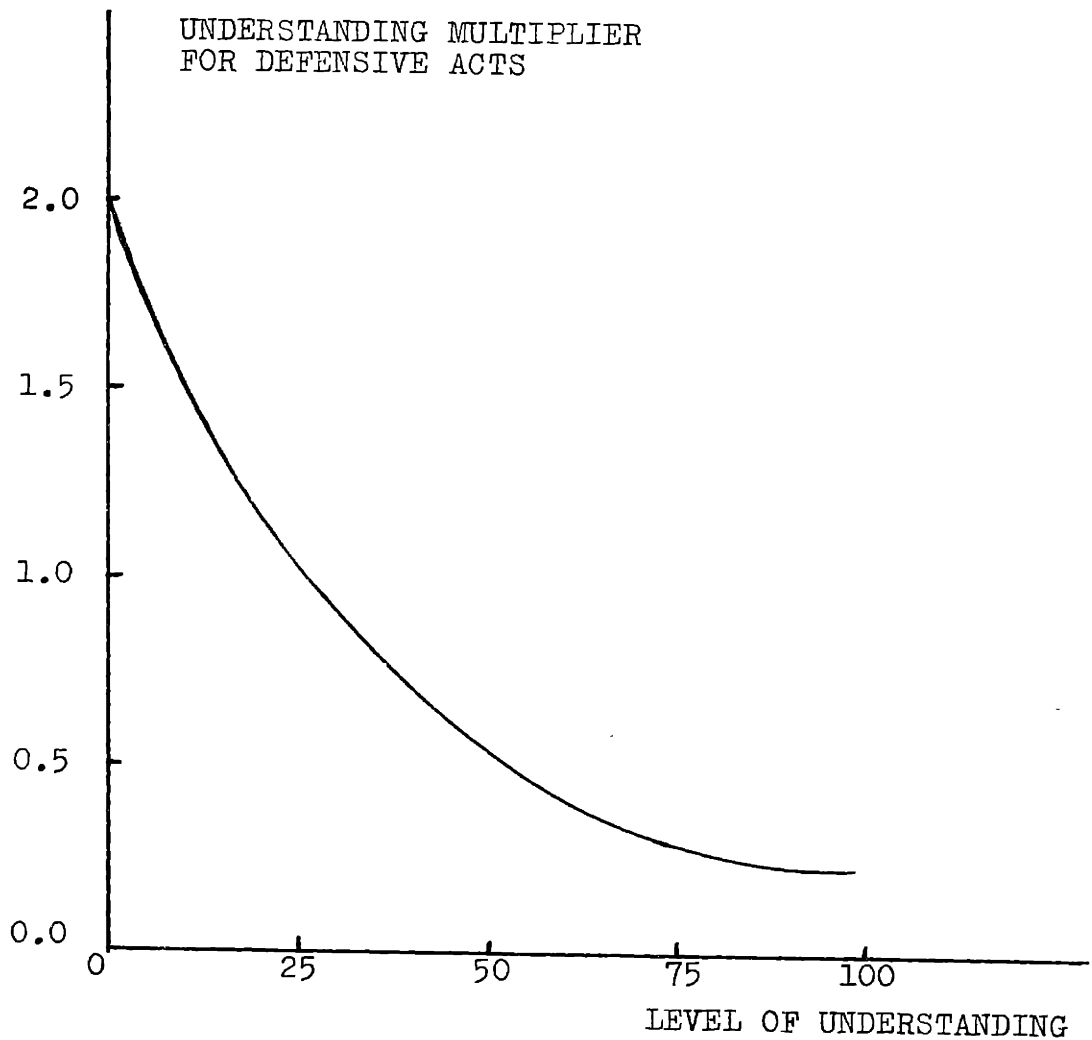


TABLE FUNCTION 13: UNDERSTANDING MULTIPLIER FOR LAWYERS INTEREST

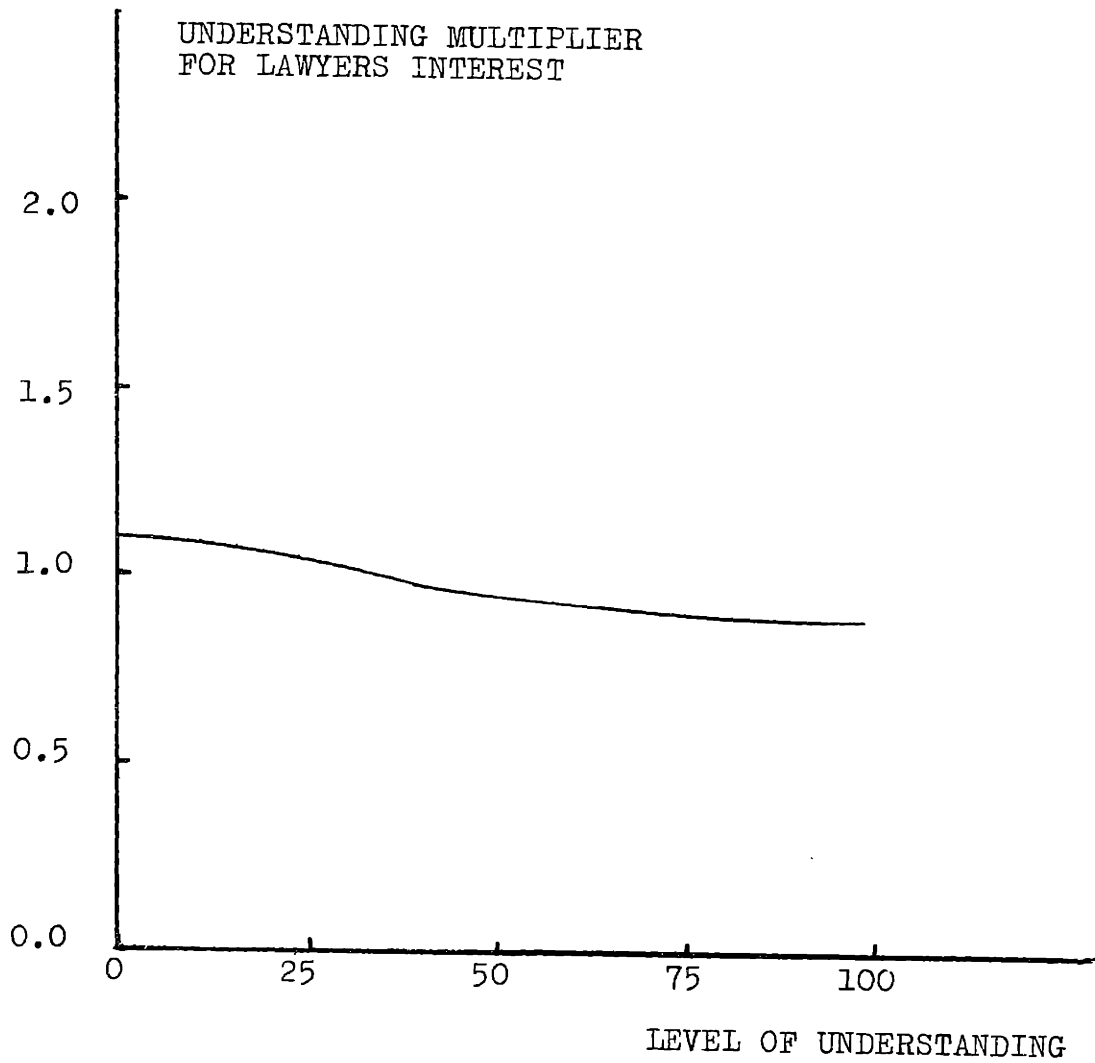


TABLE FUNCTION 14: UNDERSTANDING MULTIPLIER FOR CURRENT MEDIA

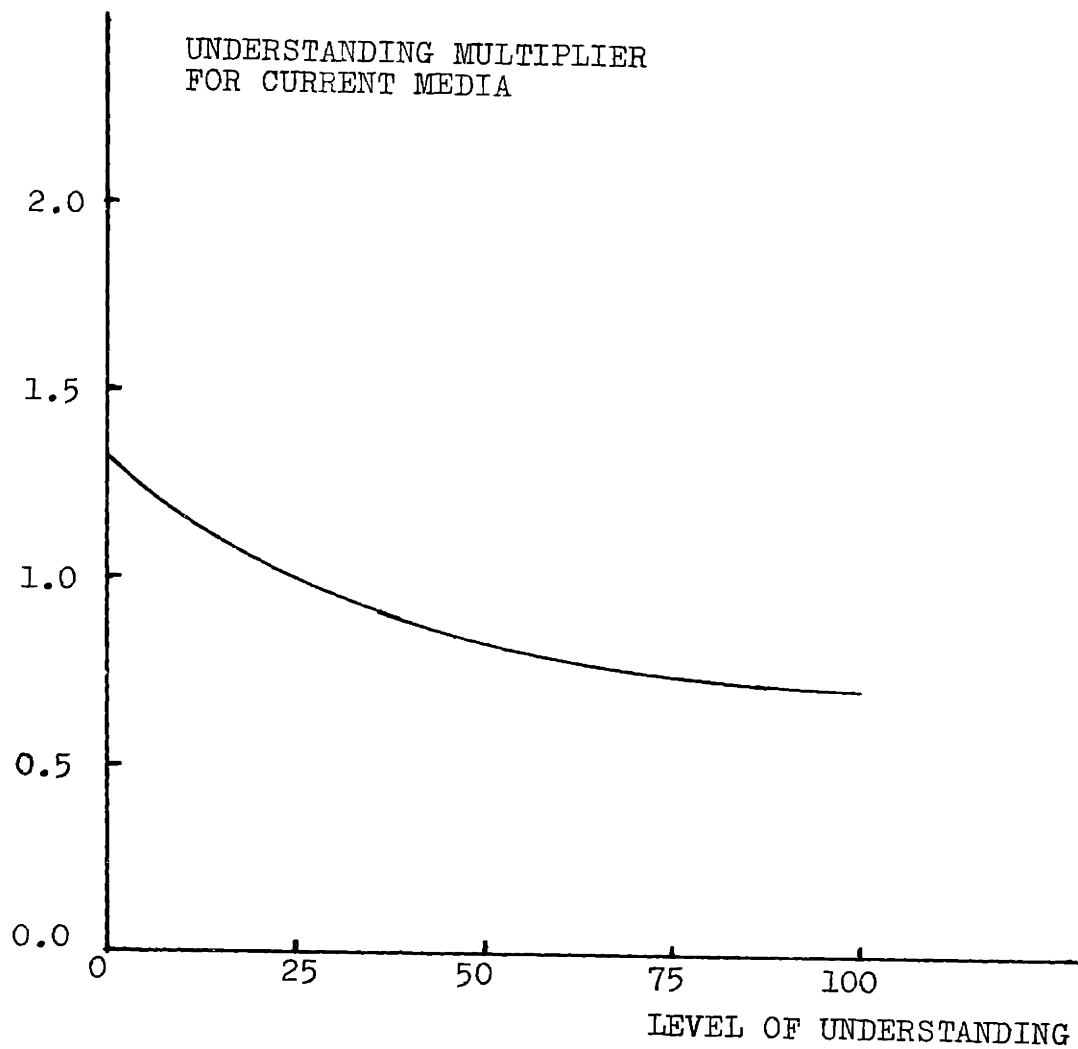
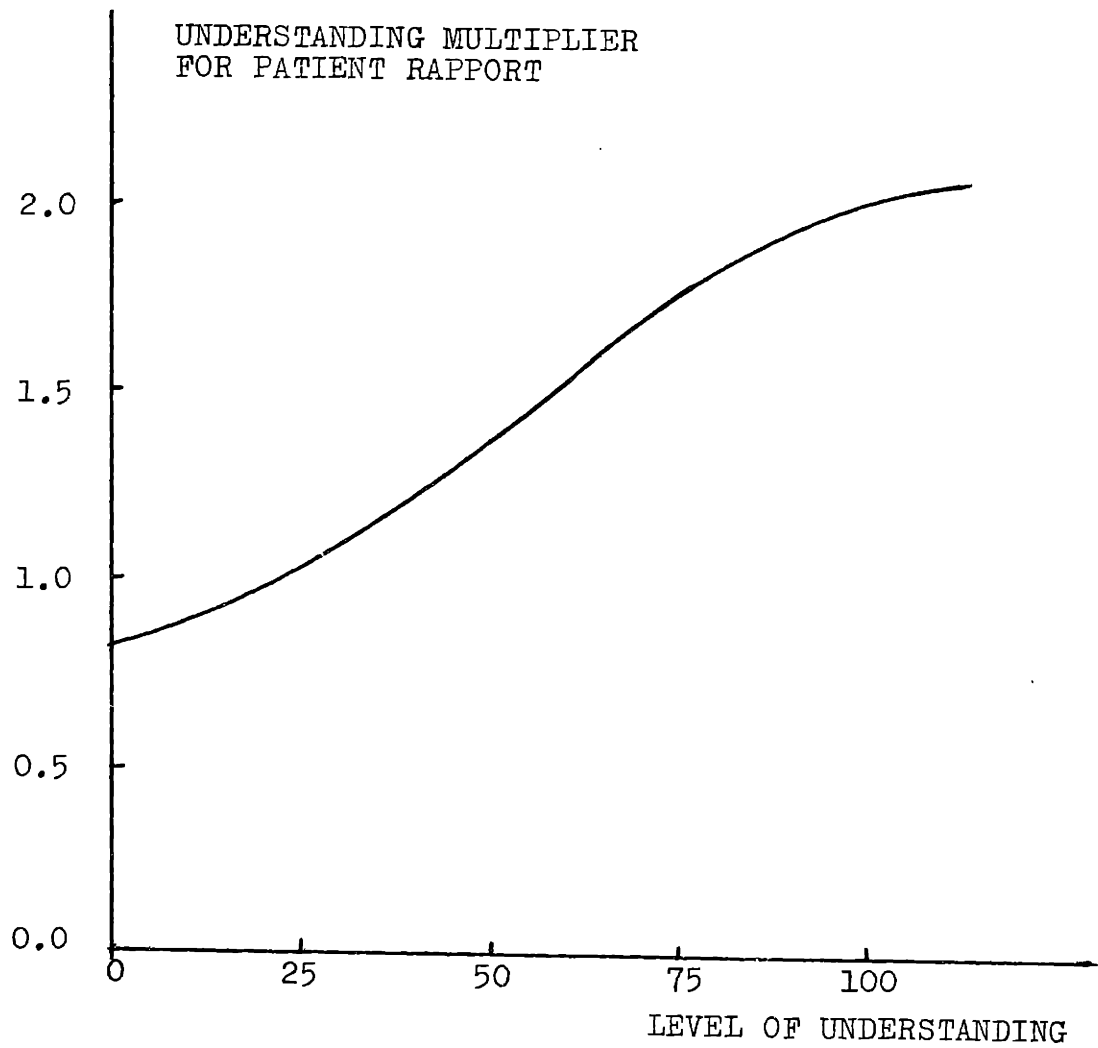


TABLE FUNCTION 15: UNDERSTANDING MULTIPLIER FOR
PATIENT RAPPORT



The reporting media are not noted for their understanding of a situation; the story always comes first. It will be difficult to convince the reporters of the true dynamics of the situation. The effect of the level of understanding on the reporting media, therefore, is small.

The level of understanding has a significant impact on patient rapport and we have shown that lack of patient rapport is a primary cause of perceived negative medical experiences and malpractice claims. Increased understanding of the risks and costs of medicine will reduce dissatisfaction and increase patient rapport.

The Lawyer

The role of the lawyer in the system is clearcut. As malpractice awards rise, the lawyer sees medical liability cases to be more profitable and therefore more desirable; more lawyers will accept medical liability cases and therefore more claims will be filed. The lawyers' interest is determined by the media, modulated by the level of understanding, and delayed by an information delay.

FIGURE 10: THE LAWYER

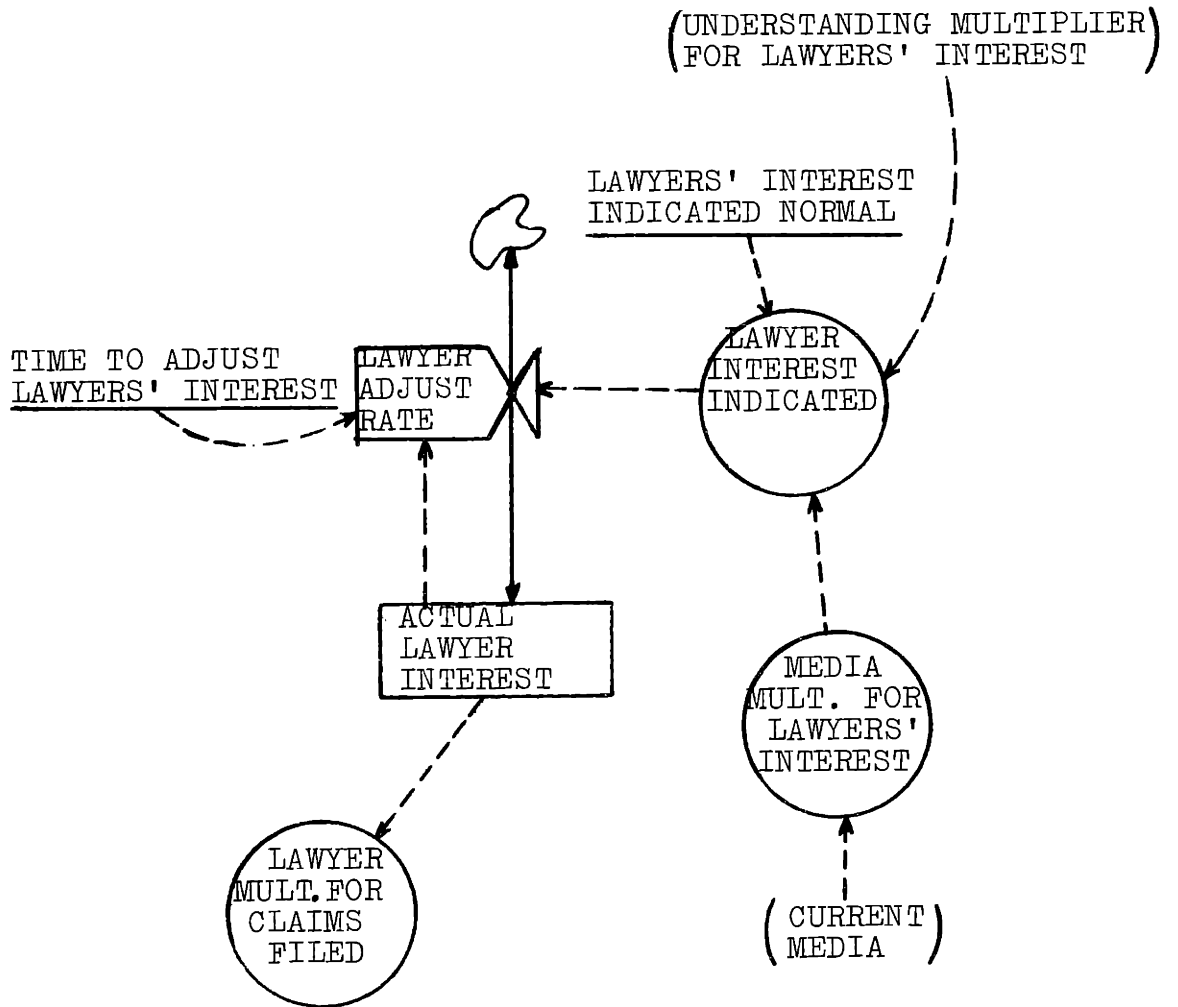
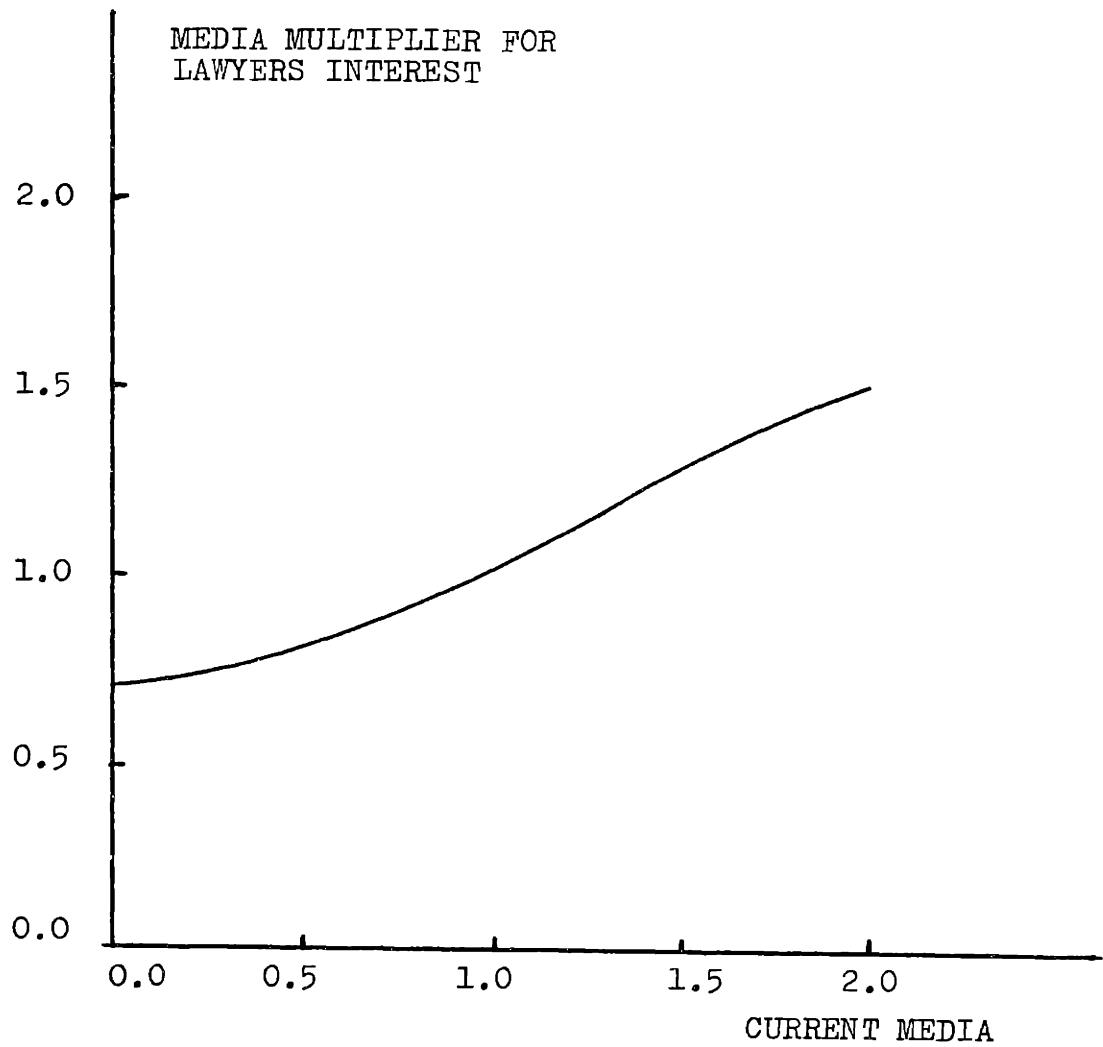


TABLE FUNCTION 16: MEDIA MULTIPLIER FOR LAWYERS INTEREST



CHAPTER FOUR: A DISCUSSION OF DYNAMO SIMULATIONS

An explicit, mathematical model of the system of defensive medicine has been developed. The next step is to observe how the system as a whole behaves. This is accomplished through simulation on a digital computer. DYNAMO simulates the model behavior by tracing through time in a step by step fashion the flows of dissatisfied patients, malpractice claims, and information, while monitoring the levels of threat, insurance, the media, and other variables. All decisions are made according to the equation specifications. The output of a DYNAMO simulation is a graph of time on the horizontal axis and the variables of interest on the vertical axis. Alternatively, a tabular output can be requested.

A brief explanation of how to interpret the graphs will be helpful. The simulations begin in 1970 and run twenty years, time being shown along the horizontal axis. The variables requested on the plot are shown along the left margin with the single letter designating their code on the plot. The scales for each variable are shown along the vertical axis with the letters at the top indicating which variables are on each scale. The letters T and M following the scale increments are scaling factors, denoting thousands and millions respectively.

The basic run simulation shows the behavior of the system assuming no policy changes are initiated. The posi-

tive feedback nature of the system is obvious; claims filed are growing faster than seven per cent per year, doubling in less than ten years. Physicians' perceived threat is growing in a similar fashion as are malpractice insurance premiums and defensive acts. Patient rapport is declining, and physicians are retiring early due to the growing threat of malpractice liability. Positive feedback cannot continue forever, however, and the system begins to control itself about year fifteen. The physician is at the point where he is practicing so much defensive medicine that he is unable to practice more in response to the ever increasing threat. The effects of the increasing level of understanding on the physician also help to reduce the amount of defensive medicine which he practices. The level of understanding is also affecting the patient and moderating the decline in the level of patient rapport. By year twenty the system has almost stabilized itself; claims filed, however, is at the level of 55,000 per year, patient rapport is less than sixty per cent of its initial value, the cost of defensive medicine is up to twenty-three per cent, and the cost of malpractice insurance is over 1.2 billion dollars per year.

The behavior exhibited by the base run is obviously undesirable and would place an incredible stress on the health care delivery system. The purpose of the following simulations is to more fully understand the dynamics of the system and discover the most appropriate areas for intervention and

control. Areas of intervention include lawyers' interest, patient rapport, defensive acts, and national health insurance. The reader should note that all interventions take place at year five (1975) or, in the case of the final sensitivity study, years five through ten.

The lawyer plays an integral role in the malpractice process. If it were possible to reduce the lawyers' interest in malpractice claims, the effect on the system's behavior should be stabilizing. It is commonly asserted that the contingent fee system allows plaintiff lawyers to earn excessive fees, thus maintaining a high level of lawyers' interest. The SCMM collected data to evaluate this assertion and finds that

by analytically reducing average plaintiff lawyers' contingent fees to an hourly basis for comparison purposes, there does not appear to be any gross discrepancy between the resultant rates charged by the plaintiff bar and those charged by the defense bar in medical malpractice cases (10, p.92).

However, the Commission recommends that legislation be enacted which will require a fee scale in which the fee rate decreases as the recovery amount increases (10, p.97).

Regardless of the method adopted, the following simulation shows the results of a twenty-five per cent reduction in lawyers' interest. The basic behavior mode of the system had not changed; exponential growth of claims filed, threat, insurance, and defensive acts are still very evident, although somewhat slower than the basic run. The system has obviously not been controlled.

The people most affected by the growing number of malpractice litigations are the physicians. It would be in their best interest to take any action that would improve the situation. The system is operating in a positive feedback mode: the defensive medicine which a physician practices, while motivated by the perceived threat and intended to reduce that threat, actually increases the threat by reducing patient rapport and increasing malpractice claims filed. By educating physicians as to the nature of the system and convincing them that they are reacting out of proportion to the threat thereby making the situation worse not better, it may be possible to reduce the amount of defensive medicine practiced by twenty-five or even fifty per cent. The results of these changes are shown in the following two simulations. Even a fifty per cent reduction is not enough to alter the behavior mode of the system: exponential growth is still evident, although it has been delayed somewhat.

The SCMM finds that the expectation of patients concerning the technical capabilities of medicine are often exaggerated and unrealistic. The Commission urges that medical and health education for the public no longer be left to chance. Special programs should be developed aimed at educating the public on a wide variety of health related matters. "There is a need to educate all patients concerning the hazards, risks, costs, and limitations of medicine, in order to reduce disappointment, frustration, and dissatisfaction with

the outcome of treatment" (10, p.198). The Commission recommends that

"Congress and the Secretary of HEW recognize that Title XVIII of the Social Security Act (Medicare) contains benefit payment restrictions and other limitations that impede patient rapport and, hence, must tend to increase the malpractice claim potential. The Commission urges re-evaluation of Title XVIII to the end that patient frustration be reduced to the extent feasible.

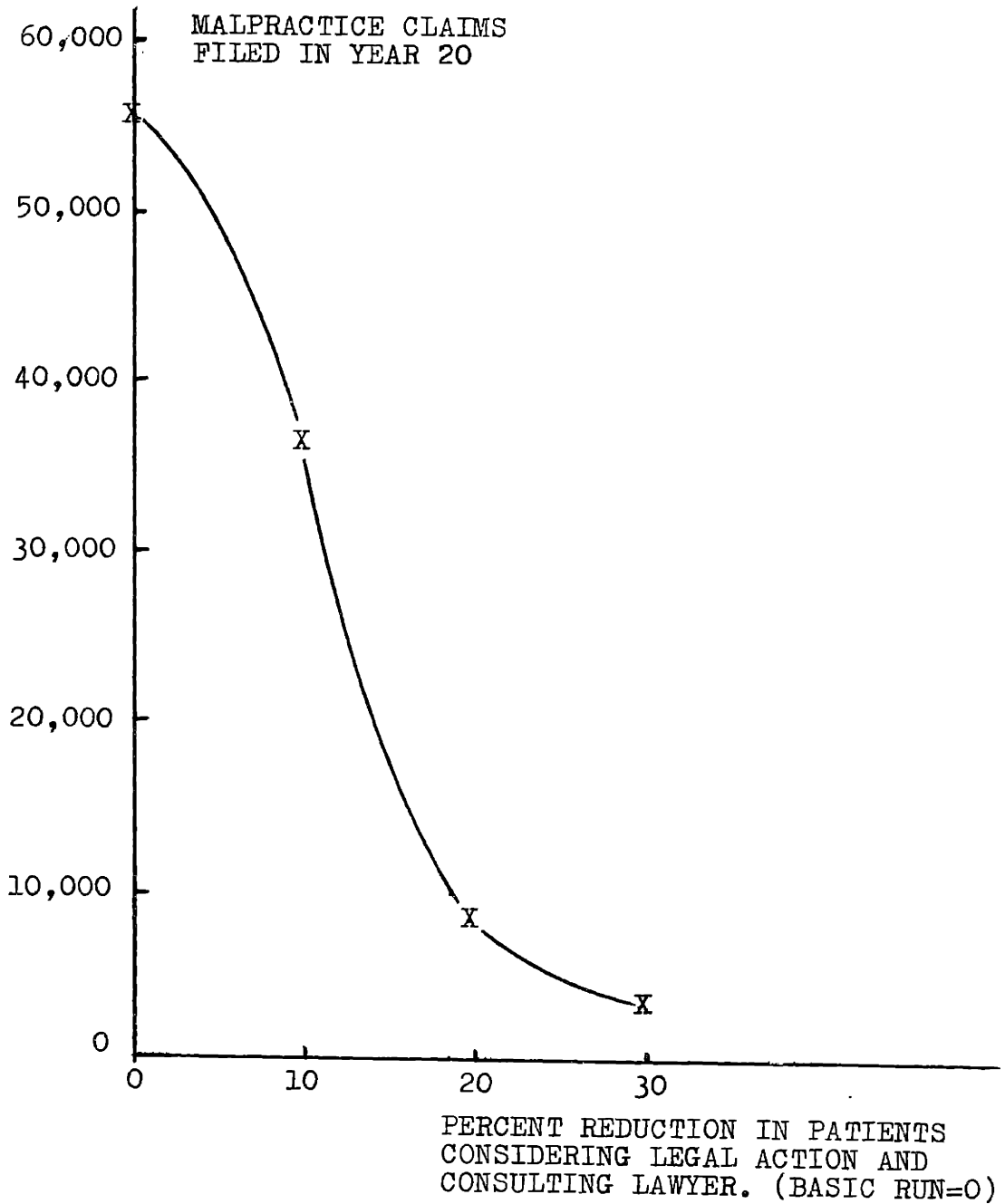
The Commission recommends the launching of an educational and public relations program aimed at Medicare participants in order to increase understanding of the program's statutory limitations and to decrease public dissatisfaction and frustration which may lead to malpractice claims" (10, p.136).

The effect of programs such as these can be examined by increasing patient rapport. Ten per cent and twenty per cent increases in patient rapport produce the next two simulations. The ten per cent improvement in patient rapport produces only a barely noticeable change in behavior. Even the twenty per cent change does not significantly alter the behavior of the system.

At this point the reader should appreciate the difficulty of controlling the exponential growth of malpractice claims. We will now examine the effects of national health insurance on the system. Most current proposals for national health insurance are payment mechanisms similar to Medicare and private health insurance. Health insurance, public or private, does not alter the liability of the health care pro-

vider; liability insurance would still be required and malpractice claims would still be prevalent unless additional stipulations were included in the legislation. For example, Section 54 of the Health Security Act of 1973, as introduced by Senator Edward Kennedy (15), prohibits double recovery in malpractice litigation by stipulating that no damages will be awarded to the injured party for remedial services which are available without cost under the Health Security program. The enactment into law of the Health Security Act or a similar bill with a section equivalent to Section 54 would affect the entire health care delivery system. The effects of interest to us here are the possible reduced number of dissatisfied patients who would consider legal action and the reduced number who would actually consult a lawyer. The justification for the reduced number of dissatisfied patients seeking legal redress after enactment of a Health Security Act lies in the prime motivation for patient action. Over fifty per cent of the patients who considered legal action were motivated to a large extent by the desire to obtain money for medical expenses caused by the unsatisfactory medical care (4, p.45). It is impossible to determine the actual reductions in patients who would consider legal action and patients who would consult a lawyer, but a twenty per cent reduction seems to be a conservative estimate. DYNAMO allows us to experiment with possible values, and a graph of model sensitivity to the parameters can then be presented.

FIGURE 11: THE SENSITIVITY OF MODEL BEHAVIOR TO VARIOUS ASSUMPTIONS ABOUT PATIENT REACTION TO NATIONAL HEALTH INSURANCE

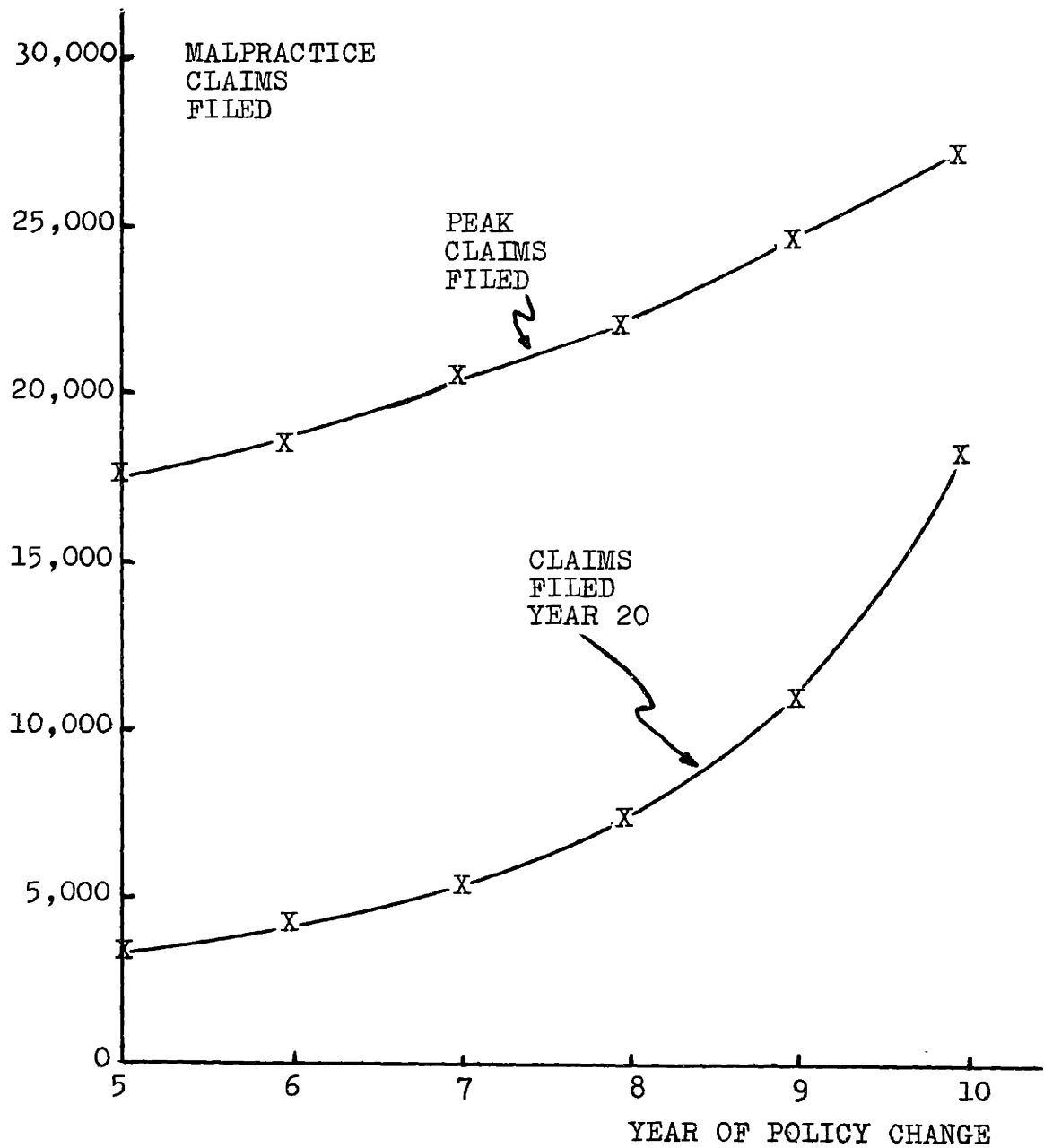


The results exhibited by the thirty percent reduction in patients considering legal action and consulting a lawyer are impressive, but the twenty per cent reduction is probably a more realistic figure. In order to obtain better results than those demonstrated by the twenty per cent reduction alone, a multi-faceted policy is tested. The next simulation assumes that the enactment of a health security act will cause twenty per cent reductions in patients considering legal action and consulting a lawyer; furthermore, educational programs are undertaken in order to reduce frustration and dissatisfaction causing a twenty per cent increase in patient rapport. The simulation shows that the effects of the combined policies are greater than the effects of either policy by itself. Five years after implementation malpractice claims filed are down to 9,500 per year and fifteen years after implementation only 4000 claims are filed annually. Furthermore, the cost of malpractice insurance declines to twenty per cent of its original value. Physicians are feeling less threatened and are practicing thirty-three per cent less defensive medicine at year twenty than year zero. Moreover, patient rapport recovers its original value and continues to improve; at year twenty patient rapport is twenty-two per cent higher than its original value and still improving.

We have established that the immediate enactment of a national health insurance bill which includes a section prohibiting recovery in malpractice litigation for services a-

vailable without cost under the program, accompanied by a patient education program, would probably have sufficient impact to alter the behavior mode of the system of defensive medicine and control the problem. But what would be the effect of delaying the legislation until 1976 or 1978 or even 1980? Six simulations were run with enactment taking place every year from 1975 to 1980. The graph which follows the simulations shows the sensitivity of model behavior to the time of the legislation. The graph illustrates the effect of the date of legislation on the peak number of claims filed and the number of claims filed in year twenty. It is not difficult to conclude from these graphs that the sooner the legislation is passed the faster will be its impact on the behavior of the system.

FIGURE 12: THE EFFECT OF THE YEAR OF THE POLICY CHANGE ON THE PEAK NUMBER OF CLAIMS FILED AND ON THE NUMBER OF CLAIMS FILED IN YEAR 20



CHAPTER FIVE: CONCLUSIONS

A system dynamics model of defensive medicine and medical liability was developed in order to gain a better understanding of the system interactions and test policies for improvement. The model clearly points out the positive feedback nature of the system. By practicing defensive medicine physicians are unknowingly increasing the threat to themselves, requiring that even more defensive medicine be used in the future and contributing to the rising cost of health care. Furthermore, the legal standards mechanism described will hinder any attempt to change the current practice of defensive medicine because physicians will be reluctant to forego using certain tests, even though the tests may not be for the patient's benefit, for fear of legal liability.

From the simulations we conclude that many proposed solutions such as a fee rate for plaintiff lawyers which declines as the award increases or education of patients as to the costs, risks, and limitations of medicine are not powerful enough to control the growing number of malpractice claims. However, the problem can be quickly brought under control by the immediate enactment of legislation which includes a section prohibiting double recovery in malpractice litigation accompanied by a patient education program. Finally, we conclude that delaying this legislation will increase the time required to control the problem.

Medical liability and defensive medicine are inextricably intertwined. Patients are dissatisfied with medical care and initiate legal action; physicians feel threatened and respond by practicing defensive medicine. Yet defensive medicine receives only occasional treatment in the media and the literature, while medical litigations are splashed about by the media and diagnosed by the experts. More research in this area is needed; quantitative information is not complete and subjective impressions of certain relationships need verification. Furthermore, the dissemination of what is already known is as important as further research. This is a tremendous task since physicians, lawyers, patients, and the media are all involved. These groups each have their own self-interest in mind; therefore education and change will be a slow and tedious process. However, dissemination of current knowledge is the essential first step. It lays the foundation for the larger steps which must be taken in order to control the growing number of malpractice litigations and the deteriorating physician-patient relationship.

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APPENDIX

DOCUMENTED MODEL LISTING

PHYSICIAN SECTOR

PERCEIVED THREAT

$MCFPR.K = SMCF.K / PHY.K$ 2, A
 MCFPR - MALPRACTICE CLAIMS FILED PHYSICIAN RATIO
 SMCF - SMOOTHED MALPRACTICE CLAIMS FILED
 PHY - PHYSICIANS

$MCMTHR.K = TABHL(MCMTHRT, MCFPR.K, 0, .25, .05)$ 3, A
 $MCMTHRT = .7/1.1/1.5/1.9/2.3/2.7$ 3.1, T
 MCMTHR - MALPRACTICE CLAIMS MULTIPLIER FOR THREAT
 MCMTHRT - MALPRACTICE CLAIMS MULTIPLIER FOR THREAT
 TABLE
 MCFPR - MALPRACTICE CLAIMS FILED PHYSICIAN RATIO

$MMTHR.K = TABHL(MMTHRT, PM.K, 0, 5, 1)$ 4, A
 $MMTHRT = .7/1.0/1.3/1.6/1.85/2.0$ 4.1, T
 MMTHR - MEDIA MULTIPLIER FOR THREAT
 MMTHRT - MEDIA MULTIPLIER FOR THREAT TABLE
 PM - PERCEIVED MEDIA

$PPM.K = TABHL(PPT, MSC.K, 0, 2.0, .5)$ 5, A
 $PPT = .6/.8/1.0/1.5/2.0$ 5.1, T
 PPM - PEER PRESSURE MULTIPLIER
 PPT - PEER PRESSURE TABLE
 MSC - MEDICAL STANDARD OF CARE

$PTHR.K = THRN * PPM.K * MMTHR.K * MCMTHR.K$ 6, A
 $THRN = 1.0$ 6.1, C
 PTHR - PERCEIVED THREAT
 THRN - THREAT NORMAL
 PPM - PEER PRESSURE MULTIPLIER
 MMTHR - MEDIA MULTIPLIER FOR THREAT
 MCMTHR - MALPRACTICE CLAIMS MULTIPLIER FOR THREAT

DEFENSIVE ACTS

$DA.K = DAN * PHY.K * THRMDA.K * UMDA.K * XMDA.K$ 7, A
 $DAN = NCDA / (ACDA * PHYN)$ 7.1, N
 DA - DEFENSIVE ACTS
 DAN - DEFENSIVE ACTS INITIAL
 PHY - PHYSICIANS
 THRMDA - THREAT MULTIPLIER FOR DEFENSIVE ACTS
 UMDA - UNDERSTANDING MULTIPLIER FOR DEFENSIVE ACTS
 XMDA - EXPERIMENTAL MULTIPLIER FOR DEFENSIVE ACTS
 NCDA - INITIAL COST OF DEFENSIVE ACTS
 ACDA - AVERAGE COST OF DEFENSIVE ACT
 PHYN - PHYSICIANS IN PRACTICE INITIAL

$XMDA.K = CLIP(XDAF, 1.0, TIME.K, XDASWT)$ 8, A
 XMDA - EXPERIMENTAL MULTIPLIER FOR DEFENSIVE ACTS
 XDAF - EXPERIMENTAL DEFENSIVE ACTS FACTOR
 XDASWT - EXPERIMENTAL DEFENSIVE ACTS SWITCH

$THRMDA.K = TABHL(DATHRT, PTHR.K, 0, 5, 1)$ 9, A
 $DATHRT = 0/1.0/2.0/3.0/3.7/4.0$ 9.1, T
 THRMDA - THREAT MULTIPLIER FOR DEFENSIVE ACTS
 DATHRT - DEFENSIVE ACTS FROM THREAT TABLE
 PTHR - PERCEIVED THREAT

$DAPHYR.K = DA.K / PHY.K$ 10, A
 DAPHYR - DEFENSIVE ACTS PHYSICIAN RATIO
 DA - DEFENSIVE ACTS
 PHY - PHYSICIANS

PHYSICIANS

$PHY.K = PHY.J + (DT) (PHYIN.JK - PHYOUT.JK)$ 11, L
 $PHY = PHYN$ 11.1, N
 $PHYN = 250000$ 11.2, C
 PHY - PHYSICIANS
 PHYIN - PHYSICIANS ENTERING PRACTICE
 PHYOUT - PHYSICIANS LEAVING PRACTICE
 PHYN - PHSIANS IN PRACTICE INITIAL

$PHYIN.KL = 10000$ 12, R
 PHYIN - PHYSICIANS ENTERING PRACTICE

$PHYOUT.KL = OUTN * MCMOUT.K$ 13, R
 PHYOUT - PHYSICIANS LEAVING PRACTICE
 OUTN - PHYSICIANS LEAVING PRACTICE INITIAL
 MCMOUT - MALPRACTICE CLAIMS MULTIPLIER FOR PHYSICIANS LEAVING

$SMCFPR.K = SMOOTH(MCFPR.K, TSC)$ 14, A
 $TSC = 5.0$ 14.1, C
 SMCFPR - SMOOTHED MALPRACTICE CLAIMS FILED PHYSICIAN RATIO
 MCFPR - MALPRACTICE CLAIMS FILED PHYSICIAN RATIO
 TSC - TIME TO SMOOTH CLAIMS

$MCMOUT.K = TABHL(OUTT, SMCFPR.K, 0, .15, .05)$ 15, A
 $OUTT = .90/1.1/1.3/1.4$ 15.1, T
 $OUTN = 10000$ 15.2, C
 MCMOUT - MALPRACTICE CLAIMS MULTIPLIER FOR PHYSICIANS LEAVING
 OUTT - TABLE FOR PHYSICIANS LEAVING
 SMCFPR - SMOOTHED MALPRACTICE CLAIMS FILED PHYSICIAN RATIO
 OUTN - PHYSICIANS LEAVING PRACTICE INITIAL

 STANDARDS OF CARE SECTOR

 MEDICAL STANDARD OF CARE

$IMSC.K = 1.0 + (NCDA / 65E9) * (DAPHYR.K / DAN)$ 17, A
 IMSC - IMPLIED MEDICAL STANDARD OF CARE
 NCDA - INITAL COST OF DEFENSIVE ACTS
 DAPHYR - DEFENSIVE ACTS PHYSICIAN RATIO
 DAN - DEFENSIVE ACTS INITIAL

$$\text{ANP.KL} = (\text{IMSC.K} - \text{MSC.K}) / \text{TANP}$$

$$\text{TANP} = 3.0$$

ANP - ACCEPTANCE OF NEW PROCEDURES
 IMSC - IMPLIED MEDICAL STANDARD OF CARE
 MSC - MEDICAL STANDARD OF CARE
 TANP - TIME TO ACCEPT NEW PROCEDURES

18, R
 18.1, C

$$\text{MSC.K} = \text{MSC.J} + \text{DT} * \text{ANP.JK}$$

$$\text{MSC} = 1.0 + \text{NCDA} / 65E9$$

MSC - MEDICAL STANDARD OF CARE
 ANP - ACCEPTANCE OF NEW PROCEDURES
 NCDA - INITIAL COST OF DEFENSIVE ACTS

19, L
 19.1, N

LEGAL STANDARDS OF CARE

$$\text{ILSC.K} = 1.0 + (\text{NCDA} / 65E9) * (\text{DAPHYR.K} / \text{DAN})$$

ILSC - IMPLIED LEGAL STANDARD OF CARE
 NCDA - INITIAL COST OF DEFENSIVE ACTS
 DAPHYR - DEFENSIVE ACTS PHYSICIAN RATIO
 DAN - DEFENSIVE ACTS INITIAL

20, A

$$\text{LSC.K} = \text{LSC.J} + \text{DT} * \text{RNP.JK}$$

$$\text{LSC} = 1.0 + \text{NCDA} / 65E9$$

LSC - LEGAL STANDARD OF CARE
 RNP - RECOGNITION OF NEW PROCEDURES
 NCDA - INITIAL COST OF DEFENSIVE ACTS

21, L
 21.1, N

$$\text{RNP.KL} = (\text{ILSC.K} - \text{LSC.K}) / \text{TRNP.K}$$

RNP - RECOGNITION OF NEW PROCEDURES
 ILSC - IMPLIED LEGAL STANDARD OF CARE
 LSC - LEGAL STANDARD OF CARE
 TRNP - TIME TO RECOGNIZE NEW PROCEDURES

22, R

$$\text{TRNP.K} = \text{TRNPN} * \text{SCMRNP.K}$$

$$\text{TRNPN} = 1.0$$

TRNP - TIME TO RECOGNIZE NEW PROCEDURES
 SCMRNP - SUCCESSFUL CLAIMS MULTIPLIER FOR
 RECOGNITION OF NEW PROCEDURES

23, A
 23.1, C

$$\text{SCMRNP.K} = \text{TABHL}(\text{TCMRNP}, \text{SSC.K}, .2, 1.0, .2)$$

$$\text{TCMRNP} = 1.8 / 1.0 / .65 / .5 / .5$$

SCMRNP - SUCCESSFUL CLAIMS MULTIPLIER FOR
 RECOGNITION OF NEW PROCEDURES
 TCMRNP - TABLE OF CLAIMS MULTIPLIER FOR RECOGNITION
 OF NEW PROCEDURES
 SSC - SMOOTHED SUCCESSFUL CLAIMS

24, A
 24.1, T

$$\text{LMSR.K} = \text{LSC.K} / \text{MSC.K}$$

LMSR - LEGAL MEDICAL STANDARDS RATIO
 LSC - LEGAL STANDARD OF CARE
 MSC - MEDICAL STANDARD OF CARE

25, A

SRMSC.K=TABHL(SRMSCT,LMSR.K,.8,1.2,.1) 26, A
 SRMSCT=.8/.9/1.0/1.1/1.2 26.1, T
 SRMSC - SUCCESSFUL CLAIMS MULTIPLIER FOR SUCCESSFUL
 CLAIMS
 SRMSCT - STANDARDS RATIO MULTIPLIER FOR SUCCESSFUL
 CLAIMS TABLE
 LMSR - LEGAL MEDICAL STANDARDS RATIO

 PATIENT SECTOR

 PATIENT RAPPOR

IPR.K=PRN*QTMPR.K*PPCMPR.K*UMPR.K*XMPR.K 28, A
 PRN=1.0 28.1, C
 IPR - IMPLIED PATIENT RAPPOR
 PRN - PATIENT RAPPOR INITIAL
 QTMPR - QUEUE TIME MULTIPLIER FOR PATIENT RAPPOR
 PPCMPR - PERCEIVED PERCENTAGE COST MULTIPLIER FOR
 PATIENT RAPPOR
 UMPR - UNDERSTANDING MULTIPLIER FOR PATIENT
 RAPPOR
 XMPR - EXPERIMENTAL MULTIPLIER FOR PATIENT RAPPOR

PR.K=PR.J+(DT/TSPR)(IPR.J-PR.J) 29, L
 PR=1.0 29.1, N
 TSPR=2.0 29.2, C
 PR - PATIENT RAPPOR
 TSPR - TIME TO SMOOTH PATIENT RAPPOR
 IPR - IMPLIED PATIENT RAPPOR

PPCMPR.K=TABHL(PCMPRT,PPC.K,0,.4,.1) 30, A
 PCMPRT=1.5/.95/.5/.3/.25 30.1, T
 PPCMPR - PERCEIVED PERCENTAGE COST MULTIPLIER FOR
 PATIENT RAPPOR
 PCMPRT - PERCEIVED COST MULTIPLIER FOR PATIENT
 RAPPOR
 PPC - PERCEIVED PERCENTAGE COST

XMPR.K=CLIP(XFPR,1.0,TIME.K,PRSWT) 31, A
 XMPR - EXPERIMENTAL MULTIPLIER FOR PATIENT RAPPOR
 XFPR - EXPERIMENTAL FACTOR FOR PATIENT RAPPOR
 PRSWT - PATIENT RAPPOR SWITCH

QTMPR.K=1.0 32, A
 QTMPR - QUEUE TIME MULTIPLIER FOR PATIENT RAPPOR

PATIENT AWARENESS OF RIGHTS

PAR.K=TABHL(PART,PM.K,0,2.0,.5) 33, A
 PART=.25/.35/.50/.68/.75 33.1, T
 PAR=.5 33.2, N
 PAR - PATIENT AWARENESS
 PART - PATIENT AWARENESS TABLE
 PM - PERCEIVED MEDIA

PERCEIVED NEGATIVE MEDICAL EXPERIENCE

$AMPNME.K = TABHL(AMT, PAR.K, 0, 1.0, .25)$ 34, A
 $AMT = .2/.5/1.0/2.0/2.5$ 34.1, T
 AMPNME - AWARENESS MULTIPLIER FOR PERCEIVED NEGATIVE
 MEDICAL EXPERIENCE
 AMT - AWARENESS MULTIPLIER TABLE
 PAR - PATIENT AWARENESS

$RMPNME.K = TABHL(RMT, PR.K, 0, 2.0, .5)$ 35, A
 $RMT = 4.0/2.0/1.0/.5/.4$ 35.1, T
 RMPNME - RIGHTS MULTIPLIER FOR PERCEIVED NEGATIVE
 MEDICAL EXPERIENCE
 RMT - RIGHTS MULTIPLIER TABLE
 PR - PATIENT RAPPORT

$PNME.KL = PNME.N * AMPNME.K * RMPNME.K$ 36, R
 $PNME = 3400000$ 36.1, N
 $PNME.N = 3400000$ 36.2, C
 PNME - PERCEIVED NEGATIVE MEDICAL EXPERIENCE
 PNME.N - PERCEIVED NEGATIVE MEDICAL EXPERIENCE
 NORMAL
 AMPNME - AWARENESS MULTIPLIER FOR PERCEIVED NEGATIVE
 MEDICAL EXPERIENCE
 RMPNME - RIGHTS MULTIPLIER FOR PERCEIVED NEGATIVE
 MEDICAL EXPERIENCE

$DISPAT.K = DISPAT.J + (DT)(PNME.JK - CLA.JK - NCLA.JK)$ 37, L
 $DISPAT = 2000000$ 37.1, N
 DISPAT - DISSATISFIED PATIENTS
 PNME - PERCEIVED NEGATIVE MEDICAL EXPERIENCE
 CLA - CONSIDERED LEGAL ACTION
 NCLA - NOT CONSIDERED LEGAL ACTION

CONSIDERED LEGAL ACTION

$CLA.KL = PCLA.K * DISPAT.K / TCLA$ 38, R
 CLA - CONSIDERED LEGAL ACTION
 PCLA - PERCENT CONSIDERED LEGAL ACTION
 DISPAT - DISSATISFIED PATIENTS
 TCLA - TIME TO CONSIDER LEGAL ACTION

$NCLA.KL = (1.0 - PCLA.K) * DISPAT.K / TCLA$ 39, R
 NCLA - NOT CONSIDERED LEGAL ACTION
 PCLA - PERCENT CONSIDERED LEGAL ACTION
 DISPAT - DISSATISFIED PATIENTS
 TCLA - TIME TO CONSIDER LEGAL ACTION

$PCLA.K = PCLAN * CLIP(NHIMCA, 1.0, TIME.K, NHISWT)$ 40, A
 $PCLAN = .08$ 40.1, C
 $TCLA = .5$ 40.2, C
 PCLA - PERCENT CONSIDERED LEGAL ACTION
 PCLAN - PERCENT CONSIDERED LEGAL ACTION NORMAL
 NHIMCA - NATIONAL HEALTH INSURANCE MULTIPLIER FOR
 CONSIDERED LEGAL ACTION
 NHISWT - NATIONAL HEALTH INSURANCE SWITCH
 TCLA - TIME TO CONSIDER LEGAL ACTION

$DPCLA.K = DPCLA.J + (DT)(CLA.JK - CL.JK - NCL.JK)$ 41, L
 $DPCLA = 150000$ 41.1, N
 DPCLA - DISSATISFIED PATIENTS CONSIDERING LEGAL ACTION
 CLA - CONSIDERED LEGAL ACTION
 CL - CONSULTED LAWYER
 NCL - NOT CONSULTED LAWYER

CONSULTED LAWYER

$CL.KL = PCL.K * DPCLA.K / TCL$ 42, R
 CL - CONSULTED LAWYER
 PCL - PERCENT CONSULTED LAWYER
 DPCLA - DISSATISFIED PATIENTS CONSIDERING LEGAL ACTION
 TCL - TIME TO CONSULT LAWYER

$NCL.KL = (1.0 - PCL.K) * DPCLA.K / TCL$ 43, R
 NCL - NOT CONSULTED LAWYER
 PCL - PERCENT CONSULTED LAWYER
 DPCLA - DISSATISFIED PATIENTS CONSIDERING LEGAL ACTION
 TCL - TIME TO CONSULT LAWYER

$PCL.K = PCLN * CLIP(NHIMCL, 1.0, TIME.K, NHISWT)$ 44, A
 $PCLN = .38$ 44.1, C
 $TCL = .5$ 44.2, C
 PCL - PERCENT CONSULTED LAWYER
 PCLN - PERCENT CONSULTED LAWYER NORMAL
 NHIMCL - NATIONAL HEALTH INSURANCE MULTIPLIER FOR CONSULTED LAWYER
 NHISWT - NATIONAL HEALTH INSURANCE SWITCH
 TCL - TIME TO CONSULT LAWYER

$DPIPCL.K = DPIPCL.J + (DT)(CL.JK - MCF.JK - NMCF.JK)$ 45, L
 $DPIPCL = 54250$ 45.1, N
 DPIPCL - DISSATISFIED PATIENTS IN PROCESS OF CONSULTING LAWYER
 CL - CONSULTED LAWYER
 MCF - MALPRACTICE CLAIMS FILED
 NMCF - MALPRACTICE CLAIM NOT FILED

MALPRACTICE CLAIMS FILED

$MCF.KL = PMCF.K * DPIPCL.K / TFMC$ 46, R
 MCF - MALPRACTICE CLAIMS FILED
 PMCF - PERCENT MALPRACTICE CLAIMS FILED
 DPIPCL - DISSATISFIED PATIENTS IN PROCESS OF CONSULTING LAWYER
 TFMC - TIME TO FILE MALPRACTICE CLAIM

$NMCF.KL = (1.0 - PMCF.K) * DPIPCL.K / TFMC$ 47, R
 NMCF - MALPRACTICE CLAIM NOT FILED
 PMCF - PERCENT MALPRACTICE CLAIMS FILED
 DPIPCL - DISSATISFIED PATIENTS IN PROCESS OF CONSULTING LAWYER
 TFMC - TIME TO FILE MALPRACTICE CLAIM

$PMCF.K = PMCFN * LIMMCF.K * SRMMCF.K$ 48, A
 $PMCFN = .12$ 48.1, C
 $TFMC = .5$ 48.2, C
 PMCF - PERCENT MALPRACTICE CLAIMS FILED
 PMCFN - PERCENT MALPRACTICE CLAIMS FILED NORMAL
 LIMMCF - LAWYERS INTEREST MULTIPLIER FOR MALPRACTICE CLAIMS FILED
 SRMMCF - SUCCESSFUL CLAIMS MULTIPLIER FOR MALPRACTICE CLAIMS FILED
 TFMC - TIME TO FILE MALPRACTICE CLAIM

$MCFIP.K = MCFIP.J + (DT)(MCF.JK - SC.JK - NSC.JK)$ 49, L
 $MCFIP = 24000$ 49.1, N
 MCFIP - MALPRACTICE CLAIMS FILED IN PROCESS
 MCF - MALPRACTICE CLAIMS FILED
 SC - SUCCESSFUL CLAIMS
 NSC - UNSUCCESSFUL CLAIMS

$SRMMCF.K = TABHL(SRMCFT, LMSR.K, .8, 1.2, .1)$ 50, A
 $SRMCFT = .8 / .9 / 1.0 / 1.1 / 1.2$ 50.1, T
 SRMMCF - SUCCESSFUL CLAIMS MULTIPLIER FOR MALPRACTICE CLAIMS FILED
 SRMCFT - STANDARDS RATIO MULTIPLIER FOR CLAIMS FILED TABLE
 LMSR - LEGAL MEDICAL STANDARDS RATIO

SUCCESSFUL CLAIMS

$SC.KL = SCR.K * MCFIP.K / TPC$ 51, R
 SC - SUCCESSFUL CLAIMS
 SCR - SUCCESSFUL CLAIMS RATIO
 MCFIP - MALPRACTICE CLAIMS FILED IN PROCESS
 TPC - TIME TO PROCESS CLAIM

$NSC.KL = (1.0 - SCR.K) * MCFIP.K / TPC$ 52, R
 NSC - UNSUCCESSFUL CLAIMS
 SCR - SUCCESSFUL CLAIMS RATIO
 MCFIP - MALPRACTICE CLAIMS FILED IN PROCESS
 TPC - TIME TO PROCESS CLAIM

$SCR.K = SCR.N * SRMSC.K$ 53, A
 $SCR.N = .41$ 53.1, C
 $TPC = 2.0$ 53.2, C
 SCR - SUCCESSFUL CLAIMS RATIO
 SCR.N - SUCCESSFUL CLAIMS RATIO NORMAL
 SRMSC - SUCCESSFUL CLAIMS MULTIPLIER FOR SUCCESSFUL CLAIMS
 TPC - TIME TO PROCESS CLAIM

 MEDIA SECTOR

SSC.K=SSC.J+(DT/TSSC)(SC.JK-SSC.J) 54, L
 SSC=4800 54.1, N
 TSSC=1.0 54.2, C
 SSC - SMOOTHED SUCCESSFUL CLAIMS
 TSSC - TIME TO SMOOTH SUCCESSFUL CLAIMS
 SC - SUCCESSFUL CLAIMS

SCPR.K=SSC.K/PHY.K 55, A
 SCPR - SUCCESSFUL CLAIMS PHYSICIAN RATIO
 SSC - SMOOTHED SUCCESSFUL CLAIMS
 PHY - PHYSICIANS

SCMCM.K=TABHL(SCMCMT,SCPR.K,0,.100,.02) 56, A
 SCMCMT=0/1.04/1.6/1.95/2.2/2.3 56.1, T
 SCMCM - SUCCESSFUL CLAIMS MULTIPLIER FOR CURRENT
 MEDIA
 SCMCMT - SUCCESSFUL CLAIMS MULTIPLIER FOR CURRENT
 MEDIA TABLE
 SCPR - SUCCESSFUL CLAIMS PHYSICIAN RATIO

CM.K=CMN*SCMCM.K*UMCM.K 57, A
 CMN=1.0 57.1, C
 CM - CURRENT MEDIA
 CMN - CURRENT MEDIA NORMAL
 SCMCM - SUCCESSFUL CLAIMS MULTIPLIER FOR CURRENT
 MEDIA
 UMCM - UNDERSTANDING MULTIPLIER FOR CURRENT MEDIA

PM.K=SMOOTH(CM.K,TPM) 58, A
 PM=1.0 58.1, N
 TPM=.5 58.2, C
 PM - PERCEIVED MEDIA
 CM - CURRENT MEDIA
 TPM - TIME TO PERCEIVE MEDIA

 CASH FLW SECTOR

CDA.K=ACDA*DA.K 59, A
 NCDA=6.5E9 59.1, C
 ACDA=25.0 59.2, C
 CDA - COST OF DEFENSIVE ACTS
 ACDA - AVERAGE COST OF DEFENSIVE ACT
 DA - DEFENSIVE ACTS
 NCDA - INITIAL COST OF DEFENSIVE ACTS

SMCF.K=SMCF.J+(DT/TSMCF)(MCF.JK-SMCF.J) 60, L
 SMCF=11000 60.1, N
 SMCF - SMOOTHED MALPRACTICE CLAIMS FILED
 TSMCF - TIME TO SMOOTH MALPRACTICE CLAIMS FILED
 MCF - MALPRACTICE CLAIMS FILED

$DSMCF.K = DSMCF.J + (DT/TSMCF)(SMCF.J - DSMCF.J)$ 61, L
 $DSMCF = 10000$ 61.1, N
 $TSMCF = 1.0$ 61.2, C
 DSMCF - DOUBLED SMOOTHED MALPRACTICE CLAIMS FILED
 TSMCF - TIME TO SMOOTH MALPRACTICE CLAIMS FILED
 SMCF - SMOOTHED MALPRACTICE CLAIMS FILED

$TREND.K = (SMCF.K - DSMCF.K) / TSMCF$ 62, A
 TREND - TREND IN MALPRACTICE CLAIMS FILED
 SMCF - SMOOTHED MALPRACTICE CLAIMS FILED
 DSMCF - DOUBLED SMOOTHED MALPRACTICE CLAIMS FILED
 TSMCF - TIME TO SMOOTH MALPRACTICE CLAIMS FILED

$XMCF.K = SMCF.K + (TSMCF + XTIME) * TREND.K$ 63, A
 $XTIME = 3.0$ 63.1, C
 XMCF - EXTRAPOLATED MALPRACTICE CLAIMS FILED
 SMCF - SMOOTHED MALPRACTICE CLAIMS FILED
 TSMCF - TIME TO SMOOTH MALPRACTICE CLAIMS FILED
 XTIME - EXTRAPOLATION TIME
 TREND - TREND IN MALPRACTICE CLAIMS FILED

$MI.K = MIN * XMCF.K / MCFN$ 64, A
 $MIN = 250E6$ 64.1, C
 $MCFN = 12000$ 64.2, C
 MI - MALPRACTICE INSURANCE
 MIN - MALPRACTICE INSURANCE INITIAL
 XMCF - EXTRAPOLATED MALPRACTICE CLAIMS FILED
 MCFN - MALPRACTICE CLAIMS FILED INITIAL

$CDM.K = CDA.K + MI.K$ 65, A
 CDM - CCST OF DEFENSIVE MEDICINE
 CDA - CCST OF DEFENSIVE ACTS
 MI - MALPRACTICE INSURANCE

$CMC.K = CGPP * PHY.K$ 66, A
 $CGPP = 65E9 / PHYN$ 66.1, N
 CMC - COST OF MEDICAL CARE
 CGPP - COST GENERATED PER PHYSICIAN
 PHY - PHYSICIANS
 PHYN - PHISCIANS IN PRACTICE INITIAL

$DCPTC.K = CDM.K / CMC.K$ 67, A
 DCPTC - DEFENSIVE COST PERCENTAGE OF TOTAL COST
 CDM - COST OF DEFENSIVE MEDICINE
 CMC - COST OF MEDICAL CARE

$PPC.K = SMOOTH(DCPTC.K, TPCOST)$ 68, A
 $TPCOST = 1.0$ 68.1, C
 PPC - PERCEIVED PERCENTAGE COST
 DCPTC - DEFENSIVE COST PERCENTAGE OF TOTAL COST
 TPCOST - TIME TO PERCEIVE COST

 UNDERSTANDING SECTOR

DLU.K=TABHL(DLUT,PPC.K,0,.5,.1) 69, A
 DLUT=20/25/40/65/80/90 69.1, T
 DLU - DESIRE LEVEL OF UNDERSTANDING
 DLUT - DESIRED LEVEL OF UNDERSTANDING TABLE
 PPC - PERCEIVED PERCENTAGE CCST

LU.K=LU.J+DT*NRED.JK 70, L
 LU=25.0 70.1, N
 LU - LEVEL OF UNDERSTANDING
 NRED - NET RATE OF EDUCATION

NRED.KL=(DLU.K-LU.K)/TAED 71, R
 TAED=2.0 71.1, C
 NRED - NET RATE OF EDUCATION
 DLU - DESIRE LEVEL OF UNDERSTANDING
 LU - LEVEL OF UNDERSTANDING
 TAED - TIME TO ADJUST EDUCATION

UMDA.K=TABHL(UMDAT,LU.K,0,100,25) 72, A
 UMDAT=2.0/1.0/.50/.30/.25 72.1, T
 UMDA - UNDERSTANDING MULTIPLIER FOR DEFENSIVE ACTS
 UMDAT - UNDERSTANDING MULTIPLIER FOR DEFENSIVE ACTS
 TABLE
 LU - LEVEL OF UNDERSTANDING

UMPR.K=TABHL(UMPR,LU.K,0,100,25) 73, A
 UMPRT=.8/1.0/1.35/1.75/2.0 73.1, T
 UMPR - UNDERSTANDING MULTIPLIER FOR PATIENT
 RAPPORT
 UMPRT - UNDERSTANDING MULTIPLIER FOR PATIENT
 RAPPORT TABLE
 LU - LEVEL OF UNDERSTANDING

UMCM.K=TABHL(UMCMT,LU.K,0,100,25) 74, A
 UMCMT=1.25/1.0/.8/.7/.7 74.1, T
 UMCM - UNDERSTANDING MULTIPLIER FOR CURRENT MEDIA
 UMCMT - UNDERSTANDING MULTIPLIER FOR CURRENT MEDIA
 TABLE
 LU - LEVEL OF UNDERSTANDING

UMLI.K=TABHL(UMLIT,LU.K,0,100,25) 75, A
 UMLIT=1.1/1.0/.95/.90/.90 75.1, T
 UMLI - UNDERSTANDING MULTIPLIER FOR LAWYERS
 INTEREST
 UMLIT - UNDERSTANDING MULTIPLIER FOR LAWYERS
 INTEREST TABLE
 LU - LEVEL OF UNDERSTANDING

 LAWYER SECTOR

LII.K=LIIN*MMLI.K*UMLI.K*XMLI.K 76, A
 LIIN=1.0 76.1, C

- LII - LAWYERS INTEREST INDICATED
- LIIN - LAWYERS INTEREST INDICATED INITIAL
- MMLI - MEDIA MULTIPLIER FOR LAWYERS INTEREST
- UMLI - UNDERSTANDING MULTIPLIER FOR LAWYERS INTEREST
- XMLI - EXPERIMENTAL MULTIPLIER FOR LAWYERS INTEREST

XMLI.K=CLIP(XLIF,1.0,TIME.K,LISWT) 77, A
 XMLI - EXPERIMENTAL MULTIPLIER FOR LAWYERS INTEREST
 XLIF - EXPERIMENTAL LAWYERS INTEREST FACTOR
 LISWT - LAWYERS INTEREST SWITCH

MMLI.K=TABHL(MMLIT,CM.K,0,2.0,.5) 78, A
 MMLIT=.7/.8/1.0/1.3/1.5 78.1, T
 MMLI - MEDIA MULTIPLIER FOR LAWYERS INTEREST
 MMLIT - MEDIA MULTIPLIER FOR LAWYERS INTEREST TABLE
 CM - CURRENT MEDIA

ALI.K=SMOOTH(LII.K,TALI) 79, A
 TALI=1.5 79.1, C
 ALI - ACTUAL LAWYERS INTEREST
 LII - LAWYERS INTEREST INDICATED
 TALI - TIME TO ADJUST LAWYERS INTEREST

LIMMCF.K=TABHL(LIMCFT,ALI.K,.50,1.50,.25) 80, A
 LIMCFT=.75/.82/1.0/1.2/1.3 80.1, T
 LIMMCF=1.0 80.2, N
 LIMMCF - LAWYERS INTEREST MULTIPLIER FOR MALPRACTICE CLAIMS FILED
 LIMCFT - LAWYERS INTEREST MULTIPLIER FOR MALPRACTICE CLAIMS FILED TABLE
 ALI - ACTUAL LAWYERS INTEREST

 PARAMETERS FOR BASIC RUN AND RERUNS

NHIMCA=1.00 80.8, C
 NHIMCL=1.00 80.9, C
 XFPR=1.0 81.1, C
 XDAF=.75 81.2, C
 XLIF=.75 81.3, C
 NHIMCA - NATIONAL HEALTH INSURANCE MULTIPLIER FOR CONSIDERED LEGAL ACTION
 NHIMCL - NATIONAL HEALTH INSURANCE MULTIPLIER FOR CONSULTED LAWYER
 XFPR - EXPERIMENTAL FACTOR FOR PATIENT RAPPORT
 XDAF - EXPERIMENTAL DEFENSIVE ACTS FACTOR
 XLIF - EXPERIMENTAL LAWYERS INTEREST FACTOR

 SWITCHES SET FOR BASIC RUN

| | |
|------------|---------|
| NHISWT=100 | 81.9, C |
| XDASWT=100 | 82.1, C |
| PRSWT=100 | 82.2, C |
| LISWT=100 | 82.3, C |

NHISWT - NATIONAL HEALTH INSURANCE SWITCH
 XDASWT - EXPERIMENTAL DEFENSIVE ACTS SWITCH
 PRSWT - PATIENT RAPPORT SWITCH
 LISWT - LAWYERS INTEREST SWITCH

 CONTROL CARDS

| | |
|------------|---------|
| DT=.1 | 82.9, C |
| LENGTH=20 | 83.1, C |
| PRTPER=2.0 | 83.2, C |
| PLTPER=.5 | 83.3, C |