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ABSTRACT

When a patient is diagnosed with cancer, the physician often faces a dilemma regarding disclosure of information to the patient. While the physician may feel that it is his/her responsibility to maintain the patient's hope and morale, even through the withholding of information, there is a risk involved: if treatment fails to be effective, the patient will eventually get to know the truth about his/her terminal condition. Patients who would rather choose to live their final days in peace than engage in nauseous treatment of an uncertain nature might be furious and frustrated with the revelation that they have been deprived of this liberty. Consequently, they are likely to end their lives feeling worse than they would had they been told the truth about the severity of their disease at the outset. This paper applies three alternative theories of decision-making under uncertainty (expected utility theory, prospect theory and regret theory) to the physician's problem of whether and to what extent to withhold information from a cancer patient, deriving comparative predictions with regard to the relationships between the physician's behavior and some illness, patient and physician characteristics.

תמצית

כאשר חולה מאובחן כלוקה בסרטן, בדרך כלל הרופא ניצב בפני דילמה בדבר מסירת מידע לחולה. על-פי הדוקטרינה של הסכמה מיודעת (informed consent), המוכרת כיום בארה״ב כאחד העקרונות האתיים החשובים של מקצוע הרפואה, לחולה יש זכות להחליט באורח עצמאי החלטות הנוגעות לטיפול בו, ועל הרופא מוטלת החובה למסור לחולה את כל המידע בעניין מחלתו כדי לאפשר לו לקבל החלטה נכונה. למרות זאת, רופאים רבים עדיין חשים כי חובתם לשמור על מורל החולה, גם אם הדבר מצריך הסתרת מידע ממנו. הסתרת מידע כרוכה בסיכון: אם הטיפול אינו נושא פרי, החולה, במוקדם או במאוחר, ילמד לדעת על מצבו האמיתי. חולים שהיו מעדיפים לסיים את חייהם בשלווה בחיק משפחתם ולא להתייסר בטיפול שאין בטחון בהצלחתו, עלולים לחוש כעס ותסכול בגלותם שנשללה מהם זכות הבחירה. גם אם יימנעו מהגשת תביעת נזיקין כנגד הרופא, סביר שיסיימו את חייהם במצב נפשי קשה יותר מאשר אילו נמסר להם מלוא המידע על מצבם הסופני מיד לאחר האבחון. המאמר הנוכחי מחיל שלוש תיאוריות אלטרנטיביות של קבלת החלטות בתנאי סיכון (תורת תוחלת התועלת, תורת ההימור ותורת החרטה) לבעיית הרופא האם להסתיר מידע מחולה סופני (ובאיזו מידה), וגוזר מסקנות השוואתיות בעניין הקשר שבין החלטת הרופא למאפייני החולה, המחלה והרופא עצמו.

I. Introduction

When a patient is diagnosed with cancer, the physician often faces a dilemma regarding disclosure of information to the patient. According to the doctrine of informed consent, currently recognized in the United States as one of the most important ethical principles of medicine, patients have a right to make autonomous choices regarding their own care, and physicians have a duty to disclose to patients all material information to enable them to make such decisions.[1] Still, many American physicians feel that it is their responsibility to maintain patients' hope, even if it involves the withholding of information.[2] While in Northern Europe there seems to be a consensus that full disclosure of information to cancer patients is morally and ethically the appropriate policy, in Southern and Eastern Europe, as well as in the Far East, the widely accepted view is that patients *should not* be told.[3]

The physician's paternalistic compassion for the patient, reflected through the withholding of bad news, is, however, risky. If treatment fails to be effective, the patient will sooner or later get to know the truth about his or her terminal condition. Patients who would rather choose to live their final days in peace (as well as make proper financial arrangements before death) than engage in nauseous treatment of an uncertain nature might be furious and frustrated with the revelation that they have been deprived of this liberty. Even if patients (or their families) avoid filing malpractice suits against paternalistic physicians,[4] they are still likely to end their lives feeling worse than they would had they been told the truth about the severity of their disease at the outset.

[1] See Faden and Beauchamp (1986).

[2] See Miyaji (1993) for a recent study of US physicians' perspectives regarding truth-telling in the care of dying patients. Half of the physicians admitted that they would withhold information, soften information, or give miracle anecdotes if the news deprive patients of hope.

[3] Striking differences in behavior among European physicians regarding the disclosure of diagnostic information to cancer patients have been reported by Thomsen et al. (1993). In a study among Norwegian physicians [Loge et al. (1996)], the great majority (81%) preferred revealing the diagnosis of cancer to patients. In contrast, withholding the truth from cancer patients has been found to be common in Greece [Mystakidou et al. (1996)], Italy [Surbone (1993)], and Spain [Estape, et al. (1992)]. Similarly, in a study among Japanese physicians [Mizushima et al. (1990)], only 31% of the respondents had revealed the diagnosis of cancer to their patients, and in Singapore [Tan et al. (1993)] only 43.6% of responding physicians had done so.

[4] For a description and analysis of a recent malpractice suit involving informed consent, see Annas (1994).

The present paper analyzes the physician's decision to withhold information from a cancer patient as a decision under risk, with the purpose of gaining more insight as regards the relationships between the physician's behavior and some illness, patient and physician attributes. Three alternative theories of decision-making under uncertainty are applied to the physician's problem: expected utility theory [von Neumann and Morgenstern (1944)], prospect theory [Kahneman and Tversky (1979)], and regret theory [Bell (1982) and Loomes and Sudgen (1982)]. All theories assume that decision-making under uncertainty depends on two factors: the value a decision-maker ascribes to each possible outcome of the risky decision and the probability that each of the possible outcomes will occur. They differ mainly in their assumptions about the mechanisms that determine the subjective evaluation of objective outcomes. While expected-utility theory suggests that people may have different attitudes towards risk, offering no general explanation for these differences, prospect and regret theories suggest that there are basic psychological mechanisms that are common to all people. The former proposes that people value objective outcomes relative to the status quo or to the accepted norm, being risk-averse with respect to positive changes and risk-seeking with respect to negative ones, whereas the latter proposes that people value objective outcomes taking into account the regret they are bound to feel if their decision turns out poorly. Applying these alternative theories to the problem at hand enables a comparison of physicians' behavior according to personal characteristics, such as their attitude towards risk, their approach towards disclosure of information, or their drive to avoid poor decisions.

Withholding information from a cancer patient is not an all or nothing decision.[5] The present paper examines not just the decision of whether or not to withhold the truth from the patient but also the extent by which the truth is understated. In addition to physicians' characteristics - the severity of the disease, the probability of treatment success, and the

[5] In a study of hypothetical cancer cases conducted among Israeli physicians [Amir (1987)], seven different choices of information giving were presented. In their answers physicians used the entire scale of choices, demonstrating that information about cancer has intermediate degrees and is not dichotomous - to inform or not. McIntosh (1974) found that physicians dealing with terminal cancer patients use a wide range of euphemisms (e.g., tumor, growth, lesion, neoplasm, lump, sore, polyp) instead of making their meaning clear. Even when physicians do convey accurate information there are varying degrees of precision (e.g., using the word 'growth' rather than 'malignant growth').

patient's preference for being told the truth (as judged by the physician) serve as explanatory variables of the withholding decision and the extent of truth understating. Section II describes the formal setting of the analysis; Sections III-V discuss the physician's behavior under the alternative decision-making theories, and Section VI concludes with a summary of the main results and some related remarks.

II. The setting

Consider a patient diagnosed with advanced cancer. Suppose that the diagnosis of cancer is certain, but that prognosis (i.e., the outcome of the illness) is uncertain and dependent on treatment. More specifically, suppose that the physician speculates that if untreated, the patient's life expectancy is T months from the time of diagnosis, yet there is some probability, p, that cancer will respond favorably to treatment within the first t ($< T$) months of administration (hereafter, the 'critical period'). If this happens, treatment will continue further beyond the critical period. If not, treatment will cease by the end of the critical period for lack of effectiveness.

Suppose now that the patient's morale, m, is inversely related to the severity of his/her illness, s, as conveyed to him/her by the physician,[6] where s is a continuous variable ranging from zero to infinity,[7] and $m(s)$ is a twice-differentiable function satisfying $m'(s) < 0$ and $m''(s) \leq 0$ (that is, morale decreases with the severity of illness at non-decreasing rates). Suppose further that the physician cares not just for the physical health of the patient but also for maintaining his/her hope and morale. While the former is beyond the physician's control, depending on whether treatment succeeds or fails, the latter may be controlled by the physician through the amount of diagnostic and/or prognostic information he

[6] The possibility that the patient might form a belief of his own with respect to the severity of illness, which does not conform with the information conveyed to him/her by the physician, is ignored in this analysis.

[7] Given that the physician would always disclose to the patient the true diagnosis (yet not necessarily the true prognosis), s can be measured by the inverse of the patient's life expectancy if untreated, as conveyed to the patient by the physician. The definition of s allows, however, for the withholding of diagnostic information as well, in which case the units by which s is measured must not relate to the possibility of death.

discloses to the patient. Consequently, the physician might consider the possibility of withholding information from the patient, telling him/her that the severity of illness is less than its true level, s^0.[8] Suppose that the greater the severity of illness the greater the amount of information to be disclosed and explained to the patient. Hence, the greater the physician's understating of the true severity level, the greater the amount of information withheld from the patient.

Given that treatment shows favorable results, the physician is assumed to stick by his initial understating of the true severity of illness for T months, after which, if the patient survives, he might take the liberty of encouraging the patient further. However, if, by the end of the critical period, treatment fails, the physician will have no other choice but to disclose to the patient (who would otherwise wonder about the discontinuation of treatment despite the continuation of illness) the full truth about the severity of his/her illness. Aside of being subjected to a lower level of morale, $m(s^0)$, during the last $T - t$ months of life (hereafter, the 'hopeless period'), the patient is bound to experience feelings of anger and frustration due to the recognition that he/she has been deceived (thus deprived of the right of making informed choices regarding his/her own care), assumed to be in proportion k (measured in 'morale units') to the magnitude of his/her deception, $s^0 - s$. A patient who has a strong preference for being told the truth about his/her medical condition will experience greater anger and frustration than a patient who has a weaker preference for being told the truth. The former will thus have a higher value of k than the latter. The physician is assumed to be able to rank patients with respect to their preference for truth-telling, based, as suggested in the literature, on the frequency and nature of their questions.[9]

[8] As reported by Weisman (1979), cancer patients frequently go through a stage of acute anxiety and depression following the disclosure of diagnosis, which deters many physicians from informing patients about their situation.

[9] While patients may ask questions in order to get reassurance that their situation is benign, or may refrain from asking questions out of fear of the answer (thus this may not be a reflection of a wish not to be informed), the literature, in general, views asking questions as a possible clue for the physician that the patient wishes to be told the truth [see, for example, McIntosh (1976)]. Studies of patients' preferences for disclosure of information reveal contradictory findings: in the United Kingdom, 92% of lung-cancer patients, interviewed within 1 week of having been told the truth about their diagnosis, felt that telling them the diagnosis truthfully had been correct [Sell et al. (1993)]; in India, 71% of cancer patients who knew their diagnosis wanted to be told the truth [Gautam and Nijhawan (1987)], whereas in Spain, 42% of terminally-ill cancer patients who were not informed of their diagnosis did not want to receive more information [Centeno-Cortes and Nunez-Olarte (1994)].

Withholding information from the patient is clearly a risky decision. While avoiding a fall in the patient's morale during the critical period of treatment, the physician might end up causing the patient a greater emotional harm during the hopeless period, when the patient knows that treatment has failed and the end is near. In withholding information from the patient the physician in fact gambles with the patient's emotional well-being. Whether and to what extent to do so thus depends not only on the patient and illness characteristics, but also on the probability of treatment success, the relative length of the critical and hopeless periods, and the physician's subjective evaluation of the possible outcomes of his decision. Three alternative theories of decision making under uncertainty have attempted to shed light on the mechanisms that guide individuals in evaluating objective outcomes. The following sections apply, in turn, each theory to the physician's problem.

III. Expected utility theory

Expected utility theory, formulated by von Neumann and Morgenstern (1944), suggests that a small number of basic axioms, widely believed to represent the essence of decision making under uncertainty, are equivalent to choice by maximization of expected utility, where 'utility' is a real-number value ascribed by the decision maker to each possible outcome of the risky decision. However, utility is not a numeric measure of happiness or well-being, but rather a way of representing the decision maker's preferences, such that a more preferred outcome is assigned a larger number than a less preferred outcome. More specifically, utility of each possible outcome is assumed to be an increasing function, $U(\bullet)$, of the absolute level of certain attributes characterizing the outcome (e.g., wealth, health, prestige, etc.). Most importantly, the utility function may be concave, linear, or convex with respect to any of the corresponding attributes, implying that the decision maker is risk-averse, risk-neutral, or risk-seeking, respectively.[10]

[10] By definition, a risk-averse individual will avoid a gamble which is actuarially fair (i.e., the expected value of which is zero), a risk-seeking individual will accept it, and a risk-neutral individual will be indifferent between avoiding and accepting the gamble. Still, a risk-averse individual will accept a gamble which is *sufficiently* more than actuarially fair, whereas a risk-seeking individual will avoid a gamble which is *sufficiently* less than actuarially fair. It can be shown [e.g., Friedman and Savage (1948)] that the attitude towards risk is determined by the sign of the second derivative of the utility function.

Applying these assumptions to the physician's problem, suppose that the physician's utility function is $U = U(m)$, where $U'(m) > 0$ for all physicians, irrespective of their attitude towards risk, but $U''(m) < 0$ for a risk-averse, $U''(m) = 0$ for a risk-neutral and $U''(m) > 0$ for a risk-seeking physician. The patient's alternative morale levels when uninformed (during the administration of treatment) of the true severity of his/her illness, m^+, and when fully informed (if treatment is discontinued), m^-, are given by

$$m^+ = m(s) \tag{1}$$

$$m^- = m(s^0) - k(s^0 - s), \tag{2}$$

respectively. Obviously, $m^+ > m^-$ for $s < s^0$. In the case that the physician decides to tell the patient the full truth about his/her medical condition at the outset, $s = s^0$, so that $m^+ = m^- = m(s^0)$.

Suppose now that the physician chooses s^* ($\leq s^0$) so as to maximize his expected utility from withholding of information, defined over horizon of T months, which contains the critical period (t months) and the possible hopeless period ($T-t$ months). This is given by

$$EU(m) = \theta U(m^+) + (1-\theta)[pU(m^+) + (1-p)U(m^-)] \tag{3}$$

where $\theta = t/T$. The expected utility expression reflects the notion that during the fraction θ of the planning horizon, when treatment is administered, the patient's morale will be m^+ for certain. However, for the remaining $1-\theta$ fraction of the planning horizon, the patient's morale depends on whether or not treatment results are favorable. If, with probability p, they are, the patient will keep his/her relatively high level of morale, m^+. If, with probability $1-p$, they are not, the patient's morale will drop to the m^- level.

Rearranging terms, the physician's expected utility can be written as

$$EU(m) = \lambda\, U(m^+) + (1-\lambda)U(m^-), \tag{3'}$$

where $\lambda \equiv \theta + (1-\theta)p$. Maximizing now (3') subject to (1) and (2), the physician's choice of s^* should satisfy the first- and second-order conditions

$$\frac{d[E(U)]}{ds} = \lambda\, U'(m^+)m'(s) + (1-\lambda)U'(m^-)k = 0 \tag{4}$$

$$\frac{d^2[E(U)]}{ds^2} \equiv \Omega = \lambda\, \{U''(m^+)[m'(s)]^2 + U'(m^+)m''(s)\} + (1-\lambda)U''(m^-)k^2 < 0. \tag{5}$$

It can easily be verified that the second-order condition is unambiguously satisfied for a risk-averse physician ($U''(m) < 0$). It will also be satisfied for a risk-neutral physician ($U''(m) = 0$) given that $m''(s) < 0$, and *may*, under the latter assumption, be satisfied for a risk-seeking physician ($U''(m) > 0$).

A sufficient condition for the physician to understate the true severity of illness is that $d[E(U)]/ds < 0$ at $s = s^0$, or (noticing that $U(m^+) = U(m^-)$ at this point) that

$$-\lambda\, m'(s^0) > (1-\lambda)k. \tag{6}$$

That is, an incentive for the physician to withhold information from the patient will arise if the expected marginal increment to the patient's morale from doing so exceeds the expected marginal fall in the patient's morale from being told the truth at a later stage. Condition (6) reveals that an incentive for not telling the patient the whole truth about his/her illness is likely to arise

(a) the greater the true severity of illness, since the increasingly lower will be the patient's morale if being told the truth, thus the greater the expected marginal increment to the patient's morale from understating the true severity level.

(b) the weaker the patient's preference for being told the truth about his/her illness, since the lesser will be his/her anger and frustration in case of finding out that he/she has been deceived, thus the smaller the expected marginal fall in the patient's morale from being told the truth at a later stage.

(c) the higher the probability of treatment success (or the longer the critical period of treatment), since the lower the risk that the patient will have to live with the truth about his/her illness (or the shorter the hopeless period), thus the greater the expected marginal increment to the patient's morale from understating the true severity level and the smaller the expected marginal fall in morale from being told the truth at a later stage.

As implied by condition (6), the physician's decision of whether or not to disclose to the patient the truth about his/her illness is independent of any utility magnitude. Most importantly, it is independent of the physician's attitude towards risk. However, given that condition (6) holds, the *extent* by which the physician understates the true severity of illness *does* depend upon his attitude towards risk. To see this rewrite the optimal condition (4) as

$$-\frac{\lambda\, m'(s^*)}{(1-\lambda)k} = \frac{U'(m^-)}{U'(m^+)}\ . \qquad (7)$$

For a risk-neutral physician, the marginal utility is constant irrespective of the level of m, so that $U'(m^-) = U'(m^+)$. Hence, the right-hand-side of equation (7) equals unity and $-\lambda\, m'(s^*) = (1-\lambda)k$ at the optimum. However, for a risk-averse physician, the marginal utility falls as m increases, implying that $U'(m^-) > U'(m^+)$. Hence, the right-hand-side of (7) is greater than unity, resulting in $-\lambda\, m'(s^*) > (1-\lambda)k$ at the optimum. Similarly, for a risk-seeking physician, the marginal utility increases with m, implying that $U'(m^-) < U'(m^+)$. Hence, the right-hand-side of (7) is less than unity, resulting in $-\lambda\, m'(s^*) < (1-\lambda)k$ at the optimum. Since $-m'(s^*)$ is positively related to s^*, a risk-neutral physician is bound to withhold more information from the patient than a risk-averse physician, whereas a risk-seeking physician is bound to withhold more information than both physicians. These results are graphically illustrated in the Appendix to the paper.

Given that condition (6) holds, consider now the physician's response to an illness of greater severity. Totally differentiating (4) with respect to s^* and s^0, yields

$$\frac{ds^*}{ds^0} = -\frac{1}{\Omega}(1-\lambda)U''(m^-)k[m'(s^0)-k], \tag{8}$$

the sign of which is positive for a risk-averse, zero for a risk-neutral, and negative for a risk-seeking physician. While the greater the true severity of illness the greater the likelihood, irrespective of the physician's attitude towards risk, of withholding information from the patient - once the 'entry' condition (6) is satisfied, the physician's response to variations in the true severity of illness becomes dependent on his attitude towards risk: a risk-averse physician will disclose more information to the patient when faced with an illness of greater severity, a risk-neutral will disclose the same amount of information, whereas a risk-seeking physician will disclose even less! In a study of information giving to cancer patients, Amir (1987) found that information giving by Israeli physicians increased with the severity of illness. This suggests that Israeli physicians behave *as if* they were risk-averse decision makers who maximize expected utility. Notice, however, that both a risk-neutral and a risk-seeking physician will necessarily *withhold* more information when faced with an illness of greater severity, whereas the effect on withholding of a risk-averse physician is ambiguous.

Consider now the physician's response to a patient of a stronger preference for being told the truth about his/her illness. Totally differentiating (4) with respect to s^* and k, yields

$$\frac{ds^*}{dk} = -\frac{1}{\Omega}(1-\lambda)[U'(m^-)-k(s^0-s)U''(m^-)], \tag{9}$$

the sign of which is positive for a risk-averse or a risk-neutral, but ambiguous for a risk-seeking physician. Hence, both former physicians will disclose more information to a patient of a stronger preference for being told the truth, whereas the latter physician might actually do the opposite. Amir (1987) found that physicians disclosed more information to more inquisitive patients, which, in the spirit of the present analysis, suggests again that Israeli physicians behave as if they were risk-averse expected-utility maximizers.

Finally, totally differentiating (4) with respect to s* and λ yields

$$\frac{ds^*}{d\lambda} = -\frac{1}{\Omega}[U'(m^+)m'(s) - U'(m^-)k], \tag{10}$$

the sign of which is unambiguously negative, regardless of the physician's attitude towards risk. Since λ is positively related to p and θ, it follows that any physician, a risk-averse, a risk-neutral, or a risk-seeking, will withhold more information from the patient the higher the probability of treatment success or the longer the critical period of treatment.

IV. Prospect theory

Prospect theory, developed by Kahneman and Tversky (1979), retains some of the features of expected utility theory, but also makes two important modifications. First, the utility function is replaced by a 'value' function, $V(\bullet)$, which ascribes a value to each possible outcome of the risky decision. However, because a decision maker adapts to a given environment and perceives stimuli relative to that environment, value is assumed to depend on *changes* in the level of the valued attribute from some reference point, rather than on the absolute magnitude of the attribute itself. The reference point represents a state to which the decision maker has adapted and is usually assumed to correspond to the status quo or accepted norm. Secondly, while the value function increases with gains and decreases with losses, it is assumed to be concave for gains and convex for losses, so that the decision maker is risk-averse with regard to the former but risk-seeking with regard to the latter.

Applying these assumptions to the physician's problem requires first to determine the reference point from which changes in the patient's morale are measured. Two alternative reference points seem likely. One is the level of the patient's morale if being told the full truth about his/her illness, $m(s^0)$. The other is the patient's morale if being told nothing about the severity of illness, $m(0)$. A physician for whom $m(s^0)$ is the reference point views telling the full truth to the patient as the norm of behavior. He thus evaluates changes in the patient's morale relative to this norm. These changes will be

$$\Delta m^{+} = m^{+} - m(s^{0}) = m(s) - m(s^{0}) \tag{11}$$

$$\Delta m^{-} = m^{-} - m(s^{0}) = -k(s^{0} - s), \tag{12}$$

during the critical and hopeless periods, respectively. Hence, the physician expects a gain to the patient's morale during the administration of treatment and a loss when treatment is discontinued. The physician's value function can now be written as $V = V(\Delta m)$, where $V'(\Delta m) > 0$, but $V''(\Delta m^{+}) < 0$ and $V''(\Delta m^{-}) > 0$.

Suppose now that the physician chooses s^{*} ($\leq s^{0}$) so as to maximize his expected value from withholding information from the patient. This is given by

$$EV(\Delta m) = \lambda V(\Delta m^{+}) + (1-\lambda)V(\Delta m^{-}), \tag{13}$$

which maximizing subject to (11) and (12) yields the first- and second-order conditions

$$\frac{d[E(V)]}{ds} = \lambda V'(\Delta m^{+})m'(s) + (1-\lambda)V'(\Delta m^{-})k = 0 \tag{14}$$

$$\frac{d^{2}[E(V]}{ds^{2}} \equiv \Psi = \lambda \{V''(\Delta m^{+})[m'(s)]^{2} + V'(\Delta m^{+})m''(s)\} + (1-\lambda)V''(\Delta m^{-})k^{2} < 0. \tag{15}$$

While the bracketed expression in (15) is indeed negative, the second expression is positive. The second-order condition should thus be assumed to hold.

A sufficient condition for the physician to withhold information from the patient is that $d[E(V)]/ds < 0$ at $s = s^{0}$, or that

$$-\lambda\, m'(s^{0}) > (1-\lambda)k\frac{V'(0)^{-}}{V'(0)^{+}}, \tag{16}$$

where $V'(0)^{+}$ and $V'(0)^{-}$ denote the right-hand and the left-hand derivatives of the value function at the origin, respectively. The latter derivative is assumed by prospect theory to be steeper than the former, thus $V'(0)^{+} < V'(0)^{-}$. Consequently, the withholding condition under prospect theory is stricter than that under expected utility theory. Hence, the true severity of illness must be greater, the patient's preference for being told the truth weaker, the probability of treatment success higher or the critical period of treatment longer in order for the truth-prone physician to withhold information from the patient. While the 'entry' condition is stricter, it nevertheless allows for the withholding of information. This can explain why in the United States and Northern Europe, where the norm of behavior is full disclosure, physicians may still withhold information from cancer patients.

Given that condition (16) holds, consider now the physician's response to an illness of greater severity. Totally differentiating (14) with respect to s^* and s^0, yields

$$\frac{ds^*}{ds^0} = \frac{1}{\Psi}[\lambda V''(\Delta m^+)m'(s)m'(s^0) + (1-\lambda)V''(\Delta m^-)k^2], \tag{17}$$

the sign of which is ambiguous. The reason for this is that the greater the severity of illness for a given s, the greater is not only the patient's anger and frustration upon the revelation that he/she has been deceived, but also the increment to the patient's morale during treatment. Since the physician is risk-seeking with respect to the former change and risk-averse with respect to the latter, no clear-cut result emerges from (8). Totally differentiating (14) with respect to s^* and k yields

$$\frac{ds^*}{dk} = -\frac{1}{\Psi}(1-\lambda)[V'(\Delta m^-) - k(s^0 - s)V''(\Delta m^-)], \tag{18}$$

implying that the physician's response is also ambiguous with respect to a patient of a stronger preference for being told the truth, as a change in k affects the physician's expected value from treating the patient at the loss region where he is risk-seeking. The physician's response to an increase the probability of treatment success or in the critical period of treatment is, however, straightforward: disclosing less information, as he would under expected utility theory.

Consider now a physician for whom $m(0)$ is the reference point. This physician views not telling anything bad to the patient as the norm or the status quo. He thus perceives any information disclosed to the patient about his/her illness (which is bound to adversely affect the patient's morale) as a loss. The changes in the patient's morale from the reference point will now be

$$\Delta m^{+} = m^{+} - m(0) = -[m(0) - m(s)] \tag{19}$$

$$\Delta m^{-} = m^{-} - m(0) = -[m(0) - m(s^{0})] - k(s^{0} - s), \tag{20}$$

during the critical and hopeless periods, respectively.

Maximizing (13) subject to (19) and (20), the physician's optimal understating of the severity of illness, s^{*}, should satisfy again the first- and second-order conditions (14) and (15). Notice, however, that because both Δm^{+} and Δm^{-} are negative in this case, the physician is risk-seeking with respect to both possible occurrences. Hence, the second-order condition may (but not necessarily) be satisfied only if $m''(s) < 0$.

It can easily be verified that a sufficient requisite for the physician to understate the true severity of illness is condition (6), which is less strict than condition (6'). Consequently, and as intuitively expected, the physician's incentive to withhold information from the patient will be greater if not telling anything is his norm of behavior, rather than telling the whole truth,. A sufficient condition for telling *something* to the patient in this case is that $d[E(V)]/ds > 0$ at $s = 0$, or that

$$-\lambda\, m'(0) < (1-\lambda)k\frac{V'\{-[m(0) - m(s^{0})] - ks^{0}\}}{V'(0)^{-}}. \tag{21}$$

The greater the true severity of illness, s^{0}, the lower the argument of $V'\{\bullet\}$, and, by risk-seeking, the lower the right-hand of condition (21). Hence, the less likely is the physician to tell something to the patient. He is also less likely to disclose anything the greater the probability of treatment success and the critical period of treatment. The effect of a patient's stronger preference for being told the truth on the physician's incentive to tell anything is, however, ambiguous.

Given that the entry conditions into withholding some information (6) and disclosing some information (21) are satisfied, the physician's response to variations in s^0, is given by

$$\frac{ds^*}{ds^0} = -\frac{1}{\Psi}(1-\lambda)V''(\Delta m^-)k[m'(s^0)-k], \tag{22}$$

the sign of which is unambiguously negative, similar to the sign obtained under expected utility theory for a risk-seeking physician. The physician's response to a change in k is ambiguous and identical to (18). An increase in either the probability of treatment success or the critical period of treatment will again have an unambiguously negative effect on information disclosure.

Intuitively, a physician for whom telling nothing is the norm of behavior is likely to withhold more information from the patient than a physician for whom telling the truth is the norm or the status quo. Unfortunately, ranking the extent of information disclosure by physicians as dependent on norms of behavior, similar to ranking information disclosure as dependent on the attitude towards risk (Section III), is impossible: while for the former physician both Δm^+ and Δm^- are negative, and , by risk-seeking, $V'(\Delta m^-) / V'(\Delta m^+) < 1$, for the latter physician, Δm^+ is positive and Δm^- is negative (i.e., the physician is risk-averse with respect to the former change and risk-seeking with respect to the latter). Hence, the relationship between $V'(\Delta m^-) / V'(\Delta m^+)$ and unity is indeterminable for the latter physician so that no conclusion can be derived from the first-order condition (14) as regards the relative extent of disclosure.

V. Regret theory

Regret theory, proposed independently by Bell (1982) and Loomes and Sugden (1982), suggests that decision making involves a desire to avoid the unpleasant psychological consequences that result from a decision that turns out poorly. Once the outcome of a chosen alternative is known, a decision maker is bound to compare it with the outcome that could have been obtained if another alternative had been chosen. This comparison will lead either to feelings of regret (if the other alternative would have turned out better) or to feelings of rejoice (if the other alternative would have turned out worse). Because decision makers anticipate these feelings, they take them into account before making a decision and calculate for each possible outcome of an alternative the amount of regret and rejoice they are likely to feel once the outcomes are known. The key assumptions underlying regret theory is that regret is an increasing function, $R(\bullet)$, of the difference (positive or negative) between the level of the attribute actually obtained and the highest level produced by another alternative, and that the regret function is convex with respect to this difference (i.e. increases at increasing marginal rates).

Applying these assumptions to the physician's problem, suppose that as long as treatment is administered the physician rejoices withholding information from the patient, whereas if treatment is discontinued the physician will regret not telling the patient the full truth at the outset. Regret will be positive in the latter case but negative in the former, increasing in the difference between the patient's level of morale at the state of full disclosure and at each possible outcome of the risky decision. These differences will be

$$\Delta m^{+} = m(s^{0}) - m^{+} = -[m(s) - m(s^{0})] \tag{23}$$

$$\Delta m^{-} = m(s^{0}) - m^{-} = k(s^{0} - s), \tag{24}$$

if treatment is administered and discontinued, respectively. The physician's regret function can now be written as $R = R(\Delta m)$, where $R'(\Delta m) > 0$ and $R''(\Delta m) > 0$.

Suppose now that the physician chooses s^{*} ($\leq s^{0}$) so as to *minimize* his expected regret from withholding information, given by

$$ER(\Delta m) = \lambda R(\Delta m^{+}) + (1-\lambda)R(\Delta m^{-}). \tag{25}$$

Minimizing (25) subject to (23) and (24) yields the first- and second-order conditions

$$\frac{d[E(R)]}{ds} = -\lambda R'(\Delta m^{+})m'(s) - (1-\lambda)R'(\Delta m^{-})k = 0 \tag{26}$$

$$\frac{d^2[E(R]}{ds^2} \equiv \Phi = \lambda \{R''(\Delta m^{+})[m'(s)]^2 - R'(\Delta m^{+})m''(s)\} + (1-\lambda)R''(\Delta m^{-})k^2 > 0, \tag{27}$$

the latter of which is unambiguously satisfied by the convexity assumption on the regret function.

A sufficient condition for the physician to withhold information from the patient is that $d[E(R)]/ds > 0$ at $s = s^0$, which reduces to condition (6), as $R'(0)^{+} = R'(0)^{-}$. This is somewhat surprising in view of Amir (1987) finding that junior physicians, who presumably are more anxious to avoid poor decisions, are more likely to disclose the truth to cancer patients than their senior colleagues. Hence, one would expect the entry condition into withholding to be stricter under regret theory than under expected utility theory. The explanation for the difference in behavior between junior and senior physicians may thus lie elsewhere: senior physicians have, over the years, adopted a more optimistic way of conveying information to cancer patients in an attempt to survive emotionally.

The physician's response to an illness of greater severity is given by

$$\frac{ds^*}{ds^0} = \frac{1}{\Phi}[\lambda R''(\Delta m^{+})m'(s)m'(s^0) + (1-\lambda)R''(\Delta m^{-})k^2], \tag{28}$$

the sign of which is unambiguously positive. Hence, a physician who seeks to minimize the amount of regret embodied in his risky decision will disclose more information to the patient the greater the true severity of illness. The physician's response to a patient of a stronger preference for being told the truth about his/her illness will be

$$\frac{ds^*}{dk} = \frac{1}{\Phi}(1-\lambda)[R'(\Delta m^{-}) + k(s^0 - s)R''(\Delta m^{-})], \tag{29}$$

which is also unambiguously positive. Hence, a regret-minimizing physician will also disclose more information to a patient of a stronger preference for being told the truth. He will, however, disclose less information to the patient the greater the probability of treatment success or the longer the critical period of treatment.

VI. Conclusions

The paper has applied three alternative theories of decision-making under uncertainty to the physician's problem of whether and to what extent to withhold information from a cancer patient, viewing the physician as a risk-taking decision maker who gambles with the patient's emotional well-being. The analysis shows that as far as the decision of whether or not to withhold information from the patient is concerned, all theories yield the same prediction: an incentive to withhold information is likely to arise the greater the severity of illness, the weaker the patient's preference for being told the truth, the higher the probability of treatment success and the longer the duration of the critical period of treatment. Moreover, with the exception of a physician for whom the norm of behavior is telling the truth, all other physicians, irrespective of their attitude towards risk, norm of behavior or work status, face exactly the same 'entry' condition into withholding. Hence, if it satisfied for one it is satisfied for them all. The former physician faces a stricter entry condition than his colleagues, thus the severity of illness must be greater, the patient's preference for being told the truth weaker, the probability of treatment success higher or the critical period of treatment longer than for other physicians in order for the truth-prone physician to join his colleagues in withholding information from the patient.

Given that the entry condition into withholding is satisfied, expected utility theory predicts that a risk-neutral physician will withhold more information than a risk-averse physician, whereas a risk-seeking physician will withhold more information than both physicians. In contrast, prospect theory does not yield an unambiguous conclusion regarding the relative withholding of information by a physician for whom telling nothing is the norm of behavior and a physician for whom telling the whole truth is the norm or the status quo. All theories predict that the higher the probability of treatment success or the longer the critical period of treatment, the less the information disclosed to the patient by any type of physician.

However, much diversity is found across theories and within a given theory with regard to the physician's response to a greater severity of illness or to a stronger preference of the patient for being told the truth. As regards the former, expected utility theory predicts that the physician's response depends on his attitude towards risk: a risk-averse physician will disclose more information to a patient of greater illness severity, a risk-neutral will disclose the same, whereas a risk-seeking physician will disclose even less! Disclosing less information is also the optimal response of the physician under prospect theory, providing that his norm is telling nothing. However, if his norm is telling the truth, the physician's response to a greater severity of illness is ambiguous. In contrast, regret theory predicts that the physician will disclose more information to a patient of a greater severity of illness. As regards the physician's response to a patient of a stronger preference for being told the truth, expected utility theory predicts that a risk-averse and a risk-neutral physician will disclose more information, whereas the response of a risk-seeking physician is ambiguous. Ambiguity also characterizes prospect theory, irrespective of the physician's norm of behavior, whereas regret theory predicts that the physician will disclose more information to a more inquisitive patent.

The analysis in this paper rests on several psychological premises. First, the patient's emotional well-being is assumed to be inversely related to his belief about the severity of illness. Second, the physician is assumed to care about the patient's hope and morale. Third, the patient's feelings of anger and frustration if finding out that he/she has been deprived of the right of making informed choices are greater the stronger his/her preference for being told the truth and the greater the physician's understating of the true severity of illness. While withholding of information from cancer patients is a problem in medical psychology, the theories applied in this paper are commonly used by economists. The paper thus belongs to as yet a small literature which applies the economic approach to the analysis of clinical/medical psychology phenomena, such as addictive behavior [e.g., Winston (1980), Becker and Murphy (1988)], suicide threat [e.g., Hamermesh and Soss (1974), Rosenthal (1993)], phobic disorder [Yaniv (1998)], or diagnosis delay [Yaniv (1998)]. As shown in this paper, the economic approach may help explain, *inter alia*, why physicians whose norm of behavior is full disclosure sometimes opt to withhold information from cancer patients, as well as psychologists' findings that physicians disclose more information the greater the severity of illness and the more inquisitive the patient.

APPENDIX: A GRAPHICAL EXPOSITION

The physician's optimal understating of the true severity of illness under expected utility theory is described graphically in Figure 1, which measures the patient's morale in the state of treatment, m^+, and in the state of no treatment, m^-, along the vertical and horizontal axis, respectively. The curve AB represents the physician's 'opportunity boundary', which connects between feasible combinations of the patient's morale in the alternative states, obtained through variations in the extent by which the physician understates the true severity of illness. Point A relates to the possibility of full disclosure, in which case the patient's morale will be $m(s^0)$ for certain. Point A thus lies on a 45-degree 'certainty line', which represents certain outcomes. Point B relates to the possibility of zero disclosure, in which case the patient's morale will be $m(0)$ during the administration of treatment, but $m(s^0) - ks^0$ if treatment is discontinued. Along the opportunity line, the physician is able to 'trade', through a marginal increase in understating, k units of the patient's morale in the state of no treatment for $m'(s)$ units of morale in the state of treatment. Hence, the opportunity boundary slope is $m'(s)/k$. Given that $m''(s) < 0$, the opportunity boundary will be concave to the origin, as depicted in Figure 1. Given that $m''(s) = 0$, the opportunity boundary will be linear.

Consider now the physician's preferences, represented in Figure 1 by a set of indifference curves, each curve representing a given level of expected utility. Along each curve the physician is indifferent between various combinations of the patient's morale in the alternative states: giving up $\Delta m^-(1-\lambda)U'(m^-)$ expected 'utils' through moving up a bit along a given curve is exactly compensated by a gain of $\Delta m^+\lambda U'(m^+)$ expected 'utils', so that $\Delta m^-(1-\lambda)U'(m^-) + \Delta m^+\lambda U'(m^+) = 0$. Hence, the indifference curve slope is $-\ (1-\lambda)U'(m^-)\ /\ \lambda U'(m^+)$, which increases with the understating of illness severity for a risk-averse, decreases for a risk-seeking, and remains constant for a risk-neutral physician. Consequently, the indifference curve will be convex to the origin for a risk-averse (as depicted in Figure 1), concave for a risk-seeking, and linear for a risk-neutral physician.

Assuming now that the physician seeks to maximize his expected utility from treating the patient, he will seek to reach the highest indifference curve possible, subject to his opportunity boundary. Hence, he will reach equilibrium at the point where an indifference curve is tangent to the

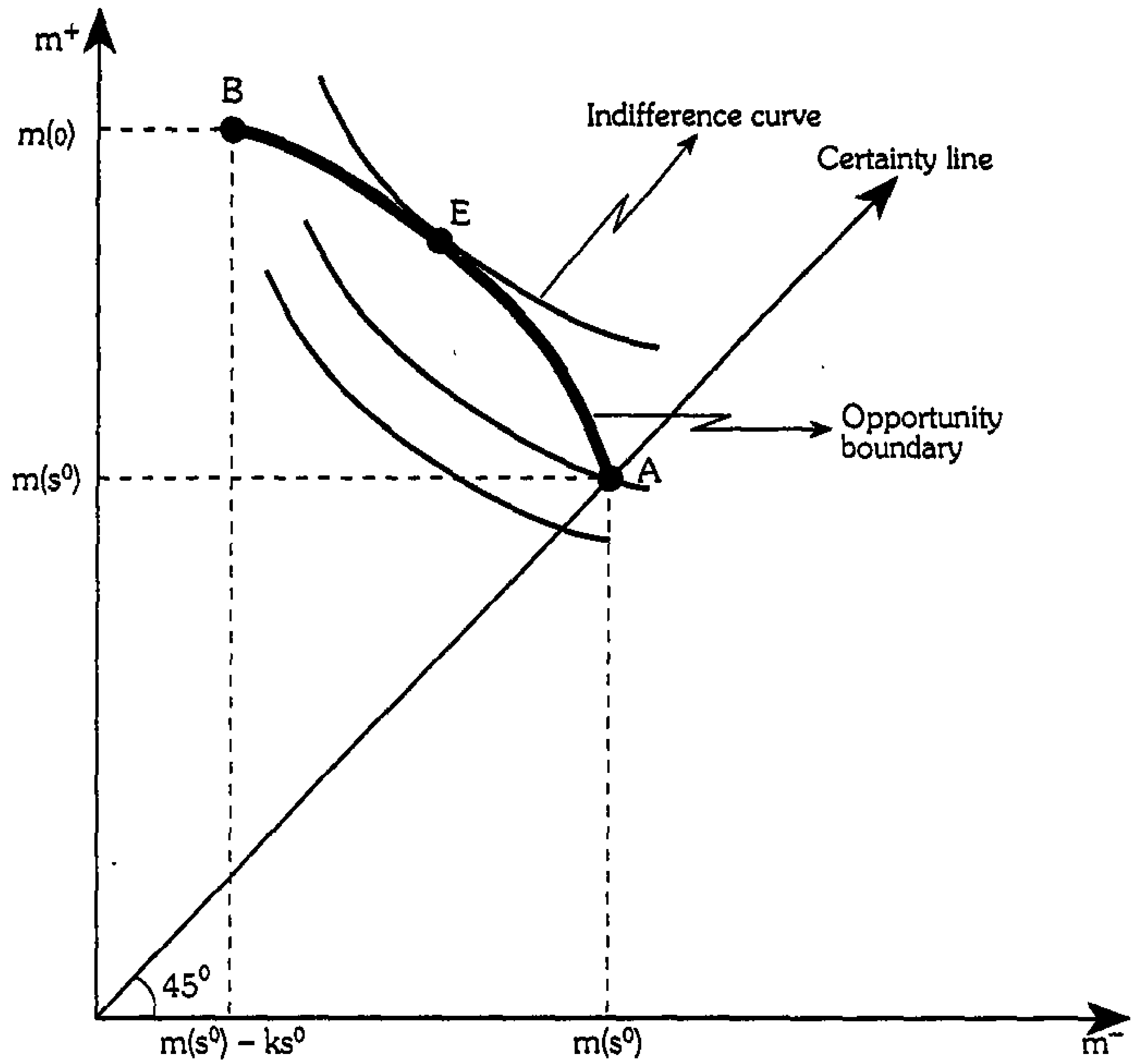

Figure 1: The risk-averse physician's equilibrium

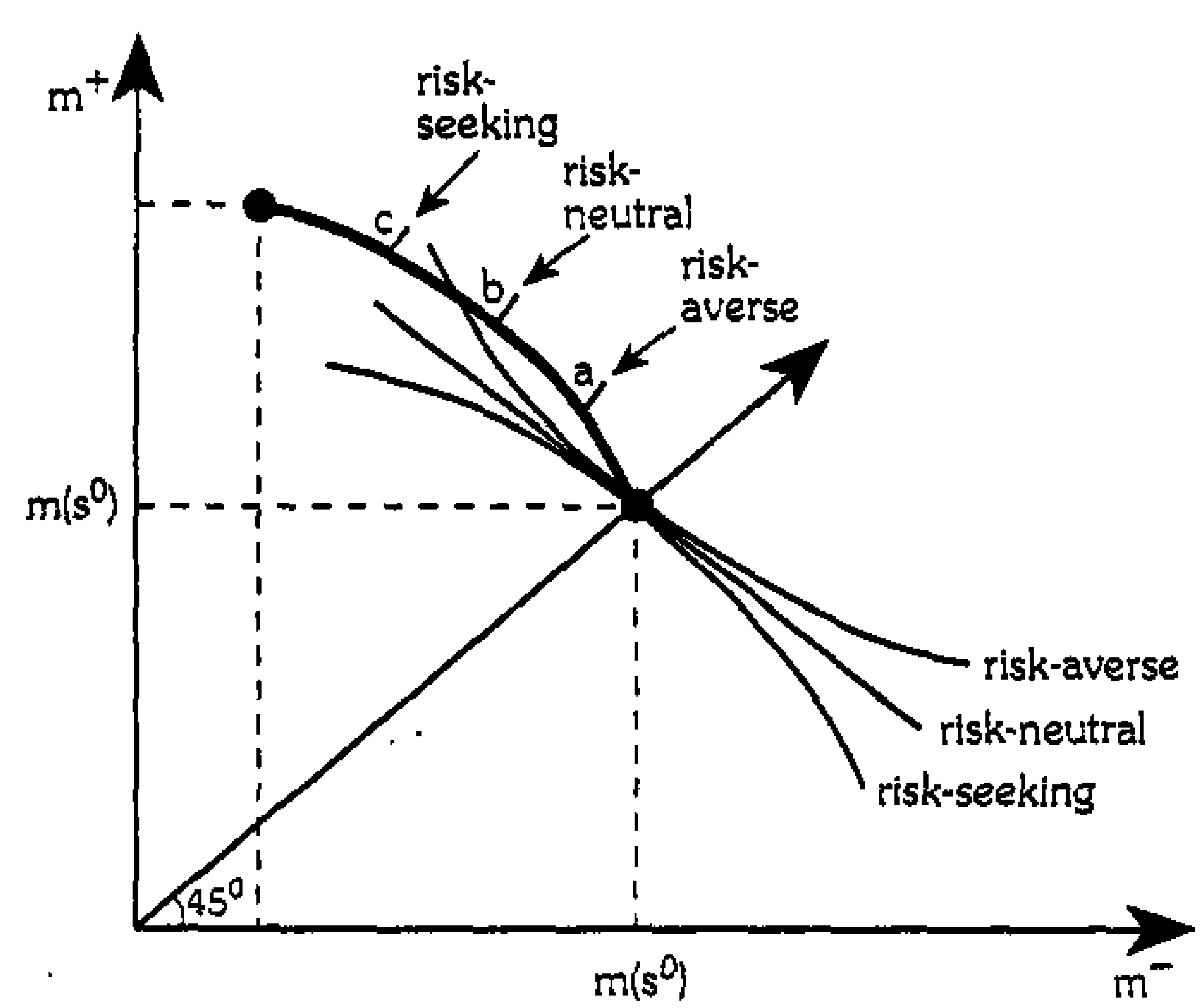

Figure 2: Physician's equilibrium by attitude towards risk

opportunity boundary (point E in Figure 1). At this point, the slopes of the opportunity boundary and the indifference curve are equal, satisfying

$$\frac{m'(s^*)}{k} = -\frac{(1-\lambda)U'(m^-)}{\lambda U'(m^+)} \quad . \tag{4'}$$

It is easily verified that (4') is in fact the first-order condition (4), after simple rearrangement of terms. Hence, point E corresponds to the (risk-averse) physicians' optimal solution as derived in Section III. A sufficient condition for withholding information from the patient - regardless of the attitude towards risk - is that the absolute slope of the opportunity boundary exceed the absolute slope of the indifference curve *at point A*, where the physician discloses the full truth to the patient. Given this condition, the physician will be able to reach tangency with the opportunity boundary at a higher indifference curve, hence expected utility is *not* maximized by disclosing the whole truth. Since $U'(m^-) = U'(m^+)$ at $s = s^0$, the indifference curve slope at the point of full disclosure is $(1-\lambda) / \lambda$ (in absolute value), irrespective of the attitude towards risk. This should be less than $- m'(s^0)/k$ for an incentive for understating to arise, which, rearranging terms, is identical to condition (6) in Section III.

Figure 2 depicts three alternative indifference curves, relating to physicians of different attitudes towards risk, at the point of full disclosure. Since the indifference curves' slope at this point, $(1-\lambda)/\lambda$, falls short of the opportunity boundary slope, an incentive for withholding information from the patient arises for all physicians. Suppose now that a risk-neutral physician, whose indifference curve is linear (thus having a slope of $(1-\lambda)/\lambda$ at *every* point), reaches equilibrium at point b, on the opportunity boundary. It is immediately seen that because of the convexity of his indifference curve, a risk-averse physician will reach equilibrium at a point like a, which lies to the right of b, and that because of the concavity of his indifference curve, a risk-seeking physician will reach equilibrium at a point like c, which lies to the left of b. Hence, a risk-neutral physician will withhold more information from the patient than a risk-averse physician, whereas a risk-seeking physician will withhold more information than both former physicians.

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