STUDIECENTRUM VOOR ECONOMISCH EN SOCIAAL ONDERZOEK

DRUG PRESCRIBING: A DISCUSSION OF ITS VARIABILITY AND (IR)RATIONALITY

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Abstract

The main purpose of this paper is to try to explain inappropriate or irrational prescription behavior on the part of physicians. It will first be argued that such behavior is a by-product of the variability in prescribing. We provide therefore an explanation for this variability before analyzing the concept of (ir)rationality in prescribing. Policy suggestions aiming at improving physicians' behavior are given next. The paper ends with a discussion on three controversial issues in drug prescribing, viz. the role of advertising, brand names and product variety.

Acknowledgments

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1. Introduction

Drugs have become an essential part of modern health care. An ever increasing quantity of drugs is there to contribute to people's health. Yet, if unwisely used, drugs may also entail adverse effects and damage health. In the next section of this paper, a discussion will be provided about some of the positive and negative aspects of drug use. It is now reported in the literature that inappropriate or irrational prescription behavior may be observed. It will be argued that such a behavior is a by-product of the variability in prescribing. That is why the third section is devoted to understanding this variability. In the fourth section, we will study the phenomenon of (ir)rational prescribing. The concept of rational prescription behavior is looked at more closely. A distinction will be made between three forms of rationality: that of the physician, the pharmacologist and the patient. Policy suggestions aiming at improving patient's welfare are offered in the same section. Three controversial issues in drug prescribing are further discussed in the fifth section, viz. the role of advertising, brand names and product variety. In the last section, a number of principal conclusions are presented.

This paper provides a bird's eye view of two main features of drug prescribing, namely its variability and (ir)rationality. Although the material in this paper will be presented and discussed in a succinct way, it hopes to contribute to a better understanding of the mostly empirically oriented literature on these particular features of drug prescribing.

2. Some reflections on the pros and cons of drug utilization

2.1. Drugs may be useful...

It can not be denied that, at present, pharmaceuticals are more than ever integrated into modern health care. From inspecting the shares of drugs in total health care expenditures for a number of OECD countries in 1975, one learns that these vary between 8 and 9 per cent for Sweden, Switzerland and the U.S., between 10 and 14 per cent for Australia, Canada, the Netherlands and the U.K., and between 17 and 20 per cent for France, Italy and West-Germany[1]. It is also interesting to have a look at the extent of drug utilization itself. From data presented by the OECD (1984) and by Abel Smith and Grandjeat (1979, p. 23), it can first be concluded that, except for the U.S., all countries mentioned above show a positive yearly growth rate of drug utilization per inhabitant between 1.5 and 8 per cent[2]. In the U.S. drug utilization per inhabitant proves to be almost stable. Secondly, these data also reveal that the average number of drugs per inhabitant varies rather widely among countries.

Does this fairly widely observed increase of drug use refer to a desirable situation, in the sense of an increased patients' welfare, or not ? A forceful defender of modern drugs is Fuchs (1974) who writes that drug therapy has improved people's health significantly. He notes, first of all, that new drugs and vaccines developed since the 1920s have seriously depressed or wiped out diseases such as tuberculosis,whooping cough, polio, measles, diphteria and measles. Since 1935, the expanded use of sulfonamide and penicillin caused a sharp decline in the death rate from in-

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[1]The data are from Maxwell (1981, p. 78). See further Table A-1 of the Appendix.

[2]See further Table A-2 of the Appendix; the growth rates are not always comparable because different time periods were considered.

fluenza and pneumonia[1]? He also points out[2] that significant advances were made in hormonal drugs, anti-hypertension, anti-histamines, anticoagulants, antipsychotics and antidepressants Some of the drugs have a clear pay-off in terms of decreased mortality. For instance, there is the evidence that antihypertensive drugs have contributed to a decline in the death rate from hypertensive heart disease from 44 per 100 000 in 1969 to 11 per 100 000 in 1970[3]. Some of the benefits of a number of drugs are often unnoticed or are difficult to capture in health statistics, however. For example, one of the main benefits of the use of birth-control pills, viz. the improved well-being of couples, is rather hard to measure. Furthermore, the fact that many drugs contribute to an increase in the speed of recovery or to a decrease in the speed of deterioration is frequently ignored. Greater relief of pain or an early stop to an infection may also be among the unnoticed benefits[4].

Among the benefits of drugs, we must also mention the possibility that the use of drugs reduces the need for hospitalization or the length of a hospital stay. For instance, it was recently shown by Bulthuis (1984) that in the Netherlands a significant drop in the hospitalisations for peptic ulcer in the period 1972 - 1980 was caused by the introduction of cimetidine. It was also estimated that this phenomenon entailed important savings in the medical care bill of the nation. The benefits also include the workdays of active people the nation as a whole gains as the result of preventing hospitalisation.

In a paper by Kirking (1983), it is implied that the continued introduction of new drugs can be beneficial to people's health.

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[1]See Fuchs (1974, p. 110).

[2]Ibid., p. 110.

[3]See Feldstein (1983, Ch. 17)

[4]See American Pharmaceutical Association (1984, p. 10)

He states, for instance, that in 1981 more new molecular entities (NME) were approved by the Food and Drug Administration (FDA) than in any of the past 20 years.[1] Many of these NME seem to be rated as important therapeutic gains. The FDA apparently acknowledges the importance of introducing NME by processing new drug applications more rapidly, especially for the drugs that promise to contain therapeutic gains over existing drugs.[2] Kirking writes further that much of the potential for new drugs 'is due to recent advances in understanding the basic physiologic actions of the body, the mechanisms of various diseases, and the disposition of drugs in the body. Growth of this understanding has been facilitated by new instruments and techniques that allow monitoring of previously unmeasurable bodily parameters'[3]. In addition progress seems to be have been made by behavioral scientists in understanding patients' noncompliance with prescribed therapies and in ways to overcome this particular behavior. These developments help new drugs to be more effective, to have less serious and less frequent adverse effects and to be simpler to administer disturbing patients' lifestyle less than before. Examples of such drugs are cimetidine (for ulcer therapy) and calcium entry blockers (for treating cardiovascular diseases).

2.2. ... but may have negative effects as well

The question is now to which extent the benefits of modern drugs, as commented on above, are counterbalanced by the negative aspects of drugs. Especially Illich[4](1976) is the proponent of the idea that society is invaded by pharmaceutical products making people dependent on drugs thereby damaging their health. In order to illustrate this overconsumption, he cites a.o. the considerable consumption of aspirin (about 225 tablets per person in the early seventies) and increasing dependence on prescribed

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[1]See Kirking (1983, p. 185)

[2]Ibid., p. 185

[3]Ibid., pp. 185 - 186

[4]Illich (1976, p. 58)

tranquillizers (per capita consumption has increased by 290 per cent over the period from 1962 to the early seventies) in the United States.[1] He also stresses that drug prescribing by physicians is no guarantee that patients' health is secured. He thereby refers to the fact that chloramphenicol was widely prescribed in the U.S. for such illnesses as sore throat, common cold and acne, knowing that typhoid was about the only disease that justified the prescription of this drug and that chloramphenicol might cause the occurrence of fatal plastic anemia. Apparently no more than one in 400 patients in the U.S. really needed this drug therapy.[2]

Illich (1976) has thus drawn our attention to the possibility of the existence of harm-causing drugs. Of course, what we have in reality is a continuum of net benefits associated with the various drugs in our drug armamentarium : at one extreme, we have drugs that are very effective and beneficial and that have few or no undesirable side-effects, while at the other extreme drugs may induce serious and sometimes fatal adverse reactions.[3] Note that adverse reactions may also necessitate hospital admissions; studies are available that estimate that 3 to 5 per cent of admissions to hospital services in the U.S. are caused by adverse drug effects.[4]

An interesting study on the therapeutic merit of the 200 most frequently dispensed drug products (covering 163 separate drug entities) in the U.S. has been performed by Rucker (1980). These drug entities are associated each time with 10 measures

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[1] Ibid., pp. 63 - 64

[2] Ibid., p. 59

[3] Examples of drugs with serious adverse reactions that were withdrawn from the market in the U.S. are the antiarthritic Oraflex and the antihypertensive Selacryn; see Kirking, op. cit., p. 184

[4] See Kirking, op. cit., p. 184

of therapeutic utility: five are indices of positive discrimination based upon the judgments pronounced in compilations of preferred drugs while the remaining five measures are drawn from lists of negative opinion. Except for two measures, all of them rely upon the advice from expert panels that judge the relative therapeutic merits of the drugs. The main results of this study are the following: only 41.1 per cent of the most frequently prescribed drug entities receive two or more positive opinions and can be said to be 'clinically superior', 10 per cent of the drug entities receive conflicting opinions whereas 35 per cent of the leading drugs get at least one negative rating. These results lead Rucker to conclude that there is no strictly positive relationship between the popularity of a drug and its therapeutic superiority over competing products.

2.3. Rational prescribing: a difficult task

It can be inferred from above that drugs can be effective in combatting diseases. They can also cause undesirable side-effects if prescribed and/or used inappropriately. Mastering a sufficient knowledge of all relevant characteristics of each drug by each physician, in order to prevent inappropriate or irrational prescribing, is surely desirable from society's point of view. However desirable this is, it does not seem easy in practice; indeed reports about irrational prescribing appear regularly in the medical literature. The concept of irrational prescribing will be discussed further in this paper. At this point, it will be sufficient to say that inappropriate prescribing entails a number of costs for the patient: money may have to be paid for unnecessary drugs, more expensive drugs may be prescribed whereas less expensive analogues may exist on the drug market, the patient may suffer from adverse reactions or may develop a bacterial resistance to antibiotics, the patient may also incur costs from underprescribing[1].

The reasons for this physician behavior cited in the literature range from lack of physicians' time to keep up with the literature on drug selection to the effect of industries' drug

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[1] See Kirking (1983, p.185)

promotion on physicians' behavior. We feel now that before tackling the phenomenon of inappropriate prescribing, we ought to discuss the variability in physicians' prescribing behavior. Indeed, understanding the main causes of this variability will help us in grasping the occurrence of inappropriate prescribing behavior. In fact, irrational prescribing behavior will manifest itself concurrently with variations in prescribing.

3. Variations in prescribing

3.1. Some data on prescribing patterns

Previously we noted that the average number of drugs used varied rather widely among countries. This variation is also observed for specific types of drugs such as psychotropics and anti-diabetics[1]. But also *within* countries, substantial variation in prescribing patterns of physicians is detected; this applies to volumes as well as types of drugs[2]. Some important evidence of *variations* in the use of different types of *drugs* is given by Temin (1981, p.177). The evidence he presents is based on a sample of over 1500 physicians who are reporting four times a year on a forty-eight hour period of their practice to IMS-America[3]. In Table 1, it is shown how the prescription of anti-biotics varies among these physicians in the treatment of the reported diseases. Temin (1981, p.179) stresses that, even if one divides the diseases in a more detailed way, physicians still prescribe a wide variety of drugs for each disease. In other words, the variation in Table 1 is not due to aggregation of certain diseases. One may judge this variation to be too large. However, it is important to note that part of the differences in prescriptions may be linked to the infection with different microorganisms. However, there was no way for the author, given the available data, to investigate this issue.

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[1] See Bergman et.al. (1979, chs.14-15).

[2] See Christensen and Bush (1981, pp.343-344).

[3] This sample is called IMS 'National Disease and Therapeutic Index.

TABLE 1

SHARE OF VARIOUS DRUGS DESIGNATED FOR THE SAME DISEASE, 1976
(percent)

Type of Drug / Disease	*Tetracyclines*	*Chloramphenicols*	*Cephalosporins*	*Erythromycins*	*Ampicillins*	*Amoxicillins*	*Other Broad-Spectrum Antibiotics*	*Streptomycin*	*Aminoglycosides*	*Other Broad- to Medium-Spectrum Antibiotics*	*Penicillins V and VK*	*Penicillins G*	*Antistaph. Penicillins*	*Other Penicillins*	*Total*
Respiratory disorders	23	*	6	17	16	5	*	*	1	2	13	16	*	—	100
Diseases of central nervous system/ sensory organs	8	1	5	12	31	12	*	*	1	1	15	13	1	—	100
Special conditions without sickness	19	2	34	5	16	1	2	*	9	3	2	4	4	—	100
Diseases of skin-cellular tissue	38	*	7	16	9	2	*	*	2	5	6	7	7	—	100
Genitourinary disorders	37	*	19	2	26	4	2	*	7	1	1	5	1	—	100
Infective/parasitic disorders	14	1	3	12	9	2	*	2	3	2	22	30	1	*	100
Digestive disorders	25	1	20	6	16	3	*	1	9	4	4	11	1	—	100
Circulatory disorders	15	*	9	12	14	2	1	1	2	1	15	24	3	—	100
Accidents and injuries	17	1	20	10	16	3	1	—	3	1	10	15	4	—	100

* Less than 1 percent.

SOURCE: IMS America, National Disease and Therapeutic Index (NDTI), 1976.; presented in Temin (1981)

A second study illustrating very well the *variation* in prescribing of alternative *therapies* is Hemminki (1975). Prescribing behavior of a sample of 72 doctors was studied using the method of behavior simulation. Namely, a set of cases was given to each doctor; for each case the doctor was invited to determine this therapy: A. drugs only; B. combined therapy (both drugs and other forms of therapy); C. no treatment (only observation, control or transfer to other doctors on places of treatment); D. non-drug therapy (measures to improve the patients' condition such as psychotherapy, avoidance of coffee, tobacco, etc.). In addition, a therapy had to be chosen for three different diagnoses. The main results of this study are given in Table 2. The reader can easily inspect for himself that the therapy recommendations are rather varied.

Table 2 : Treatments suggested for cases (A) and three diagnoses (B) - Percentage distribution

	Drugs only	Combined therapy	Nondrug therapy	No therapy	Σ	Number of doctors
A. Psychic group						
Insomnia	33	52	14	1	100	72
Depression	20	43	20	17	100	70
Alcoholism	16	18	18	48	100	71
	23	38	17	22	100	213
Diet group						
Hypertension	22	39	26	13	100	72
Constipation	7	71	22	-	100	72
Increased blood sugar	-	39	60	1	100	72
Gastritis	3	70	27	-	100	71
	8	54	34	4	100	287
Miscallaneous						
Myalgia in neck	4	51	44	1	100	72
Common cold	28	34	17	21	100	71
Chronic bronchitis	4	74	21	1	100	71
	12	53	27	8	100	214
B. Obesity	-	10	90	-	100	71
Distorsio & distensio Dorsi (twisting & distending of back)	-	62	38	-	100	72
Occasional headache	36	33	28	3	100	67

Source: Hemminki (1975, Table 2).

3.2. Why is there so much variability?

3.2.1. Introduction

In this section, a simple framework will be presented that will help us understand why there is so much variation in prescribing among physicians. We will start by assuming that the physician is a *perfect agent* of his patients. In other words we assume that he will attempt to deliver the product *health* to the patient as close as possible to the amount chosen by the patient himself. Furthermore he will be assumed to supply those *quantities of care* that would be demanded by the patient if the latter were endowed with the same knowledge and information as the physician[1]. In the seminal work of Grossman (1972), a formal model for the determination of optimum health and the optimum quantity of medical care is developed. Elements of uncertainty regarding the effectivity of medical care and the accuracy of the doctor's diagnosis were introduced in the Grossman-model later on by Pauly (1980). Although the Grossman-model gives us quite a number of illuminating insights into the economics of demand for health and medical care, no further use of it will be made here. We will rather focus on the physician's *decision process* at the moment of confrontation with a patient's complaints.

After having seen and examined the patient, the physician's decision process merely starts. He first has to make a *diagnosis*. One can define the latter as 'the act of identifying a disease from its signs and symptoms'[2]. In other words, the physician needs to identify the disease which corresponds most to a given set of signs and symptoms. In quite a number of cases, the disease is easy to identify. For instance, in the case of symptoms of sneezing, stuffed nose and/or a light headache, a common cold is readily diagnosed. In other cases, the diagnosis is more difficult, however. For instance, a patient's back pain related to dislodged vertebras or to neuritis. It can certainly

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[1] See Pauly (1980, p.5).

[2] Barnoon and Wolfe (1972, p.11).

not be denied that in quite a number of cases, uncertainty is involved in making a diagnosis. This leads Barnoon and Wolfe (1972, p.13) to state that 'it is almost impossible to be perfectly certain about a medical diagnosis. The symptom-disease relationship is, for the most part, probabilistic'.

In the following sections we will describe the consequences of physicians' decisions, by means of the technique of *decision trees*[1]. First, it will be assumed that the diagnosis is perfectly known. Secondly, we will consider the case of uncertain diagnosis.

3.2.2. On the physician's strategy in the case of perfect diagnosis

In this case, it is assumed that the disease is known with certainty. A strategy remains to be selected then. Let us rule out here, for simplicity's sake, the possibility of referral to specialists or the ordening of diagnostic tests before choosing a therapy. Following Hemminki (1975), four main groups of therapy will be considered: 1. drug therapy alone; 2. combined therapy; 3. nondrug therapy and 4. no treatment. These alternatives are depicted in the decision tree in Figure 1. Let us also suppose that each of the therapies is well defined. For instance, in the case of drug therapy, it will be assumed that the type of drug is identified and that dosis, frequency of the drug intake as well as its length are completely defined. It can now be seen that each of the therapies may lead to three[2] different health outcomes H_{ij} with a particular probability τ_{ij}; note that the indices i and j refer to the therapy group (i=1,...,4) and the possible health outcome (j=1,...,3) respectively. The health outcome H_{ij} may be expressed, for instance, in terms of the degree of a patient's disability: it could vary between 0 (ab-

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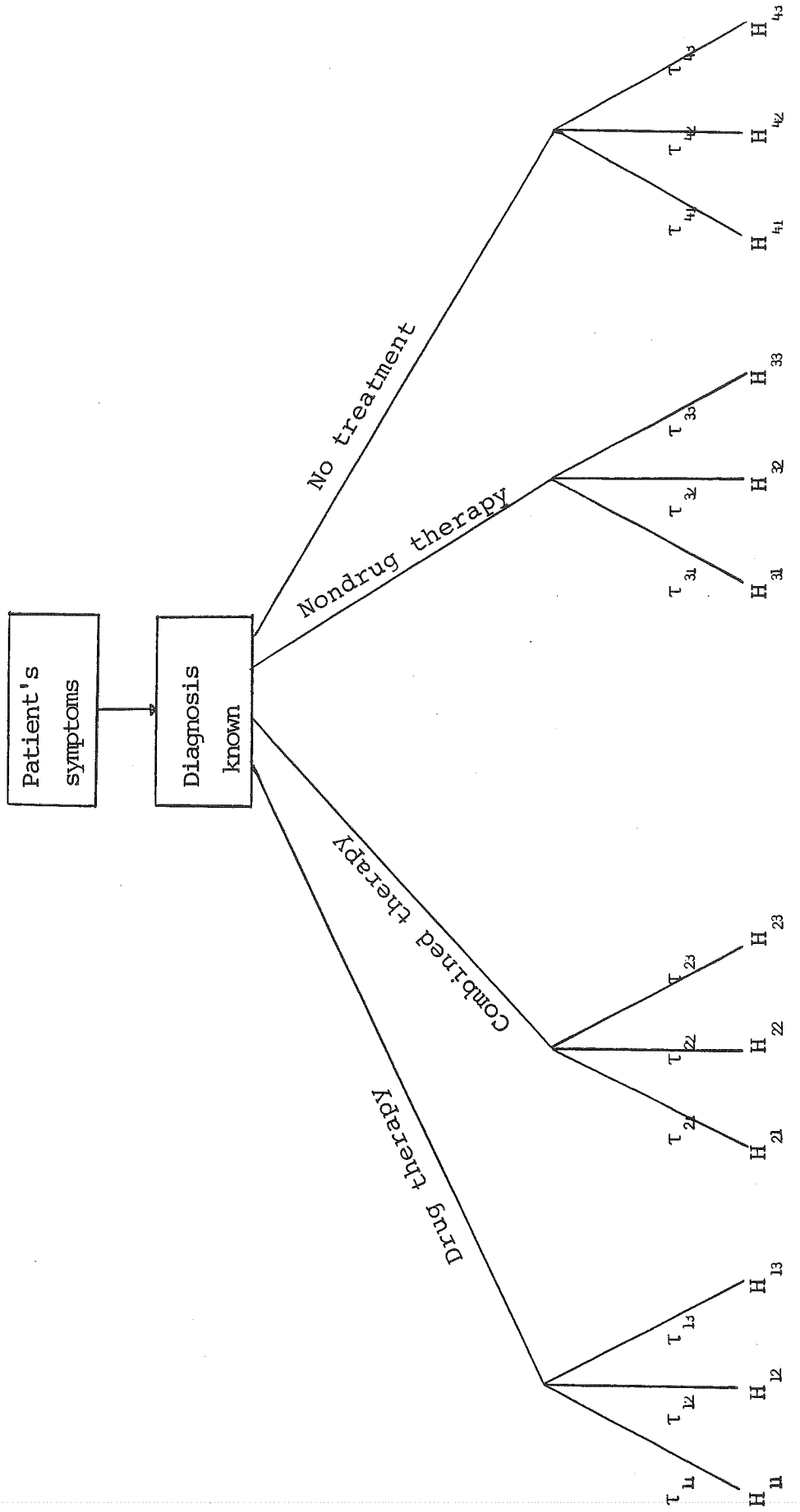
[1] Use will be made of Barnoon and Wolfe (1972, ch.8).

[2] This particular number is only used here by way of example. In reality, each therapy may have a different number of possible outcomes.

Figure 1 : Decision tree for the case of perfect diagnosis



sence of disability, referring to a successful therapy) and 1 (complete disability, implying an ineffective therapy outcome), say. Note that it is possible to incorporate the impact of side effects in this measure: the more harmful the side effects, the more H_{ij} could be made to differ from zero.

The decision tree in Figure 1, as simple as it is, points clearly at a basic uncertainty implied in clinical decisions, viz. the probabilistic nature of health outcomes. Suppose now the doctor wants to maximize the expected health outcome for the patient: he will therefore choose the therapy that will provide the lowest expected degree of disability. A convenient way to measure the relative value of the therapy is to compare its health outcomes with the health outcome from the no-treatment strategy. We will call this relative value the *expected gain from therapy i*, to be computed as follows:

$$EG_i = \sum_{j=1}^{3} \tau_{ij} (EH_4 - H_{ij}) \qquad \forall\ i \quad (1),$$

where EH_4 is the expected health outcome of the no treatment decision, to be computed as $EH_4 = \sum_{j=1}^{3} \tau_{4j} H_{4j}$. As can be seen in (1), EG_i is obtained by summing the weighted differences between the expected health outcome of the no treatment decision and the possible health outcomes of therapy i, the weights being equal to the probabilities with which the possible health outcomes are presumed to occur. The therapy with the highest EG_i will, of course, be the one that secures the lowest expected degree of disability. We have observed now before that doctors display a significant degree of variability in prescribing when all of them are confronted with the same disease. A first reason for this variability that can be inferred from the present analysis is that the physicians may have *different information* about the health outcomes H_{ij} and their associated probabilities τ_{ij}. Indeed, the more information about these elements varies, the greater the likelihood that physicians will select different

strategies for the same disease. In other words, the choice of therapy varies as long as physicians obtain different values for EG_i.

According to us, the unequal stock of knowledge may be mainly explained by differences in education, in clinical experience and in the amount of time that physicians devote to gathering updated information about alternative therapies. We must stress, however, that in quite a number of cases there is simply no adequate information on the health outcomes and their associated probabilities of alternative therapies under controlled circumstances. In other cases, the information may be incomplete or even contradictory. Schwartzman (1976, pp.352-354) reports, for instance, that experts do not agree on the best drugs to use for the treatment of hypertension, schizophrenia and diabetes. It is also implied in the studies by Rucker (1980) and Gillis c.s. (1981) that there is often a variance in expert opinion. It follows that a physician's search for a rational therapy may be further impeded because either the probabilities τ are unknown or because the probabilities τ_{ij} themselves are subject to uncertainty[1].

3.2.3. On the physician's strategy in the case of uncertain diagnosis.

Physicians' decision strategies become still more complicated once one allows for uncertainty in the diagnosis. One notices that in the decision tree in Figure 2, we have assumed, by way of example, two possible diagnoses given a set of patient's symptoms. Again the physician is likely to choose the best health outcome for his patient. He seeks therefore a therapy with the highest expected net gain. In view of the probabilistic character of the diagnosis, formula (1) needs to be adjusted, viz.

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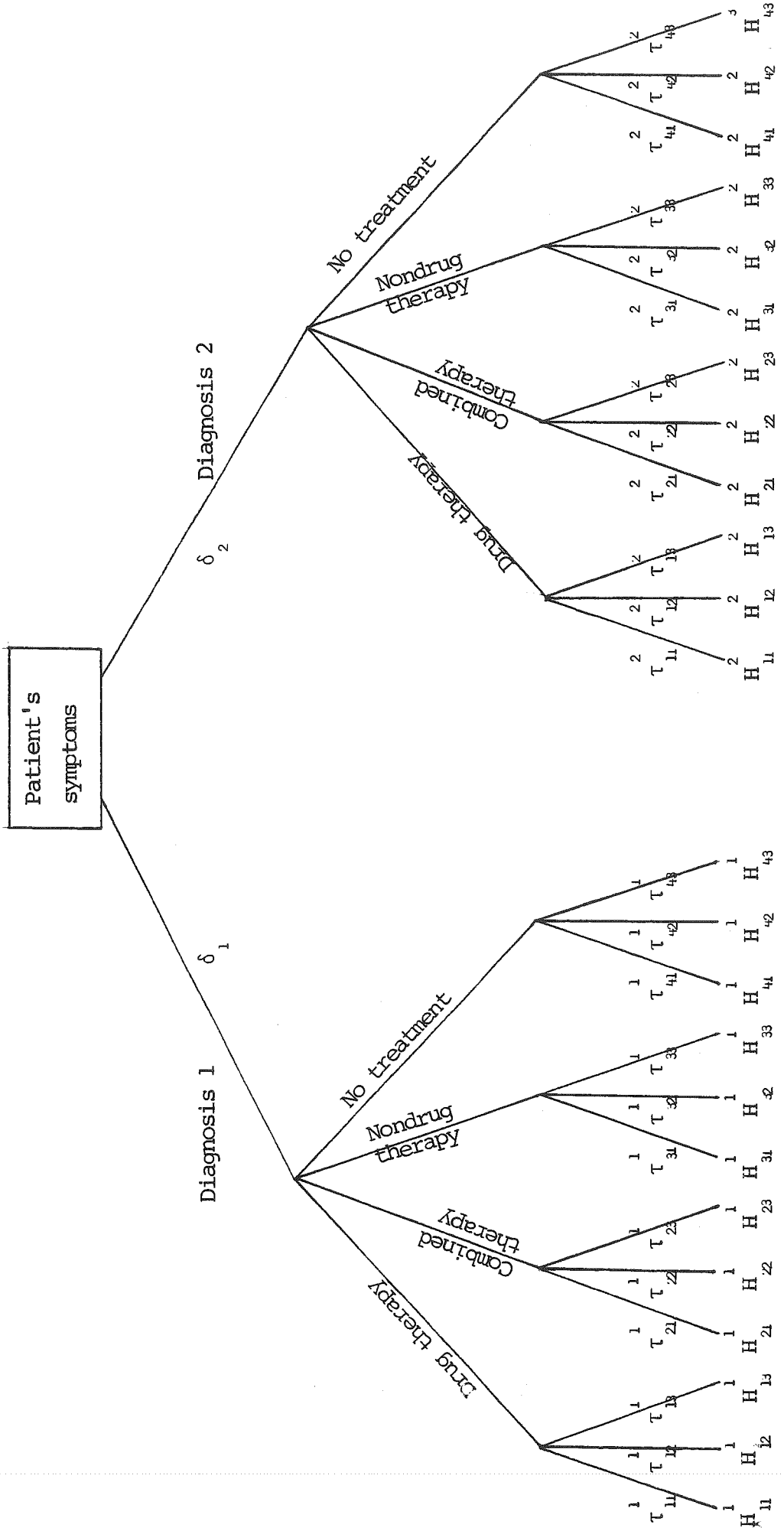
[1] The subject of professional uncertainty is tackled more profoundly by Wennberg c.s. (1982).

Figure 2 : Decision tree for the case of uncertain diagnosis



$$EG_i = \sum_{k=1}^{2} \delta^k \left[\sum_{j=1}^{3} \tau_{ij}^k \left(EH_4^k - H_{ij}^k \right) \right] \qquad \forall\, i \qquad (2),$$

where the superscript k refers to the diagnosis (k=1,2). A further widening of the variability in prescribing is likely to occur as soon as physicians have different information about the probabilities associated with the different diagnoses. As before we can say that differences in education, clinical experience and time reserved for information-gathering activities account, to a large extent, for different perceptions of the probabilities δ^k. The remarks made about professional uncertainty in the previous subsection apply here too, of course.

Note that there is still scope for further refinement of the basic model. One important refinement would be to take account of the fact that the physician's eventual use of diagnostic tests may change his opinion[1] about the diagnoses and their associated probabilities. It follows that differences in physicians' practices of using diagnostic tests will contribute to differences in the perception about the expected net gain of alternative therapies. Another refinement would be to generalize the decision rule by taking account, next to the expected gain, of the variance of the possible gains associated with each therapy[2]. This would enable one to model a decision process whereby the choice among therapies, having different expected gains and variances, depends in part upon the physicians' *attitudes towards risk*. One can expect, for instance, that the more risk averse a physician is, the more his choice will be directed towards therapies with the lowest variances. It is easy to understand then that differences in physicians' risk preferences are likely to widen the differences in prescribing even more.

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[1] In the jargon of the theory of decisions under uncertainty, one would say that diagnostic tests transform prior probabilities into posteriori probabilities; the latter can be studied by means of Bayes' formula, see Barnoon & Wolfe, op.cit., pp.59-62.

[2] In economics, this is referred to as the mean-variance approach. See e.g. Green (1971, ch.14).

3.2.4. On the influence of patient characteristics in prescribing

The physician is not merely confronted with a patient's symptoms, of course. There are also specific patient characteristics which he may want to take account of when prescribing a particular therapy. A first set of characteristics is *age and weight.* It is conceivable that for certain diseases, different ages and/or weights require different therapies. If a drug therapy is required, the type of drug, its dosis, frequency and the length of the period of intake may have to be adjusted to the patient's age and weight. A second characteristic is the *likelihood of adverse reactions* with the patient. It is indeed likely that the physician will attempt to adjust his drug therapy to the patient's sensitivity to drugs. Thirdly, the patient's own *attitudes towards health and, more specifically, towards pain and adverse reactions* may co-determine a physician's prescribing behavior. For instance, it is known that some pain-killers have drowsiness and stomack problems as side effects; people's preferences for these drugs may depend, partly, on the relative weight attached to pain and side effects. These preferences may also be associated with the patient's economic status: for instance, a pensioner may want to depress pain by taking a pain-killer, thereby accepting drowsiness as a side effect. However, an active worker with a demanding job may be willing to bear some pain, refusing to take medication and thereby avoiding the possible drowsiness caused by intake of the painkiller. Another related example is about an active worker with a disease that normally requires a lengthy episode of convalescence at home. This worker may in contrast to a pensioner, say, be willing to pay for drugs that radically attack the disease in order to speed up his return to work, thereby willing to accept some unpleasant side effects.

To summarize, physicians may, firstly, adapt their prescriptions to patient characteristics such as age and sensitivity to adverse reactions. Secondly, if the doctor recognizes that patients may have particular preferences concerning pain, adverse

reactions and the amount of money they are willing to forego for certain therapies, his prescriptions may be modified accordingly. We now posit that the variance in patient characteristics and preferences will explain part of the variability in the prescription of alternative therapies.

3.2.5. A note on the physician-as-a-perfect-agent

We discussed in the previous subsections how variability in prescribing arises. One of the causes of variability mentioned was the difference in the amount of information that physicians have and acquire about alternative therapies. Does this mean that some physicians are less perfect than others in their professional activities? In fact, it boils down to the question what is the expected behavior of the physician about the fine-tuning of this professional knowledge.

Arrow in his seminal article[1] of 1963 discusses the expected behavior of the physician in a more general way. He especially stresses that, because the patient has less information about medical care than the physician, there is an element of *trust* in the relationship between the physician and his patient. He also puts some emphasis on the social duty of the physician by writing[2] that "the ethically understood restrictions on the activities of a physician are much more severe than on those of, say, a barber. His behavior is supposed to be governed by a concern for customer's welfare which would not be expected of a salesman". If physicians' behavior would correspond more or less to that described by Arrow, physicians would surely all tax the collection of information as very important as it would enhance patients' health; differences in the amount of information possessed by physicians would be rather small in that case.

However, since Arrow (1963), various alternative models have been developed, whereby the *ethical conduct* in physicians'

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[1] Arrow (1963).

[2] Arrow (1963, p.949).

behavior is given less prominance. These models help to explain why physicians display different kinds of behavior in reality. Some models include the hypothesis that physicians maximize real income[1] or wish to achieve a certain target income[2]; others contain the hypothesis that physicians may manipulate information in order to gain income[3]. A more recent model whereby money income, physicians' allocation of time as well as ethical conduct[4] determine physician's utility is that of Zweifel (1983). In any event these models clearly depart from the view that the physician is concerned exclusively with patients' welfare.

Assuming now that the physician maximizes his own utility rather that that of the patient may provide additional insight into the issue of variability of prescribing. Suppose indeed that the physician has a utility function featuring the same variables as that in the Zweifel model. We will assume further that acquiring information by the physician will improve his therapeutic decisions, that in turn will improve patients' health status. The amount of time devoted to collecting information can, therefore, be seen as a measure of the physician's ethical conduct. One has to realize now that collecting information requires time and is, hence, an activity that competes with alternative allocations of the physician's time. The alternatives are time used for generating income or for leisure activities. The utility maximizing physician will thus need to compare the value of acquiring information with the value to him of alternative uses of time. It is evident that the more physicians evaluate their alternative uses of time differently, the more their allocation of time towards the collection of information will be different. We now offer the proposition that differences in the uses of time for collecting information are in part the result of differences in the utility physicians derive from ethical behavior. Alternatively, we can say that different allocations of time

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[1] See Pauly (1980, p.49).

[2] See Feldstein (1979, ch.9).

[3] Pauly (1980, pp.51-54 and pp.74-75).

[4] In the Zweifel model, ethical conduct is measured by the reduction of the patient's mortality risk as a result of the physician's treatment of the patient's illness. The inputs used during the treatment are the physician's time and the amount of medical technology, including drugs.

arise because physicians may have a *different perception of their task as perfect agent*. The latter can now be understood also as an *indirect* cause of the variability in prescriptions.

4. Irrational prescribing of drugs

4.1. Introduction[1]

In the previous section, the physician's decision problem was highly simplified, first by restricting the number of alternative therapies and diagnoses and, secondly, by refraining from further specifying the contents of drug therapy. Suppose now that the physician considers a drug therapy to be the most rational therapy. Then his task of selecting an *optimal drug* for his patient merely starts. The choice between broad classes of drugs, for instance between analgesics and antibiotics, may not be that difficult. However, it may be more tedious to discriminate between similar drugs and certainly between different brands or manufacturers of the same drug. As before, one could study this problem by means of a decision tree: each drug could be associated with some probably health outcome. In practice of course this relationship between drugs and health outcomes is likely to very complicated. First of all, we know that the meaning of health outcome may differ from patient to patient. Secondly, drugs have a multitude of characteristics as well: the degree of ability to correct the undesirable condition, the method of administration (oral, parenteral, topical), the dosage required, the speed and durability of action and variations among adverse reactions[2]. It is easily understandable that the reasons for a variance in drug prescription behavior are very similar to the ones given above for explaining the variance in prescribing of therapies in general. Indeed, differences in physicians' information about the impact of dif-

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[1] For a well documented survey on physicians' prescribing habits, see Blum and Kreitman (1981).

[2] See Temin (1983).

ferent drugs on health together with physicians' attention for patient characteristics mainly explain the variance in drug prescriptions. This variance leads a fortiori to prescriptions that are deemed inappropriate or *irrational*. We will attempt to clarify the concept of rational (and hence irrational) prescribing in the following subsection.

4.2. What is (ir)rational prescription behavior?

We know from above that physicians may prescribe different drugs in the case of similar diseases. Sometimes this variance may be justified, for instance when the prescribed drugs are adjusted to patient characteristics. In other cases, insufficient knowledge and information about drugs may lead to prescriptions that are responsible for a deterioration of health: the prescriptions may be ineffective, may be unadapted to patients' age and weight or may cause adverse effects or interactions with other drugs.

Can we require more appropriate or rational prescription behavior from the physician? Of course, the answer depends on what is meant by the word rational. We have learned in the meantime that variation in knowledge and information about diagnoses, effectiveness of alternative therapies and, more specifically, of alternative drugs is one of the causes of variation in prescribing. From the physician's point of view, this variation and the possible concurrent inappropriate prescriptions can not merely be called irrational. Above, in section 3.2.5, we suggested that physicians maximize their own utility function rather than behaving solely in the patients' interests. Let us repeat that this does not mean that the physician would not behave ethically at all. Indeed, ethical conduct can be one of the arguments of the physician's utility function. In any case, it can said that physicians may have a different opinion about their social duty to behave ethically. This implies that they will behave differently with respect to collecting information. The latter is then likely to influence therapeutic

decisions and, hence, patients' health. Does this mean that physicians will admit freely that doctors' performances may be of a different quality? The answer is no. Each doctor is likely to claim that he does the best he can and aims at restoring his patients' health, *given* his current knowledge and information about medicine. In this scenario, therefore, doctors strive for optimal decisions that are only bounded by constraints on knowledge and information. The latter is a simple description of what one may call *physician's rationality*.

It is obvious that in this concept of physician's rationality, the actual state of prescribing behavior, how good or bad it is, is somehow condoned. Let us now introduce two *normative* concepts of rational prescription behavior. First, there is *pharmacological rationality*. The latter would apply to a physician who, for a particular patient with specific characteristics, prescribes a drug with the correct dosis and frequency of intake such that it constitutes a true effective treatment of the patient's diagnosed illness. The physician's rational behavior, as described above, is likely to deviate in practice from a pharmacological rational behavior to the extent that the physician lacks the necessary scientific information about the appropriate drugs. Secondly, we have the concept of *economic rationality*. The choice of a drug for a particular patient is economically rational if that patient's utility if maximized. To understand what is meant here, consider first the following example. Imagine a patient with a (painful) disease that can be treated by two alternative drugs. These are supposed to be equally priced, so that only the benefits of the drugs matter in making a choice. Suppose further that the first drug is more efficient in reducing pain that the second one. However, it also produces more toxic effects that the second one, thereby reducing life expectancy. It may well be that the patient, after being informed of the pros and cons, still opts for the first drug, accepting thereby the risk of shortening his life. Such a choice may be rational from the patient's point of view: he

may prefer a life with a minimum amount of pain to a longer life with more pain. In other words, for this patient the utility of choosing the first drug exceeds the utility derived from the second one, hence the first drug is preferred. A second example is about the choice between two drugs with very similar qualities but different prices; the reader may think here of the choice between a generic and a branded product. Utility maximization dictates in this case that the cheapest drug be chosen. A third example is related to the choice between alternative drugs that have different qualities and different prices. Suppose that a choice needs to be made between two drugs of a different effectiveness: the first drug is more effective than the second one, but it also commands a higher price. The proper decision rule here is to choose the drug with the highest utility per dollar paid by the patient. It may thus be rational for the patient to prefer the second drug in view of a better utility to price-ratio; in other words the additional effectiveness of the first drug insufficiently compensates the price differential with the second drug.

Henceforth, when we speak of irrational prescription behavior, it must be understood that we refer to the two normative concepts of rationality. Thus the more a physician lacks the necessary pharmacological knowledge about drugs and the more the he neglects his patients' preferences, the more he will engage in irrational prescribing.

4.3. Consequences of irrational prescribing

A first type of consequence is the *unnecessary lack of benefit* of a drug therapy. By this we mean to say that inadequate therapy is sometimes prescribed to patients with treatable diseases. We can make a further distinction here between *misuse* and *underuse* of drugs. Misuse of drugs can be associated with an unwise qualitative therapeutic decision; an example is

the prescription of the wrong antibiotic for the treatment of a curable pneumonia. Underuse of drugs means that a particular therapy was withheld from patients or that an inadequate therapy was prescribed. One example of the former is given by Melmon c.s. (1975): they report that of the more than 25 million people in the U.S. that are suffering from hypertension, only 3 million are being effectively treated whereas, according to them, 90 per cent of hypertensives can be treated effectively. Note that it is reported that physicians' fear[1] for the side effects of treatment, is an important cause of underuse of drugs. Symmers (1973) gives the example[2] of five patients who died from a disseminated fungal infection because amphotericin B was withheld from them out of fear for hepatic and renal toxicity. Symmers referred to such physician behavior as *pharmacophobia*. An example of inadequate therapy is the prescription of an antibiotic other than chloramphenicol in the case of typhoid, where it is clearly proven than chloramphenicol is the most effective. Inadequate therapy may also be the result of the choice of drug that has the effect as desired by the physician, but that has no effect on the outcome of the disease. An example given by Melmon c.s. (1975) is the use of oral hypoglycemic agents in the treatment of asymptomatic hyperglycemia (early diabetes). These drugs appear to be commonly prescribed despite available information that the course of diabetes is not modified.

A second type of consequences is loss of benefit due to *drug toxicity* to patients. Melmon c.s. (1975) state that one cannot avoid some toxicity or hypertensitivity, but that a great majority of drug toxicities can be predicted and may be avoided. They cite three main causes of avoidable reactions. First, drugs may be given inappropriately thereby causing toxic reactions. An example is the prescription of antibiotics for irrational and ineffective prophylaxis. Secondly, drugs may be given in inappropriate doses; for example an inappropriate dose of an anticoagulant may cause bleeding. Thirdly, drugs may be pre-

[1] See Weintraub (1983).

[2] Cited in Weintraub (1983, p.358).

scribed too frequently; this seems often to be the case in the prescription of antibiotics in the event of a common cold.

A third type of consequence or cost to patients is the result of *drug overuse* and *drug abuse*, both of which refer to unwise and wrong drug therapies. Drug overuse signifies that the net effect on health is considered to be harmful. Examples are the extended use of tranquillizers by patients whose disease does not call, in normal circumstances, for a prolonged use of these drugs. Drug abuse is drug overuse in its extreme form and is generally regarded upon as drug addiction; an example is the unwarranted use of heroin.

A fourth type of consequence of irrational prescribing is the lack of benefit due to the fact that physicians may take account insufficiently of patients' specific preferences towards the desired health outcome. A fifth type of cost is the waste of the patient's money when the physician neglects to be cost-effective in his choice of drugs.

Lack of loss of benefits may thus be caused by drug toxicity, drug misuse and underuse, drug overuse and abuse, neglect of the patient's preferences and lack of cost-effective behavior. It is evident that these effects are certainly not desired by the physician. Somehow they are the result of his own behavior which, paradoxically, he may judge to be rational. In the next section, we will explain why physicians may engage in prescribing behavior taxed as irrational from the pharmacological and economic point of view.

4.4. The main causes of irrational prescribing

Economic rationality of prescription requires, first of all, that the physician recognizes the patient as a partner in the decision-making about the appropriate drugs. This is an attitude that is usually not cultivated during the physician's training. Secondly, the lack of cost-effective behavior in the patient's favor often arises because the physician has inadequate information of the cost of drugs and the patient's share in those costs. Furthermore, physicians are usually trained insufficiently in making utility-cost comparisons. The idea that some economic thinking is necessary in the practice of medicine is indeed relatively new and still awaits penetration in medical schools and professional organizations.

Turning to pharmacological irrational prescribing, a first explanation may be sought in the inadequate training in pharmacology and/or medical therapeutics. The latter may further lead to some physicians' difficulty in understanding condensed information[1] about drugs in specialized journals. Secondly, a number of physicians lack ready knowledge about the characteristics of currently used drugs. In turn, a principal reason for this lack of knowledge seems to be the *sheer lack of time* on the physicians' part to keep up with drug information : a heavy workload[2] frequently precludes physicians from fine-tuning their knowledge about drugs. In some cases, irrational prescribing may be due to the fact that information on adverse effects, interactions or even the absence of therapeutic benefit was available in principle but was not published yet. The reason is frequently that when physicians observe adverse reactions, say, their findings are usually not transmitted fast enough to specialized publica-

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[1] See Peters (1981, p. 102)

[2] The desired workload depends on the physician's utility function. See the discussion in section 3.2.5.

tions[1]. In other cases, the occurrence of adverse effects or bad interactions may not be the physicians' fault because these effects or interactions may have been observed for the first time. Of course, this often happens after prescribing new drugs. Indeed, not all adverse effects or interactions can be discovered during the clinical trials performed before the licensing of the drug.

A third reason for pharmacological irrational behavior is that doctors frequently underuse the possibility of obtaining knowledge about drugs from their clinical experience. Why would this happen ? An interesting study on prescribing behavior was carried out by Temin (1981, 1983). Table 3 summarizes the main findings based upon data collected by IMS-America from 491 U.S. doctors. It can be seen, for instance, that a number of doctors use quite a number of different drugs. A very interesting finding is also that the estimated average number of new prescriptions of each drug used per doctor is about 12, irrespective of the total number of prescriptions written by these doctors. In that case, it becomes very difficult to evaluate the benefits and risks of one drug relative to benefits and risks associated with other drugs. Indeed, Temin's findings reveal that in general such a variety of drugs is prescribed by the physician, making it a tedious task to acquire sufficient experience with each of the drugs.

Why do physicians not stick to fewer drugs ? Would it not be easier to learn about the relative merits of drugs, by choosing from a basket with a smaller amount of different products ? Temin answers that, in general, it is very difficult for physicians

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[1] In some cases, physicians may hesitate about their own findings and not alert the medical community. In other cases, central agencies to whom doctors report may only publish the information after a sufficient amount of similar information has been obtained.

to learn from their own prescribing. A major obstacle is that, even if a physician would be willing to keep records of patients together with the associated diagnosis and prescribed drugs, it would take him a long time to obtain a sample large enough so as to observe differences in effects of drugs. The latter is then a major explanation why quite a number of physicians are not likely to learn themselves about the characteristics of different drugs. In giving up this attempt to learn about drugs themselves, they are not very selective and do not hesitate to choose from a large amount of different drugs. This behavior is clearly another cause of irrational prescription behavior.

4.5. Towards a more rational prescription behavior

4.5.1. Introduction

Which is the type of rationality physicians would have to aim at ? It seems safe to say that a physician who possesses and uses an adequate amount of pharmacological knowledge for prescribing, while at the same time respecting patient's preferences, is displaying a good behavior from *patients' welfare* point of view. On the one hand, the more pharmacological the physician uses, the more effective and appropriate will be his drug prescribing, enhancing patients' health and welfare. On the other hand, patients' welfare or utility level will also be enhanced if doctors respect patients' preferences and if they display a cost-effective prescribing behavior. We will argue next that improving the information about drugs for both the physician and the patient is essential if we aim at a physician's behavior that has due regard for both the pharmacological and economic rationality.

TABLE 3

AVERAGE NUMBER OF DRUG PRODUCTS USED AND NEW PRESCRIPTIONS WRITTEN PER DOCTOR, (JULY 1975 THROUGH JUNE 1976)

Number of Drug Products Used	*Percentage of Doctors Using This Number of Drug Products* (1)	*Average Number of New Prescriptions per Doctor* (2)	*Average Number of New Prescriptions of Each Drug Product per Doctor* (3)	*Possible Range of Average in Column (3)* (4)
1–50	0.8	305	8	—
51–100	5.7	832	10	8–16
101–150	20.4	1,500	12	10–15
151–200	23.0	1,664	10	8–11
201–250	16.1	2,240	10	9–11
251–300	14.1	3,226	12	11–13
301–350	8.4	3,692	11	11–12
351–400	6.3	5,299	14	13–15
401–500	3.9	5,924	13	12–15
501+	1.4	11,095	20	—

Source: IMS America, presented in Temin (1981,p.175)

4.5.2. Minimum drug information for the physician

If the doctor selects a drug therapy against a patient's disease, he will have to choose among a significant number of pharmaceutical products. Ideally he will need suitable information about the drugs he is going to prescribe. According to Peters (1981, pp. 94 - 95), the minimum amount of information should consist of[1] :

"1. the pharmacological effects and, if relevant, the mechanisms of action of the drug;
2. its absorption, distribution, metabolism and excretion;
3. the usefulness of the drug against the condition to be treated or the symptom to be eliminated;

[1] The need for basic information about drugs in order to obtain a rational drug therapy is also stressed, for instance, by Philp (1970) and Smith (1972).

4. the established merit of the drug as compared to that of other drugs used for the same purpose and to that of other therapeutic procedures;
5. the contraindications of the drug;
6. possible dangers of the drug under particular physiological or pathological conditions;
7. adverse effects on organ systems; and
8. the known clinically relevant drug interactions.

Furthermore, the prescriber must be informed on :

9. the range of useful and tolerated doses for his patient, the usual doing interval, the average duration of treatment; and

10. changes of the usual dose required by particular conditions, such as impairment of renal or biliary excretion or of metabolism etc.;

11. in the interest of his patient and of the community, physicians should also be informed on the cost of the use of drugs.

Since all drugs may, occasionally, be taken in doses other than those prescribed, either inadvertently or with suicidal intent, prescribers should be familiar with :

12. the symptoms of poisoning by overdoses and the treatment of such poisoning."

It is easily understood that acquiring this drug information is certainly not costless. Indeed, a drug is not a *search good* in the sense of Nelson (1970) : this concept refers to a good whose quality can be assessed rather easily by the consumer; a typical example of such a good is fresh food. A drug has rather the characteristics of an *experience good*, whereby it takes some time

to appraise its quality. A first way to collect information is by receiving the visit of drug company representatives and/or independent advisors. A second way of obtaining information about drugs' qualities is by means of studying or reading printed information: the latter includes drug information in medical and pharmacological journals and references on drugs sponsored either by independent organizations[1] or by industry[2]. A third way of learning about drugs is by participating in continuing education programs. Fourthly, information may also be obtained by means of communication with colleagues. Fifthly, the physicians may learn about drugs themselves by monitoring positive and negative effects of drugs in their patients[3].

All of these information-gathering activities command a price in terms of lost opportunities: either leisure or money will have to be foregone if the doctor informs himself. By decreasing the opportunity cost of information activities, doctors are likely to be stimulated to increase the quantity of time devoted to acquiring information. Firstly, visits by drug company representatives or independent advisors may play a role in the physician's endeavor to inform himself. The study by Peay and Peay (1984, p.1022) reveals, for instance, that for a sample of 124 doctors in private practice in Australia, the drug company representative was the most frequently cited source of *first* information about drugs. The latter is also one of the findings in the study by Coleman c.s. (1966). Presumably, one of the reasons for the apparent importance of representatives as a first source of information is the relatively low cost involved for the physician; a visit is indeed likely to supply the physician with a minimum amount of first information about drugs in a relatively short time, and is therefore fairly cost-efficient. We should not exaggerate the importance of this type of information for the act of prescribing, however. For instance, the same study by Peay and Peay shows that other

[1] Examples are the American Medical Association's Drug Evaluation and Medical Letter and the Food and Drug Administration's Drug Bulletin.
[2] Examples include the Physician Desk Reference and the Merck Manual in the U.S.
[3] See also Rucker (1976).

sources of information (Journals, postgraduate education, formularies and colleagues) are judged to be more useful than information by drug company representatives[1]. These other sources of information are discussed next. Secondly, *drug formularies* that contain independent and scientific information and that survey meticulously the international literature on drugs are apt to save doctors a considerable amount of time. Its use should therefore be encouraged. Drug information could also be provided by means of a computerized information system. For instance a terminal in the doctor's office could be linked with a central operating system from which any information on drugs could be retrieved. It is sometimes not clear who should be responsible for the production and distribution of drug information. A first possibility is assigning this task to the government in view of the information's importance for public health. However, note that since physicians are likely to recognize the benefits of drug information, they may be willing to pay spontaneously to secure its availability. Therefore, the production of a drug information system by an independent organization or even by a private firm may well be feasible because it may be sustained by the physicians' willingness to pay.

Thirdly, encouraging the attendance of continuing education programs is another way to upgrade the stock of knowledge of the physician. Fourthly, information may also be obtained by stimulating communication with colleagues. It is conceivable that the cost of this particular way of information can be brought to a minimum in group practices, in which communication between health personnel is somehow institutionalized. Fifthly, the physician may learn about drugs himself by monitoring positive and negative aspects of drugs in their patients. It has to be recognized that this may be a worthwhile though costly endeavour since the physician's time input (or that of his assistant) may be considerable. The design of appropriate tax incentives to encourage this monitoring may be warranted in this case.

[1] See Peay and Peay (1984, p.1023).

4.5.3. Minimum drug information for the patient

It is true that quite a number of patients have no special need for information about the drugs they are advised to take. This may be because they trust the physician completely and consider him as a perfect agent. Another reason for declining information may be that the information cost for the patient is too high relative to what he may gain from this information. Other patients desire information about drugs, however. They may argue that it is generally the patient's own decision to use a prescribed drug or not, and that before effectively taking it they need to know what are the drug's main benefits, its adverse effects or adverse interactions with other drugs. This demand for information is usually accompanied by an overall desire to have a say in the choice of an appropriate drug. Indeed, the more information the patient has, the more likely he will be able to communicate his preference for alternative drug therapies to the physician. In other words, by having a minimum of drug information the patient becomes, to a certain extent, the physician's partner in making rational drug choices. There is the additional advantage that, as a result of better information, the degree of patients' non-compliance with drug therapies is likely to decrease. The latter is confirmed by the study of George, Waters and Nicholas (1983, p.1195): patients who received penicillin prescriptions were more likely to comply with the prescribed doses if they had received a prescription information leaflet on penicillin.

A recent study[1] by CBS (1984) shows that many people are indeed interested in obtaining information about prescription drugs. This is illustrated by the following main findings. First, it appears that 14 million prescription-using households own a Physicians' Desk Reference (PDR) whereas over 27 million of prescription-using households consult the PDR to obtain

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[1] The results of the study are based upon in-home interviews with 1233 consumers with prior prescription drug experience. The results of this sample are projectable to 77.4 million U.S. households with prior prescription drug experience.

information about drugs. Secondly, current knowledge about prescription drugs is judged to be insufficient: three quarters of households want to have more information about prescription drugs. In particular, more information about safety and efficacy and the proper home use of prescription drugs is needed. Thirdly, the largest gaps in current knowledge are found in topics concerning the limitations, the content and ingredients, comparisons, liability of manufacturers and advertisers. Fourthly, there is a high level of concern about prescription drug issues in the U.S. More than two-thirds of all housekeepers claim that they are very much concerned about drug costs, drug dependency, the intake of unneeded drugs and the fact that drugs are sometimes prescribed too readily.

How can the desire for more information be satisfied? Prior to the actual drug selection, there are two main ways of obtaining drug information. First, patients could make use of *patient's drug formularies* that convey in an accessible language a minimum amount of drug information to the patient. Note that the production of such a drug formulary is not necessarily the government's task. As long as there is a willingness to pay for drug information in this form, the production of these formularies by non-profit or commercial organizations may be quite feasible. A second source of information for the patient is the *physician* himself. Note that it was found in the study by CBS (1984) that people considered the physician to be among the most useful sources of information about drugs. Because of an apparent feeling of trust of patients towards physicians, the transfer of oral as well as printed information from the latter to the former can be very effective indeed; this information should at least be related to the purpose of a particular prescription and the effects to be expected from taking the drug[1]. In general one might expect that, in the long run, physicians stand to gain from this transfer of information to their patients. Patients will come to recognize in that case

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[1] See Peters (1981, p.115).

that the *quality* of physicians' services is enchanced. Cet. par., this quality increase will tend to augment the demand for health services by physicians that transfer information. This higher demand generally entails a higher monetary benefit; hence, signaling this monetary benefit to physicians could be one of the ways to incite them to increase the flow of information to their patients.

The patient can thus make use of the drug information, coming either from a drug formulary or from the prescribing physician himself, in steering the prescribing physician towards a choice of drug that best matches his own preferences. The next source of information could be the dispensing pharmacist. It was also reported in the CBS study that the *pharmacist* was considered by patients to be a very useful source of information. One could also delegate the task to the pharmacist to help make a cost-effective drug choice. In other words, one might ask him to substitute the prescribed drug for a cheaper alternative, provided that the latter has the same characteristics as the prescribed drug of course. This would certainly make the drug choice more economically rational: indeed a cost-effective choice guarantees that the utility (derived from the intake of a drug) per dollar is maximized, hence enhancing a patient's overall utility level. A subsequent source of information, once the patient has taken the dispensed drug home, is the *patient package insert* (PPI). It is recommended by Hermann, Herxheimer and Lionel (1978) that this insert should tell the patient in clear language how the drug has to be taken (e.g. amount, manner and timing of doses), how it has to be stored (e.g. information about the proper storage and how to recognize that a medicine becomes subpotent), how the drug is expected to help (e.g. disease or symptoms to be affected, potential consequence of non-compliance, how to recognize the desired effect and to act upon its absence) and how to recognize problems caused by the drug (e.g., how to recognize unwanted effects and how to act if they occur, how to act if overdosage occurs)[1]. We know that some

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[1]Based upon Hermann, Herxheimer and Lionel (1978, p.1133).

essential information about drugs should already have been given by the physician. It follows that the PPI can, in a first instance, be seen as a reminder of information. More importantly, however, is its role of giving more *detailed* though clear information about the drug and its appropriate doses, its purpose, its storage and possible problems. Another advantage of the PPI is derived from the fact that, for a number of patients, it may be the sole source of drug information.

5. Controversial issues in drug prescribing: a brief discussion

5.1. The role of advertising

A rather controversial issue is the role of advertising in medical journals or in mail circulars. Does advertising worsen appropriate prescribing or not? The answer is not straightforward, given that advertising has advantages as well as disadvantages. A first advantage is that doctors save on search time because they get to know the products available on the drug market together with the identity[1] of the sellers of those products[2]. This information by way of advertising may be of such value to some physicians that they prefer journals with rather than without advertising. Secondly, advertising and promotional expenditures in general facilitate new drugs to enter the market. Note that Leffler (1981) presents empirical results that demonstrate that entry of therapeutically important new drugs is enhanced by product promotion. Peltzman (1975) also welcomes promotional expenditures when they contribute to diffusing innovative drugs. Thirdly, advertising of drugs and their prices may increase price competition. The latter may contribute to widening the price differentials between competing products and may, hence enable

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[1] The identity of sellers is not unumportant to the physician, see section 5.2.

[2] See Stigler (1961) on advertising and information.

patients to save on drug costs[1]. However, it may be remarked at once that if price competition causes a downward pressure on price levels, quality may be forced to deteriorate as well. There is clearly some debate in the literature as to the effect of price competition on quality erosion[2]. We may say, however, that in the case of drugs it is dangerous for a pharmaceutical company to let the quality of drugs slide away if there is competitive pressure on prices. Sooner or later, quality erosion will be noticed by physicians and patients entailing a loss of credibility for such a company. In fact, pharmaceutical companies tend to obtain a higher return on investment in advertising the higher is the quality of their products. Schwartzman (1976, p.185) argues correctly that 'the better the experience of their patients has been with the drug, and the more favorable the information about it from colleagues and other sources, the more favourably doctors will respond to an advertisement and the more often they prescribe the drug'.

Among the disadvantages, we first mention the fact that advertising provides doctors with partial rather than complete report about the different drugs in therapeutic markets. Indeed, it is understandable that a pharmaceutical company will only stress the advantages of its own products. The doctor therefore awaits the task to make further inquiries about competing drugs that are alledgedly equal in therapeutic value. Secondly, it is possible that in advertisements, adverse reactions of drugs are downplayed or that certain claims are not true. However, we reiterate that such a practice is generally not to a pharmaceutical company's advantage. As Schwartzman (1976, p.185) says 'companies will find that false claims persistently made over a period will not increase sales ...'.

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[1] See Cady (1976) on restrictions of drug price advertising. For a general survey on the effect of advertising on competition, see Comanor and Wilson (1979).

[2] See e.g. Kwoka (1984).

It seems to us that curbing drug advertisements is, on the whole, not necessarily a wise decision. Indeed there is the likelihood that price competition in the pharmaceutical industry decreases which is generally unfavorable to patient-consumers. Less advertising is also likely to delay the introduction of new drug products. Less advertising will also increase information costs to doctors. Of course, one may retort that advertising may be biased and have a negative effect on good prescribing behavior. But then, advertising should not be considered to be the information source of last resort. For the physician, advertising is only *one* source of information to be complemented by more scientific information sources. Note also that the idea that the public would gain from curbing or even abolishing drug advertisements does not seem to be supported by published evidence. Smith reports that 'while the logic of rethoric is often persuasive, there is little hard evidence that journal advertising alone has affected the quality of prescribing'[1]. It is also interesting to note, however, that despite some strong theoretical arguments in favor of advertising 'there is no (or little) evidence that such advertising has had any positive effect on that prescribing'[2].

5.2. The role of brand names

The use of brand names in advertising is particularly important in conveying some information about the quality of a drug produced by a particular pharmaceutical company. In fact, a brand name product has more attributes than initially thought. Indeed, apart from the therapeutic value of a branded product, the general *reputation* of the firm producing it is also an attribute. That is to say that a physician may also put a value on a company's innovative power or its capability of producing high quality drugs, resulting in favoring that company's drugs. As Telser (1981, p.197) argues the demand for a drug turns out to be

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[1] See Smith (1983, p.274).

[2] Ibid., p.274.

'a demand for a joint product consisting of the given drug itself and all of other services, including research and promotion, furnished by the pharmaceutical company'.

This attribute or reputation may also lead doctors to prefer certain drugs offered by specific companies over cheaper versions produced by less reputed companies. This physician's behavior is certainly not irrational. Branded products are associated with the reputation or the stock of knowledge of a firm and therefore, contain, implicitly, *information* about the drugs' expected qualities. Brand names may therefore be favored by the doctor to the extent that they decrease his cost of acquiring information.

As Stigler (1961, p.224) writes 'reputation is a word which denotes the persistence of quality, and reputation commands a price ... because it economizes on search'. It is thus difficult to blame the doctor for relying on reputation in his prescribing strategy. Should one do so, one assumes incorrectly that the doctor can make use rather readily and costlessly of a large amount of drug information, permitting him to tax in an objective way the quality of drugs.

The above does not mean that recommending an increased use of generic drugs, for cost-containment purposes, would be futile. There is only the implied warning that such recommendation is not likely to fully succeed, if one cannot convince physicians that the quality of generic drugs is equivalent to that of their branded counterparts that are often produced by reputed firms.

5.3. The role of product variety

Would patient's welfare be enhanced by more or less product variety? Before answering this question, it must be said first that pharmaceutical companies have an interest in making their drugs as distinct as possible. Indeed, they try to make their product as less substitutable as possible, thereby trying to shield their products from price competition. In other words

they aim at increasing or, at least, stable market shares. Drugs can be made *distinct* in a number of ways: minor changes may be applied to the chemical formula, a combination product may be produced or new dosage forms (e.g. substitution of capsules for tablets and of inhalants for liquids) may be offered[1]. This behavior of seeking distinctiveness in drugs is beneficial to patients' welfare if the variation in products caters to patients' needs and preferences. It may happen, for instance, that new dosage forms satisfy a certain cohort of patients better than before. Minor modifications in the molecular composition of a drug may also be therapeutically important to certain patients. Hence, a preliminary conclusion is that as long as variety of drugs corresponds to a variety in patient characteristics, a case can be made in favor of product variety.

The appearance of *new* drugs on the market may thus improve patients' welfare if they have therapeutic characteristics that other drugs do not have. Fuchs (1974, p.118) stresses that 'the availability of an efficacious drug for a particular condition is not a sufficient reason to bar a less efficacious alternative from the market'. He gives the example of an existing drug that is effective 50 % of the time, without effect 40 % cf the time and harmful 10 % of the time. Suppose there is a new drug in the same category that is effective 30 % of the time and harmful 20 % of the time. Some may argue that the appearance of the latter drug is superfluous because it seems to be less effective than the existing drug. However, such an argument is not necessarily in the patients' interest because the new drug may be effective in cases where the existing drug is not!

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[1] See Fuchs (1974, p.110).

Let us repeat that variety is desirable as long as drugs are not very good substitutes. However, one has to pay attention now to the fact that variety may also be costly to patients if *economics of scale* are present in the production of drugs. In the latter case, there may be important cost savings by producing a limited number of drugs. When attempting to pin down an *optimal variety*, two considerations seems to be important[1]. First, the variety of drugs enhances patients' welfare if it contributes to meeting the variety of patients' needs. Secondly, economies of scale in drug production may make variety of drugs rather costly. The optimal variety is likely to differ between therapeutic categories that may each be characterized by a different substitutability of drugs and/or a different magnitude of economies of scale. One technique which can possibly help to make an optimal decision is cost-benefit analysis; however, mainly the fairly considerable problems in quantifying the monetary value of therapeutic benefits associated with different degrees of variety have yet precluded the practical use of this technique in this matter.

6. Conclusions

We have first indicated that variability in prescription behavior is mainly due to different amounts of information about diagnoses and alternative therapies and to the variance in patient characteristics. Variability in drug prescriptions is observed for the same reasons. Variability is also said to imply irrational drug prescribing affecting people's health adversely.

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[1] We use Meade (1974).

A rational prescription behavior was then defined as one whereby the physician takes account sufficiently of pharmacological information about drugs as well as of patients' own preferences regarding drugs, and whereby the physician has an eye for the cost-effectiveness of drugs. Giving the physician easy access to drug information by way of drug formularies, continuing education programs about drugs, transfer of information between colleagues and developing own clinical experience with drugs were sees as major ways for the doctor to improve his prescribing. Drug prescribing can also be improved by making patients more knowledgeable about drugs. Drug information supplied by the physician himself and by drug formularies for patients will tend to give patients a say in the choice of drugs, enhancing patients' welfare. In addition, information from the pharmacist or from patient package inserts will improve patients' well-being.

Some attention was paid in this paper to three controversial issues in drug prescribing. The main conclusions from this discussion are the following. First, although advertising may sometimes be biased, it is a potential source of information to the physician. It is argued that abolishing advertising would probably do more harm than good. Secondly, branded products have a competitive edge over generic drugs in the sense that they frequently convey a message of reputation (of the producing firms) to the physician. Because this reputation gives prior information about the branded products' qualities, physicians may tend to downgrade generic drugs. Improving the quality-appeal of generic drugs will be necessary if a generic drug-policy, for cost-containment purposes say, is to be effective. Thirdly, one the one hand product variety enhances patients' welfare when it corresponds to a variety of patient characteristics and preferences. On the other hand product variety is costly as soon as economies of scale in drug production become significant. Considerably study is still needed before one can determine the optimal product variety in each therapeutic drug category.

Appendix

Table A - 1

Expenditures on Pharmaceuticals (Prescribed and Over the Counter) as a percentage of Total Health-Care Expenditures, 1975

Country	Percentage of Total Health-Care Expenditures
France	21.0
Italy	20.0
West-Germany	17.9
Netherlands	14.3
Australia	13.3
United Kingdom	12.7
Canada	10.4
Sweden	9.0
Switzerland	8.5
United States	8.3

Source : Maxwell (1981, p. 78)

Table A - 2

Average number of drugs per capita and per year and
Growth rates of average number od drugs per capita

Country	Average number of drugs per capita 1977	Growth rate of average number of drugs per capita	
		%	Period
France	24.1	4.66	1972 - 1981
Italy	21.5	7.20	1962 - 1977
West-Germany	11.0	5.78	1968 - 1975
Netherlands	4.5	4.16	1963 - 1970
Australia	6.5	3.97	1960 - 1981
United Kingdom	6.5	1.77	1960 - 1980
Canada	n.a.	n.a.	n.a.
Sweden	5.6	2.38	1960 - 1979
Switzerland	n.a.	n.a.	n.a.
United States	4.3	- 0.74	1965 - 1977

[1] Source : OECD (1983, p. 83). The values for West-Germany and the Netherlands pertain to 1973 and 1974, respectively.

[2] The computations were made using the data in OECD (1983, pp. 82 - 83); for West-Germany, the data in Abel Smith & Grandjeat (1979, p. 23) were used. Note that an exponential trend growth rate was calculated, using the observations at the beginning and the end of the period mentioned.

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