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THE RISK EPIDEMIC IN MEDICAL JOURNALS

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Abstract—Searches in *MEDLINE* databases show a rapid increase in the number of articles with the term 'risk(s)' in the title and/or abstract in the period from 1967 to 1991. This trend is found in medical journals giving a general coverage of medicine and journals covering obstetrics and gynaecology in U.S.A., Britain and Scandinavia. The most rapid increase is, however, found in epidemiological journals. Comparisons of the developments in the occurrence of such terms as risk, hazard, danger and uncertainty show that the increasing frequency of the term risk in the medical literature can not be explained as a change in terminology alone. It is hypothesized that the ongoing trend, which resembles an epidemic, is a result of developments in science and technology, that has changed our beliefs about the locus of control from factors outside human control to factors inside our control. The origins of the epidemic may be traced to the development of such disciplines as probability statistics, increased focus on risk management and health promotion, with recent developments in computer technology as the factor responsible for the escalation seen in the past decade. With the cultural selection of risks in mind, the social construction of risk is discussed. Potentially harmful effects of such an epidemic are discussed, exemplified through controversies over current epidemiological risk construction and strategies for coronary risk reduction. It is finally argued that the risk epidemic reflects the social constructions of a particular culture at a particular time in history.

Key words—risk, epistemology, epidemiology, health promotion, risk management

INTRODUCTION

In present thinking the concept of risk has, as Hayes [1] has noted, become prominent in our thoughts about health and health care. This point is further underlined by The British Medical Association's statement [2] that "risk . . . . touches upon every single aspect of health and human welfare".

The medical profession has an important position in giving meaning to their own and the public's concept of risk and risk factors. This makes the study of the risk concept in medical literature interesting. One of the most striking features about present day conceptions of risk and the behaviour related to these conceptions, is a paradox or rather a set of paradoxes. The lack of coherence between the estimated magnitude of different risks and the subjective perception and acceptance of these risks, is one example of this paradox. This paradox has been illustrated through numerous papers on risk communication and risk perception [3].

A related phenomena is found in both prophylactic and curative health care. In prophylactic health care this is shown by the fact that the life expectancy at birth at present is higher in Europe and North America than ever before and among the highest in the world [4]. Despite this there has never been so many people occupied with identifying and fighting risks to our health as at present. One consequence of this is that we today are regularly informed about "The Menace of Daily Life" [5] through numerous epidemiological studies.

In curative medicine we have never before had a safer and better medical technology. On the other hand, there has never been a larger emphasis on the hazards of malpractice than today [6]. The vast resources applied to further reductions of the risks of iatrogenic diseases, may be seen as a symptom of this risk paradox. In curative medicine increased use of monitoring devices, introduction of risk management, systematic surveillance of perioperative complications and development of medical device simulators are among the risk reducing remedies presently applied in western countries.

The cost-effectiveness of measures aimed at reducing already minute risks is not altogether verified through scientific investigations. In anaesthesia, for instance, there has been controversy over the amount and type of patient monitoring needed to provide acceptable patient safety [7, 8]. One strategy adopted to resolve such controversies has been the development of standards for patient monitoring [9, 10]. The outcome of this strategy has been questioned [11], as anaesthesia related deaths were few prior to the introduction of practice standards. As a consequence it is difficult to get sufficient statistical evidence of an improved patient safety related to monitoring. A further methodological difficulty has been the lack of control with other factors that may influence the outcome.

Another medical technology wherein we have seen the same symptoms is obstetrics, where substantial practice variations are found between such countries as U.S.A., The Netherlands and Norway [12]. With

regard to what is seen as a safe practice in perinatal care, U.S.A. has adopted a 'worst case-strategy' (all patients treated as high risk patients) whilst The Netherlands are at the opposite end of the risk pendulum, with midwife assisted home-births as the rule. Norway has adopted a strategy somewhere in between these two extremes.

There seems therefore to be other, more subjective factors behind resource allocation in both prophylactic and curative medicine. As such these examples correspond well with Douglas and Wildavsky's [13] statements regarding cultural selection as to which risks are attended to and how they are handled.

To study and understand the mechanisms behind these developments should be a challenge for social scientists. This paper presents the first results of a series of studies aimed at taking up this challenge regarding the social construction of risk in health and health care.

The purpose of this article is to describe some recent trends in the occurrence of the term risk in the medical literature, which resembles an epidemic, and to suggest some hypotheses regarding the causes of these trends. Furthermore, some possible implications of 'the risk epidemic' are discussed.

METHODS AND MATERIALS

The data presented in this paper are based on searches in the *MEDLINE* databases, covering the 25 year period between 1967–1991.

The first set of searches was performed to identify articles containing 'risk(s)' in the title and/or abstract. [To avoid a constant repetition of "articles containing 'risk(s)' in the title and/or abstract", these articles will be referred to as 'risk-articles'.] To be able to find the percentage of 'risk-articles', searches were also performed for the total number of articles published in the selected journals. For this part of the study all *MEDLINE* databases and seven journals with a general coverage of medicine were chosen. The former was chosen to find the overall trend in *MEDLINE*. The 'generalist' journals were selected from the U.S.A. (*The New England Journal of Medicine*, *The Journal of The American Medical Association*), Britain [*The British Medical Journal* (*BMJ*), *The Lancet*] and Scandinavia (*The Journal of The Norwegian Medical Association*, *The Journal of The Swedish Medical Association*, *The Journal of The Danish Medical Association*).

The American and British journals were selected because they are read throughout the world and are considered among the most reliable and prestigious journals, thus being among the most influential medical journals [14]. The Scandinavian journals were selected to see if the trends found in the internationally most renowned journals also were found in Scandinavia.

According to Mary Douglas [15] the meaning of the word risk has changed throughout history. This made it relevant to ask whether such changes also may have taken place during the 25 year period studied. Risk is a word with several meanings, as gamble, hazard, danger, probability, uncertainty, and odds ratio may all be used as synonyms for risk. The results of the first set of *MEDLINE* searches could therefore, to some extent, be due to a change in terminology, as the same topics may have been covered under one of the synonyms in the sixties, seventies and early eighties. To find an answer to this question a second set of *MEDLINE* searches was performed for the terms 'hazard(s)', 'danger(s)' and 'uncertainty(ies)'. Unlike the on-line search for the word risk(s), searches for these words were restricted to all *MEDLINE* databases and *The British Medical Journal*, *The Lancet* and *The New England Journal of Medicine*.

Thirdly, another set of searches for 'risk-articles' and the total number of articles was performed for a set of more specialized medical journals. This search was done to see if the results found in the 'generalist journals' could be reproduced in journals covering medical specialities anticipated to be 'risk prone' specialities. Would the identified development be even more profound in these journals?

The selected specialities were anaesthesiology (*Anesthesiology*, *Anaesthesia*, *Acta Anaesthesiologica Scandinavica*), obstetrics and gynaecology (*Obstetrics and Gynecology*, *American Journal of Obstetrics and Gynecology*, *British Journal of Obstetrics and Gynaecology*, *Acta Obstetricia et Gynecologica Scandinavica*) as well as epidemiology (*American Journal of Epidemiology*, *International Journal of Epidemiology*).

Following the thesis that we choose the risks we concentrate on [13], a separate analysis was performed on the basis of the titles and abstracts of the 325 'risk-articles' published in *The Journal of the Norwegian Medical Association*. This analysis was done to see if there was any difference in the frequency of articles concerning risks that are introduced in health care and risks which have their origin outside health care.

The Norwegian articles were sorted into two categories:

(1) *Iatrogenic illnesses/diseases*, i.e. illnesses/diseases which originate from the health care system. This category was divided into four sub-categories: side-effects of drugs; perioperative complications; postoperative complications; and other iatrogenic illnesses/diseases. The sub-categories were chosen according to the category of medical procedure seen as causing the iatrogenic illness/disease. As such the sub-categories could have been subject to even further categorization, but this was not seen as necessary to fullfill the purpose of this study.

(2) *Illnesses/diseases without any known iatrogenic origin*. This category was also divided

into four sub-categories: cancer; coronary heart disease (CHD); HIV/AIDS; and other illnesses/diseases. The sub-categories here were well accepted categories of medical diagnoses. Again further sub-categorization might have been possible, but the chosen categorization proved sufficient for the purpose of this study.

The categorization was done in accordance with the perspective of the authors of the involved articles. This was done for practical purposes and does not take into consideration any possible controversies over classification, as may be the case for some preventive interventions like screening etc.

As this analysis was performed manually it was restricted to *The Journal of The Norwegian Medical Association*, which had the lowest actual frequency of 'risk-articles'. Another reason for choosing these articles was that they will be included in a follow-up study, where the use of the term 'risk' will be subject to a more thorough analysis.

RESULTS

The word risk has rapidly gained frequency in medical journals over the past three decades. As shown in Fig. 1 the same increasing trend has appeared in all the generalist journals, perhaps with the exception of *The Lancet*, which seemed to have reached a plateau. The results are given in per cent of the total number of articles published in each journal. There is therefore more to this increase than a mere reflection of the overall increase in the total number of articles published.

Representing 0.1% of the articles registered in *MEDLINE* in 1967, there has been a steady increase of 'risk-articles', reaching up to 5% of the articles published in 1991. The increase has been even more rapid in the 'generalist journals' studied here, where the 10–12% level was reached in 1991, again with the exception of *The Lancet* (6.5%). Another striking feature was the escallation of this trend. More than 50% of the 'risk-articles' were published in the last five years. The number of articles registered in *MEDLINE* in the same period sums up to 27% of all articles registered between 1967 and 1991. 'Risk-articles' seem therefore to have been rising in numbers much faster than the general increase in the total number of published articles. Although minor variations were found between the journals, the the same general pattern was shown in the British, American and Scandinavian journals.

More of the same trend was shown in the specialist journals studied, although a different pattern was shown in the anaesthesia journals. The results from these journals are shown in Fig. 2.

In these journals there had also been an increase in the number of 'risk-articles' from almost 0 to close to six % in the first half of the eigthies. The most remarkable feature in the figures from the anaesthesia journals however, were that the increase in risk-articles had been brought to a halt and there were signs of an actual decrease.

In obstetrics and gynaecology journals there were again indications of an ongoing rapid increase in the number of 'risk-articles'. The results are shown in Fig. 3.

The trend was even stronger for these journals than for the 'generalist journals', reaching close to 20% in one journal for the latest five year period and not dropping below 11% in the three others.

The most remarkable increase was to be found in the epidemiological journals, whose results are shown in Fig. 4.

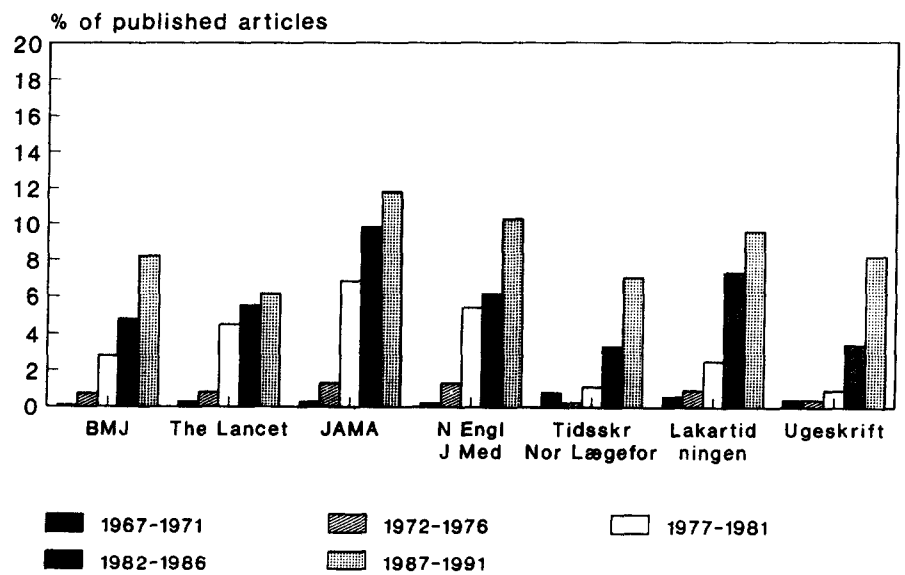

Fig. 1. Percentage of articles with risk(s) in title and/or abstract. Various general medical journals 1967–1991.

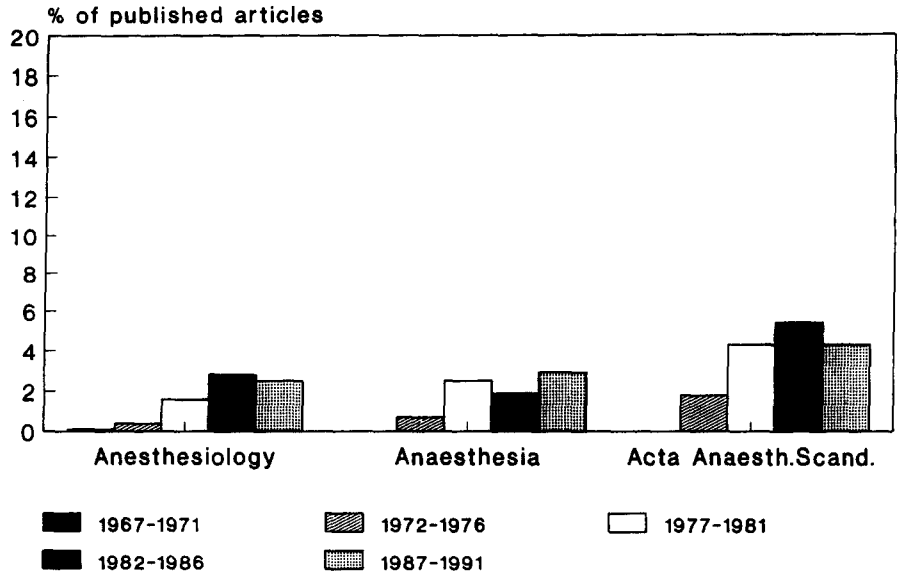

Fig. 2. Percentage of articles with risk(s) in title and/or abstract. Various anaesthesiological journals 1967–1991.

For these journals the figures had grown to around 50% 'risk-articles' in the last five year period. This may not have come as a surprise, considering that risk identification and estimation is at the nucleus of this discipline. It was, however, striking to see the amount of increase in 'risk-articles' over the past ten years. For the two journals studied, more than half the 'risk-articles' have been published within the last five-year period. In actual numbers this means that 1054 'risk-articles' were published in the first 20-year period, whilst the number for the last five year-period was 1193 'risk-articles'.

One possible explanation for all the results mentioned above, could be that they were due to a change in terminology. If this were true we should expect the number of articles with 'risk' and its synonyms to be fairly constant over the years, and that 'risk-articles' should be taking over an increasingly larger part of this fairly constant number of articles. The results of the second set of searches, with risk and its synonyms are shown in Table 1.

As we can see there has been no similar development in the occurrence of terms that might be used as synonyms for risk. Hazard(s) occurred slightly more

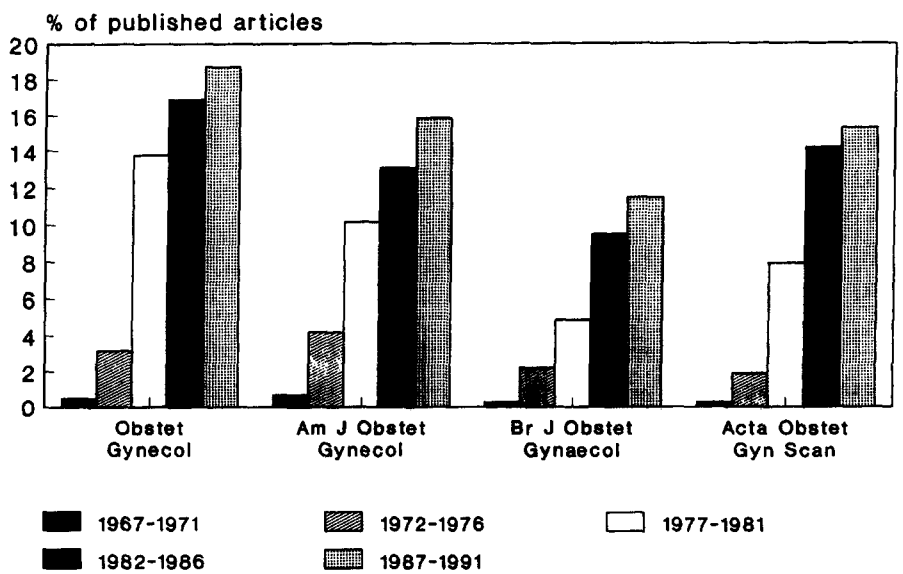

Fig. 3. Percentage of articles with risk(s) in title and/or abstract. Various journals of obstetrics and gynaecology 1967–1991.

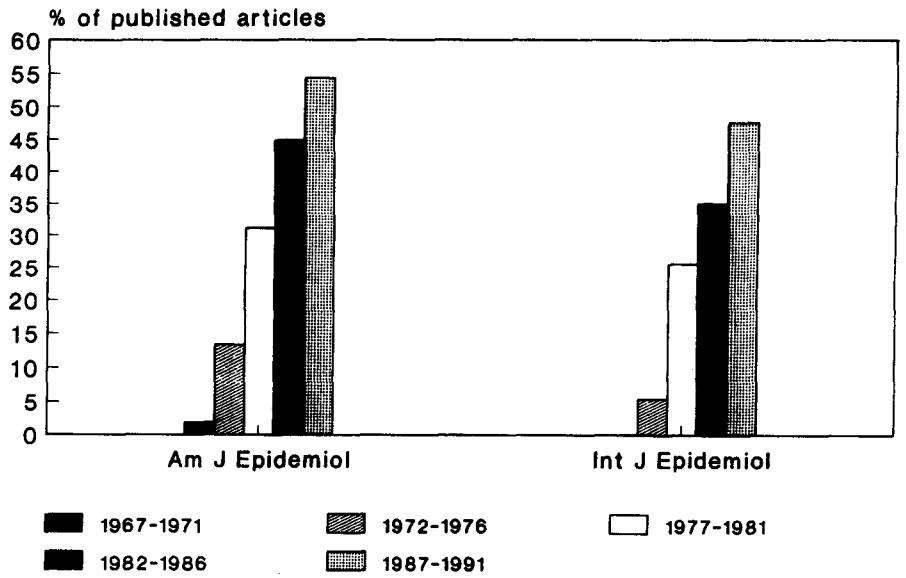

Fig. 4. Percentage of articles with risk(s) in title and/or abstract. Various epidemiological journals 1967–1991.

frequently than risk in the late sixties and early seventies, but has only had a minor increase since. As for danger(s) and uncertainty(ies), none of them seem to have been contesting risk as the most frequently used term in this terminology. The same trends as in *MEDLINE* overall were found in the *BMJ*, *The Lancet* and *The New England Journal of Medicine*, although hazard was more frequent in these journals than in all of *MEDLINE*.

Table 1. Percentages of articles with risk(s), hazards(s), dangers(s) or uncertainty(ies) in title and/or abstract. *MEDLINE*, *BMJ*, *The Lancet* and *New England Journal of Medicine* 1967–1991

	Risk(s)	Hazard(s)	Danger(s)	Uncertainty(ies)
MEDLINE 1967–1991				
1967–1971	0.1	0.1	0.04	0.01
1972–1976	0.6	0.2	0.08	0.02
1977–1981	1.8	0.2	0.1	0.05
1982–1986	3.0	0.2	0.09	0.07
1987–1991	4.5	0.3	0.1	0.1
BMJ 1967–1991				
1967–1971	0.1	0.6	0.2	0.00
1972–1976	0.7	0.7	0.4	0.04
1977–1981	2.8	0.8	0.2	0.06
1982–1986	4.8	0.6	0.3	0.08
1987–1991	8.2	0.4	0.2	0.08
The Lancet 1967–1991				
1967–1971	0.3	0.2	0.01	0.01
1972–1976	0.8	0.3	0.1	0.00
1977–1981	4.5	0.5	0.1	0.02
1982–1986	5.5	0.4	0.2	0.04
1987–1991	6.1	0.4	0.1	0.02
New England Journal of Medicine 1967–1991				
1967–1971	0.2	0.6	0.2	0.02
1972–1976	1.3	0.4	0.1	0.03
1977–1981	5.4	0.6	0.1	0.06
1982–1986	6.1	0.4	0.1	0.2
1987–1991	10.3	0.7	0.1	0.2

Percentages of articles with risk(s), hazard(s), danger(s) or uncertainty(ies) in title and/or abstract.

Even though a shift in terminology may have occurred, so that phenomena that previously were referred to as hazards, dangers or uncertainties today are labelled as risks, there has been an actual and dramatic increase in the use of the term risk in the medical literature.

As shown in Fig. 5 there has been an increase in 'risk-articles' for both iatrogenic and non-iatrogenic illnesses/diseases in *The Journal of the Norwegian Medical Association* in the period studied. The increase in the number of articles on illnesses/diseases without iatrogenic origin was shown to be substantial in comparison to the increase in the number of articles on iatrogenic diseases.

The most frequent risk related illnesses/diseases among the former were, not surprisingly, cancer, CHD and HIV/AIDS. The observed increase in the number of articles on risk related to these three medical conditions did, however, only account for $< 50\%$ of the overall increase. The largest part of the increase was due to a large number of illnesses/diseases represented in the material with one or two articles each. This indicates that risk is no longer exclusively associated with the large 'lifestyle illnesses/diseases', but has become a term commonly applied in various approaches to other medical conditions as well. Although this last result may be seen as restricted to Norway, the spreading of the use of the term risk to a wide set of illness/diseases might prove another trend well worth looking into. This possibility will be focused on in the follow-up study on the Norwegian articles.

Although the increase in the number of articles published on the risks associated with iatrogenic

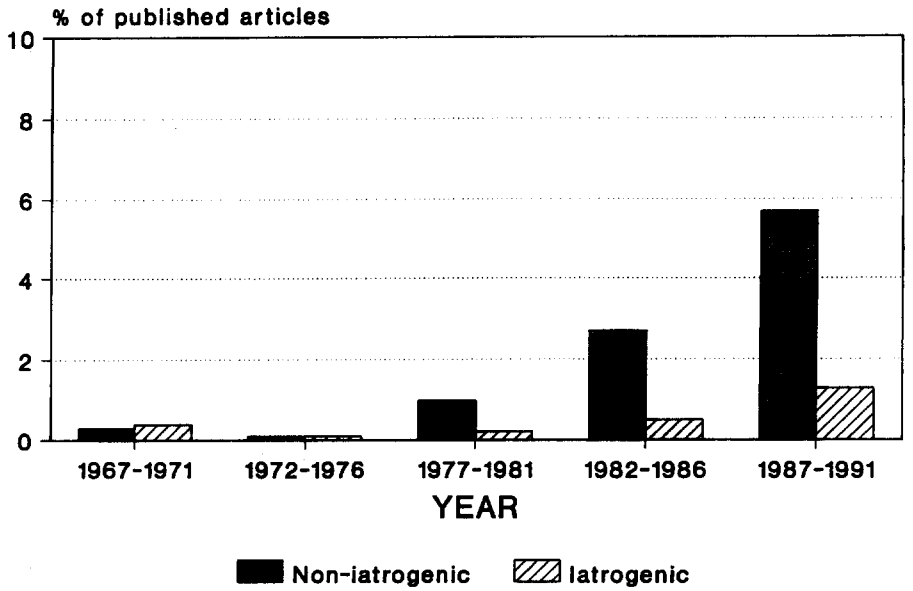

Fig. 5. Percentage of articles with risk(s) in title and/or abstract. Iatrogenic and non-iatrogenic illnesses/diseases. *Journal of the Norwegian Medical Association* 1967–1991.

illnesses/diseases was less impressive than that from non-iatrogenic conditions, their number have quadrupled in the past five years, of which the last two have shown a particularly large growth. Most of these articles covered perioperative complications and side effects of drugs.

The differences in frequency of articles addressing risk related to iatrogenic and non-iatrogenic illnesses/diseases respectively, probably reflect a time difference in the emphasis on these risks. Health promotion has been a major interest in the Norwegian medical community for some time, with the Oslo heart study [16] as one of the most well known examples. Risk management and quality assurance, on the other hand, have only recently come to its attention in a manner which makes it acceptable for publication in medical journals.

DISCUSSION

There are several questions to be considered regarding the quality of these data. One issue is whether the results may be due to changes in the registration practice at *MEDLINE*, thus introducing systematic bias in the results. To avoid such a bias the search was performed by searching for the word risk in title and/or abstract, and not using risk as a medical subject heading. One systematic registration bias in the data was found, as *MEDLINE* changed their registration practice between 1974 and 1975. Before 1975 abstracts were not registered systematically, but this was put into practice from that year. This resulted in more than a doubling in the number of articles with risk, hazard, danger or uncertainty in title and/or abstract in 1975 compared to the year before. Although the increase in the total number of articles registered in *MEDLINE* was larger between these years than the years before, it was nowhere as evident as the increase in the number of articles with the above mentioned terms. As a result of this bias the percentages for the two first five year periods are most likely too small, making the increase between 1972–1976 and 1977–1981 too large. This does not, however, take away the effect that has been noted in the last three periods. The effect in these periods seems to have been substantial in all but one of the 'generalist journals', and in the epidemiological journals. In the obstetrics and gynaecology journals the increase has been a more steady one.

Do we see a risk epidemic?

The rapid increase in the occurrence of the term risk in medical journals, gives rise to the question of whether we see the symptoms of an epidemic. This certainly seems to be true with regard to both prevalence and contagiousness in its use in the medical community. As for actual frequency, the number of 'risk-articles' published has risen from about 1000 articles in the first five year period covered, to > 80,000 in the last, which also means that more than half of these articles have been published in the years 1987–1991. The contagiousness is indicated by the increase in the number of illnesses/diseases that are subject to some kind of risk approach.

A crucial issue, however, is whether the present occupation with risk may be seen as leading to illness/disease. This is an issue of considerable controversy, which can not be answered on basis of the data presented in this paper. As can be seen from other studies, which will be discussed below, there has been

an indication that the consequences of the present occupation with risk are not exclusively healthy ones.

Based on the fulfilment of the criteria of contagiousness, high prevalence and, at least partly, of possible side effects that may lead to illness/disease, it seems a fair conclusion that what we are facing clearly resembles what, at least metaphorically, might be labeled a 'risk epidemic'.

Some possible origins of the 'risk epidemic'

A point of crucial importance for the analysis of the origins of the 'risk epidemic', is that the risk epidemic is not a homeogenous phenomena. Just like the term cancer covers a widespread set of cell dysfunctions, various notions of risk make up the 'risk epidemic'. The diversity of these notions of risk has been demonstrated earlier by Hayes, who has also pointed out the lack of interest in the epistemology of risk [1]. This lack of interest may reflect the strength of the impact of the 'risk epidemic'. It seems that the various notions of risk may already have reached a 'taken for granted' status in our present conceptions of health and health care, as part of our social construction of reality [17]. What we see are the results of a constructional process wherein risk has been reificated, i.e. established as natural phenomena which can only be identified by means of scientific tools, and not as products of human conduct. To trace this process is far beyond the scope of this article, which will be limited to indicate some of the paths along which the tracing should proceed.

A characteristic of the present situation, then, is a lack of conceptual coherence, due to the diversity of the origins of the risk epidemic. This may pose a problem to those interested in the development of a more uniform conceptual framework. Lack of conceptual coherence does not, however, seem to be a problem for most of the scholars contributing to the 'risk epidemic', which is illustrated by the fact that > 80,000 'risk-articles' were published in the period from 1987 to 1991. Which risk concept they applied has probably not been a problem to the majority of the authors of these articles or the editors accepting them for publication. This conceptual incoherence should be kept in mind when reading the rest of the article, as the various paths of the risk epidemic may apply several notions of risk, which is one of the characteristic symptoms of the 'risk epidemic'. This symptom seriously imply that risk is not a neutral concept, but a set of concepts to which various ideological meanings have been attached [1, 18–20].

Various explanations of the observed phenomena may be given from different positions within the social sciences. It is not the aim of this paper to launch a grand theory on the occurrence and use of 'risk' in health and health care, but merely to point out some likely hypotheses that might be fruitful for future studies. The hypotheses suggested here are based on the development of several disciplines and run along the same lines that Fielding [21] has described as influencing the development of the health risk appraisal approach. The considered factors include disciplines that have been developed for various risk calculations expressed as statistical probabilities, recent developments in computer technology, risk management, quality assurance and health promotion. Contributions have also come from various social sciences, through studies of such subjects as risk perception, health behaviour modifications, health education, and risk communication.

The general background against which the development of the 'risk epidemic' may be seen, is one in which beliefs about the locus of control have changed from factors outside human control to factors well inside our control [22]. Throughout the human history the major threats to our health have come from risk factors outside our control, from nature itself or what we have seen as supernatural powers.

Correspondingly, our attitudes towards these risks were mainly fatalistic, our perceptions dominated by religious beliefs, superstition and destiny, and the means of handling risks were mainly restricted to prayers, sacrifices and other ritualistic behaviours [23].

Substantial changes in the beliefs regarding risks and the handling of them have come about in the past three centuries, due to scientific and technological developments within medicine and other disciplines. Nature may no longer be the main reason for risks to our health. Most present risks can be seen as created by humans, being side effects of developments that are mainly viewed as benefits to humans.

These recent advances have contributed to a change in the basic attitudes where matters of life and death are concerned. The risk acceptance that is internalized in a fatalistic attitude to these matters is being replaced by an ideology whose primary goal is to gain control over life and death, where identification of and the struggle to reduce/eliminate risk factors have become activities of considerable importance and prestige within the health professions.

These changes have first and foremost taken place within the professional communities, wherein the basis for the risk epidemic has been laid. Davison, Frankel and Davey Smith [24] have shown that fatalistic attitudes towards risks to our health are still common in a lay population in South Wales and probably also within the lay community at large. This observation is of importance when we look at the possible consequences of a 'risk epidemic', which is done at the end of this article.

Increased human control over nature has lead to a much more scientific and optimistic approach to the handling of risks. Risks are no longer haunting ghosts, but something that may be subject to concrete estimations. This optimism over what can be achieved by the scientific handling of risk, was thus illustrated in a recent issue of *Scientific American*; "Inadequate approaches to handling risk may result in bad policy.

Fortunately, rational techniques for assessment now exist" [25].

The most vital contribution to the 'risk epidemic', then, has come from the development of scientific thinking itself. Within this thinking there has been a movement from a paradigm of monocausal determinism towards a paradigm of multiple causes and effects, accepting uncertainty as a vital factor. When physicians, epidemiologists in particular, talk of factors causing illness or disease, this is seldom expressed as a certain, ever reproducable cause effect relationship. There is most often uncertainty involved, which along with probability constitute a central element of many of the various notions of risk. This combination does also contribute to a certain perpetuality of this research field, as conclusions of '*further research is needed*' may frequently be called for.

A further path for tracing the origins of the 'risk epidemic' would be to look at the development of risk calculations. The scientific basis of risk calculations are probability estimates, which are essential in all types of risk calculations. Risk, as a measurable construction, may therefore be traced back to the middle of the seventeenth century [26]. Several disciplines have been developed for the purpose of risk calculations. The first was actuarial science, developed to meet the insurance companies' need of risk estimates for the pricing of life insurance policies [27].

In preventive health care risk estimation is an essential part of epidemiology, a discipline developed for the purpose of tracing the origins of diseases, whose prevention is hoped to be achieved through the elimination of these origins. This discipline is often seen as established in the middle of the nineteenth century, but which has risen to prominence in the past two or three decades [28].

Along with what has been called the critical clinical school [29] and the introduction of double blind randomized therapeutic trials, there has also been the development of biostatistics. Related to this comes the development of clinical epidemiology. Altogether this methodology has been developed over the past few decades as an answer to critical questions being raised over the effectiveness and efficiency of medicine. The first concerns the evaluation of whether various medical interventions actually alters the course of a disease for the better, the second concerns whether medical interventions are used optimally [30]. This methodology should then help the physician to choose the most effective therapy on the 'right' group of patients with the most optimal use of available resources.

Although traceable to the old Babylonians, we have also in this century had the development of risk analysis [31]. It was developed within the engineering disciplines, mainly since World War II, as a result of the need for estimating (and legitimizing) the risks involved in the handling of various types of energy like nuclear power and potentially dangerous chemicals. Applied to medicine this type of analysis may be used in the pursuit of identifying and estimating risks connected to various medical procedures and technologies, as well as a management technique for risk handling—risk management—which will be treated later in this article.

One origin of the 'risk epidemic' may therefore be found within the frame of the present statistical paradigm of scientific medicine and the tools mentioned above. This may also in part explain why risk has become such a frequently used term, or more correctly, why various notions of risk has become so frequently used. Compared to danger, hazard and uncertainty, risk is more frequently associated with probability estimates than the others, as is shown in epidemiology where various risks as attributable risks, relative risks and risk ratios may be calculated. Given the present emphasis on statistically supported data in medical journals, this may very well be a factor contributing to the 'risk epidemic'.

The mentioned methods for risk calculation have existed for a much longer period than the 'risk epidemic' itself. They may therefore be seen as necessary conditions for the epidemic, but not as sufficient ones. Other factors must also be considered. This leads us to another path along which the origins of the 'risk epidemic' may be found.

Why then, did the risk epidemic not emerge until the 1980s? A fair hypothesis seems to be found in the developments of computer technology during the past two decades. The spreading of this technology has enabled an enlarged number of medical researchers to perform far more statistical analyses on large amounts of data than were possible only a few decades ago. Computer technology and probability statistics thus look to be vital factors contributing to the 'risk epidemic'. These factors do, however, remain mere tools or techniques, which needs to be placed within the frame of a medical technology, providing the ideological background wherein the application of these techniques becomes legitimate.

A path providing such an ideological background is health promotion. Our belief in past successes has left us with a substantial optimism as we take on new challenges in the pursuit of eliminating risks and promoting health. The elimination of various infectious diseases as the major cause of death in the western world in the first half of this century, has undoubtedly generated such optimism, and may be seen as one of the reasons for the raise of health promotion as an important ideology of health. Whether this success can be rightfully attributed to medical interventions has been challenged, from different angles, by both McKeown [32] and Illich [33].

This critisism has not, however, severely harmed the beliefs of what may be achieved within the frames of health care. For various health promotion strategies the identification and estimation of risk factors have been regarded as basic knowledge and a major path on the road to improved health. Health promotion, here

considered as a medical technology covering various techniques as health education, immunization programmes etc., may therefore contribute with the ideological frame needed to explain the present emphasis on factors regarded as risks to our health.

Through the ideological frame of health promotion we can get a glimpse of some of the functions served by the 'risk epidemic'. These functions may be seen as mechanisms contributing to the shaping of the 'risk epidemic', thus being a part of its origins. They are not necessarily the results of goal-directed efforts of the involved parties, but it can be argued that there are beneficiaries of these functions. The most obviously accepted function is the prediction of unwanted events as loss, disease and death. Through this function it sets the scene of risk identification and estimation as a modern, rational way of gradually gaining control over illness and disease, as compared to our not too distant history. It thus confirms our optimism and the belief of what can be achieved through science. This is probably reflected through both raised funding of projects taking on this pursuit and the willingness to print articles giving the results of these projects. Strongly related to this function is also the assumption that part of the rationality here involves cost savings. Health promotion not only serves to keep the healthy free from illness, but it is also expected to save us from expensive health services.

Another function stems from the linkage between risk factors and causal factors. Risk factors do in many cases serve as causal hypotheses, a status which is frequently stretched beyond the rules of good science, when these hypotheses are treated as if they were already verified. This is most clearly shown within the area of coronary risk factors, where presently > 300 risk factors have been identified [34]. Having gained this causal status, rightly or not, makes the risk factors subject to treatment. They become diseases to be cured. The expansion in the number of risk factors identified, therefore also means an expansion in the number of diseases to be treated, and of course an expansion in the 'turf' available for medical intervention. A 'risk epidemic' may therefore also be seen as serving such an expansion, on part of the medical profession and others parties with interests in this field [35].

As *medicalization* is a term that comes to mind in such circumstances, it does also seem likely that there is a need for legitimation of these interventions. This legitimation has been established through the scientific means by which risks are identified and measured. 'Proper' risks may to a lesser and lesser extent be identified and validated through everyday experiences. The proper identification and handling of risks is more and more becoming a question of having a scientific approach to the matter. This also serves to draw a line between those competent to do this and those that are not.

The 'risk epidemic' may thereby also be seen as part of a concerted effort to make medicine a more scientific discipline. Within the art/science debate the increase in the scientifically constructed risks is a movement from the art dimension towards a more scientific medicine. The 'risk epidemic' may thus be seen as a tool moving medicine as a discipline based on 'beliefs' towards a discipline based on 'knowledge'.

The paths of the 'risk epidemic' does also include paths for clinical medicine

Recent technological innovations in medicine may also be seen as having enlarged our sense of control. Symptoms of this are seen through an enlarged number of malpractice claims and raising expectations as to what may be achieved in health care. Whether this sense of control is called for or not may be subject to controversy. The matter of interest here is what happens when control is attributed to doctors; by themselves, lawyers, media or the public.

This perceived control has raised the expectations concerning the identification, reduction and elimination of risks involved in medical procedures, thus giving raise to such disciplines as risk management and quality assurance. Risk management is, as mentioned, based on the development of risk analysis. Its introduction to health care has been heavily motivated by the raising insurance premiums and other raising costs of health care [36]. The development of these disciplines may be seen as yet another path along which to seek for the origins of the 'risk epidemic'.

Related to the development of risk analysis and risk management has been the rise of other disciplines as risk perception and risk communication. These disciplines arose as the results of risk analysis did not have the impression on lay people as the experts behind the methodology had expected. In its 'neutral' version the purpose of studying risk perception may be stated as the 'study of how people form their opinions about risk'. Risk perception studies soon lost their neutrality, however, when the real purpose behind the studies was uncovered as to " . . . . aid policy makers by improving communication between them and the lay public, anticipating public responses to experiences and events . . . ., and directing educational efforts" [37]. These disciplines constitute the last path of the origins of the 'risk epidemic' to be mentioned here.

Judging from the data from *The Journal of The Norwegian Medical Association* and the two epidemiological journals, the paths including health promotion as an ideological frame and epidemiology as a main tool for identification and estimation of risks seems to be the most travelled of the paths at present. The increase in 'risk-articles' in the 'generalist journals', may be due to an increased number of epidemiological articles submitted to these journals. Angell [38] has indicated such a tendency to be true for *The New England Journal of Medicine*. For this reason, most of the discussion in the remainder of this article will build on epidemiological examples.

Risk construction—a study subject

A fundamental question is whether the 'risk epidemic' is reflecting enlarged dangers to our health or whether it is mainly an epidemic that has entered the minds of a substantial number of persons involved in health care. Judging from the fact that the risk epidemic has been parallelled by increased life expectancy in the Western world, the latter suggestion may certainly have something to it. By saying this, I do not mean to indicate that present conceptions of risk are mere fantasies, but that social construction plays an important part in shaping these conceptions.

As the 'risk epidemic' is a reflection of present scientific activities, the scientific construction of risk is central to this process, whereby risks and risk factors may become 'realities of our everyday life'. If 'rationality' applied, the construction process should be simple: risks are identified by scientists doing proper science, the results of proper science are communicated to the public, who changes their behaviour accordingly, thus prolonging their life expectancy. There is, however, no determinism related to whether scientifically constructed risks will gain the status of 'reality' or not [18]. This is, as mentioned, one of the puzzles that has triggered the interest for research on risk perception and communication.

One of the problems of this puzzle, is that risks may also be constructed through 'improper' use of scientific methods and still gain the status of 'fact'.

Ideally, scientific constructions of risk are made according to descriptions given in methodological textbooks. These descriptions often represents ideals that are hard to follow, so that more practical appliances of these ideals are frequently chosen.

Thus, in epidemiology 'fake' risks may be constructed due to methodological errors, when confounding variables are not controlled for [5, 39, 40]. Many factors have been identified as risk factors because they appear together with a factor actually contributing to the illness/disease, which is one of the reasons that so many coronary risk factors have been identified [41].

Once published, these factors may gain acceptance as 'facts' in the medical and lay community. As Lipton and Hershaft [42] have shown, serious methodological flaws are not sufficient hindrances when it comes to accepting dubious research findings. In response to this problem there have been tutorial efforts by the journals, regarding the interpretation of epidemiological research [38, 43]. The implicit assumption behind such efforts is that there are two sets of risk, 'fake' risks constructed through methodological flaws and 'true' risks constructed through the proper use of epidemiological methodology. Both still have the potential to become 'real' risks though, through the social construction process. Tutorial efforts may influence this construction process, but whether they will be successful or not remains to be seen.

To fully understand the development of the 'risk epidemic' would, as mentioned, require in depth studies of this process. Studies of the social construction of risk in health and health care should prove useful and interesting in this respect. A methodology for studying these constructions in the development of science and technology has been suggested by Latour [44]. Basic to this methodology is the assumption that science is made up of two parts, one consisting of established 'knowledge' and another where there at present is no such knowledge, where this is still sought and controversy over the constitution of this knowledge still prevails. The characteristic of established 'knowledge' is that it is perceived as if no such controversy exists and never has, having reached the position of what is labeled 'closed black boxes'.

The purpose of this methodology is to open these black boxes, studying the scientific controversies of the past and how they were closed, thereby studying the scientific construction of facts and artifacts. This can be done through studies of the scientific literature, where, among other things, the selective use of references plays an important role in the establishment of knowledge. An interesting example of this has been done on the success of cholesterol lowering trials. According to this study, these claims for success have been constructed through the selective citation of supportive trials [45].

Concerning the risk epidemic this methodology could be used for tracing how some risk factors have gained status as facts, whilst others no longer exist in the risk literature. By applying such a methodology we would hopefully get a clearer picture of the processes in which risk factors are chosen, studied and become facts or artifacts in the pursuit of scientific inquiry.

The scope of such studies should, however, not be restricted to simply gaining knowledge of these developments. This knowledge should also be used for the benefit of health and health care. As such, studies of the social construction of risk could be helpful in the assessment of health promotion and other medical technologies. The need for such assessment is indicated by some of the possible consequences of the 'risk epidemic'.

Potential harms of the risk epidemic

In accordance with the constructionist view the question of possible harmful effects of the 'risk epidemic' remains open to construction, as few black boxes have been closed and many of the subjects covered by the 'risk epidemic' are still subject to controversy. There is no simple answer to whether the present occupation with risk may be seen as leading to diseases or not. We see both symptoms of a disease and indications of a state of health. Whilst cherishing the healthy symptoms, the disease symptoms should be treated seriously, because they may lead to what Illich [33] called social iatrogenesis or, rephrasing McKeown's [32] warning: "misinterpretations of the major influences on health improvement, leading to misuse

of resources and distortion of the role of medicine". To avoid this is one of the major challenges that lies ahead. The examples given below will therefore focus on some of the potentially questionable sides of the 'risk epidemic'. It should be kept in mind, of course, that these are examples and not the results of an extensive, all-inclusive evaluation of the possible effects of the 'risk epidemic'.

Misinterpretations and misuse of resources in prophylactic medicine may come from focusing on the 'wrong' risk factors or even from focusing on risk factors at all, if promoting health may prove to be something different than avoiding risks, and there should prove to be serious limitations to the presently applied methodology for risk identification. Problems are also showing in curative medicine, where risk aversion may lead to defensive medicine, preoccupied with avoidance of malpractice suits, thus hampering the progress of medicine and health care.

One set of critisism that has been raised, concerns the present scientific methodology. It has been claimed that problems related to scientific risk construction is not limited to erratic appliance of epidemiological methodology, but that it stems from shortcomings of the methodology itself. The apparent ease with which associations between fatal diseases and everyday activities are established by current epidemiological methods, is at the core of this critisism [5, 46, 47].

In accordance with the critisism, it becomes tempting to raise questions about the relationship between the present number of identified risk factors and the tools available for risk identification and estimation. One comparison that was made more than a decade ago, is that between the witch-processes of medieval Europe and the increase in attention to risk factors [48]. During the witch-processes there was a development of more and more sophisticated methods for witch identification. This development may be compared to the present situation, where increasingly sophisticated statistical tools give us the option of finer and finer risk estimations. Are we then in a situation of introducing self-fulfilling prophecies? At present the answer to this is not known, but it is definitely an option we should be aware of.

Another methodological critisism of what can be achieved by further focus on risk and risk factors, has come from authors seeing the limits of present linear models on which risk estimations are based. They claim that human bodies are complex non-linear systems, which can not be grasped wholly by the presently applied methodology, and that application of chaos theory will be called for in the future [49, 50]. Such arguments would, if given credit, raise serious questions about an important part of the foundation on which the 'risk epidemic' is based, thus underminding the value of present activities.

In the pursuit for identification, quantification and elimination of risks there is invariably the possibility of introducing new ones. The magnitude and acceptability of the risks involved in various health promotion programs have therefore been subject to substantial controversy. This seems particularly true for screening programs for various types of cancers [51–53] and coronary risk factors such as cholesterol [45, 54, 55], and has lead to claims for the application of the same ethical principles for prophylactic medicine as are presently practised for curative medicine [56]. The already mentioned controversy regarding sufficient patient monitoring serves as an illustration of similar controversies regarding risk management in medicine [7, 8]. These controversies cover a wide range of questions regarding various ethical, medical, economical and psychological issues.

To further illustrate such controversies and possible ill effects of the risk epidemic, an elaboration of the controversy over cholesterol lowering trials serves the purpose. Cholesterol has for a long time been identified as a coronary risk factor, and little controversy remains over its status as a risk factor. Ample controversy remains over the strategy for reducing this risk factor and the effects of such efforts, however.

Some of the central issues of this controversy are who should be testet, at what intervals, who belong to the treatment groups, how should they be treated and what are the effects of the treatment? The alternative answers to the first question has been a choice between a population strategy and a high risk strategy. In a population strategy the whole population is tested, whilst in a high risk strategy only those considered to be at high risk will be subject to testing. The definition of high risk groups remains one of the problems of the latter strategy, as various factors as age groups, gender, genetical dispositions, single/multiple risk factors have been suggested as possible inclusion criteria [57]. Whatever strategy chosen, a large percentage of the healthy population will be subject to cholesterol testing procedures.

Regarding the interval between tests, suggestions have been ranging from every time a person consults a physician to once in a life-time. Controversy has also prevailed over which cholesterol scores that qualify for treatment. In the U.S.A. recommendations that would put 60% of the population in the treatment group have been given [58], whilst the entry criteria for a particular British study would include a third of the British population [59].

Although the above mentioned strategies represent the more extreme recommendations given, they are not untypical of the atmosphere that has prevailed around cholesterol monitoring. As such strategies sound rather expensive and involve a large potential for medicalization, one would expect that such efforts should be supported by the effectiveness of the applied treatment.

The available treatment is dietary modifications and/or drug treatment, of which dietary changes is the most widely recommended. Whether cholesterol reducing trials have been successful or not, is at the

nucleus of the present controversy, which can be illustrated by some of the papers published on the subject in the *BMJ* over the past two years. In 1992 doubts about the success of efforts to prevent CHD were expressed in an editorial, due to dispute over the effectiveness of the cholesterol reduction trials and indications of a raised total mortality in intervention groups, in particular the mortality related to suicide and violent deaths [54]. Claims for a much more restrictive use of cholesterol lowering drugs were also made [59].

Two years later another editorial claimed that "Lowering population cholesterol concentrations probably isn't harmful" [55], lending support from studies claiming that the association between serum cholesterol concentration and ischaemic heart disease has been underestimated [60], that significant reduction of the risk for such disease is achieved through reduced serum cholesterol concentration [61], and that the risks of such reductions are outweighed by the benefits [62].

New chapters in this controversy will obviously be written and it should not come as a big surprise if the pendulum swings back and forth for some time still. The present status of the cholesterol controversy does, however, serve to illustrate that effectiveness and efficiency in preventive medicine is as important as it is in clinical medicine, perhaps even more important.

Considering the large number of people affected by the potential side effects of such massive interventions, this certainly calls for a more cautious approach than what has been demonstrated through many of the recommendations given on cholesterol monitoring and treatment during the 1980s. If what we have seen are medical experiments on large populations of healthy people, despite insufficient knowledge about their effect and side effects, this is truly unethical and supports the call for the implementation of ethical standards in preventive medicine [56].

Coping with a 'risk epidemic'

If we are to believe the epidemiological risk constructions, there seem to be few, if any, things in life that are purely healthy or unhealthy. This is clearly shown when many of the identified risk factors turn out to be factors related to our daily living [2, 5]. Research in recent years has made us aware of more risk factors than ever before in history. This does not automatically make us healthier and happier human beings. In fact, this knowledge may in some instances lead to a duller way of life, restraining people from a quality of life that is open to them.

The present emphasis on risk may also influence our self-evaluation of health. As Fylkesnes and Førde [63] have pointed out, several studies have shown that our health evaluations are found to predict mortality. Some people may therefore be seen as having entered a vicious circle in which knowledge of risk factors reduces their subjective health which again may lead to diseases, whose presence confirms their concern for risk factors in the first place.

If the 'risk epidemic' may be seen as imposing unnecessary strain and fear on what are basically healthy individuals, there may be some comfort in lay people's own coping strategies. Davison, Frankel and Davey Smith's studies from South Wales [24, 64] indicate that people have their own strategies for coping with the professional community's increased emphasis on risks. These strategies have more fatalistic elements than what may be appreciated by the most ardent supporters of health promotion. At best these coping strategies may lead people to avoid unhealthy stress and reduced quality of life related to worrying about the uncontrollable, in line with Skrabanek and McCormick's advice [34]:

> Since life itself is a universally fatal sexually transmitted disease, living it to the full demands a balance between reasonable and unreasonable risk. Because this balance is a matter of judgement, dogmatism has little place. Present-day preoccupations with health are largely unhealthy as the media constantly draw to our attention hazards to health. Many of these hazards are rare and our individual risk of being harmed extremely small; in this circumstance they should be ignored.
>
> At worst such advice may lead to ignorance of health hazards that might have been avoided. Then again, knowing which is which, remains an unsolved enigma.

From 'beliefs' to 'knowledge'—the rich world's hope and illusion?

A final reflection on the effectiveness and efficiacy of the 'risk epidemic' may be Marshall H. Becker's conclusion that we at present have reached a stage where former 'beliefs' about what promotes health have become 'knowledge' through extensive and costly investigations, and the old proverb '*moderation in all things—and moderation in that*' is the best conclusion that can be drawn from these efforts [65]. If so, several of the activities reflected by the 'risk epidemic' may prove to be costly and ill-devised efforts of mind seduction. The apparent success of such efforts should not surprise us, though, if we accept our strive for a sense of control as central to our well being.

This finally shows another vital characteristic of the risk epidemic. It is reflecting the socially constructed reality of a particular culture at a particular time in history. In a global and historical context it may be seen as a luxury problem of the richest part of the world. After all, '*moderation in all things—and moderation in that*' requires a freedom of choice that so far has been denied the majority of humans.

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APPENDIX

The Risk Epidemic in Medical Journals: Numerical Data Tables

	Risk articles	Published articles	% Risk articles
MEDLINE			
1967–1971	990	1029289	0.1
1972–1976	6485	1160317	0.6
1977–1981	23190	1298885	1.8
1982–1986	44077	1487893	3.0
1987–1991	81586	1802671	4.5
The British Medical Journal			
1967–1971	11	8062	0.1
1972–1976	79	10709	0.7
1977–1981	330	11789	2.8
1982–1986	423	8821	4.8
1987–1991	724	8814	8.2
The Lancet			
1967–1971	27	10231	0.3
1972–1976	106	14204	0.8
1977–1981	564	12656	4.5
1982–1986	666	12180	5.6
1987–1991	798	13101	6.1
New England Journal of Medicine			
1967–1971	8	5490	0.2
1972–1976	84	6461	1.3
1977–1981	351	6558	5.3
1982–1986	352	5765	6.1
1987–1991	510	4962	10.2
Journal of the American Medical Association			
1967–1971	17	5938	0.3
1972–1976	88	6679	1.3
1977–1981	443	6527	6.8
1982–1986	592	6026	9.8
1987–1991	766	6475	11.8
Tidsskrift for Den norske lægeforening			
1967–1971	16	2102	0.8
1972–1976	4	2570	0.2
1977–1981	23	2020	1.1
1982–1986	66	2016	3.3
1987–1991	216	3103	7.0
Läkartidningen			
1967–1971	16	2592	0.6
1972–1976	25	2819	0.9
1977–1981	63	2486	2.5
1982–1986	104	1427	7.3
1987–1991	291	3028	9.6
Ugeskrift for læger			
1967–1971	7	2024	0.4
1972–1976	13	3007	0.4
1977–1981	32	3466	0.9
1982–1986	138	4028	3.4
1987–1991	355	4322	8.2
Anesthesiology			
1967–1971	1	988	0.1
1972–1976	5	1224	0.4
1977–1981	24	1471	1.6
1982–1986	56	2019	2.8
1987–1991	60	2438	2.5
Anaesthesia			
1967–1971	0	432	0.0
1972–1976	5	685	0.7
1977–1981	27	1090	2.5
1982–1986	32	1694	1.9
1987–1991	67	2329	2.9
Acta Anaesthesiologica Scandinavica			
1967–1971	0	124	0.0
1972–1976	4	228	1.8
1977–1981	19	444	4.3
1982–1986	37	682	5.4
1987–1991	32	736	4.3
British Journal of Obstetrics & Gynaecology			
1967–1971	3	911	0.3
1972–1976	21	960	2.2
1977–1981	50	1015	4.9
1982–1986	117	1233	9.5
1987–1991	162	1404	11.5
American Journal of Obstetrics & Gynecology			
1967–1971	19	2666	0.7
1972–1976	121	2888	4.2
1977–1981	309	3031	10.2
1982–1986	441	3372	13.1
1987–1991	608	3848	15.8
Obstetrics & Gynecology			
1967–1971	8	1526	0.5
1972–1976	56	1738	3.2
1977–1981	260	1888	13.8
1982–1986	341	2020	16.9
1987–1991	474	2535	18.7

—continued

	Risk articles	Published articles	% Risk articles
Acta Obstetricia & Gynecologica Scandinavica			
1967–1971	1	373	0.3
1972–1976	7	369	1.9
1977–1981	45	572	7.9
1982–1986	104	732	14.2
1987–1991	114	745	15.3
American Journal of Epidemiology			
1967–1971	12	618	1.9
1972–1976	80	596	13.4
1977–1981	248	795	31.2
1982–1986	479	1065	45.0
1987–1991	788	1451	54.3
International Journal of Epidemiology			
1967–1971			
1972–1976	14	247	5.5
1977–1981	67	263	25.5
1982–1986	154	441	34.9
1987–1991	405	850	47.6

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	Non iatrogenic illnesses/diseases			Iatrogenic illnesses/diseases		
Period	Risk articles	Total number of articles	% Risk articles	Risk articles	Total number of article s	% Risk articles
1967–1971	7	2102	0.3	9	2102	0.4
1972–1976	2	2570	0.1	2	2570	0.1
1977–1981	20	2020	1.0	3	2020	0.2
1982–1986	56	2016	2.7	10	2016	0.5
1987–1991	177	3103	5.7	39	3103	1.3