

REVIEW

RISK FACTORS, PROTECTIVE FACTORS AND MEDICAL DECISIONS

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A b s t r a c t

For some diseases, definite and unique causes like certain infections may be found. For other diseases, multifactorial causes have to be assumed, mostly because of lack of knowledge. On the one hand, we find risk indicators or risk factors, on the other hand, we find factors that protect a person or even indicate optimal conditions.

A medical decision concerning diagnosis, preventive measures or therapy should be based on definite knowledge. However, sometimes decisions may have to rely on very vague assumptions or conclusions. A theoretical description of inter-relations between facts, interpretations and consequent decisions ranges from the theory of games over the application of statistical algorithms, or of Bayes' theorem, to the catastrophe-theory and the theory of stability and instability of complex non-linear systems, including the so-called chaos theory. The application of these theories permits a better insight into the dynamics of some of the described procedures, including their time dependence. It helps to explain some details of a disease process, the diagnostic observation and prediction, and the phenomenon of a sudden outbreak of symptoms or of death.

In the following short overview, we will discuss a concept for the development and causes of sudden infant death syndrome as a multi-factorial event. The factors used for its description indicate risk, protection, optimality, conditioning and triggering.

Key words

Risk factors, Protective factors, Conditioning, Triggering

INTRODUCTION

Multi-factorial causes of disease

Sudden infant death syndrome (SIDS) is, by definition, characterised by sudden death for which, at autopsy, no recognised cause can be found, although occasionally certain specific causes for sudden infant death (SID) are claimed.

The historical development of a theory relating diagnostic procedures, prevention and therapy has recently been summarised by *Kurz, Kenner and Poets* (7). Retrospective and prospective studies have provided a list of factors whose observation or presence indicates either an increased or a decreased risk of sudden death. The existence of both protective and risk factors has only recently been

proposed in "The Tasmanian SIDS case control study" by *Ponsonby et al. (10)*. Sleeping in the prone position, high room temperature and tobacco smoke in the baby's environment are typical risk factors. Further factors listed as being protective were: maternal age over 25 years and more than one child health clinic attendance. In practice the authors conclude that the results provide further support for current health education activities which inform parents of modifiable risk factors for SIDS.

Risk factors and protective factors

We used the definition by *Schaefer and Blohmke (13)* to explain the term risk factor. This states: "Following the concept of a multifactorial generation of certain diseases, a set of possible causes of the disease should be found. The effect of each contributing cause to the disease process should be studied. Any process is defined as a risk factor which can be considered as being involved in the development of a disease."

In order to better specify the meaning of the terms risk factors or protective factors, the following considerations should be taken into account.

1. All different types of factors – indicating risk or protection – can be assumed to exert only weak influences or to indicate weak correlations (12). From a statistical viewpoint, in the index group, any of the factors can be observed with a prevalence of a certain small percentage (6,9). In any particular case, neither the presence nor the absence of a factor will indicate a 100% pathological or healthy outcome during the critical phase of life; in the case of SIDS, this is the first year of life.

2. As far as SIDS is concerned, there are factors that exert a harmful influence on an infant, e.g., tobacco smoke in the sleeping room. Such a factor may contribute to the onset of sudden death. In this case, the factor can be called a risk factor in the strict sense. If, on the other hand, the observed event or process has a statistical correlation but no direct causal relation to sudden death, it merely indicates a risk and the factor, therefore, is described as a risk indicator (6,9,12,13,14). Such indicators that, *per se*, do no harm to an infant are still signs or signals of an existing risk. An example of a risk indicator is "frequent bronchitis in siblings" but close examination shows that the use of this term often merely demonstrates lack of knowledge. The above example may be a real risk factor through infection or may indicate a genetic weakness of defence mechanisms in the family.

On the other hand, there are factors and indicators that act as protecting mechanisms or have a health promoting influence. These factors are called protective factors or protective indicators.

Based on a retrospective study using a questionnaire and an interview with parents of babies who died of SIDS, a "Risk-Questionnaire" has been designed. This consists of a list of 26 items comprising factors and indicators; 21 of these

questions are clearly related to risk factors. The questions in each item can be answered by "yes" or "no". All parents of newborn babies in Styria (Austria) receive this questionnaire in order to check the overall risk for their baby (2,3,4,5).

3. There are additional terms defined in the literature from the viewpoint of health improving effects. One such term with a more general meaning is "salutogenetic" (1). This term includes all social and environmental influences, which have a positive effect on a person's health.

An interesting concept concerning the health of newborns is the "optimality concept" suggested by *Prechtl* (11). *Velickovic Perat* (15) has published a potential list of perinatal optimality factors according to *Prechtl*'s concept. He has listed 51 items which, in an observed baby, are either present, absent or are "within normal limits". Answers are considered "optimal" if the expected normal result is recorded. In 27 of the 51 items, the absence of the listed factors (with the explicit answer "no") is considered optimal. This indicates that at least half of the factors listed in the perinatal optimality list are actually risk factors or risk indicators which, under optimal conditions, should be absent. The rest of the items indicate data values within the normal range or observations which can be considered to demonstrate protective phenomena. Examples of the latter are: the number of previous pregnancies (optimum, 2 to 4) or the number of hospitalisations (optimum, 0).

4. The construct of factors and indicators is incomplete unless weighting of each factor and interaction, and synergies between factors are quantifiable.

Conditioning factors and trigger mechanisms

For any catastrophe, like disease or death, there are both conditioning factors (genetic and environmental) and trigger mechanisms. If these lead to a catastrophe, a unique sequence of events can be observed (8). This can even be described as a "disease strategy". Analysis of this disease strategy still seems to be an unresolved problem that requires urgent study in order to understand the development of the disease processes leading to sudden death of an infant.

We think that lists of factors, the presence or absence of which can be answered by either yes or no, are better than nothing. However, a quantitative analysis and an analysis of the time course of the events should follow this procedure. The application of Bayes' theorem is one approach to this problem (3).

DISCUSSION

The health of a person depends on their ability to cope with risk factors in the presence of certain genetic and environmental conditions and of events that may act as triggers for the development of disease or the onset of death.

From the viewpoint of medical decision, the knowledge of risk factors and other relevant factors, conditions and events is necessary in order to proceed with prevention or therapy.

We tried to provide a short summary of the attempts to design lists of risk factors and corresponding lists of optimal health conditions, which may include the activity of protective factors. This overview has an additional purpose to demonstrate the need for more precise definitions in medicine. From a mathematical viewpoint, "optimisation" and "optimality" are well defined. The use of these or related words in connection with normality, health and lack of risk factors leads to the interesting question of whether, in biological systems, "normal", "healthy" and "optimal" always express the same condition.

We used the example of SIDS as a disease process in which apparent health, the presence of risk factors, pre-existing conditions and triggering events are most closely connected to death, a state which is in absolute contrast to health or biological optimality.

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RIZIKOVÉ FAKTORY, PROTEKTIVNÍ FAKTORY A LÉKAŘSKÁ ROZHODNUTÍ

S o u h r n

U některých chorob je možno najít jasné a jednoznačné příčiny, jako jsou určité infekce. U jiných chorob je nutné předpokládat multifaktoriální příčiny, většinou kvůli nedostatečným znalostem. Na jedné straně nacházíme rizikové indikátory nebo rizikové faktory, na druhé straně nacházíme faktory, které chrání osobu nebo dokonce indukují optimální podmínky.

Lékařské rozhodnutí týkající se diagnózy, preventivních opatření nebo léčby může být založeno na přesně definovaných znalostech. Některá rozhodnutí však mohou být založena na velmi neurčitých předpokladech nebo závěrech. Teoretický popis takových vzájemných vztahů mezi fakty, interpretacemi a následnými rozhodnutími sahá od teorie her přes aplikace statistických algoritmů nebo Bayesova teorému k teorii katastrof a teorii stability – nestability komplexních nelineárních systémů, včetně tak zvané teorie chaosu. Aplikace těchto teorií dovoluje lepší pohled na dynamiku některých popisovaných procedur včetně jejich časové závislosti. Pomáhá vysvětlit některé detaily procesu onemocnění, diagnostického pozorování a predikce, a jev náhlého úmrtí. V následujícím stručném přehledu se budeme zabývat popisem vývoje a příčin syndromu náhlého úmrtí dítěte (sudden infant death syndrome - SIDS) jako multifaktoriální příhody. Faktory použité pro popis indukují riziko, ochranu, optimálnost, podmínky a spouštění příhody.

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