

Medical Prevention

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Prevention is risk management. The aim is to prevent or delay unwanted events, thereby making them less likely. This probability (the risk) is determined as the number of events occurring per 1,000 at-risk individuals during a certain period of time (incidence). Prevention is thus a population-based (epidemiological) concept).

The most important population-based goal of preventive healthcare is reducing the incidence of disease, disability or premature death” (Walter et al. 2012). The positive goal of preventive healthcare is to increase the number of disability-free years of life. We can talk about *medical* prevention when the unwanted events or, even more, the measures necessary to reduce the incidence require medical intervention (e.g. vaccinations, drugs to lower blood pressure, removal of skin cancer precursors).

However, prevention as risk reduction is not readily reconcilable with medical intervention. Conventionally, medical professionals are approached by those needing help, in other words, individuals take the first step. The medical profession then works on the cases at hand, with a curative or alternatively a palliative purpose. Preventive or proactive medicine, which begins before there is any need for help, requires a new justification for medical interventions as well as an expanded professional identity on the part of medical professionals. This - in principle desirable - change in the professional sphere of activity has to be weighed against the negative consequences of medicalizing areas of life that previously were not in the scope of medical care.

Figure 1 lays out the concept of risk reduction. To do so, it first sets up a graph, whose x-axis represents the maximum possible lifespan. The y-axis shows the different stages of a disease as it relates to care. For illustrative purposes, this graph contains a case where no intervention took place (A-B). The other curves depict different progressions that have been influenced with preventive purposes in mind. Uninfluenced progressions, which occur only rarely in a functioning medical system, are called “natural progressions’. A representation in the form of case progressions plays to the kind of thinking and action that focuses on providing medical care to an individual. It ignores the fact that every individual case is merely the manifestation of *one* of many possible progressions. For this reason the progression depicted stands for just a *distribution* of possible progressions. It is easy to see that prevention as a concept involves a person’s entire life span.

Figure 1. Parameters of prevention using a case progression as an example (modified as per Flatten et al. 1988).

A: Beginning of a progression; A is strictly speaking not a point but a distribution of start times, as suggested by a second point A*)

A-B: case with a (fast) progression without intervention during any of the stages, premature death (B) with the loss of potential lifespan (C-B)

A-D: very early medically influenced, decelerated progression, symptom-free for the rest of the individual’s life (correspondingly delayed development A*-D*)

A-E-F: case detected early in the pre-clinical phase, progression influenced; G-E lead time brought forward, F-H gain in lifespan, (B-H-F-C) - (E-G-I) increase in quality-adjusted life-years

A-J-K: favorably influenced progression after clinical manifestation, gain in lifespan, delay in requiring care, while lengthening the time spent in care

A-L-M: lifespan gained after entering the need-for-care phase (M-B)

The *maximum possible* lifespan (horizontal x-axis) is an epidemiological concept, which, for the individual, is the lifespan that 'nature' has allocated to this individual, even if everything goes well from a preventive perspective. This maximum is not something a doctor can predict for an individual. Epidemiologically however, it can be determined quite well by obtaining data in situations with and without well-organized prevention.

Prevention can literally prevent the clinical manifestation of a disease, in other words the disease itself will remain asymptomatic (A-D). An example: after an injury the wound is cleaned and the patient is injected with a vaccine (and a serum) to prevent the outbreak of tetanus. We are talking about *primary* prevention. Prevention can also delay the outbreak of a disease (A*-D*).

If the progression continues into the pre-clinical phase, in other words the individual does not yet notice any symptoms but early signs of the disease or preliminary stages are detectable with medical tests, this is per se insignificant for the individual and financially for his health fund (right top section of A-D). Medically speaking this would be a case of 'over-diagnosis' if one were to try and recognize, in the pre-clinical phase, such hidden progressions that would not have become manifest during the patient's lifespan.

If the case progresses beyond the pre-clinical threshold into the pre-clinical phase, and if a screening test discovers the early stages of a disease in an asymptomatic patient (A-E), we talk about early detection or *secondary* prevention. Whether early detection does more good than harm depends on whether early intervention (still) allows the natural progression to be favorably influenced. This improvement in prognosis can only be assessed on the basis of sufficiently large comparative studies (with vs. without early recognition), not by looking at an individual case. In the schematic graph the progression is improved to A-E-F, i.e. this patient will reach his/her maximum possible lifespan. However, this is by no means the case for all early-detection measures. The gain in lifespan is F-H (not F-E), the gain in quality of life is the rectangle B-H-F-C. However, loss of quality of life as a result of early detection and consequent early treatment has to be subtracted from the quality of life gained at the end (triangle E-G-I). *Furthermore*, the evaluation of an early-detection strategy depends on the number of false positives and the number of over-diagnosed cases relative to the cases with favorably influenced prognoses. Over-diagnosed individuals and those faced with false positives suffer nothing but disadvantages through the early-detection program.

After crossing the symptom threshold, we are in the core area of the medical system. Doctors are at great pains to make the correct diagnoses and mitigate acute complaints. However, even in this phase the manner in which the natural progression can (still) be favorably influenced is crucial for the individual's prognosis (*tertiary* prevention). A large segment of medical care at this stage aims at tertiary prevention, e.g. stopping the blood from clotting after a heart attack, regulating blood-sugar levels in diabetics as well as the many check-ups and consultations patients are invited to attend. From a methodological point of view, there is therefore no fundamental difference between tertiary prevention and clinical medicine with effective prognoses. Preventive measures can also be taken for patients requiring care (A-L-M), e.g. by preventing falls or bedsores.

A special problem arises when, in the spirit of prevention, the clinical manifestation threshold is medically redefined, i.e. lowered, for example when limited glucose tolerance is classified as a pre-diabetic disorder and is diagnosed and treated as a disease in its own right. Tests and interventions have to be offered to more people as a result. In the case of limited glucose tolerance it suffices, at this stage, to make lifestyle changes; there is no need for the use of drugs. And the relevant lifestyle changes would be recommendable to everyone anyway. Even in the case of full-blown diabetes, activating the patient by getting him/her involved in influencing their disease progression with regard to losing weight and improving their metabolic situation is effective.

We talk about *quaternary* prevention when patients and insured individuals are to be protected from being over-diagnosed, over-treated and medicalized. Quaternary prevention is the responsibility of all the insured individuals themselves and of all medical professionals, but particularly of general practitioners, who co-ordinate care, and for evaluative healthcare research.

Risk magnitude and intervention intensity

It is plausible that the nature and intensity of the intervention should depend on the magnitude of the risk. Figure 2 presents three intervention categories suggested by the American Institute of Medicine in 1994: universal, selective and indicated. The greater the risk, the more intensive and risk-specific the intervention. This corresponds to the German proportionality principle. Measures that target the general population cannot be particularly intensive and must not be burdened with side-effects (e.g., recommendations regarding a healthy diet, banning the sale of tobacco to young people). The intervention can be more selective among at-risk groups (e.g., warning messages on cigarette packets). High-risk groups need intensive targeting and even preventive medication, e.g., nicotine substitutes. One would think that medical prevention is largely "indicated prevention". But this is not necessarily the case. Pediatricians, for example, are available for consultations about vaccinations in children's institutions, and high-risk groups need supporting structural prevention (e.g., ex-smokers at risk of relapsing need an environment with smoking bans, the overweight need calorie-reduced options in canteens).

Figure 2. Risk magnitude, intensity of the intervention and intervention categories (Mrazek and Haggerty 1994).

The British epidemiologist G. Rose (1992) drew attention to the fact that from the perspective of the total population the greatest preventive potential lays not with the relatively small high-risk segment of the population but with the relatively large groups at moderate risk (prevention paradox). Bearing that in mind, a health funder would be ill-advised to bank only on prevention in high-risk groups. In addition, the magnitude of a risk does not say anything per se about the extent to which the risk can be influenced. However, the potential net benefit (i.e. the health benefit less the unavoidable undesirable effects and costs) is crucial when it comes to the development and the intensity of a risk intervention. In that respect Figure 2 can be modified: between the area of low risk with a low net potential ("irrelevant") and the area of high risk with a high net potential ("indicated") a middle area can be characterized as "preference-based", where individuals as well as service providers agree on the preventive measures that seem sensible and feasible to them (see Figure 3). Immediately lowering the blood pressure of someone with alarmingly high blood pressure must be classed as "indicated" for example. The lower the measured blood pressure, the more the intervention would be preference-based. These considerations are constantly in flux.

Figure 3. Magnitude of the risk, expected net benefit and intervention categories (own graph).

It is often assumed that preventive measures make savings possible. However, only some of the preventive measures pay for themselves at the level of healthcare funding; the larger part is to be seen as an investment in better health. The relationship between cost and benefit has a similar distribution for preventive measures as it does for measures of curative medicine (Cohen et al. 2008).

Medical preventive measures

The top half of the illustration on page A1810 in the article "[Risikoabschätzung tödlicher Herz-Kreislauf-Erkrankungen: Die neuen SCORE-Deutschland-Tabellen für die Primärprävention](#)" (U. Keil et al. 2005) quantifies the risk of dying in the next ten years from cardiovascular disease. The structure of the table illustrates the interplay of five risk factors: gender and age as non-modifiable risk determinants, cholesterol, blood pressure and smoking as modifiable factors. A sixty-five-year-old non-smoker with a systolic blood pressure of 140mm Hg and a total cholesterol count of 190 mg/dl has a risk of 6%, a smoker with all the other factors the same has one of 12% etc. Even though the three risk factors cited are reversible, the reverse conclusion does not necessarily hold, namely, that a smoker with the figures given will precisely halve his risk if he quits. The table's color-coding contains a demand to action: "those individuals who have a risk of 5% or more, or who will reach this risk midway through life are considered high-risk and should be particularly intensively advised, monitored and potentially treated with drugs" (Keil et al. 2005). This demand to action comes from an expert consensus. Although the theme is not specifically addressed, it implies a cost-benefit analysis, meaning that it allots means from the whole community and puts a price on a saved life. Putting a price on a life is ultimately unavoidable; however it is not (well-meaning) experts who are entitled to do so, but - insofar as a prevention formula is developed for an insured community - the insured community, and - insofar as an individual weighing of interests needs to be performed beyond that - the insured individual (and *mutatis mutandis* the community and individual in non-insurance-based systems). In addition, there is no guarantee that this weighing between different providers in the healthcare sector will be done in a consistent manner, for example that similar cost-benefit configurations will be considered acceptable in early cancer detection as in cardiovascular prophylaxis for example.

Family doctors and patients will get a better-structured decision-making aid, for example, in the form of software that takes patients' individual risk profiles in order to calculate a risk prognosis for heart attacks and strokes in the next ten years, and quantifies the effects to be expected from various treatments. This effect profile serves as a consultation basis in a process of joint decision-making. In this process, doctors should avoid the abstract terms "risk" and "percent". Instead, the connections are to be illustrated in "natural frequencies": "Imagine you have 100 doppelgangers, all with the same age, the same blood pressure, the same cholesterol etc. as you. Of these doppelgangers, three will suffer a stroke or heart attack in ten years." (www.arriba-hausarzt.de).

In the United States, medical prevention measures are given a standardized assessment by the United States Preventive Services Task Force (USPSTF) using evidence-based criteria and compiled in the "Guide to Clinical Preventive Services", which is updated annually. The 2012 edition contains 64 preventive measures for adults, from screening for aortic aneurysm (enlargement of the aorta) to advice regarding tobacco consumption. Only some of the measures are emphatically recommended; for tobacco consumption, the recommendation is, "*Ask about tobacco use. Provide tobacco cessation interventions to those who use tobacco products.*" Many measures are justifiably discouraged, while there is insufficient evidence for others (at the moment). It is thought there is insufficient evidence for screening for raised intraocular pressure, for example. Because of the lack of evidence of any benefit, this service is justifiably not seen as a preventive measure by the German public health funds. Nevertheless it is offered by eye doctors for a fee. If a net benefit cannot be determined, preventive services are neither ethically defensible, nor should they be marketed as preference-based.

Prophylaxis and the public health insurance funds

If medical prevention is not to be billed as a private service, it has to be integrated into the catalogue of services provided by the public health insurance funds. Historically speaking, Bismarckian health insurance did not have a preventive remit. Incapacity to work (compensation for wages as the primary service) and help in the event of illness were what the health funds were created to pay for. The current German Welfare Legislation Code (*Sozialgesetzbuch V*) now gives those insured by the public health funds a right to protection from diseases and their aggravation (section 11), protective vaccinations (section 20d), protection from dental complaints (sections 21, 22), to medical preventive services (sections 23, 24), services relating to pregnancy and maternity (section 24c) as well as to the early detection of diseases (sections 25, 25a, 26). The health fund coordinating body known as the *Gemeinsamer Bundesausschuss* has a competence regarding services for early detection (section 92). The charters of health funds are required to include services of primary prevention "which improve the general state of health and which contribute to a lessening of socially determined injustice relating to health opportunities. The association of health funds (*Bund der Krankenkassen*) shall decide jointly and uniformly, having consulted independent experts, about priority areas of actions and criteria for services [...], especially with regard to need, target groups, access avenues, content and methodology" (section 20).

An institution which provides information for doctors and patients on behalf of the health funds, the *Zentralinstitut für die Kassenärztliche Versorgung* (www.zi.de/cms/projekte/studien/akzeptanz-von-frueherkennungs-untersuchungen/) reports on the uptake of early detection examinations. As part of the "national cancer plan", early cancer detection screening has been critically assessed (www.bmg.bund.de/praevention/nationaler-krebsplan.html). This has led to a specification of the legal framework conditions for such measures ("organized early cancer detection programs", section 25a of the Welfare Code): regular invitations, systematic assessment, quality monitoring and improvement, paying special attention to the participation rates, the incidence of interval carcinomas (i.e. diagnosed between screening rounds), false positives and the mortality due to the relevant cancers among the program participants. These conditions presume a compilation of early cancer detection figures with cancer register and mortality data in line with data protection - this was regulated by law in 2013 (Krebsfrüherkennungs- und Registergesetz (KFRG)). When it comes to early cancer detection measures, on the one hand a high level of participation in those measures whose benefit has been proved is still the goal, but primarily there is a need to provide potential participants with balanced information about the risks and side-effects of the early detection measures in order to promote informed decision-making (www.bmg.bund.de/praevention/nationaler-krebsplan/was-haben-wir-bisher-erreicht/ziel-1-inanspruchnahme-krebsfrueherkennung.html). With this latter double goal, the public health insurance funds have drawn the necessary conclusions and taken the necessary measures arising from the false positives, unnecessary follow-up examinations and over-diagnoses in healthy individuals arising as a result of these measures. By the way, section 1 of the Welfare Legislation Code states: "The insured are jointly responsible for their health; they are to avoid the onset of disease and disability and overcome the consequences of the same through a health-conscious lifestyle, early participation in preventive health measures as well as active participation in treatment and rehabilitation. The health insurance funds are to help the insured by providing information, advice and services and by working towards healthy living conditions."

Medical prevention and health promotion

When doctors advise, encourage and enable their patients to implement and monitor appropriate preventive measures on their own, we can talk about health promotion through medical service providers. In particular, this includes preventive measures that cannot be "prescribed", including change of diet, more physical activity and a reduction of emotional stressors in everyday life. However, asthma training, which enables chronically sick individuals to control their medication themselves, is also an act of health promotion. In this sense, some of the rehabilitation measures that help affected individuals gain a greater degree of control over their health can also be categorized as health promotion. Prevention, health promotion, curative medicine, and rehabilitation are therefore not in competition; rather, they supplement and reinforce one another.

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