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SICK PEOPLE AND SICK POPULATIONS – LEGACY OF GEOFFREY ROSE

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ABSTRACT

Developed by *Geoffrey Rose* strategy of preventive medicine caused a major breakthrough in thinking about the effectiveness of preventive measures. The distinction between actions within the high-risk groups against activities at the level of the whole population raised awareness of public health workers that focus on highly vulnerable individuals may lead to underestimation of the problem of cases among individuals out high risk groups, who due to their numbers in the population, participate to a greater number of cases. The author of this study points to the importance of this distinctions, but also highlights some methodological problems of *Rose* theory. It is postulated efficiency-oriented approach to prevention that takes into account integrated action which includes activities at the level of the whole population, but also an attempt to deliver individualized messages to smaller groups and ant to individuals including those beyond high-risk groups. In the author's opinion this is of particular importance in the context of strong social stratification.

Keywords: *Geoffrey Rose, the strategy of preventive medicine, social stratification*

INTRODUCTION

Geoffrey Rose in his article from 1985 “*Sick Individuals and Sick Populations*” (1) formulated the basis for new strategies to prevent the disease. In subsequent publications, especially in the book: “*The Strategy of Preventive Medicine*” (2) *Rose* developed these ideas and their strategy applied to other groups of diseases. *Rose* views had a major impact on the approach to public health. It made some kind of revolution in the understanding of prevention issues. By many epidemiologists and public health activists *Rose*'s distinctions have been accepted without reservations, although soon after the publication of the “*Strategy*” there were some critics of the *Rose*'s approach (3). How is his model viewed today, after almost three decades of the development of epidemiology? Is it still a paradigm of prevention of diseases in the population, or *Rose*'s strategy would require at least a partial revision?

Geoffrey Rose took distinction between the causes of individual cases and the causes of the disease incidence in the population as the starting point of the proposed strategy. He indicated that these causes can markedly vary from each other. Using metaanalysis *Rose* has confronted numbers of cases occurring in the high risk groups with those in the population out of those groups. As a result he has shown that in many situations

cases occurring in the so-called high risk groups, i.e. patients with particularly high exposure parameters, are less numerous than in other members of the population among which the exposure level is significantly lower. It happens despite probability of getting sick is higher in the risk groups, the number of people out of risk groups is so much higher, that cases among them outnumber those which occur in the risk groups. With all the importance of this observation, it is in fact very simple. The number of new cases in a given time in a given subpopulation is the product of incidence and the number of people in this subpopulation. Thus, among those not exposed or with less exposure the number of cases may be greater than in the risk groups, if the ratio of incidence in risk groups to the incidence in the rest of the population will be less than the ratio of the number of persons outside the risk groups to the number within these groups.

$$I_n \times L_n < I_{nn} \times L_{nn} \equiv \frac{I_n}{I_{nn}} < \frac{L_{nn}}{L_n}$$

where: I_n is an incidence in risk groups, L_n is number of people within risk groups I_{nn} is the incidence out of risk groups and L_{nn} is population size outside risk groups.

The second fundamental observation of *Rose* is a distinction between the causes of individual cases and

causes of incidence. The causes of individual cases Rose interpreted as formulated by Roy Acheson: "Why is this patient ill with this disease at this time?" Such a method of search for causes of the disease is characteristic to a doctor admitting a new patient. It is based on an checking of previously known risk factors of the disease, and where applicable, also its direct causes.

When considering the causes of incidence Rose notes that in populations in which the causative agent is very common, especially when it is widespread as air pollution or the drinking water, demonstrating that given exposure is a risk factor may be virtually impossible within the single population and requires a comparison of the relation of exposure to incidence in at least two different populations. It is a true observation, known at least since the *Goldberger* study on pellagra and it is an important departure from the rigorous treatment of ecological fallacy (4).

The distinction between the causes of individual cases and of the incidence is in the *Rose* theory a premise to focus prevention rather on populations than on individuals. Evaluation of *Rose's* message should therefore include both elements: how justified are his premises and how rational is the postulate of targeting prevention activities on the entire population.

SICK POPULATION

For philosophical purists, the term "sick population" could constitute an attempt to introduce into epidemiology an abstract entity. However, reading of the *Rose's* texts clearly shows that it is simply a figure of speech, for which he hides incidence of a specific disease in the population. *Rose* demarcates the determinants of individual cases and the determinants of incidence rate.

And here it is hard to disagree with him, but the language he uses for this distinction needs to be clarified. Something else is the presence of a particular risk factor in an individual person, than is the prevalence of this factor in the population. While in the case of a single event of illness, the cause is a set of known and unknown risks factors, sufficient to make person ill, the incidence in the population is a consequence of the prevalence of the same and other risk factors present in different combinations in numerous people who have got sick in this population.

It is doubtful that the doctor can determine risk factors that favored the occurrence of the disease in a single patient in isolation from epidemiological studies, which previously stated that the disease in the population occurs more often in people who come into contact with these risk factors. *Rose's* argument that in populations which differ in terms of the average values eg. of the distribution of blood pressure, there are the factors that affect the population as a whole, goes

beyond empiricism of epidemiological studies. *Rose* says: "*Why is hypertension absent in the Kenyans and common in London?*". *The answer to that question has to do with the determinants of the population mean; for what distinguishes the two groups is nothing to do with the characteristics of individuals, it is rather a shift of the whole distribution—a mass influence acting on the population as a whole*".

It is hard to inquire how *Rose* imagined "*a mass influence acting on the population as a whole*". The distribution of the characteristic (eg blood pressure) in the population is the distribution frequency of its occurrence in individual members. The shift of the distribution to any side can hardly be interpreted differently than by change in the prevalence in this population of the environmental or individual factors which increase or decrease the likelihood of the occurrence of specific characteristic in the individual people, or change in its numerical value, eg blood pressure or fasting glucose levels. In the specific case of differences in the mean value of distribution of blood pressure in people of Kenya and London, this may be a factor occurring at different frequencies and/or quantities in both populations or present in only one of them. Today we know many of such factors, which in this case would have a high preliminary likelihood of influence on the distribution of blood pressure. It would be worth to assess them in both populations, if since the time of *Rose* it has not been done yet. In any case, whichever modification of the distribution of variables in a population otherwise than by the interaction with its individual members is beyond my imagination.

THE HIGH RISK STRATEGY AND POPULATION STRATEGY

The division of preventive strategies *Rose* relied on his distinction between individual risk and the risk to the population. In his opinion, a high-risk strategy is based on cutting the fragment of the distribution of incidence (or prevalence) versus the exposure and remaining only its end of high risk (1).

In prevention of diseases, high-risk strategy *Rose* seems to understand as a domain of the doctors, who their traditional practice previously targeted on people who are ill, expand to healthy individuals at high risk selected from the population as a result of screening. It is, therefore, prevention applied individually, characterized by a high motivation of the person participating in it and by physician who carries it out. In the opinion of *Rose* it is a strategy with a high individual effectiveness. According to *Rose*, disadvantages associated with this strategy have their source in the high cost and difficulty of conducting the screening. Preventive measures ad-

dressed to individuals have limited the effect in time and scale and in individual cases they relate to the low levels of initial probability of illness. Rose as a significant difficulty in their implementation considers the mismatch of healthy lifestyle habits (eg. diet) with the customs of other people with whom the person is associated.

Promoted by Rose's population strategy can be realized by improving the health conditions of the environment, and especially through the promotion of healthy behaviors in society and shaping of some social norms. Achieving success in this way would give a very significant reduction in the incidence of the disease, to which those actions would be addressed. As an example Rose gives the result of the Framingham study that the reduction in the mean population blood pressure by 10 mm Hg would reduce the mortality rate due to cardiovascular diseases by 30%. Also rightly points out that the introduction of health behaviors as social norms would avoid conflicts or the stigma associated with behaviors offstanding from the socially accepted.

Rose was aware of the limitations of the population strategy. Among them he mentions little benefit to individuals and the resultant low motivation of both physicians and people to which preventive measures are addressed. Disadvantages listed here are particularly difficult problem in the case of rare events. It may be the case when preventive measures entail significant costs, as it is in prevention with the use of medicinal preparations or vaccines, and when these measures may be accompanied by adverse side effects.

Both strategies are not mutually exclusive what Rose clearly emphasizes. Selection of disease prevention strategies should take into account its severity and prevalence, but also the safety and the costs of preventive measures and epidemiological studies which give the diagnosis of the problem. If limited range of prevention is expected, the cost of screening emerge as important factor for rationale of preventive program.

In many actual publications, including those prepared by WHO, *Rose's* division of prevention strategies for population oriented and individual ones in high-risk groups is the basis for the classification (5). Numerous preventive measures comply fully to this classification. However, there are some, which combine the features of both types and their classification in those terms, depends on how these actions are interpreted. An example of such a prevention is mandatory vaccination. It applies to the whole population, but is given to individual people who mainly belong to vulnerable groups as are children in the first years of life. Rose, indeed, accept the possibility of simultaneous application of both types of prevention, but in his work their definitional separation is clearly indicated.

PREVENTION TARGETED ON EFFECTIVENESS

Population approach to prevention measures has two main lines of action: massive environmental interventions and actions through influence on the prevailing patterns of conduct in society. Both of these courses of action are applied to reduce or eliminate exposure, so they belong to primary prevention. Historical overview of the activities in the field of environmental interventions indicates that perhaps the greatest success in this field was the introduction of sewerage and water supply systems in cities. Although in the first period sometimes happened that they spread gastrointestinal diseases, as indicated for example by Snow studies (6), but with technological improvements they have become one of the most important factors in reducing the incidence of infectious disease.

Another area to improve the safety of the environment is the reduction of the air pollution. Despite the presence in the vehicles exhaust combustion products and other substances with carcinogen potential, the share of air pollution in the risk of lung cancer is negligible compared with cigarette smoking (7). Much more serious is the impact of air pollutants on chronic bronchitis (8). Without questioning the importance of the release of human settlements from the nuisance associated with air pollution, and this also applies to other environmental pollutants, it is important to link environmental interventions with the reliable epidemiological studies which should asses their potential impact. And what is equally important, in all preventive measures it is necessary to weight the expected benefits against the projected costs.

Many variables of exposure are associated with the style of life and are in a direct way dependent on conscious actions of individuals or on norms and customs of the population accepted without reflection. They represent risk factors of diseases or injuries which are well documented in epidemiological studies. The most important and widely known are: smoking, obesity and diets high in fats and carbohydrates, lack of physical activity, alcohol abuse, and use of psychoactive substances. Changing the habits of the population is perhaps even more difficult than improving the environment. A moderate success in smoking reduction came with the fear of lung cancer, which prompted many adults to quit smoking. At the same time, however, the number of teenage smokers increases in many countries.

The undoubted failure of the attempts to change habits is the increase of the incidence of obesity in many countries. Preventive measures by raising awareness at the population level collide in this case with easy access to fast food places serving foods rich in fats and

sweets eaten between meals. Aggressive advertising and incentives appear to have much greater impact than even the best- documented, but unattractive instructions, which refer to the time-delayed effects. Reported by cardiologists and diabetologists difficulties associated with the change of dietary habits of persons with initial or even advanced symptoms, indicate how difficult it is to change established habits, even in a situation of serious threats and health disorders. And this happens in secondary and tertiary prevention promoted by doctors to the patients in direct contact.

The great potential to improve health through prevention acting at the population level, emphasized by Rose on the example of hypertension, is in most cases difficult to exploit and in most countries not used. This is why examples of a few successful population preventive measures such as the North Karelia Project, are so important. Known for many years problem of premature deaths caused mainly by cardiovascular diseases among residents of North Karelia became the starting point of large-scale epidemiological studies aimed at identification of the prevalence of different risk factors of coronary heart disease in the target population.

As particularly important for the people of Karelia was high-fat diet, smoking, low physical activity, and alcohol abuse. Other known risk factors for coronary artery disease such as excessive psychosocial stress, did not occur in these studies as variables specific for this particular population (9). In the next stages of the program the authors turned to preventive measures. Since these tasks are largely related to the impact of healthy behavior and life styles related to it, health promoters used on a large scale theoretical achievements of sociology and psychology of behavior. The authors of the program worked with great dedication combining methods as affecting the population by the media, but also by the action involving doctors to identify individual risk factors of their patients and to apply measures aimed directly at them. Another extremely important element in this program was constant evaluation of its results .

How North Karelia project fits into the classification of Rose? The fact that Rose had joined in its program both interventions at the population level and action addressed to the individuals is at least consistent with his classification. However, in many cases, the problem is the practical inseparability of individual and population-based interventions. Starting from the example of Rose, in which he compares the average blood pressure of nomads from Kenya and administrative staff in London, it can be seen that a change in environmental conditions of Londoners into Kenyan ones would be less than realistic . Therefore, it would be also unrealistic to influence the average blood pressure of the population of London in this way. Blood pressure is a variable dependent on so many genetic and environmental factors that addressed

by the action on the population as a whole, for example by recommendation of low-sodium diet, could be only slightly if not negligibly effective.

The primary activity, which in this case could lead to a significant reduction in the mean blood pressure would be detection of a large enough fraction of people with hypertension and subjecting them to treatment, but also providing them and others, who do not have hypertension with detailed information on the recommendations for lifestyle and diet. And act similarly, regarding elevated levels of LDL cholesterol and triglycerides. For some parts of the population dietary recommendations would suffice, but some should be qualified for the treatment with statins according with the doctor's decision based on an assessment of reputed risk score, like eg. the Framingham / ATP III (10). Separation of the population in these groups can be made only on the assessment of physicians in individual contacts.

Therefore, in a holistic approach to prevention, as it was conducted in the North Karelia Project , population-based activities carried out through the media should be extended for the same message applied to individual patients in direct contacts with doctors . And these individual messages on preventive recommendations should be an integral part of the doctor-patient relations , not necessarily related to the primary purpose of the visit .

While the distinction of prevention at the population level and through individual actions is theoretically justified and came for good to the foundations of public health, in practical activities this division can be maintained when it comes to environmental interventions, but when it comes to the prevention by change of behavioral patterns, the message to the population cannot do much without reaching the individual members. In this case, the individual actions of medical staff have a much greater impact than media messages (11).

Social and economic stratification within countries really complicates the ability to reach evenly different subpopulations by media messages on prevention. It also causes differences in the use of media recommendations in practice, and even creates problems for the various strata of the society with access to the benefits of the natural environment and the communal facilities. Wilkinson's study clearly indicate the role of economic stratification, which turns out to be much more important than the average level of wealth of a society, as a determinant of health and longevity of the population (12). It must be stressed, that the average survival time of a population is a weighted average survival times of different subpopulations, which may differ very much from each other. Subpopulations may also differ markedly in their sensitivity to the transmitted recommendations, their understanding of messages and ability to adapt to them. Large differences can occur in the possibilities of reaching out to these groups. Therefore,

addressing prevention activities to the entire population is a gross simplification. To achieve the effect for population-based preventive measures, it is necessary to vary their content addressed to different social groups and possibly widespread reaching out to individuals, including not only high-risk groups.

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