

## Physical Activity, Health and Health Economics

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Ideally this article should begin with a mathematical model—an equation. On the left we should put together contributions and expenditures in terms of hours, money and effort. On the right we should enter the profits in terms of years of life, money and quality of life. Unfortunately it is not that easy. The literature is comprehensive but also not complete. At the request of the British Department of Social Welfare, Fentem & Bassey went through the literature on exercise and health—1334 references (4), and were unable to draw up any conclusion in the form of a mathematical equation. They could only make a declaration which they called “The case for exercise” (10).

Lack of scientific proof should not stop us from drawing probable conclusions. In the article below we set out our reasons for the conclusions we have arrived at. In brief, the conclusion should be: “exercise is healthy and health is profitable”.

For many, the phrase “health economics” is a contradiction in terms. They feel that life and health are priceless values which neither can nor should be measured in terms of money, while economics is just the science of prices and money. Hence doctors and economists belong in different worlds.

We do not see it that way but regard it as important to work on the border between the two worlds in order to study the relationships between health and economics. This knowledge can be used in the service of health, since it makes it easier to see how one can work most effectively in the health field.

In this article we shall discuss the relationships between physical activity, health and health economics. Everybody knows that it is profitable to take part in physical activity because this makes for enjoyment, wellbeing and health. But is it also

economically rewarding? We cannot advance precise figures for the rewards, but our estimates have in any case convinced us that it is profitable.

### WHAT IS PHYSICAL ACTIVITY?

Physical activity is anything from a stroll to a gruelling competitive physical effort. What interests us is a lifelong goal-directed but relatively moderate degree of physical activity such as half an hour's exercise three times a week plus a Sunday walk (7, 12). This degree of activity is enough to give the individual a substantial amount of the gain in health obtainable through exercise. Lesser activity will still contribute to a certain improvement in health. More intense activity will improve performance but probably contributes little more to health and increases the chance of injury. Competitive sport hardly makes a significant contribution to gain in health but it does play a considerable part through the inspiration it gives to the participant.

### MODEL

When a change in personal health takes place it has economic consequences both for the person and for the community. This happens through:

- A change in economic productivity (work output, sickness absence etc.),
  - change in length of life in the productive years,
  - change in length of life in the unproductive years,
  - change in need and demand for health services.
- There are also relationships in the opposite direction:
- change in economic circumstances has consequences for health,
  - change in the economic situation of the community has consequences for supply of health services.

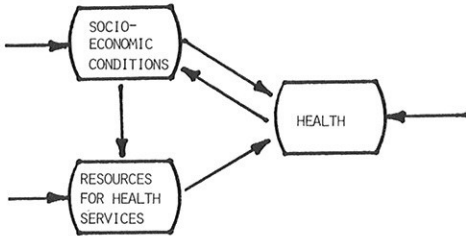


Fig. 1. Health and economics—a model.

These relationships are links in a system (Fig. 1), but the system is not a closed one. There are external influences on all the links:

- Socio-economic levels are to a great extent the result of technical-economic development.
- Resources available for health are not only a function of the actual health situation as determined by the health authorities and the treasury, but to a large extent the result of medical development and the desire of the population for such services.
- Health may be influenced in a positive or negative direction by changes in lifestyle.

The system is also internally coherent in the sense that changes in one part of the system will with time spread to the rest of the system. Everything depends on everything else in economic terms. If the resources available to the health authority are increased, health will improve. As a result, on the short term the need and demand for health services may diminish. But on the long term the need and demands may increase because of an increased need for care of the aged who are living longer because of their better health. To what extent attempts at health improvement are associated with economic gain may therefore often be extremely doubtful.

It is important to stress this point. Those who are interested in a disease or a project often calculate the financial rewards if the community were to follow their advice. For example those who want the community to stop smoking calculate the returns from a diminution in diseases of the heart and lungs. Calculations of this nature are always grossly exaggerated. We are in agreement with the good intentions but these calculations overlook the fact that mortality in the end remains at 100%. Those who escape one disease live longer and have a greater chance of contracting another disease,

perhaps finally dying as a very old invalid. This consideration renders all these calculations uncertain. It can also be useful, especially if it is necessary to choose between alternative projects.

The cycle of life has its economic aspect (2). The last phase of life is economically unproductive but is also of considerable worth both for the individual and for society. We cannot agree with the view that old age should be entered on the debit side in calculating health. This shows the need for accuracy in the assumptions on which health economics calculations are based and for caution in these calculations.

It is important to emphasize that economic yield should not be a condition for starting any health promoting activity. Financial gain is important and should be taken into account but a financial loss for society should be regarded as part of the price paid for the gain in health under consideration. It is customary to pay a price in order to obtain a benefit. The remarkable thing about many health undertakings is that they yield not only better health but also economic gain. It is however self-evident that we cannot limit ourselves in health projects to those financially advantageous.

Because everything depends on everything else in this system, one can intervene at any point in order to achieve a gain in health. There are principles derived from economics theory for determining the best place and the best extent to intervene. This article is chiefly concerned with the effect on health of increased physical activity.

Even if the model or theory is tolerably clear our analysis will be hampered by lack of information. We are therefore not in a position to give completely analysed examples. However, in what follows we present some partial analyses, based in part on factual information and in part on bold assumptions.

### STROKE

First an example out of many. Lund-Johansen shows in his article (9) that physical activity can lower a moderately elevated blood pressure. Let us suppose that this is sufficient to prevent a stroke. If it prevents a non-fatal stroke with permanent paralysis in a young individual this is an economic gain, if the preventive action costs less than an outlay which can run into several million kroner. If on the other hand it prevents a fatal stroke in a 70-year-old, society will suffer a considerable

economic loss, and this loss is the price paid for the benefit of living beyond 70 years of age.

### MYOCARDIAL INFARCTION

Benestad (1) shows that lack of exercise has appeared as an important risk factor for myocardial infarction. Most commonly myocardial infarction affects persons over 67 years old. Nevertheless for our economic calculations we will limit ourselves to myocardial infarction in the economically productive age group (15 to 67 years) and base them on the following assumptions arising out of the current statistics for Norway:

Deaths from myocardial infarction in the age group 15–67 years, about 2400 per annum.

Total number of myocardial infarctions, about 2.5 times the number of fatal cases=6000 per annum.

Duration of hospital stay for myocardial infarction, 15 days.

Absence from work due to myocardial infarction, 100 days.

Economic value of a working day, 400 Norwegian kroner (Nkr).

Daily cost of hospital stay, 1000 Nkr.

We will take up two items: hospital costs and sickness absence costs. Based on the foregoing, hospital costs will amount to:  $6000 \times 15 \times 1000$  Nkr = about 90 million Nkr. Cost of absence from work =  $6000 \times 100 \times 400$  Nkr = about 240 million Nkr, making a total of 330 million Nkr.

(The value of lost lives might also be included. Fatal cases of myocardial infarction between 15 and 67 years lead to an annual loss of about 17000 years of life. This number of lost years represents a considerable value. For example if one calculates the average annual income at 75000 Nkr, 1275 million Nkr are lost every year. However, calculations of this nature raise major problems (8), not least the ethical ones. We therefore prefer not to use them.)

The above is a rough estimate of the economic burden due to myocardial infarction in the working population (15–67 years). How much of this can be prevented? If all the risk factors are reduced, a considerable number of the 6000 cases can be prevented. We believe that it is realistic to assume that increased physical activity alone could reduce the number by about 10%. The latter is probably a low estimate because increased physical activity

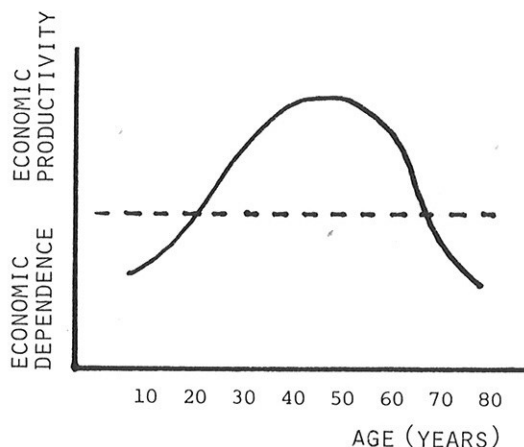


Fig. 2. The economics of ageing.

brings with it simultaneously a reduction in the other risk factors. A reduction of 10% corresponds to 33 million Nkr, which could finance a considerable amount of training and health education.

### FEMORAL NECK FRACTURE

This fracture affects many individuals, especially elderly women, and leads to considerable suffering and treatment costs. Physical activity strengthens the skeleton (2) and it is not unreasonable to suppose that it can also strengthen bone structure in the femur and pelvis and therefore prevent at least some of these fractures. The great majority of those who fracture the neck of the femur are over 67 years old. We are therefore only calculating the hospital costs and making the following assumptions based on current statistics:

Number of persons admitted with femoral neck fracture, 5000 per annum.

Average period of hospital stay for persons with fractured femoral neck, 14 days.

Daily cost of hospital stay, 1000 Nkr.

Hence hospital costs are  $5000 \times 14 \times 1000$  Nkr = 70 million Nkr.

In addition there are expenditures for follow-up and rehabilitation. If again we assume that 10% of these can be prevented by increased physical activity, we are running into millions.

### PSYCHIATRIC DISORDERS

Presumably physical fitness can prevent and/or reduce some psychiatric disorders (5, 6). We may make the following assumptions:



Mental hospital beds, 7 650.

Daily cost per bed, 600 Nkr.

Total consultations with general practitioners annually, 9 million.

Of these, psychiatric consultations 15%.

Consultation fee, 50 Nkr.

Mental hospital:  $600 \times 365 \times 7\,650$  Nkr = about 1 700 million Nkr.

Expenditure on drugs, 120 million Nkr.

Consultation with doctors:  $50 \times 9\,000\,000 \times 0.15$  Nkr = 67 million Nkr.

Consultation with psychiatrists?

This estimate is of course inaccurate; for example, part of the expenditure on drugs is included in the running costs for the psychiatric hospital. It is however clear that the expenditure on items for the psychiatric health services is about 2 billion Nkr. In addition there is the loss of production due to absence from work. A reduction of only one per cent would amount to 20 million Nkr.

From an economic standpoint therefore one would need to speculate a great deal more in seeking a relationship between physical fitness and psychiatric illness. It is not unlikely that a major argument for physical activity in this respect will be discovered.

#### INCAPACITY FOR WORK

Absenteeism in the working population has serious economic consequences for total production. Let us adopt the cautious view that sickness absenteeism can be reduced by one per cent if the population becomes more fit as a result of increased physical activity. Let us assume the following rough and simplified figures:

Working population 1.5 million.

Total sickness absence 10 days a year.

Economic value of a day's work 400 Nkr.

This gives  $1.5 \times 10^6 \times 10 \times 400 = 6$  billion Nkr (6 000 million) as the total annual loss of production due to sickness absenteeism in Norway. One per cent of this would be 60 million Nkr.

Is an estimated change of 1 per cent realistic? We must admit that we know very little about this figure, but we believe on the basis of what has previously been said that this is a low estimate. We must also add that the reduction in sickness absenteeism is only one of the advantages which would be gained. In addition there would be a saving in health services. We would not presume to

calculate the magnitude of this, because many cases of absence from work are due to minor illness which does not affect the health services.

#### THE DEBIT SIDE OF PHYSICAL ACTIVITY

All calculations have a debit side. This is also true of calculations concerning health economics and physical activity.

In the examples given above we must recall that health gains are net gains, and that any injury to health must be deducted. Information on such injury is very scanty. Such observations as exist are mostly related to top-class sport and we doubt whether it is justified to regard intensive competitive sport as comparable to the type of physical activity designed to promote health. Many are involved in serious sport more for the sake of competition than for the sake of health.

Physical activity at a lower level also probably leads to injury to health of considerable magnitude. This in turn leads to illness and consumption of resources. Although statistical information on this matter is totally absent, we believe that it is reasonable to assume that the extent of such injury to health is small in comparison with the expected gain in health.

Another debit item is the equipment (skis, bicycle, jogging shoes etc.) required for physical activity. Sports equipment is an important item in a family's budget. An average household will require to spend 1 000 Nkr annually, or more i.e. a total expenditure of 1.5 thousand million Nkr for the  $1\frac{1}{2}$  million households (Central Statistical Bureau, personal communication 1980). For households with growing children and physically active adults the expenditure may amount to several thousand Nkr annually.

#### COMMENTARY

The most important motive for physical activity, as for cultural activity, is that people enjoy it. It promotes wellbeing and increased enjoyment of work and life. In addition it confers better health.

We have attempted to elucidate the relationship between physical activity and health economics. We have limited ourselves to a few arguments and examples. This is in part due to the lack of data but also to the fact that one can so readily get

lost in detailed calculations of minor credit and debit items, thus leading to neglect of much greater but incalculable items. Suppose for example that physical activity could increase work satisfaction and productivity by 1 per mille. That would imply a gain for society of about 233 million Nkr annually (one thousandth of the gross national product). It is important to see this area in the correct proportions, otherwise it is all too easy to take more interest in details than in the main issues.

### CONCLUSIONS

Physical activity leads to better health. It is a benefit and undoubtedly also of economic value. It is therefore worthwhile to pursue physical activity, also because of its value in health economics.

However, caution is required with detailed calculations, because the latter contain major unknown items. One main problem is that mortality is of necessity 100%. A long life in good health may terminate with prolonged and costly care during the final years. Health should therefore be seen as a benefit in itself, a benefit desirable even if it puts the community to expense. In all other sectors, benefits have a price. It is unreasonable to expect that health in addition to everything else should yield a net profit. Our examples indicate never-

theless that physical activity can diminish disease and therefore costs. We conclude that physical activity is worthwhile—in every respect.

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