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Medical education, care, and research in Norway

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Abstract Health care and medical research are almost wholly supported by the State. The number of doctors has increased markedly (in 1972, to one per 689 people), but not enough to keep up with the expansion of medical services, especially in the hospitals. There is therefore a shortage of doctors. The medical schools at the Universities of Oslo and Bergen train too few doctors (165 and 120 students, respectively, each year) for present needs; consequently, one new school has been opened in Tromsø in 1973, and a fourth is planned in Trondheim.

Norwegian medical research is carried out mainly in the universities. It is strong, fairly well financed, and generally of high quality. About 65% is basic, 25% clinical, and 10% social medical research. Because of the predominance of basic research and the shortage of doctors, many basic scientists enter medical research. We believe high-quality basic research should continue, but medical research must also tackle pressing problems in social medicine and health care characteristic of the modern state.

The country needs a better distribution of doctors, better preventive medicine, better primary medical care (especially in the cities), and better institutions for the chronically ill and the old; medical research is necessary to solve these problems.

Ideally, medical care, medical education, and medical research should be a functional trinity, united by a common philosophy of service to patients, mankind, and society. In practice, however, they are often quite separate, pursuing their own goals defined by historical, social, political, and economic reasons. To understand the system of a given country, one needs to know some of these reasons, and we shall therefore go beyond a report of existing conditions and try to expose and discuss problems, often in a personal way.

Norway is fairly large—324 000 km²—but long and narrow. The coast line, including the fiords, is about 21 000 km long. It stretches surprisingly far up towards the North Pole and is inhabitable only because its waters are heated by

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the Gulf Stream. The population is 3.9 million, and the country is the most sparsely populated on the European continent, with only 12 people per km².

MEDICAL CARE

Organization

The medical system has three levels: municipality, county, and State. In 1860, parliament passed a General Health Act which transferred power and responsibility in health matters to the municipalities (of which there are 407 rural and 47 urban at present). Each municipality has a board of health, consisting of elected members but chaired by a State-appointed district medical officer. The government pays part of his income for preventive, administrative, and social work. In addition, he does general practice on a fee-for-service basis and thus earns the other part of his income. The country is divided into 369 medical districts, and the district medical officer is often the only practitioner in his district. In the larger cities, the district medical officer must have specialized in public health and has a city department of health.

In the early years of this century, the growth of medical knowledge and specialization began to require larger administrative units (the 20 counties), especially for hospitals. Each county has a medical team, which is responsible for supervision and planning of health care in the county. Its special duty is to develop a complete health plan for the county, including a hospital programme. The system is managed centrally by a Directorate of Health under the Department of Social Affairs.

This system has two basic principles. One is decentralization, and the other is co-ordination of public control and medical expertise in the health boards of the municipalities and counties. Health is too important to be left to the doctors, but also too complex to be left entirely to elected representatives.

At present, there are about 689 people to each active physician, and Table 1

TABLE 1
Active physicians in Norway, 1972

2690	(47.2%)	in hospitals
2445	(43.2%)	in practice, 1/3 as specialists
313	(5.4%)	in teaching and research
183	(3.2%)	in administration and prevention
59	(1.0%)	in other work
5690		

shows what these physicians do. We have more doctors than ever before (4–5 times more than in 1900), but there is still a shortage and a marked maldistribution of doctors, with 1 doctor to as many as 1300 people in some of the rural counties.

Financing

In 1911 a State-operated, non-profit insurance programme was organized, which was compulsory for the lowest income groups. This programme has gradually been enlarged until membership was made compulsory for everybody in 1956. More services have been added, and in 1967 the National Insurance was established as an integrated and co-ordinated social insurance system, which covers medical care and pensions. Doctors in practice work on a fee-for-service basis, and the patients pay part of their fee: about 40 % at the first visit, and later less and less. Hospitals are publicly owned; hospital doctors work full-time on salary, and hospital treatment is free. Essential drugs are paid for by the programme, less important ones by the patient. Dental care is generally not included.

The expenses have increased very rapidly. Between 1961 and 1971 public expenses for health and welfare increased from 10.9 to 17.4 % of the gross national product, and the average annual increase in public expenses for health and welfare went up from 13 % for 1961–66 to 22 % for 1971–72. Two items are particularly expensive: hospitals and pensions. In 1971 the total expenses for health and welfare (Table 2) were \$2640 million (taking \$1 = 6.59 N.Kr.). About 60 % was paid by the National Health Insurance, the rest by other public sources (e.g., the counties pay 25 % of the hospital bill). The expenses for the National Health Insurance are shared by four parties: about 47 % by the employers, 33 % by the members, 10 % by the municipalities, and 10 % by the State.

TABLE 2
Health and welfare: expenses 1971

	<i>Expenses in \$</i>	
	<i>Total (millions)</i>	<i>Per capita</i>
Total expenses for health and welfare	2640	678
Medical expenses	660	168

Conclusions

Medical care has improved enormously in this century: life expectancy has increased from 50 to 71 years for men and from 54 to 77 years for women. Good care is available to the people, and insurance has removed the economic barriers to the individual. The system is popular with both patients and doctors, but it is increasingly threatened by over-ambitious doctors and politicians and is now running out of money. Obviously, the rate of further progress must be reduced.

PREVENTIVE MEDICINE

Preventive medicine should be an important area of medical research, and we therefore include this section. On the local level, preventive medicine is directed by the board of health and its chairman, the district medical officer. At his side is a public health nurse, who has proved to be an effective person in the community. The cities have special health departments. Their programmes are co-ordinated centrally by the counties and by the Directorate of Health; they are financed by tax money and are separate from the National Health Insurance.

These programmes have had a tremendous effect, especially on tuberculosis, but traditional preventive medicine directed against poor sanitation and infectious diseases is obviously not going to take us much further. This is simply because present problems are entirely different: smoking, alcohol, drugs, urbanization, pollution, traffic accidents, vascular diseases, behaviour problems—in short, the problems of the developed, industrial welfare state. To attack these problems, we need new methods and more money. (To get more money, incidentally, we need to develop the economy further, thereby probably increasing all these problems.) Paradoxically, we have the knowledge to solve many of these problems, but lack political drive and organization. Smoking and lung cancer, traffic accidents, and tooth decay may serve as examples.

MEDICAL EDUCATION

Norway has three medical schools: Oslo with an intake of 165 students, Bergen with 120, and Tromsø with 40. The last is a new university in the Arctic; its medical school opened in 1973. The fourth university, in Trondheim, will probably start a medical school within 5 years. The two new medical schools have been founded to stop the shame of Norwegian medicine: for years, we have not educated enough doctors, and about 120 students each year go abroad to study medicine.

The four Norwegian universities are all State universities, operating on tax money. The Department of Church and Educational Affairs controls their use of money, but does not usually interfere with academic affairs. Thus, the universities enjoy a fair degree of academic freedom to develop their own characteristics. They co-operate on a voluntary basis through meetings of rectors and deans.

The Norwegian youngster starts in school at 7 and is ready for medical school 12 years later. During the last 3 years of school he must specialize in a main group of subjects (natural sciences, humanities, or social sciences), and until 1972 only students with natural sciences could apply to medical schools. Now, medical schools are in principle open to all students and provide extra courses in natural sciences for those who are weak in them.

The medical schools have a fixed intake (*numerus clausus*), and there are about five applicants for each place. Previously, the intake was strictly on the basis of the final examination from the *gymnasium*, and these students did excellently in medical school. However, a good student does not necessarily become a good doctor, and the public have complained that the medical schools turn out a product which is too rigidly standardized and more interested in medicine than in patients. The entrance requirements have therefore been under constant attack and revision. These revisions attempt to maintain high intellectual standards and at the same time take into account motivation and relevant experience (e.g., 1 year as an auxiliary nurse). The applicants are therefore often 20–21 years old and have 1–2 years of experience after school. It is too early to judge whether these changes will result in better doctors. The dropout rate is very low (less than 5%, usually in the first 6 months).

Undergraduate training lasts 6 years. The programmes in Oslo and Bergen are similar: 2½ years of pre-clinical and 3½ years of clinical studies. The students sit a written examination in each of the pre-clinical sciences after 2½ years and are later examined in each of the clinical specialties. At the end, they have a more comprehensive examination, testing overall clinical knowledge and judgement. No thesis is required.

The students are exposed to research during their study, but are not required to do research of their own. However, some of the students take 1–2 years off to join research groups, and the Medical Research Council gives about 30 student-fellowships a year. Many of these students have been very successful, and continue in research after their final examination.

Norwegian medical education is solid and traditional, and the goal is still to train a competent general practitioner fit for solo practice anywhere in the country. The emphasis is on clinical training in small groups, which requires many teachers (see Table 3 for some data on internal medicine). The overall

TABLE 3

University departments of internal medicine in Norway: university staff.

	<i>University of</i>		
	<i>Oslo</i>	<i>Bergen</i>	<i>Tromsø</i>
Departments	10	2	1
University staff			
Professors*	11	2	1
Associate professors*	9	8	1
Lecturers†	11	2	1
Research fellows†	4	5	—

* Clinical positions for patient care, teaching, administration, and research.

† Not tenured.

student:teacher ratio in 1972 was 4.6 in Oslo and 3.8 in Bergen (these figures include clinical teachers principally employed by the hospitals). The student:bed ratio is difficult to calculate exactly, but the teaching hospitals in Oslo have about 4100 beds and in Bergen about 1100 beds. (Tromsø will have about 600 beds.) Total student intake per year is about 250, so the ratio (considering clinical years only) is about 1:7. Because of the shortage of doctors, the medical schools are under constant pressure to increase the size of classes.

After medical school, there are obligatory internships: 6 months in surgery, 6 months in medicine, and 6 months as assistant to a district medical officer. Finally, there is 1 year of military service. The young doctor is now about 29 years old. He (or she—about 20 % are women) can now go into practice or enter specialist training. The postgraduate clinical education and training is supervised by the Norwegian Medical Association. It comprises 5–6 years of hospital training, and part of this training must be in a large hospital with a postgraduate programme. In addition, a number of courses is required; these courses are given by the universities. At present, young specialists are 'accepted' on the basis of their training, but formal examinations will be required in the near future. So far, general practice is not a specialty, but the feeling is growing that it ought to be. In the future, therefore, all doctors will be specialists, and their total education will last some 27 years—in our opinion, too long.

The entire educational programme has been criticized on the basis that it does not recognize the great changes in medicine and society, nor the social and economic problems so closely related to medicine, nor the fact that it—unconsciously—trains the students away from general practice. The loyalty of the medical schools is primarily to hospital practice, to scientific medicine, and to international research, not to practical medicine and to national problems. There is no connection between the medical schools and the national health

system, and the medical schools have been little influenced by the tremendous changes in medical practice, the development of urban and social problems, and the need for better medical care outside the hospitals. Likewise, the national health service and preventive medicine have developed along their own lines, with too little support in research and education.

The new medical school in Tromsø is trying to develop its own programme to remedy some of these weaknesses. Thus, we shall have an integrated curriculum based on the organ systems, we shall teach general practice, we shall send the students to the local hospitals and health centres, we shall emphasize the social problems in medicine, and we shall have some outside physicians in the faculty.

MEDICAL RESEARCH

Role of the universities

By far the greater part of research is carried out in the universities, and for three reasons. The first is historical: medical research started in the universities and has continued to grow there. The second is economic: a small country must concentrate its resources of men and money if it wants an active role in international research. The third is educational: medical education should take place in a scientific environment. Outside the universities there are only two major research institutes: the State Institute for Public Health in Oslo (microbiology, virology, cell biology) and the Norwegian Radium Hospital with its affiliated Norsk Hydro's Institute for Cancer Research in Oslo. In addition, a small Institute on Hospital Research is growing up in Trondheim.

Until about 15 years ago, medical research was concentrated in the institutes for pre-clinical sciences at the faculty of medicine, University of Oslo. Since then, there has been a rapid growth, mainly along the following lines. First, the new medical schools have established their pre-clinical departments, Bergen in 1963 and Tromsø in 1972. Second, the old departments have grown and become more diversified, e.g., the Department of Anatomy in Oslo has a research group of electron microscopists, biochemists, and molecular biologists. Third, the clinical departments have built up extensive research laboratories, e.g., the Department of Medicine A at Rikshospitalet, Oslo, has developed a well-known Institute for Thrombosis Research. In this development there has been a conflict between two views: concentration of resources for maximum efficiency versus distribution of resources to enrich the clinical departments. Both views have strong advocates. Fourth, new institutes have been formed, especially at the University of Oslo, namely, institutes for immunology, genetics, virology, clin-

ical chemistry, experimental medicine, and surgery. These institutes have proved to be vigorous and productive. Looking back, the development has been impressive; looking forward, there is a need for painful adjustment and concentration, because the growth rate will probably decrease.

Pharmaceutical industry runs good, though small, research departments which concentrate on applied research (drugs and reagents).

Organization

Academic research is entirely in the hands of the university institutes. It is hardly influenced by the medical faculties and is not at all influenced by the Department for Church and Educational Affairs. Over the last few years, however, the Department of Social Affairs has allotted some money to research in social medicine, and this department will probably demand more applied medical research and greater influence.

The Medical Research Council was established in 1949 as part of the Norwegian Research Council for Science and the Humanities under the Department for Church and Educational Affairs. It is responsible for medical, dental, and some veterinary research and is directed by a board of representatives from the universities, the veterinary college, and the Directorate of Health. Its budget is not large, about \$1.1 million in 1972, but this is 'strategic money' which is mostly used to support young research fellows (about 70 for 1973), to initiate research in new fields, and to supply productive research groups with extra money for equipment and technicians. The policy of the M.R.C. is that of the medical scientists; there is little influence by the central administration and politicians.

Total volume and distribution over main subject areas

The Research Council compiles statistics on medical research. This is difficult, since most research is done by people who also teach, administer, or see patients, and it is necessary to estimate the fraction of each person's time devoted to research. Table 4 shows that the total effort in man-years almost doubled between 1963 and 1970. Financial expenditure more than doubled in this time, which suggests that it costs more and more to keep each worker happy. The research effort increased more than the teaching effort: the total intake of medical students increased from 170 in 1963 to 245 in 1970, i.e., an increase of only 50 %.

TABLE 4

Volume of Norwegian medical research: 1970 compared with 1963. Man-years indicate time spent in active research (not including teaching, administration, and clinical practice). Expenses for 1963 have been inflated to 1970 values and are total running costs, including salaries. Data compiled by Norwegian Research Council for Science and the Humanities.

	1963	1970
Scientific personnel		
Number	686	1373
Man-years	257	476
Technical personnel		
Number	523	1176
Man-years	265	491
Equipment and running expenses (\$ million)	5.1	12.5

Very arbitrarily, medical research can be divided into three main areas: basic sciences, including pathology, microbiology, and pharmacology; clinical sciences; and social and psychiatric sciences, including epidemiology, nutrition, and hygiene. Table 5 shows that there has been little change during the years 1963–1970, and the main effort is in the basic sciences. Since clinical research is also oriented towards the laboratory, one could conclude that medical research spends 90 % of its effort on the body and 10 % on mind, soul, and society.

TABLE 5

Main subject areas of Norwegian medical research in 1963 and 1970: relative distribution of manpower and expenses. Data compiled by Norwegian Research Council for Science and the Humanities.

	% of total		
	Basic sciences	Clinical sciences	Social and psychiatric sciences
Scientific personnel, man-years	66 (64)*	25 (25)	9 (11)
Technical personnel, man-years	80 (74)	13 (14)	7 (12)
Equipment and running expenses	69 (67)	23 (22)	8 (11)

* Figures for 1963 in parentheses.

Financing

Table 6 shows the main sources of research money. Clearly, the State pays more and more in the form of direct allocations to universities and institutes. The money of the Medical Research Council comes from two sources: about

TABLE 6

Financing of Norwegian medical research: main sources in 1963 and 1970.
Data based on total running costs, excluding cost of new buildings. Data compiled by the Norwegian Research Council for Science and the Humanities.

<i>Sources</i>	<i>%</i>	
	<i>1963</i>	<i>1970</i>
Public money		
State	61	79
Medical Research Council	9	7
Counties and other sources	5	2
University funds	4	3
Private funds	15	7
Industry	1	1
Foreign sources	5	1

two-thirds from gambling (the State operates a betting business in football) and one-third from taxes. This money makes up only 7%, but its effects are out of proportion to the amount (see above, 'strategic money'). The private funds are mainly for cancer and cardiovascular research and have supported a large and continued effort in these areas, leading to internationally significant results (e.g., on blood platelets, chalcones). Foreign sources, usually American, have been very important in the past but now play a smaller role.

Training and careers

Permanent positions are in academic medicine (teaching, research and, for clinicians, clinical service); there are hardly any permanent positions exclusively for research. University people with tenure have the right and duty to spend 50% of their time on research, but many—especially the clinicians—have too much routine work to fulfil their research obligations.

Because of the predominance of basic sciences in Norwegian medical research and the general shortage of doctors, medical research is invaded by young people with non-medical training. The best ones may compete for permanent positions in the basic sciences, but medicine is a blind alley for many of them, and they are also not well prepared for medical teaching. Their research is often very good, but more related to basic sciences than to medicine. This problem has not yet been accepted for general debate. If it is allowed to grow, the medical schools may end up carrying a large and costly burden of research having little relevance to their main purpose.

There is no formal training for research, no curriculum, and no examination. The young scientists usually start in an institute on the basis of an M.D. or

M.A. They have either applied for fellowships or they have been recruited by 'talent scouts' from enterprising institutes. Their training comprises two parts. The first is work on their own project, usually within a group, and after about 3 years they are expected to defend a thesis ('doctor of medicine'—about 30 every year). The other is a more formal training through postgraduate courses given by the universities. Fellowships are granted on a competitive basis, by the universities, the M.R.C., or the private funds.

Publications

There is only one medical journal in Norwegian, the *Journal of the Norwegian Medical Association*, which keeps the general doctor informed. Scientific articles are published in international or Scandinavian journals (such as *Scandinavian Journal of Haematology* or *Acta medica scandinavica*). Previously, the doctoral thesis was published in one volume, often as a supplement to a journal. Now the thesis usually consists of 6–12 related papers published in one or more journals.

There is no publication similar to *Scientific Research in British Universities and Colleges*. General information can be obtained from the universities or the M.R.C.; special information, directly from the institutes.

International relations

A small country depends heavily on international collaboration and exchange. Most Norwegian scientists have spent a year or two abroad, often in America. There is much exchange, and many institutes co-operate with related foreign institutes on a long-term basis. Such co-operation is generally based on personal relations and is considered very important. Norwegian authorities also recognize the need for travel money to avoid isolation and provincialism.

Norwegian scientists generally join international, European, and Scandinavian organizations in their own field, such as the International Society of Hematology or the International Society on Thrombosis and Haemostasis.

COMMENTS

In this presentation we have touched upon many problems, and we shall end with brief comments on the most important of them.

Lack of unified medical philosophy

The most serious weakness in modern medicine is, we believe, the lack of a unified medical philosophy. *Medical care* is facing extremely difficult problems. Should the 'acute' hospitals continue to grow at an ever-increasing rate, or should primary medical care and long-term care have priority? Paradoxically, medical ethics forces us to prolong life at all costs for hospital patients, but not to improve life for the old, disabled, and chronically ill outside the hospitals. What should have the higher priority: to add years to life or life to years? *Preventive medicine* is still polishing old and rather unimportant problems instead of attacking all the new problems of the modern state. The thrust of *medical research* is mainly directed towards interesting basic problems, while the pressing problems of the people, the health service, and society are left on one side. *Medical education* is not sufficiently geared to serve present needs, and postgraduate medicine is marching forward, leaving ordinary people's ordinary problems in a vacuum. Most important, has medicine become so expensive that it is saddling the community with too heavy a burden? The well should aid the sick, the old, and the handicapped, but somewhere there is a limit to the medical burden a society can carry. Medicine should help to find this limit and also how to use the resources most profitably. All these problems are obviously related, and point to the need for a new medical philosophy.

Quality versus relevance in medical research

Traditionally, medical research is judged only by its quality. We believe that it should be judged by both quality and relevance and conclude that good research is often not relevant to today's problems, while relevant research is often not good enough. It is necessary to build a new type of research aiming at the problems of medical care, preventive medicine, long-term illness, old age, and health economy. This has proved to be a slow and difficult process, and it is necessary to nurse this type of research, even if its quality seems to be improving too slowly.

Quantity of research

It is essential to continue high-quality basic and clinical research. We believe, however, that further expansion of medical research in Norway should primarily be in the 'new' fields we have mentioned above. The enormous expenses of

medicine require a constant research effort simply to keep the medical programme on the right track. We believe, therefore, that the total volume of medical research should increase considerably in the next decade.

Research in medical schools

Much research is now carried out by non-medically trained scientists. We believe that the medical schools should consider this situation carefully. Sooner or later many schools may be forced to choose between two kinds of staff for their pre-clinical departments: non-medically trained basic scientists, or medical subspecialists who are qualified in both basic and clinical aspects of their fields.

Academic freedom

Academic freedom is essential for high-quality research. However, experience indicates that academic medicine left entirely to itself will often divorce itself to some extent from the medical problems of the society. A certain distance may be beneficial, but medical schools should not let the distance grow too large. One safeguard would be to invite a minority of practitioners and lay representatives on to the faculties.

CONCLUSIONS

1. The national health service is well organized but has difficulties adjusting to modern problems. We need a better distribution of doctors; we must improve primary medical care, especially in the cities; we need better institutions for the chronically ill and the old.
2. The national insurance is good but is running out of money. Ambitions must be kept at a realistic level, priorities must be firmer, and evaluation tougher.
3. Prevention has largely solved the problems of poor sanitation and infection, but has not yet come around to a broad study of and attack on the medical and social problems of the modern welfare state.
4. Medical education is solid, but must be modified to train doctors for modern society.
5. Research is of high calibre, but it is not aiming at the most urgent problems. Present research should be continued, but a new type of medical research should be developed, aiming at the large and pressing medical and social problems of today's society.