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# Medical-Ethical Principles on Xenotransplantation

**Statement of Position of the SAMS**
*Swiss Academy of Medical Sciences*

***Foreword***

*A first version of the medical-ethical principles concerning xenotransplantation were published by the SAMS, for consideration, in the Bulletin des Médecins Suisses (1999; 80:1896-1911). The SAMS received various opinions, comments and constructive criticism. These reactions were largely taken into account in the new version which was approved by the Senate of the SAMS at its meeting of 18 May 2000. It must be stressed that these are recommendations concerning the experimental phase and not guidelines, since this field of top research is in a state of constant development. The SAMS, through its Central Ethical Committee, will continue to closely follow the developments in this field in the months and years to come, in order to be able to judge the right moment to update these recommendations or, if necessary, to issue the appropriate Guidelines.*

*Prof. Michel Vallotton, President of the Central Ethical Committee of the SAMS*
*Prof. Ewald R. Weibel, President of the SAMS*
*Basle, June 2000*

## I. Introduction

The spectacular advances in the field of allogeneic organ transplantation achieved in the course of the last 30 years have made it possible to improve not only the life expectation but also the quality of life of a large number of patients. Unfortunately, transplantation surgery has become a victim of its own success: in all countries the increasing demand has led to a considerable shortage of donor organs and consequently to increasingly long waiting lists. As a result, a certain number of patients who could have been helped by an organ transplant are dying. Understandably, alternatives to allotransplantation are constantly being sought. One of these alternatives could be xenotransplantation, i.e. the transplantation of live cells, tissues or organs of one species into the organism of another species.

Although in the years from 1990 to 1995 some scientists expected that within short time transplantations of animal organs into humans could be undertaken with real chances of success, today the majority are in fact more pessimistic. All the experimental organ xenografts that have been carried out up till now have proved unsuccessful in the short or medium term. In fact, this new biotechnology poses complex problems, in particular problems of an infectiological, immunological and physiological nature. There are as yet no answers to many of the questions that arise in this connection.

It therefore seems to be appropriate for the Swiss Academy of Medical Sciences to define how one should approach this new biotechnology from the point of view of medical ethics. In this connection, respect for the human personality and the question of biological safety have to be given first priority: the risks to which not only the recipients but also those who come into contact with them are exposed have to be kept to the minimum. Man's obligations towards animals also have to be taken into account.

As a matter of fact, it is imperative to reflect on the following fundamental questions:

- Bearing in mind our cultural and moral values, is the transplantation of animal organs, tissue or cells in humans desirable or acceptable?
- What are the necessary ethical justifications for such a procedure?
- What restrictions have to be established?
- What priorities can a highly developed country such as ours reasonably set in the field of public health?

These questions are perhaps not addressed primarily to the doctor, but rather to the philosopher, the ethicist and the theologian. In the final analysis it is the task of society to provide the answers and that of the politicians to decide on them. The aim of the Academy, however, is to open the discussion of these questions (see also Chapters 2 and 5.2).

On the basis of the Article 24decies of the Constitution, which was accepted in accordance with the popular referendum of 7.2.99, a law on transplantations is at present drafted. This law will apply to any use of human or animal organs, tissues or cells that are destined for transplantation into humans. It is therefore time to open a broad-based debate, so that after it has been fully informed society in general will be in the position to express its opinion on the aforementioned ques-

tions. In this debate the xenotransplantation of tissues and cells, which in Switzerland and certain other countries is already in the phase of promising clinical trials, must be completely separated from the xenotransplantation of organs, a field where the research is still in the preclinical phase and the future of which is still uncertain.

It has to be pointed out that up till now no state and no international organisation has proposed a moratorium on clinical trials in xenotransplantation, but that in all countries they require official permission.

The medical-ethical principles on xenotransplantation that are formulated here by the Swiss Academy of Medical Sciences have to be constantly adapted to new medical-technical knowledge acquired from the fields of basic research and applied research.

## II. Medical-scientific principles

### A. Definitions

The term xenotransplantation (xenogeneic transplantation or xenografting) covers different technologies, the aims of which are to replace inadequate organs, tissues or cells of one species with a live transplant from another species. Xenotransplantations are described as concordant when the two species are phylogenetically closely related (e.g. apes and humans), and as discordant when they are distantly related (e.g. pigs and humans).

### B. Forms of application

*1. Xenotransplantation of organs*

The organ of a donor animal that has been genetically modified in order to prevent a hyperacute rejection of the transplant is implanted in a recipient of another species, by the creation of anastomoses between the blood vessels of the donor organ and the blood vessels of the recipient. In this way the organ is perfused with the blood of the recipient. The transplanted organ, e.g. heart, liver or kidney, has to take over all the functions of the organ that it replaces.

*2. Xenotransplantation of tissues*

A piece of live tissue, e.g. skin, cornea or bone is tranplanted from one species to another. Secondary revascularisation takes place, starting from the recipient tissue.

*3. Xenotransplantation of cells*

Here, a differentiation is made between two types of transplantation:

With the first type the donor cells (genetically modified or not modified), e.g. bone-marrow cells, pancreatic cells or foetal brain cells, are injected, at a well vascularised site, into the organism of another species, where they release hormones and other factors that make it possible to compensate the insufficiency of certain organs or tissues (diseases of the central nervous system, diabetes etc.).

With the second type, the cells (often genetically modified) of a foreign organism are encapsulated in semipermeable membranes. In this way they are protected against antibodies and immunocompetent cells. The secreted molecules are however able to diffuse through the membrane. This new type of treatment was developed in order to prevent the rejection of animal cells. The implant can be removed from the organism at any time.

*4. Extracorporeal perfusion*

The plasma or blood of a patient is perfused through an organ of another species or through a bioartificial organ that contains live animal cells enclosed in a permeable capsule. These two procedures are carried out in order to bridge, for a limited period, a sometimes reversible organ failure or the waiting time before a planned allogeneic transplantation.

The term xenotransplantation covers neither those products of animal origin that contain only molecules (e.g. porcine insulin) nor tissue grafts consisting of inactivated cells (e.g. porcine heart valves).

### C. Identification of the risks

Every transplantation, whether allogeneic or xenogeneic, exposes the recipient to an immunological risk and to the risk of infection. In order to prevent rejection due to an immune reaction, a high level of immunosuppression is induced by means of drugs, which however greatly impairs the defence against infection. This effect is a significant cause of the morbidity following allogeneic transplantations and the mortality after the organ xenograft.

One option for xenotransplantation is to take primates as donors. Such a concordant transplantation is however restricted to baboons, as anthropoids display a highly developed socialisation, are difficult to breed and are also threatened with extinction. Because of the close genetic relationship there is, however, a considerable risk of infection (HIV and the Ebola virus have been passed from apes to humans). Furthermore, it is not possible to breed baboons that are entirely free from germs. For these reasons a discordant animal species has been chosen as organ donor, namely the genetically modified (transgenic) pig, to which one or more human genes have been transferred in order to prevent hyperacute rejection. The porcine species was chosen because the risk of infection is less than with the use of apes, because it is possi-

ble to breed pathogen-free animals and also because the organs of the pig are about the same size as those of humans. On the other hand, up until now the pathogens specific for the pig have caused disease in humans only in exceptional cases. Endogenous porcine retroviruses, which as has been shown can be transferred to human cells and which exhibit a high rate of mutation and recombination, give greater cause for concern. Although the studies that have been carried out up until now have not revealed any evidence of pathogenicity of these retroviruses, it cannot be excluded that this could appear a considerable time after the infection. Detection tests by means of which an infection with certain viruses of this type can be proven have recently become available. However, many of these viruses can still not be identified and therefore constitute a risk of disease that has to be taken seriously, especially in patients whose immune system is suppressed following a xenotransplantation. The possibility that such a patient could infect those around him cannot be discounted and is in fact horrifying to some people.

The danger of physiological and biochemical intolerance is also a factor that has to be considered with organ xenotransplantation. Even though one day it may be possible to achieve a lasting tolerance of xenotransplants in humans, it is not certain that the physiological and biochemical processes of the animal organ are sufficiently compatible with that of the recipient to guarantee its optimal functioning in the long term.

**D. Possible advantages of xenografts**

There are some indisputable advantages of xenotransplantation that have to be mentioned:
- the large number of available organs;
- shortening of the waiting times;
- the possibility of planning operations in advance;
- the possibility of testing the transplants more thoroughly before the operation;
- reduction of the risk of transfer of human pathogens;
- the decreased danger of illicit trade in human organs.

## III. Legal regulations, guidelines and recommendations

As in most European countries, the USA and Canada, also in Switzerland many reports have been published with recommendations or guidelines on xenotransplantation. Until relevant laws have been passed there are at present only provisional regulations in force. All the experts stress the international dimension of the problem and recommend that the necessary measures be harmonised. For example, steps must be taken to ensure that neighbouring countries do not introduce contradictory laws regarding licensing procedures or epidemiological monitoring.

On 8.10.99, following the corresponding decision of the Upper House of the Swiss Parliament, the Lower House approved a modificaton to the Federal Resolution on the control of blood, blood products and transplants. The new Article 18a allows – with the corresponding approval of theresponsible Federal authority – the implantation of transplants of animal origin in humans (see Attachment I).

## IV. Medical-ethical principles in the clinical trials stage

The clinical trial is an essential step in the development of xenotransplantation. Only by means of clinical trials is it possible to define the risks and to develop strategies to prevent them. However, strict medical-ethical principles have to be observed.

*1. Essential criteria concerning humans as recipients*

- Respect for the personality of the individual in accordance with the guidelines of the SAMS (Attachment I/1.4).
- Observance of all appropriate measures for minimising the risk of infection: use of organs, tissues and cells that are free from known pathogens; preoperative and postoperative tests; short-, medium- and long-term checks.
- control of the rejection reaction.
- Assurance of a lasting physiological and functional compatibility of the xenotransplant and its survival must at least promise a lasting improvement of the patient's quality of life.

In the case of cell transplants that are encapsulated in a membrane, the problem of the rejection reaction still does not seem to be permanently controllable, and there is probably a risk, although slight, of infection. With bioartificial organs, with the extracorporeal perfusion of organs and with cells contained in a membrane capsule, the limited life of the transplant is acceptable, as the procedure can be repeated several times.

*2. Essential criteria concerning the animal as donor*

- The rules of good practice for the reproduction and breeding of animals that are free from known germs.
- The well-being of the animals must be assured and they must not be exposed to any unnecessary suffering (see Attachment I, 1.4).
- The sequential removal of organs from the same animal is not allowed.
- Primates may not be used as potential organ donors for humans in view of the increased risk of infection and the difficulties with the breeding of these species. Depending on the advances in scientific knowledge, suitably justified exceptions may be allowed.
- These rules are based on the assumption that the use of animals as donors for humans is accepted in principle.

*3. Essential criteria in regard to society*

- The use of genetically modified or cloned animals as donors of organs, tissues and cells to the advantage of humans must be justified by a genuine therapeutic benefit for the recipient.
- In order to prevent the appearance of diseases, strict regulations regarding biological safety are laid down.
- The economic aspects are taken into account from the outset and attention is paid to ensuring that in the development of xenotransplantation the interests of society at large are not prejudiced by the financial interests of industry.

*4. Criteria for the selection of patients*

In the selection of patients for xenotransplantation, during the experimental stage all the following preconditions must be met:

- The patient is suffering from an incurable disease and xenotransplantation is the only therapeutic possibility or there is no suitable human donor organ available.
- The aim of the xenotransplantation of organs, tissues or cells must be to improve the quality of life or the life expectancy of the patient better than any other known treatment.
- Children may not be considered as recipients, except within the framework of a trial in connection with a children's disease.

Xenotransplantation must however continue to be considered as the "ultima ratio".

*5. Declaration of informed consent*

In the experimental stage of xenotransplantation, and all the more if this treatment is one day introduced as normal procedure in clinical practice, it is no longer the recipient alone who is involved; the recipient must declare his consent that the persons close to him (spouse, partner, children etc.) be fully informed, in particular concerning the demands and the risks associated with xenotransplantation. The recipient must be convinced of his moral obligation, after the transplantation has been carried out, to adhere to the instructions contained in the protocol, in his own interest and in that of those around him.

*6. Data register*

With the start of the clinical trials a national data base must be created for the data that are obtained, in collaboration with an international data base and in accordance with the law on data protection.

The setting up of a data base is today very important, as the multicentre studies that are essential for estimating the risks require standardised procedures, especially for the monitoring for infectious diseases, which can appear a very long time after the contagion (endogenous retroviruses, prions etc.).

All the data must be available to all the participating countries, in order to be able to very rapidly detect any problem that may arise.

The ongoing studies must also meet these requirements.

*7. Alternatives*

As long as the results from the experimental study phase are lacking all opportunities to promote new solutions to overcome the shortage of allogeneic donor organs must be considered. It would be appropriate to first take the following steps:

- To intensify the prevention of diseases for which a transplantation is the only lasting form of treatment.
- To request the specialists involved to come to an understanding in order to reach a broad consensus concerning the indications for a transplantation.
- To encourage organ donation in the case of death, in particular through better information of the general public and by setting up offices for coordinators in all hospitals, whose task is to look out for potential organ donors and who are trained in talking to the relatives.
- To explain to the general public the possibility of removing an organ or parts of an organ, and tissues or cells (kidney, liver, bone marrow etc.) from a live donor, giving exact details of the conditions and risks of such a donation.
- To call on public and private institutions to support basic research and applied research in all fields associated with allogeneic and xenogeneic transplantations (omnipotent stem cells, bioartificial and artificial organs etc.).

## V. Future tasks of the SAMS in the field of xenotransplantation

It is the task of the Swiss Academy of Medical Sciences to follow up this new technology in its short, medium and long terms, since it constitutes an ethical challenge for medicine and science. The SAMS therefore makes the following proposals:

*1. All those involved in the public health sector, the general public and the authorities should be informed clearly and comprehensibly. This information must be provided continuously and must always take account of the developments in the field of research.*

The dissemination of the information is primarily the responsibility of the scientists participating in this research, the transplantation team and the treating physicians. The media play a very important role in this process. The World Health Organisation has decided to set up a "Xenotransplantation page" on the Internet. The responsibility for planning of the dissemination of the information could be transferred to a national Expert Committee (see 5.3.).

*2. A broad-based public discussion should be initiated on the aims of allogeneic and xenogeneic transplantations and on other potential solutions for the problem of the shortage of donor organs.*

The organisation of a "public forum" could be useful in order to open the debate. As already emphasised, a clear line must be drawn between the xenotransplantation of organs and the transplantation of tissues and cells, which raise different problems. It is important that the costs and the benefit for the patient and for society are discussed, as well as the ideological differences existing within the general population.

*3. An Expert Committee for Xenotransplantations should be appointed at the national level.*

The task of this committee would be to monitor the development of the research in the field of transplantations, to create a national data base, to make contact with similar organisations abroad and in Switzerland, for example with the SCBS (the interdisciplinary Swiss Committee for Biological Safety), in order to achieve a harmonisation of multicentre research projects at the international level. The members of this committee must include scientists (physicians, veterinarians and biologists), lawyers, ethicists (philosophers and theologians), nursing staff, politicians and a representative of the Swisstransplant Foundation (who is not a member of a transplantation team). The committee should be authorised to make expert appraisals of all clinical research projects in the field of xenotransplantation before they are submitted to the responsible Federal authority for approval.

*4. Economic aspects*

*The whole field of transplantation medicine should also be investigated from the economic viewpoint. This will make it possible to weigh the advantages for the patients against the costs to society.*

For allogeneic transplantations, all-in tariffs have been established for the costs of inclusion on the waiting list, the removal and allocation of the organs, the surgical operations and the postoperative treatment. These tariffs probably do not include the true total costs of allogeneic transplantations.

It is at present not possible to assess the costs for xenotransplantations, as there are too many unknown factors. But without doubt we must be prepared for a considerable increase in the demand; the costs for the animal organs will also probably be higher. The life-long immunosuppressant therapy and life-long surveillance of the recipient and his direct surroundings will constitute a major financial burden. All these factors require very close consideration.

*Approved by the Senate of the SAMS on 18th May 2000.*

For the Xenotransplantation Sub-Committee:
Prof. Noël Genton, Lausanne, President; Prof. Bernard Baertschi, Geneva; Prof. François Dermange, Geneva; Ms Yolanda Hartmann, Lausanne; Prof. Michel Jeannet, Jussy; Prof. Martin Rothlin, Meggen; Ms Béatrice Schaad, Lausanne; Prof. Daniel F. Schorderet, Lausanne; Prof. Gunther Stratenwerth, Basel; Prof. Peter Thomann, Zurich

## Bibliography

**Various reports**

1 Nuffield Council on Bioethics. Animal to human transplants. The ethics of xenotransplantation. London: Editions Alexandra Lacassagne Beneska; 1996.
2 Ronchi L. OECD policy considerations on international issues in transplantations. Biotechnology including the use of non-human cells, tissues and organs. Paris: OECD Publications; 1998.
3 WHO 1.98: Xenotransplantation: Guidance on infectious diseases, prevention and management.
4 WHO 2.98: Report on WHO consultation on xenotransplantation. Geneva, Switzerland. 28th–30th October 1997.
5 WHO 1999: Round Table; Bulletin of the World Health Organisation, 1999, 77 (1).
6 Hüsing B., Engels E.M., Frick Th., Menrad K., Reiss Th. Xenotransplantation. Swiss Scientific Council, TA Programme. Berne, 1998.
7 Ducluzau R. et al. Ethique et Xénotransplantation. Les cahiers du comité consultatif national d'éthique pour les sciences de la vie et de la santé. Paris: Editions Alexandra Lacassagne Beneska; 1999;(21):2–32.
8 Xenotransplantation: International Policy Issues. OECD Publications. Paris, 1999; No. 50575, 114 pages.

**Various publications and analyses**

9 Bach FH, Fishman JA, Daniels N, Proimos J, Anderson B, et al. Uncertainty in xenotransplantation: Individual benefit versus collective risk (Commentary). Nature Med 1998;4:141–4.
10 Baertschi B. Les xénotransplantations: aspects éthiques et philosophiques. Schweiz Med Wochenschr 1998;128:961–72.
11 Daar AS. Ethics of Xenotransplantation: Animal Issues, Consent and Likely Transformation of Transplant Ethics. World J Surg 1997;21:975–82.
12 Fishman JA. Xenosis and xenotransplantation: Addressing the infectious risks posed by an emerging technology. Kidney Int 1997; 58 (suppl.):41–5.
13 Hammer C, Linke R, Wagner F, Diefenbeck M. Organs from Animals for Man (Review). Int Arch Allergy Immunol 1998; 16:5–21.
14 Kennedy I. Xenotransplantation: Ethical Acceptability. Transplant Proc 1997;29:2729–30.
15 Michaels MG. Xenotransplant-associated Infections. (Special Topic Overview). Laboratory Animal Science 1998;3:228–33.
16 Stoye J. No clear answers on safety of pigs as tissue donor source. Lancet 1998;352:666–7.
17 Weiss RA. Science, medicine and the future. Xenotransplantation (Clinical Review) BMJ 1998;317:931–93.
18 Weiss RA. Xenografts and Retroviruses. Science 1999;285: 1221–2.

## Attachment: Legal regulations, guidelines, Swiss and international recommendations

### 1. Legal principles in Switzerland

*1.1 Constitutional Articles*

– Art. 120, al.2, of 18.4.99, regarding the dignity of life
– Art. 119a, of 18.4.99, regarding transplantation medicine

*1.2 Laws*

– Animal Protection Law of 9.3.78, Revision of 1.7.95, Art. 13.
– Law on Epidemics of 18.12.70, Revision of 10.6.97, Art. 1 and 2.
– Federal Law on the modification of the Federal Resolution on the control of blood, blood products and transplants of 8.10.99.

[1] For the implantation of implants of animal origin in humans, the approval of the responsible Federal Office is required.
[2] Transplants of animal origin can be implanted in humans within the framework of a clinical trial, if the risk of infection for the general population can be excluded with a large degree of probability and if a therapeutic benefit can be expected from the transplantation.
[3] Transplants of animal origin can be implanted in humans within the framework of a standard treatment, if according to the present state of scientific and technical knowledge a risk of infection for the general population can be excluded and if the therapeutic benefit of the transplantation has been proved in clinical trials.

*1.3 Regulations*

– Regulation on Drugs in the Clinical Trials Stage, of 18th November 1993
– Intercantonal Office for the Control of Medicines, Berne, 1993
– Guidelines on the Handling of Personal Data in the Field of Medicine. EDB (Federal Delegate for Data Protection), Berne, 1997

*1.4 Medical-ethical guidelines that have already been published, and other positions of the SAMS and the SANS*

– Medical-Ethical Guidelines for Organ Transplantations, Revision of 1995.
– Guidelines for Research Investigations in Humans. Schweiz. Ärztezeitung 1997:78:43;1585-92.
– Medical-Ethical Guidelines on Somatic Gene Therapy in Humans. Schweiz. Ärztezeitung 1998:79:49;2498-501.
– Medical-Ethical Guidelines for the Transplantation of Human Foetal Tissue. Schweiz. Ärztezeitung 1998 79:39;1936-40.
– Ethical Principles and Guidelines for Scientific Experiments in Animals. Ed. 1995
– Position on the term "Dignity of the Animal" (SANS & SAMS). Ed. 1998
– Contribution on the Ethical Assessment of Xenotansplantation in Regard to Protection of the Dignity of Animals (Ethical Committee for Animal Experiments of the SAMS and the SANS). Schweiz. Ärztezeitung 200;81(1):36-7.
– Ethical Considerations on the Allocation of Materials in Short Supply in the Health Care Sector (Conclusions of the 1996 SAMS Symposium held on 15th /16th November 1996 in Interlaken), Schweiz. Ärztezeitung 1997:78:46; 1709-15.

### 2. Regulations in Europe and the USA

*2.1 United Kingdom*

At the suggestion of the Nuffield Council on Bioethics an interim committee for the regulation of xenotransplantation was appointed in 1997 (UK Xenotransplantation Interim Regulatory Authority – UKXIRA). This committee is thus charged with drawing up guidelines for biological safety. It is empowered to decide on the approval of clinical studies.

*2.2 France*

Law No. 98-535 of 1.7.98, the implementing statutes of which are in preparation. Xenotransplantations belong to the field of clinical studies and are subject to approval by the Ministry of Health.

*2.3 Council of Europe*

In the Recommendation No. 1399 of the Parliamentary Assembly of the Council of Europe of 29.1.99, a moratorium on all clinical xenotransplantation trials was suggested to the Council of Ministers. The Council of Ministers shared the concern of the Parliamentary Assembly but did not take up this suggestion for a moratorium, and took the decision "to create a working group with the task of preparing a project for guidelines in the field of xenotransplantation, which takes into account other works already carried out by other, mainly international authorities, as well as the necessary collaboration at the global level".

*2.4 United States*

Xenotransplantations are subject to control by the FDA and the CDC. The work is coordinated between these two authorities.

Guidelines concerning risks of infection and their prevention are in preparation.

All clinical studies require the approval of the FDA.

**3. Guidelines of international organisations**

*3.1*

International Ethical Guidelines for Biomedical Research involving Human Subjects, Geneva, 1993.

*3.2*

In 1998 the World Health Organisation (WHO) published two documents entitled "Xenotransplantations: Guidelines concerning the prevention of infectious diseases and their management" and "The ethical aspects of xenotransplantations".

*3.3*

The Organisation for Economic Cooperation and Development (OECD) has organised several conferences with the aim of establishing a common attitude in regard to transplantations, and pressed for international cooperation in the field of biological safety in connection with xenotransplantations. A concluding report was published in October 1999.

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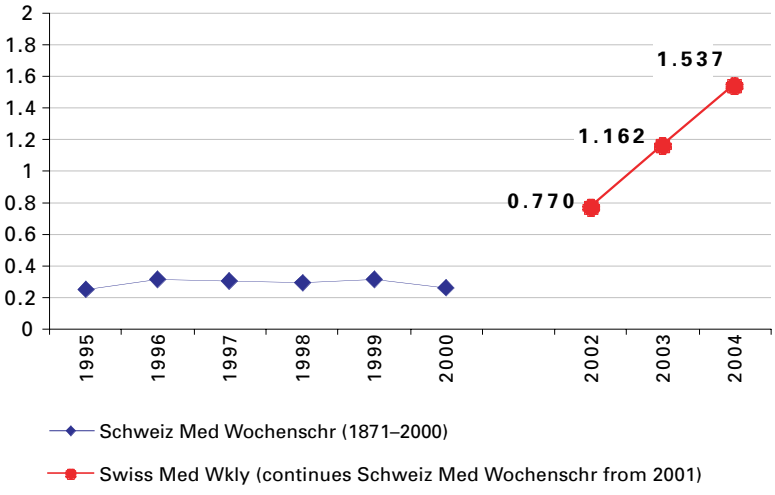


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