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Final Report – Government Commission Concerning Health Technology Assessments of Medical Devices

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Preface

The Swedish Dental and Pharmaceutical Benefits Agency (TLV) was commissioned by the Swedish Government on 4 April 2012 to conduct health technology assessments of medical devices. This activity would be conducted on a trial basis and be concluded with a final report no later than 31 October 2013. The final report will consist partly of a knowledge base in the form of health technology assessments of the selected medical devices, and partly of an assessment of whether the research activities should be made permanent and how this should be structured.

On 17 October, the TLV was given a new commission by the government continue with and expand the research activities regarding the health technology assessment of medical devices. A final report on this commission will be presented no later than 31 December 2014 and will consist partly of each of the knowledge bases with associated assessments, partly of an assessment of how an orderly system for the introduction of medical devices should be structured and what such a process is dependent on when it comes to development of data sources, i.e. accessible, structured volumes of information, in the healthcare system.

This report is partly a final report on the commission of 4 April 2012, partly a starting point for subsequent work.

Stockholm, 31 October 2013



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Summary

The commission

The Swedish Dental and Pharmaceutical Benefits Agency (TLV) has been commissioned by the Swedish Government to conduct health technology assessments of medical devices. The aim of this commission is to produce assessments that can support the organisations responsible for healthcare in deciding whether to introduce new methods and in procurement processes. The work has involved the evaluation of insulin pumps and continuous glucose monitoring, as well as implantable cardiac defibrillators, home blood pressure monitoring and temperature-controlled laminar airflow for allergic asthma. In October 2013, the government extended the commission until 31 December 2014. In accordance with the new commission, TLV will conduct health technology assessments of at least two new medico-technical product groups, of which one must be comprised of products used for the treatment of chronically ill patients. The product groups that are chosen must also be in different stages of their product life cycles, with at least one group consisting of products with new and innovative technology.

Background and current situation

Medical devices are a heterogeneous group, encompassing everything from cannulas to robots. The cost of medical devices is judged to be significant for the county councils. The Swedish market for medical devices turns over about SEK 23–25 billion every year. There are, however, large regional variations in prioritisation and purchasing. As it stands, each county council makes their own assessment of whether and to what extent each medical device will be used. Some county councils have their own units for knowledge evaluation, others chose their priorities in other ways. There is a danger that this leads to unjustifiable differences between county councils. There is also a danger that this leads to patients and service users not receiving the best possible health outcomes in return for the tax-payers' money that is being spent on medical devices.

When it comes to medicines, Sweden has, in recent decades, created a national system for evaluation and prioritisation, primarily through the establishment of the TLV (formerly the Swedish Pharmaceutical Benefits Board, LFN). The TLV conducts health economic evaluations of medicines and consumables and makes decisions on whether these will be included in the benefits system.

There are also governmental agencies that evaluate medical devices. The Swedish National Board of Health and Welfare (*The National Board of Health and Welfare*) draws up national guidelines in which medical devices may be included. The Swedish Council on Health Technology Assessment

(SBU) produces overviews of the current evidence base, in which evidence is graded, that are published in the form of various reports. These reports have encompassed a large number of methods based on medical devices.

The quantity of scientific data that is available to demonstrate the effectiveness of a device varies significantly between the different groups of devices, but can in general be said to be clearly worse than, for example, medicines. The methods used to grade the evidence do not differentiate between medicines and medical devices. This leads to a situation in which few medical devices can be shown to have sufficient evidence and consequently, The National Board of Health and Welfare and SBU normally conduct no investigations into their cost-effectiveness. The consequence is that county councils and municipalities usually receive limited guidance from The National Board of Health and Welfare and the SBU prior to purchase or procurement.

It is also important to ensure that innovative devices that can be beneficial actually do benefit the patients and at a reasonable cost.

A requirement for supporting evidence

There is currently a clear requirement from both county councils and from the medical devices industry for additional health economic data. This requirement applies primarily to medical devices that have a weaker documented scientific basis, where the current evaluations by The National Board of Health and Welfare and SBU do not provide sufficient support for the county council decisions on procurement and utilisation. This can, for example, concern early evaluations of methods based on medical devices in the development stages or medical devices that have just been launched and which have been assessed as having a high sales potential.

There is currently a gap between the evaluations that review evidence, which often result in a conclusion that there is the evidence is absent or deficient, and the county councils' decisions on procurement and utilisation, in a market that turns over about SEK 23–25 billion every year. The type of evidence base that is lacking, and which the TLV has begun to produce within the scope of this commission, needs to provide support to the county councils in situations where the evidence is absent or deficient.

Furthermore, it is urgent that medical devices are evaluated at the national level to a greater extent in such a way that the county councils are provided with better and more consistent evidence bases in advance of making decisions about purchasing and utilisation. It is essential that the evaluations appear at the right time and that they can be used by the county councils in practice. In order for the evaluations to be of the greatest benefit, they should be conducted at an early stage, sometimes even before the publication of clinical evaluations. The health economic evaluation must be based on the best available data.

Organisations responsible for healthcare have asked for supporting data that also considers aspects other than health economy, such as ethical aspects. The evaluation should not be limited to the performance of the medical device, but must also consider the application of the product in the healthcare system. A device may have several purposes such as diagnosis, treatment, rehabilitation etc. It is also important to evaluate another medical technology such as treatment and processes.

The TLV's experience in conducting health economic evaluations of medicines and consumables provide the natural prerequisites for reviewing medical devices as well. In this way, pre-existing investigative expertise can be utilised and create the conditions for a more evidence-based and consistent utilisation of medical devices across the entire country.

The review of medical devices should be based on the same ethical platform as has been stipulated by the Riksdag (Govt. bill 1996/97:60) and that applies to the other activities of TLV. Being able to prioritise without the risk of sub-optimisation is an economic principle to adhere to. The activities of TLV should be conducted as a complement to the health technology evaluation activities that are already being conducted by other governmental agencies, so as not to run the risk of the work overlapping.

All stakeholders should be able to put forward proposals on which medical devices to review. In order to utilise society's resources in the best possible way, a choice does however have to be made. TLV has compiled a list of criteria containing seven points that, in a transparent and predictable way, will establish which groups of devices should be subject to review with the associated health economic analysis.

The TLV's knowledge base and overall assessment

The aim of the knowledge bases that are produced concerning medical devices is to support the county councils in advance of decisions on procurement and utilisation. Thus, it is important that the data appears at the right time and is as unambiguous and user-friendly as possible. The knowledge bases contain two parts. The first is a report on the current situation as regards knowledge and the data that is available. The second then goes on to describe the quality of the data and the uncertainty surrounding, for example, evidence. The first part concludes with an overall assessment, the aim of which is to provide guidance to the county councils in advance of their decisions, but is not to be seen as a binding recommendation. The second part is a consequence analysis concerning the effects on the county council budget, which procurement parameters may be important, any follow-up and evaluation needs etc. The knowledge bases are produced in collaboration with the county councils, industry, patient organisation and other stakeholders.

Decisions concerning knowledge bases and overall assessments are normally made by the director-general with the support of the Board for Pharmaceutical Benefits.

Terminology

Opportunity cost – a fictitious cost used when designating alternative uses for resources. The cost is the income lost from the alternative that has not been chosen.

Phase III study – a clinical trial on healthy or ill people, used to study the effects of a drug or treatment method. Phase III studies are conducted on a very large group of patients (300–30,000) in order to conclusively determine how usable the drug is for treating the disease in question. This group of patients must, to the greatest possible extent, be similar to the population in which the finished drug will be used.

Consumable – product that is required in order to get a drug into the body or that is required for the patient to monitor their own medication. One example is test strips that are used to check the blood sugar levels.

Generic drug – drug that may be manufactured and sold once the patent on the original drug has expired. These contain the same active ingredients in the same quantity as the original and have the same effect, but often at a lower price.

Approved indication – the conditions that may be treated with a specific drug that has been approved by the Swedish Medical Products Agency or its European counterpart, the European Medicines Agency.

Incremental – a phenomenon that is based on a gradual increase.

QALY, quality-adjusted life year – a measure of quality of life defined as a useful value between 0 (dead) and 1 (perfect health). The calculation is based on the individual's own assessment of their quality of life, together with the estimated number of years they will live.

Pharmaceutical benefit – a drug that is included in the pharmaceutical benefits is subsidised and included in the high cost reimbursement system.

Original drug – the original drug that a company has developed and own the patent of.

RCT – randomised controlled trial in which the participants are randomly assigned to different groups. The trial can take place blinded and double blinded, which means that either the participants or the researchers are unaware of which group each participant belongs to (blinded) or neither the researchers nor the participants know this (double blinded).

Steady-state period – no change in the patient's condition.

Sub-optimisation – means that there is a danger of reaching a solution that is not the best possible when attempting to divide a complicated problem into manageable pieces.

Subsidy – that part of the cost of a drug or dental treatment paid for by the state. Applies to drugs and dental treatments that are included in either the high cost reimbursement system for drugs or the high cost reimbursement system for dental treatment.

1 The Commission

1.1 Aim and scope

In April 2012 the Swedish Government commissioned the Swedish Dental and Pharmaceutical Benefits Agency (TLV) to undertake health technology assessments of medical devices¹ This activity will be conducted on a trial basis and encompass a minimum of two groups of medical devices. In accordance with the commission, one of these groups will comprise insulin pumps. A final report on the commission will be presented by 31 October 2013 at the latest. The final report will consist partly of a knowledge base in the form of health technology assessments of the selected medical devices, and partly of an assessment of whether this trial should be made permanent, and if so, how it should be structured. The health technology assessments that the projects will produce are expected to provide support for the organisations responsible for healthcare in their clinical decision-making and procurement.

The government's motivation is that health technology assessments of medical devices are beneficial to patients and the healthcare system in several ways. The assessments are expected to contribute to:

- providing a better evidence base for clinical decision-making and the procurement of medical devices,
- greater transparency surrounding the cost-effectiveness and prices of medical devices,
- better utilisation of existing resources for the evaluation of knowledge as a result of the assessments being conducted by a national agency and not by all of the organisations responsible for healthcare, and
- a more evidence-based and consistent use of medical devices throughout the entire country.

Over the course of the commission, we have become aware of other potential effects of eventually making this role permanent, and have included such issues in the work.

Within the scope of this commission, the opportunity to stimulate and support innovation with the field of medical devices has been identified. By reviewing innovative products before they are put to use in the healthcare system, knowledge can drive the faster and better organised introduction of cost-effective devices. On the other hand, it can also contribute to devices that are not cost-effective being introduced into the healthcare system with greater consideration or not at all. This type of knowledge is of even greater

¹ Government decree S2012/2788/FS (partly)

importance when there are two or more treatment alternatives paid for from different budgets, for example, pharmaceuticals and other medical technology.

The TLV has also found that there are many and somewhat varied expectations of the clinical and practical results of this commission. Some of these are the patients' rights to both modern and safe care, as well as a more permissive climate for medical innovations in the healthcare system. In each of these cases, a knowledge base and an overall assessment can be of significance, but collaboration with other parties will also be required. For example, it is natural to collaborate with the Swedish Medical Products Agency with regard to issues of patient safety and with VINNOVA when it comes to innovation. Furthermore, it is important to maintain an ongoing collaboration between the TLV, the SBU and The National Board of Health and Welfare on matters including development methods.

The government gave the TLV an expanded commission in October 2013. The commission involves extending the trial until 31 December 2014. In accordance with the commission, TLV will evaluate at least two new groups of medical devices. At least one of these groups will be devices for the treatment of chronically ill patients. The product groups that are chosen must also be in different stages of their product life cycles, with at least one group consisting of products with new and innovative technology.

1.2 The Ethical Platform

Health economic evaluations can be used to make rational and transparent prioritisations for how resources are allocated within the healthcare system. They function as one of many tools for prioritisation and thus reduce the danger of decisions being made arbitrarily and make recommendations and the bases for decisions more predictable and the decisions more transparent. Two methods that lead to the same use of resources (cost to society) and offer the same benefit for the patient and society as a whole are evaluated in the same way. In the prioritisation process, a health economic evaluation provides the space to provide more health care for the money than a system in which the resources are allocated evenly between different groups of patients.

The Health and Medical Services Act contains fundamental and overarching regulations for all healthcare. Section 2 of the Health and Medical Services Act (1982:763) stipulates that the goal of the healthcare system is good health and care on equal terms for the entire population. Care will be provided with respect for everyone's equal value and the dignity of the individual (principle of human dignity). Care will be prioritised on the basis of greatest need (principle of need and solidarity). At the same time, the cost also has to be weighed against the benefit within the healthcare system (principle of cost-effectiveness, which, from the perspective of pharmaceutical benefits, is expressed in the Pharmaceutical Benefits Act (2002:160)). Together, these three principles constitute an ethical platform in assessments and when

making prioritisation decisions². The intention of this platform is to state a general attitude in prioritisation situations and cannot resolve all of the points of view that exist.

A board of the TLV, the Board for Pharmaceutical Benefits, will adhere to the Pharmaceutical Benefits Act (2002:160) when making decisions. In addition, the ethical platform should be taken into consideration for all TLV decisions. According to these regulations, a prescription drug must be covered by the pharmaceutical benefits, and the cost and sale prices must be set on the conditions that: 1. the costs of using the drug, taking into account the regulations in Section 2 of the Health and Medical Services Act (1982:763), appear to be reasonable from medical, humanitarian and economic perspectives, and 2. that there is no other drug or treatment method available that, when weighing up the intended effect and potential harm, as intended by Section 4 of the Medicinal Products Act, is judged to be significantly more expedient.

The duty of TLV is to weigh these three principles against each other to come to a comprehensive assessment in their decisions. The cost of utilising one drug should, with the application of the principle of cost effectiveness, be reasonable in terms of medical, humanitarian and economic aspects. It is important to adopt a comprehensive view when making this assessment.

Need can be defined based on the severity of the condition, as the expected benefit of a treatment or as a combination of the two. Consequently, when making decisions on subsidies, TLV weighs up the cost-effectiveness of the drug and the severity of the condition.

If need is assessed based on the severity of the condition, this means that care of the person whose condition is relatively more severe is prioritised. A more severe condition implies that the condition is responsible for a relatively poorer quality of life or a greater number of lost years of life. By using this method of identifying need, TLV strives to ensure health equality.

The condition's severity is defined based on the initial condition and the risk of permanent harm or early death (prognosis) without treatment. An assessment of severity requires taking several factors into consideration. The appraisal of these factors can either be done qualitatively as a description of the consequences that a disease will have on expected lifespan, functionality etc. or by calculating the expected number of remaining quality-adjusted life years (QALYs).

The knowledge bases that are produced within the scope of this commission must, as with the TLV's other activities, adhere to the ethical platform for healthcare. TLV has begun a review of how we work with the interpretation

² see the Swedish Government Bill *Prioritisations within the healthcare system* (Govt. bill 1996/97:60 pp. 18 ff.)

and application of the ethical platform, with the aim of reviewing and developing the application and appraisal of the three principles. This work involves both internal and external activities and initiatives. However, this development process cannot be accounted for within the scope of this report and TLV intends to return to the issue in future.

2 How the Trial has been Conducted

2.1 Organisation

The trial evaluation of medical devices has been conducted in the form of a project.

2.1.1 Project group

The project has been led by project manager Malin Blixt. Others involved in the projects are health economists Ann-Charlotte Dorange and Ingrid Tredal, medical analysts Inger Hemmingsson, Mia Levévn and Björn Södergård, legal officer Lena Telerud and analyst Patrik Hidefjäll. External consultants were engaged to provide additional expertise such as modelling, literature search and device evaluation as required.

2.1.2 Reference group

A reference group has been formed as part of the project with the aim to function as a communication channel to the county councils. The reference group is structured following consultation with the *National Coordination Group for Evidence-based Governance* (NSK) and consists of people with a wide range of knowledge, interest in medical technology and lengthy experience of county council-directed care. The reference group also contains representatives from county councils both large and small, from various parts of the country with varying demographic challenges, county councils that have travelled various distances in terms of prioritisation and health economic evaluations. The group has met on five occasions over the course of the project.

The group consists of the following people: Lennart Philipson, research director, Örebro County Council; Björn Löfqvist, head of medical technology, Kalmar County Council and the Swedish Association of Local Authorities and Regions (SALAR); Björn-Erik Erlandsson, deputy head, School of Technology and Health, Royal Institute of Technology (KTH); Elisabeth Persson, medical advisor, Stockholm County Council; and Bo Hallin, healthcare strategist, Region Västra Götaland.

2.1.3 Steering group

The director-general has appointed a steering group for the project. The steering group has submitted its points of view on the project direction and the proposals from the project group. The steering group has met about once a month over the course of the project.

TLV director-general, Gunilla Hulth-Backlund, chaired the steering group from April to August 2012, followed by acting director-general Anna Märta Stenberg from August 2012 to 23 June 2013 and finally director-general

Sofia Wallström from 24 June 2013 until the end of the project. The other members of the steering group are unit chief Niklas Hedberg, TLV; project manager Malin Blixt, TLV; health economist Ann-Charlotte Dorange, TLV; Professor Per Carlsson, Linköping University; and healthcare director Catharina Andersson-Forsman, Stockholm County Council. TLV chief economist, Douglas Lundin, and senior health economics advisor, Niklas Zethraeus, were also members of the steering group in autumn 2012.

The director-general made the final decision on the positions to be adopted by the TLV.

2.2 Consultation with several stakeholders

The commission states that TLV must consult with the organisations responsible for healthcare and other organisations concerned. The TLV must also consult with the governmental agencies concerned with respect to working practices, as well as the materials that will be used in the assessments and how the TLV will gain access to this. The TLV must also enter into a dialogue with the organisations responsible for healthcare in order to adapt the knowledge bases to the needs of their recipients. It also appears that the TLV and the trade organisations for medical technologies must enter into a dialogue as part of the development process about which data will be used and how the agency will gain access to relevant information.

The TLV has consulted and collaborated with a wide range of actors in various ways, partly through meetings with the individual stakeholders, partly through various workshops to which identified stakeholders have been invited and where key issues in the commission have been discussed.

2.2.1 Organisations responsible for healthcare

TLV has worked closely with the organisations responsible for healthcare over the course of this commission. The results have been reported successively for various stakeholders; the healthcare directors, the NSK, the individual county councils and our reference group. TLV has also included a representative of the organisations responsible for healthcare in the steering group.

The organisations responsible for healthcare have contributed in various ways. For example, TLV has received valuable contributions concerning the county council requirement for decision-making support and the type of information that should be included in the TLV's knowledge bases.

2.2.2 Trade organisations

There are two trade organisations for medical technologies, *Swedish Medtech* and *Swedish Labtech*. TLV has had several meetings with these trade associations, and they have made important contributions to the process. The TLV has also been in contact with

Läkemedelsindustriföreningen – the research-based pharmaceutical industry in Sweden (LIF), which has participated in several meetings and provided valuable points of view. Aside from entering into a dialogue about which data will be used and how the agency will gain access to it, the trade organisations have been a link between the TLV and the companies.

2.2.3 Concerned governmental agencies

TLV has been involved in an ongoing dialogue with the Medical Products Agency since the commission was begun. The other agencies concerned in this commission are the SBU, The National Board of Health and Welfare and VINNOVA. The TLV has consulted with all of these agencies and collaborates continually in order to benefit from their experience, prevent the same work being done twice or to prevent agencies from arriving at conflicting results. The agencies' contribution has been an important part of the project's development.

Because the county councils may continue to receive data from several agencies, for example, The National Board of Health and Welfare's guidelines, SBU reports and the TLV's knowledge bases and overall assessments, it is important that the agencies improve their coordination in order to simplify matters for the recipients and ensure the quality of what is provided. This may involve, for example, the selection of areas, formulation of and restrictions on questions and time for reporting. Clarity in communications to the recipients of the agencies' respective data is also important.

It can also be noted that medical technologies are included as a small part of the project “Orderly Introduction” within the National Pharmaceuticals Strategy.

The collaboration with VINNOVA that TLV is about to make more in-depth involves many interesting opportunities related to innovation. When it comes to the conditions for clinical trials and the development of medical technologies, TLV has also contacted the government investigator in charge of the central government's investment in increasing the number of clinical trials, and the Royal Swedish Academy of Engineering Sciences (IVA).

2.2.4 Companies

TLV has met with a large number of companies, partly within the scope of the fields that have been evaluated within this project, partly in advisory meetings in advance of the potentially permanent nature of this commission, as well as various meetings under the auspices of trade associations. The companies have been important stakeholders as they can contribute with data and information about devices and methods. They also have a good insight into what our challenges will be when it comes to the introduction of innovative products etc.

2.2.5 Medical experts

As the scientific data is normally relatively weak in comparison with medicines, it is important to bring a broad range of medical expertise to bear on the evaluation of medical technologies. TLV has made connections with a large number of experts with clinical expertise, researchers and medical technologists in order to guarantee the best possible data.

The role of the experts is to contribute clinical knowledge about the diseases and devices in question and act as discussion partners in, for example, investigating whether or not the company's various assumptions in the health economic models are clinically reasonable. The TLV collects proposals from experts from the Medical Products Agency, the SBU, The National Board of Health and Welfare and the Swedish Society of Medicine.

2.2.6 Patient and service user organisations

Public collaboration

One general foundation of the commission is the stipulation in the Health and Medical Services Act about good, equal care for the patient. Involving patient and service user organisation in the work is thus of the utmost importance. Contact with patient and service-user organisations was initiated at a relatively late stage of the project, when the conditions were appropriate to discuss concrete proposals. By way of an introduction, the TLV took part in a meeting involving several counties on 13–14 May 2013 organised under the auspices of the LIF. The meeting was targeted at all of the Swedish Disability Federation's (HSO) county representatives.

TLV organises a dialogue forum twice per year to which we invite the HSO members. During autumn's dialogue forum, the TLV presented the medical technology commission. The patient and service user organisations have also been welcome to come to the TLV and discuss the project and the report.

Collaboration on specific issues

With regard to the groups of medical devices that we reviewed within the scope of the trial, we have been in contact with the identified patient organisations concerned. Insulin pumps and continuous glucose monitoring concern diabetics and there are two patient associations in Sweden, *Diabetesorganisationen i Sverige* (the Diabetes Organisation in Sweden, DiOS) and *Svenska Diabetesförbundet* (the Swedish Diabetes Association, SDF). Both of these organisations were invited to TLV in connection with us having received the government commission in May 2012. Both the SDF and DiOS have also participated in a consultation meeting with the TLV, which took place in June 2013, and provided their opinions on both the process and the work we had done concerning insulin pumps and CGM. The TLV also met with the SDF and DiOS in October 2013.

Initially, it was as yet unclear which groups of devices would be reviewed in addition to insulin pumps; as such, it was not possible to identify the patient groups concerned at that point. It was only in autumn 2012 that it became clear which other groups we would review. TLV chose to review home blood pressure monitoring, implantable cardiac defibrillators and temperature controlled laminar airflow for the treatment of patients with allergic asthma.

The patient organisations concerned most distinctly by these devices was judged to be the Swedish Heart and Lung Association and *Astma- och allergiförbundet* (the Asthma and Allergy Association), respectively. These patient organisations were invited to meet with TLV in June 2013. The aim of this meeting was for them to have the opportunity to provide their points of view about the data and also about how the process would continue from there.

International

Evaluating medical devices is becoming more common, not only in Sweden, but also in other countries; however, different methods are used in different countries. The TLV has visited two other governmental agencies in Europe, the *National Institute for Health and Care Excellence* (NICE) in England and Wales and the *Health Care Insurance Board* (CVZ) in the Netherlands. Both of these conduct health economic evaluations of medical devices. The aim of these meetings was to learn from the insights and experience gained by these organisations as they have built up their roles. TLV has also conducted telephone interviews with other international governmental agencies that have similar roles, for example, the *Canadian Agency for Drugs and Technologies in Health* (CADTH).

2.2.7 Other stakeholders

The Swedish Standards Institute

As a result of this commission, TLV has become a member of the Swedish Standards Institute (SIS). The SIS is a non-profit membership organisation that specialises in national and international standards. It has participated in several meetings and external workshops with the TLV. The SIS has provided the benefit its knowledge about standardisation processes and about how future activities may be developed with the help of standards for such things as the grading of evidence from the results of trials of medical technologies.

The Centre for Technology in Medicine and Health

The Centre for Technology in Medicine and Health (CTMH) is a collaboration between Karolinska Institutet (KI), the Royal Institute of Technology (KTH) and Stockholm County Council (SLL) that aims to contribute to developing the Stockholm region into a world-class centre for medical technologies. The CTMH vision is the realisation of the combined potential of KI, KTH and SLL through the creation of a medical technology research and development environment that is unique in Sweden.

The TLV and the CTMH have had several meetings over the course of 2013, with the aim of investigating whether it is possible to collaborate in a more enduring way if the TLV's trial activities in this field become permanent.

2.3 Selection of devices and working practices

The government commission stipulates that TLV must evaluate *at least* two different product areas, one of which is insulin pumps.

The TLV began by conducting a situational analysis of the county councils and other governmental agencies. This was conducted partly in order to find out how they deal with medical technologies and partly in order to map out the systems for evaluation and prioritisation of medical technologies or other transparent selection processes.

Following that, the trade organisations, other governmental agencies and the county councils (through NSK) were invited to submit proposals regarding which medical devices we should evaluate within the scope of the trial. A large number of proposals were submitted; everything from wound care to scalpels, three-wheeled wheelchairs, IT systems and MRI scanners. Bearing in mind that the commission was also to evaluate whether the activity should become permanent and, if so, how it should be structured, we were of the opinion that it was important to review products that were very varied and that presented various challenges from the point of view of evaluation. In order to gain plenty of experience, we chose to evaluate more than two different groups of devices.

One ambition was to find an area in which the assessments would offer knowledge that could make a difference in day-to-day clinical practice. We also wanted to select areas in which we could use different evaluation and working methods, where the clinical basis had different qualities and where the relevant alternatives for comparison were dissimilar. Bearing in mind the relatively short time available to complete the commission, we selected product areas that already had data available, but where issues such as the effect on budgets, disease severity and epidemiology, insufficiently satisfied clinical need, inequality of care and the cost-effectiveness of the device were yet to be dealt with.

A stated foundation was a perspective of the effect on the economy of the whole of society with the same ethical platform as applies in the Health and Medical Services Act. Early on in the commission, it was discovered that there was a need for TLV to deliver more than just a health technology assessment of cost-effectiveness. The representatives of the organisations responsible for healthcare conveyed their requirements that several parameters be highlighted in the knowledge bases presented by the TLV. Cost-effectiveness is one part, but it is also important to consider other aspects of the ethical platform, as well as the other consequences of the new

technology, the patients' integrity and autonomy, and organisational and financial impact.

Consequently, we engaged, among others, an ethics researcher from Linköping University. The researcher has helped us to highlight and analyse the principle of cost-effectiveness against the principles of human dignity and needs and solidarity. One model used to illustrate how other ethical issues can be highlighted in an analysis have been produced, see Chapter 6.6. The complete model is presented in Appendix 2.

2.3.1 Insulin pumps and continuous glucose monitoring

In April 2012, TLV made the decision to remove insulin pumps from the benefits system³ as these products are not considered to be consumables. One consequence of this decision is that each individual county council needs to procure insulin pumps themselves in order for patients to have access to them. In order to create the conditions for the county councils to procure insulin pumps and thus create a smooth transition for patients, the date this decision came into force was set 18 months after the decision had been made. Consequently, the decision comes into force on 1 December 2013.

There are already large differences throughout the country in both the proportion of patients who receive insulin pumps and the indications for this. In the county councils with the lowest level of prescription, about ten per cent of all type 1 diabetics receive insulin pumps, whereas the figure is about 25 per cent in the county councils with the highest level of prescription. There is concern, from the patient organisations, amongst others, that the differences between the county councils will become even larger once the devices are no longer included in the pharmaceutical benefits system.

The commission stipulates that insulin pumps are one of the product groups that the TLV must review within the scope of this trial. A one of the overarching goals of the commission is good and equal care, the ambitions to deliver a document that prevents the differences between county councils becoming even greater than they already are. Our goal was to create a document that would support the county councils in the procurement of insulin pumps when these are removed from the pharmaceutical benefits system on 1 December 2013.

In the initial phase of the work on insulin pumps, we consulted with medical experts, the county councils and involved companies among others. During these consultations, it appeared that it would not be satisfactory to simply conduct an evaluation of insulin pumps. The development of the technology means that continuous glucose monitoring (CGM) is increasingly linked to insulin pumps. Consequently, there is a requirement to review CGM as well.

³ TLV reference numbers 781/2012, 782/2012, 783/2012, 789/2012

We chose to evaluate CGM from two perspectives, partly for those patients who use insulin pens, partly those who use insulin pumps.

When it comes to insulin pumps, the initial impulse was to compare the pumps with one another. This was partly because it had not been done previously and there appeared to be a relatively large difference in price between the products, despite being aimed, according to the manufacturers, at the same patient population, partly because the commission stipulated that the TLV's document must support the procurement process.

Because the government commission is to conduct a trial for a limited period of time, there has not been room to employ our own staff to conduct the work that is required to produce a usable evidence base for the evaluation of insulin pumps and CGM. Instead, we have been reduced to taking on external help for large parts of the work.

KTH

Against this background, we engaged KTH in order to conduct a usability analysis, a bench test (evaluation of the products functions) and an analysis of willingness to pay on the insulin pumps and CGM systems. KTH tested five insulin pumps and four CGM systems. A technical evaluation of the devices was conducted first, followed by interviews with researchers about the products' usability and peculiarities and people's willingness to pay for the devices. The four models of pump that were on the market at the start of the projects were tested by 20 people who had not used insulin pumps previously and then by ten people who had. The fifth model of pump (which was not on the market at that time) and the CGM systems were tested by 30 people. Finally, KTH conducted a review of the development of the technology over time linked to patient benefit. The report (see Appendix 1) analyses how the technical development of, for example, insulin pumps contributes to increased benefit to the patient and how this benefit is best measured.

The SBU and The National Board of Health and Welfare

The National Board of Health and Welfare began the work of updating the national guidelines for good diabetes care in spring 2012. In connection with this, The National Board of Health and Welfare requested SBU to produce a knowledge base that indicates the scientific support for the effectiveness and cost-effectiveness of CGM when this technology is integrated with an insulin pump to help treat diabetes. TLV also asked SBU to produce a corresponding knowledge base with regard to CGM used without an insulin pump and also an insulin pump used on its own. TLV also wanted these knowledge bases to report on the effects of use by adults and children separately. The SBU was positive it could accomplish this.

The companies

The companies involved have participated in this review. They have taken part in several meetings with TLV, both individually and in groups. In December 2012, the TLV held a hearing concerning insulin pumps and continuous glucose monitoring and invited experts, companies and other governmental agencies. The hearing dealt with issues such as how the TLV would gain access to information, how the process would work with KTH's evaluation, which health economics models are currently used within the field of diabetes and the limitations of these in capturing technological development. Valuable opinions were provided, which indicated the importance and benefits of collaborating with both industry and the professions.

2.3.2 Temperature controlled laminar airflow in cases of allergic asthma

Airsonett AB is a Swedish medical technology company that manufactures and markets Airsonett, a temperature controlled laminar airflow device for patients with allergic asthma. There is no other similar product on the market in Sweden. Airsonett is not primarily intended to replace drug treatment, but is to be regarded as a complement for severely ill patients who do not gain sufficient relief from the standard drug treatment.

Even prior to receiving the government commission, representatives of the company and trade associations had requested that TLV review the device and its cost-effectiveness. The company has conducted both clinical trials and health economic studies and believes that these show that the product is both clinically beneficial and cost effective. Despite this, the company has found it difficult to get the healthcare system to invest in the product and begin using it. The business believes that this is because the same requirements are placed on medical technologies as on pharmaceuticals, which it considers to be both unreasonable and unachievable.

The TLV is of the opinion that an evaluation of this device, in addition to investigating whether the product is cost-effective, may also highlight the difficulty of introducing a new method into the healthcare system, a situation that is made more difficult as the alternative it is compared with is paid for out of a different budget. This is further complicated by the fact that there is sometimes not such a great opportunity to produce evidence for medical technologies. In this evaluation, the company has contributed by providing data that the TLV has reviewed.

2.3.3 Implantable cardiac defibrillator

An implantable cardiac defibrillator (ICD) is an active implant that, via an electrode placed in the heart, can supply the heart muscle with a high energy shock when it detects ventricular fibrillation. An ICD can also be combined with a biventricular pacemaker (CRT). This combination therapy is used in heart failure, when the contractions of left and right ventricles are out of sync.

Both the SBU and The National Board of Health and Welfare have evaluated implantable cardiac defibrillators. Despite this, TLV was requested to review ICD and CRT by both individual county councils and the trade associations.

Generally speaking, there are no alternative treatments that can reduce the risk of cardiac arrest and, although treatment with an implantable cardiac defibrillator is relatively expensive, it is important that the treatment is provided to those patients who have the greatest need. Patients can be affected by sudden cardiac arrest, which in most cases is fatal. Fewer ICDs are implanted in Sweden than in the rest of Europe and the difference is even greater when compared with the USA. The hypothesis for the work is that the devices are cost-effective for certain groups and that too few ICDs may be being implanted into these groups in Sweden.

TLV has commissioned the *Centre for Medical Technology Assessment* (CMT) at Linköping University to conduct a health economic evaluation and ethical analysis of ICD and CRT.

No attempt has been made to differentiate between the two devices in this review, instead the focus is on an evaluation of the entire group of devices in order to investigate the cost-effectiveness of treatment with ICD and CRT.

Under the auspices of Swedish Medtech, we have had two meetings with the five companies that marked ICDs in Sweden. The companies have been allowed to see a first draft of the results. The companies have also had the opportunity to express their opinions on both the results and the TLV processes concerning ICDs specifically. The companies have also had the opportunity to send in materials about ICD and CRT.

2.3.4 Home monitoring with automatic blood pressure monitors

High blood pressure is one of the most common causes of regular visits to the doctor and an important treatable risk factor for the development of cardiovascular disease. Once blood pressure treatment has been initiated, blood pressure should be checked regularly, which leads to blood pressure checks being a very common measure within the healthcare system. As an alternative to blood pressure checks at a clinic, the patient can check their own blood pressure at home with the help of an automatic device.

There is an SBU Alert Report on home blood pressure monitoring the conclusions of which are as follows. 3.

For people with high blood pressure, home blood pressure monitoring is just as effective in guiding anti-hypertensive drug treatment as measurement at a clinic. The patients take prescribed medication to the same extent and the reductions in blood pressures are the same.

Home blood pressure monitoring is thought to be at least as successful as blood pressure monitoring at a clinic in predicting the risk of death and cardiovascular disease. However, it is not possible to assess whether home blood pressure measurement used to guide treatment is better or worse when it comes to reducing the risk of death and cardiovascular disease.

The evaluation focuses on whether the method of home monitoring as such is cost-effective. No specific products are reviewed in this evaluation.

2.4 Results of the sub-projects

2.4.1 Insulin pumps and continuous glucose monitoring (CGM)

Patient benefit

Insulin pumps

Based on the scientific data available concerning the benefit to patients, together with long-term, extensive proven experience in Sweden, it can be concluded that insulin pumps and insulin pumps in combination with continuous glucose monitoring (SAP) provide a treatment effectiveness that is in the same order of magnitude as intensive insulin treatment with injections, which is the relevant alternative for comparison. The uncertainty is, however, great.

For certain groups of patients, who have problems with fluctuating glucose levels and hyper- or hypoglycaemia despite optimised insulin therapy, the use of an insulin pump is beneficial in comparison with intensive insulin therapy with injections. These benefits are also thought to occur in the case of insulin pump treatment of patients with low BMI (and low insulin doses), the dawn phenomenon, repeated episodes of diabetic coma, unconsciousness caused by hypoglycaemia or severe diabetic gastroparesis. The same applies to children.

However, it is very important to evaluate the use of insulin pumps and reassesses whether a patient is receiving any benefit (including quality of life benefits) from the insulin pump and discontinue it with there is no beneficial effect.

Continuous glucose monitoring (CGM)

Based on the available scientific data concerning the benefit to patients, together with the experience that exists in Sweden, it can be concluded that there are significant gaps in our knowledge of CGM and that the clinical experience of this method is shorter (<10 years) that is the case for insulin pumps. The treatment effectiveness of CGM appears to be in the same order of magnitude as blood glucose measurement with test strips. The uncertainty is, however, very large.

Treatment with CGM has advantages for patients who have a particularly large problem with recurrent serious hypoglycaemia (that the patient cannot deal with on their own), inability to detect the warning signs of

hypoglycaemia, for children who need to have their blood glucose tested very frequently (>10/day) and for patients who have inexplicably high HbA1c levels or fluctuating blood glucose.

However, it is very important to evaluate the use of CGM and reassess whether a patient is receiving any benefit (including quality of life benefits) from the CGM and discontinue it with there is no beneficial effect.

Cost-effectiveness

In order to undertake a satisfactory health economic evaluation, both cost and the effectiveness must be surveyed and supported by data of a sufficiently high quality.

In its reports, the SBU has worked out the average annual cost of treatment with insulin pumps and CGM, compared to treatment with injections and measurement with test strips. The SBU emphasises that the cost is high for the various treatments, but have not investigated the effectiveness side in their cost analysis. As such, this analysis does not show whether the treatments are cost-effective or not. The cost analysis that has been conducted by SBU does, however, provide a solid basis from which to further develop a cost-effectiveness analysis.

According to the SBU, there are eight cost-effectiveness analyses comparing insulin pumps and injection treatment that are of a good scientific quality. However, the SBU is of the opinion that these analyses have used a reduction in the change in HbA1c values that is too large. They do, however, indicate that certain patients experience an improvement in their quality of life on insulin pump treatment.

According to SBU, there is on one relevant cost-effectiveness analysis that compares an insulin pump combined with CGM with injection treatment and glucose measurement with test strips. The study builds on American data and healthcare costs that are not directly comparable with Swedish circumstances, this results in a great deal of uncertainty. The results from the sensitivity analysis that best reflect Swedish circumstances show that the cost per quality-adjusted life year (QALY) is about SEK 675,000 for treatment with SAP. TLV is of the opinion that the cost per QALY is high, but that there is a great deal of uncertainty about the transferability to Swedish circumstances.

With regard comparisons between CGM and glucose measurement with test strips, there are model analyses that maintain sufficient quality according to the SBU. These two analyses are both based on the American data and healthcare costs, which leads to a great deal of uncertainty with regard to their results. According to these studies, treatment with CGM leads to a cost of between SEK 300,000 and 660,000 per QALY. TLV is of the opinion that

the cost per QALY is moderate to high, but that there is a great deal of uncertainty about the transferability to Swedish circumstances.

Follow-up and evaluation

We have identified a need to update the clinical guidelines for diabetes, and also to include guidelines for SAP and CGM, which are currently lacking.

Follow-up of these aids is very important, especially follow-up of the impact on quality of life. Consequently, SBU is of the opinion that additional controlled trials of high quality, with a longer follow-up time and covering all groups of diabetes patients are needed if the effects are to be determined. According to the TLV experts, this type of comparison would require thousands of patients to be monitored over the course of up to 10 years. Therefore, we cannot expect to be in possession of such data within a reasonable length of time. However, if the follow-up is carried out correctly, and the registry achieves a high degree of coverage, we will gain this information gradually, even if it takes the form of the results of controlled trials.

Overall assessment

With regard to insulin pumps, there is a lack of relevant cost-effectiveness analyses. Thus, we cannot comment on the cost-effectiveness.

The results show that the cost per QALY is about SEK 675,000 for treatment with SAP. TLV is of the opinion that the cost per QALY is high, but that there is a great deal of uncertainty about the transferability to Swedish circumstances.

The cost-effectiveness ratio appears to be reasonable with regard to the severity of the disease, which is judged to be moderate to high.

The results show that the cost per QALY is between SEK 300,000 and 660,000 for treatment with CGM. TLV is of the opinion that the cost per QALY is moderate to high, but that there is a great deal of uncertainty about the transferability to Swedish circumstances. The cost-effectiveness ratio appears to be reasonable with regard to the severity of the disease, which is judged to be moderate to high.

The organisations responsible for healthcare may therefore decide whether or not the method will be introduced for those patients who fulfil the treatment targets without these aids.

However, it is important to follow-up and evaluate their use. If a patient does not receive any beneficial effect (including improvements in their quality of life) the use of these aids should be stopped.

2.4.2 Temperature controlled laminar airflow (TLA) in the treatment of allergic asthma

Patient benefit

The proven positive effect of the treatment applies primarily to asthma-related quality of life. For patients with incompletely controlled asthma, however, all improvements in quality of life are significant as the disease constitutes a barrier to productivity, family life and social functions. The risk for serious, unwanted side effects is judged to be very low as the treatment is neither pharmacological nor invasive.

TLV assesses, based on the studies available, that the benefit to patients is greater than the alternative used for comparison (pharmacological treatment alone) for those patients who suffer the most from allergic asthma. This is because the treatment improves quality of life for individuals with serious limitations to their daily lives. In this assessment, TLV draws its conclusions based on randomised, double-blinded controlled trials that are of an acceptable quality. Despite the seriously limited number of patients, the knowledge base is larger than what is normally available within the medical devices field. The limited data does, however, mean that there is a high level of uncertainty with regard to the treatment effectiveness and primary target group.

In cases of incompletely controlled allergic asthma, an improvement to quality of life as a result of a more effective treatment can mean better sleep, a lower rate of absence due to illness, an increased ability to concentrate and a more active life. If the treatment is provided as a complement to optimised drug treatment, the ethical consequences are minimal. Before treatment is started, patients should be informed about the limitations to the knowledge about the treatment's effectiveness, as well as the drawbacks the method may involve in terms of comfort.

Cost-effectiveness

Two health technology assessments of treatment with TLA have been published in which the cost-effectiveness of Airsonett has been evaluated, but which both use the same model. The result of this evaluation indicates moderate cost-effectiveness. In addition, the manufacturer has produced two health economic models, one for the Swedish market and one for the British market. Both of these indicate a moderate cost-effectiveness ratio, even though the cost data from the British model is not directly transferable to Swedish circumstances. Each of the three models has a different basis and are therefore hard to compare with one another. Even though the bases are different, the analyses of the models still gives an idea of the size of the cost-effectiveness ratio.

The TLV has also conducted its own sensitivity analyses of the Swedish model that the manufacturer produced. These analyses indicate that the

cost-effectiveness ratio is sensitive to a change in the initial parameters. When using a conservative assumption, no healthcare cost savings, there is a cost-effectiveness ratio of SEK 405,000 per quality-adjusted life year (QALY). That is to say, TLV deems the cost-effectiveness ratio to be moderate. The model is relatively sensitive to the price of the device, with an increase in the monthly cost by SEK 500 leading to an increase in the cost-effectiveness ratio of SEK 50,000 per QALY. A change in quality of life also has a relatively large impact on the result, with a 20 per cent reduction in quality of life leading to a cost-effectiveness ratio of SEK 635,000 per QALY.

The data used in the health economic model is uncertain as there is a prevailing uncertainty surrounding both the effectiveness of the treatment and the costs associated with the treatment. None of the models reports on the cost to society as a whole, which probably underestimates the cost-effectiveness of the treatment.

Follow-up and evaluation

Follow-up and registration of the effectiveness of the treatment is of great importance. It is appropriate to conduct an evaluation of the effects on the individual patient, as well as to make a decision on whether to continue treatment following three months of treatment.

Overall assessment

The treatment appears to be cost-effective based on the best available data. This is conditional on the use being limited to certain specific patients. These patients should have comparable problems and circumstances to those patients for whom the treatment has been shown by the available studies to have an effect.

The organisations responsible for healthcare may thus consider whether or not to introduce this method. However, it is advantageous to refer patients for whom this may be appropriate to a specialist physician/allergist for individual assessment.

2.4.3 Implantable cardiac defibrillator

Patient benefit

According to the TLV's assessment, the benefit to patients of ICD treatment is better than that of treatment with medication alone. This assessment is based on scientific studies with a low level of uncertainty and that are of a good quality. The results of the studies show statistically significant reductions in mortality when using ICD treatment for both primary and secondary prevention, compared to patients who have only received pharmacological treatment.

In certain cases however, the clinical benefit in general differs for certain sub-groups within the patient population in terms of primary prevention.

This mainly involves differences in the risk of sudden cardiac death. This aspect should be taken into consideration on an individual bases when making treatment decisions. Otherwise there is a risk that resources are taken from other urgent healthcare measures that may be assumed to provide a greater net benefit.

The benefit to patients in cases of secondary prevention, as well as the effect in cases of imminent or ongoing ventricular fibrillation, is considered to be equal for all patients who receive the treatment. It should also be emphasised that the benefit to patients is considered to be equal for all individuals with a high risk of sudden cardiac death, regardless of their sub-group.

Cost-effectiveness

The general assessment is that ICD is a cost-effective treatment for the relevant patient population. This assessment is based on the severity of the condition being considered high in cases of both primary and secondary prevention and because the treatment saves lives.

The cost per quality-adjusted life year (QALY) for primary prevention is estimated as SEK 365,000 from a healthcare perspective. For secondary prevention, the cost per QALY is about SEK 360,000 from a healthcare perspective. From the perspective of the cost to society as a whole, there is no improvement in cost-effectiveness. The cost-effectiveness ratio appears to be reasonable in relation to the severity of the disease, which is judged to be high.

The data underlying this health economic analysis is considered to have a high degree of certainty, reliability and relevance. However, there is a certain degree of uncertainty in the quality of life weighting, which means that the certainty with regard to the results from the cost-effectiveness analysis is considered to be moderate.

Follow-up and evaluation

Further studies into a number of parameters are of importance, primarily when it comes to how quality of life is affected by an ICD and how the clinical benefit varies in the patient population. Current remote monitoring requires a more extensive foundation to enable more definitive conclusions concerning clinical effect, patient benefit and cost-effectiveness.

Overall assessment

Organisations responsible for healthcare may decide whether or not to introduce the method to a greater extent as it is probably the case that the treatment is currently underused. When making individual decision on priorities, consideration should be given to how the patient's quality of life will be affected by the treatment, for example, in the terminal stages of life. This should be weighed against the patient's motivation, their risk for sudden cardiac arrest, their biological age and general health.

2.4.4 Home monitoring with automatic blood pressure monitors

Patient benefit

For people with high blood pressure, HBPM is just as effective in guiding anti-hypertensive medication as measurement at a clinic.

The TLV assesses that the patient benefit is good. There is a prevailing certainty about the treatment efficiency of the method.

HBPM is advantageous for motivated patients because of the greater convenience and fewer visits to the clinic. The patient's participation in care can have a positive impact on the treatment results, but can also be felt to be a far too great responsibility, which can lead to increased worry.

Cost-effectiveness

HBPM, as a complement to blood pressure measurement at a medical clinic, can be a cost-effective method for measurement and monitoring of blood pressure for patients with hypertension. In cases of mild hypertension, there is an associated increase in cost of SEK 16 per patient-year, while for patients with moderate and severe hypertension, this method is associated with cost savings for society as a whole.

However, there is great uncertainty in the data that support this analysis as it is entirely based on a retrospective collection of data from patient records. The results of the analysis are sensitive to a number of different factors and follow-up studies are needed to see how HBPM affects the use of resources and the frequency of clinic visits.

Follow-up and evaluation

In order to gain a broader picture of how HBPM is used in practice by different county councils, a larger survey study of different care levels and with regional distribution would need to be designed. It has not been possible to implement this within the scope of this project.

As there are no Swedish guidelines for the HBPM method, these would need to be drawn up.

Overall assessment

HBPM can be offered as a complement to blood pressure measurement at a medical clinic to patient who are judged to be both eligible for and motivated to use the method. Patients who are not judged to be motivated or who, for other reasons, chose not to use HBPM, must be able to continue having their blood pressure checked at a medical clinic. The ethical consequences of introducing the method are assessed to be minimal under these conditions.

The organisations responsible for healthcare may thus consider whether or not to introduce this method for motivated patients.

2.5 Overall experience of the project

2.5.1 The county council's requirements

TLV has established that there is a very great need in the county councils for knowledge about the cost-effectiveness of medical devices. The healthcare system requires a usable evidence base to support decision-making when it comes to purchasing and implementation. The current healthcare system does not wait for the establishment of a significance evidence base, rather it presses ahead and introduces methods without it. Sometimes, methods are implemented, despite there being nothing to support their effectiveness. It is thus important that TLV carries out an evaluation of the evidence base using the best available data.

2.5.2 Improved evidence base over time

It is possible to apply the same health economic models to medical technologies are used for pharmaceuticals, but there is often a lack of satisfactory data. The TLV has learned from the experience gained when we began requiring more data in applications concerning consumables within the benefits system that the companies have successively begun to produce better and more usable data about their products.

We also commissioned KTH to conduct a generic template for the evaluation of products. The background to this is that we have often seen that companies claim usability benefits for their products when it comes to applications for subsidies. This is something seldom seen in the case of pharmaceuticals. Quality of life tools are most often far too obtuse to capture usability benefits, there may, for example, be small or large buttons, large screens etc. The idea was for the company to use the generic template to conduct an evaluation of their product themselves and in this way be able to demonstrate any usability benefits in a simpler way. However, KTH was not able to successfully produce such a model. This is probably because it is not possible to produce such a model.

2.5.3 Different processes are required

The existing processes used by TLV for pharmaceuticals have been shown to work well for certain devices, such as Airsonett. On the other hand, the investigation into home blood pressure monitoring demonstrated the requirement for a completely different process. In this evaluation, there are no health economic data from the company. However, this has not been necessary as the method of monitoring blood pressure in the home has been considered to be just as effective as monitoring blood pressure at a clinic.

2.5.4 Collaboration with external actors

It is important for the county councils that TLV can deliver data as quickly as possible. It is thus necessary that the TLV has control over its own resources.

In some cases where we have engaged external consultants, it has taken a longer time than has been reasonable, based on the county councils' requirement to receive data as quickly as possible.

The conclusion is that TLV must have control over the deliveries and, as a rule, internal expertise for each part of the execution. However, it is important to collaborate with, for example, universities when possible. The TLV sees that it is key to track the development that takes place within the field and also collaborate, as long as this does not endanger the deliveries to the county councils and is not associated with a non-acceptable delay of the knowledge bases.

2.6 Received points of view

In order to obtain as thoroughly worked out a final result as possible, we chose to publish a draft of the final report on TLV website from 6–27 September 2013, for all interested parties to have the opportunity to provide their points of view.

TLV has received written points of view from Region Västra Götaland, The National Board of Health and Welfare, the SBU, the Swedish Institute of Assistive Technology, Swedish Medtech, Swedish Labtech, LIF and HSO Stockholm.

2.6.1 Summary and measures adopted

We have made some material changes to the final report based on the points of view received. Certain clarifications have been made in the text, while other points of view have led to changes in how we plan to implement the project going forward.

The majority find it positive that TLV is to continue producing usable knowledge bases and supporting the county councils in advance of their decisions on the utilisation and procurement of medical devices. Nevertheless, there is a desire for a clearer delineations between the governmental agencies' roles in order to prevent the same work being done twice, for example. There is also desire for clearer criteria about how the selection of areas to be reviewed takes place.

Some are of the opinion that TLV should not make any recommendations at all, others that it should be possible to appeal a recommendation because a recommendation can have serious consequences for the companies affected. For example, a negative recommendation makes it impossible for companies that provides the technology to get into or continue working within the Swedish market. Against this background, TLV has chosen not to make a recommendation, but instead to provide a knowledge base and an overall assessment.

Collaboration between the governmental agencies and with the patients is considered to be important, but there is a desire to see how this will take place in practice. It has also appeared that there is a risk of governmental agencies arriving at conflicting results. There is also considered to be a need to work with the municipalities.

It is pointed out that there is a need to further investigate which grade of evidence will be considered sufficient for the knowledge bases. Some are of the opinion that a lower level of evidence may hasten the introduction and development process of new medical devices, while others that the same grade of evidence must apply to both drugs and medical technologies. It is also questioned whether it is possible to put together health economic knowledge bases that are based on data of a lower quality. There are points of view that we will continue to work on, for example requirements for evidence and the criteria for the selection of areas that will be evaluated.

One argument is that the impact of the TLV commission on the industry must be analysed, as must the effects of TLV's work on the introduction of innovation.

It has also appeared that there is a lack of perspective on assistive devices and disability and this should be raised.

Furthermore, it is stated that the board's composition should be changed as a result of this commission.

3 Medical Technologies – Background

3.1 Medical devices

When we talk about medical devices in this report we base this on the definition that can be found in Section 3 of the Medical Devices Act (1993:584):

“A medical device is considered by law to be a product that, in accordance with the manufacturer's instructions, will be used, separately or in combination, to in human beings

1. diagnose, prevent, monitor, treat or ease the symptoms of a disease,
2. diagnose, monitor, treat, ease the symptoms of or compensate for damage or reduced function,
3. investigate, change or replace anatomy or a physiological process, or
4. monitor fertilisation.

However, if the device achieves its primary, intended effect with the help of pharmacological, immunological or metabolic agents, it is not a medical device according to this act.”

From an evaluation perspective, however, *medical technology* should be understood to have a wider interpretation than simply a medical device. In this report, the term medical technology also incorporates how and in which contexts or with what aim the medical device is used. What is considered to be medical technology is not entirely clear and depends primarily on how the term technology is interpreted. If technology is taken to mean technical knowledge, a general tool or method, the methods and organisational processes used in healthcare also count as medical technologies. This interpretation also encompasses drugs. One way of differentiating medical technologies from pharmaceuticals, which the Centre for Medical Technology Assessment (CMT), amongst others, has chosen, is to talk about “non-pharmacological healthcare technologies” .

3.2 The Medical Devices Field

In the 1990s, an EU directive on medical devices was introduced. A new initiative was chosen at that time called “New Approach” . Instead of requiring a governmental agency to review and approve the devices, a greater amount of responsibility was placed on the producers of medical devices to ensure that their products complied with the laws, regulations and standards encompassed by the medical devices directive. The purpose was to better reflect circumstances of the medical technologies industry, namely very varied product areas, fast product life cycles etc. Another aim of the regulations was to ensure that there are essential requirements for safe

products and that the medical devices achieve their intended purpose, as well as that the benefits of the devices outweigh the risks of using them. Any remaining risks must be minimised with the help of alarms etc. and subsequently noted in an accompanying usage instructions.

3.2.1 Risk Classes

The requirements for evidence vary depending on the risk profile of the medical device. In Europe there are four risk classes: lowest risk (Class I), medium-low risk (Class IIa), medium-high risk (Class IIb) and high risk (Class III). The area in which the device is used dictates the class to which it belongs. For devices classified into Class II or III, the manufacturer must engage an independent certification organisation, i.e., a *notified body*, that will participate in the evaluation and certify that the device fulfils the requirements.

3.2.2 Global Medical Device Nomenclature

Medical devices can be everything from very simple products such as pins, plasters and bandages, to advanced imaging technologies such as CT scanners or active implants, for example, implantable cardiac defibrillators. In Europe, Global Medical Device Nomenclature (GMDN) is used, which specifies 17 classes of medical technology (see Table 3.1). Even if the medical devices in the various classes differ significantly, what they often have in common is that they are built on technologies that were originally developed and had uses outside of the medical field. Ultrasound, computed tomography, implantable cardiac pacemakers and defibrillators are examples that are built on technologies that were originally developed for military or industrial purposes.

Table 3.1 Medical categories according to GMDN

| | |
|--|---|
| 01 Active implantable devices | 09 Reusable instruments |
| 02 Anaesthetic and respiratory devices | 10 Single use devices |
| 03 Dental devices | 11 Assistive products for persons with disability |
| 04 Electro-mechanical medical devices | 12 Diagnostic and therapeutic radiation devices |
| 05 Hospital hardware | 13 Complementary therapy devices |
| 06 <i>In vitro</i> diagnostic devices | 14 Biologically-derived devices |
| 07 Non-active implantable devices | 15 Healthcare facility products and adaptations |
| 08 Ophthalmic and optical devices | 16 Laboratory equipment |
| | 17 Medical information systems (software) |

3.3 The medical technology industry

The medical technology industry is characterised primarily by its wide range of products. The character of the companies also varies, from large multinationals involved in a large number of product groups, to more specialised medical technology companies. There are about 590 medical

technology companies in Sweden with at least five employees and with a net turnover of over SEK one million. Around 180 of these companies carry out research and development in Sweden. In addition to these companies, there are a large number with 0–4 employees. 10.

There are no comprehensive official statistics that state how large the Swedish medical technology market is. TLV estimates that the Swedish medical technology industry had a turnover of SEK 23–25 billion in 2010.⁴ This can be compared with the total expenditure on medication and other non-durable medical supplies or consumables, which amounted to about SEK 39.4 billion in 2010. This total includes over-the-counter medication, and also other medical consumables, which is why the total is somewhat too high to constitute a good measure of the Swedish market for medication. If it is only the expenditure on prescription medication that is being taken into account, the total amounts to SEK 28.6 billion in 2010. Further information is found in Appendix 1.

3.4 How is medical technology used in contemporary healthcare

The county councils' decisions about purchasing of medical devices and the use of device-based methods appear to take place on relatively variable grounds. In certain county councils the direct impact on the budget appears to govern these decisions, in others it is more unclear how priorities are made. What is clear is that resources for evaluating the evidence base vary. According to the TLV assessment, a systematic evaluation of the medical devices that are used in the Swedish healthcare system is rarely conducted. Medical technology is often held up as a cause of the rising cost of healthcare. On closer analysis, however, we see that medical technology has a key role in a rationalisation and restructuring of healthcare to make it more patient-centred, which can also result in greater efficiency, increased safety and better treatment results. This has been noted in the Ministry of Health and Social Affairs' report "Empathy and high tech".

3.4.1 Lack of evidence

There is normally no requirement for extensive clinical trials in order to CE mark a medical device. Even in those cases where clinical trials are required for CE marking, the aim is to show that the benefit outweighs the risk. In a health technology assessment, the relationship between the benefit and the cost (including the device's price) are evaluated, which require additional data. This type of data is normally lacking for medical devices. Consequently, it is often difficult to conduct health technology assessments of medical devices without a good knowledge base.

⁴ This estimate is based on several methods, but primarily statistics from the Health Accounts of Sweden (see Appendix 1).

Another important aspect in the assessment of medical devices is their usability in a specific context, which may often be of great significance to the treatment results and safety, but the effects of which are very rarely documented. The specific context in which medical devices are used can be more decisive than the device itself in achieving good clinical results. Are all the necessary peripherals and other staff on-site in order for the product to be used effectively, and is the operator sufficiently educated and trained? Has the method and the technique been implemented correctly into the chain of care and have they been integrated into effective care processes? These are examples of questions that should be taken into consideration in the evaluation of medical devices.

3.4.2 Procurement of medical technology

The majority of medical devices in the healthcare system are procured in accordance with the Public Procurement Act (2007:1091). The aim of the procurement regulations is to ensure free movement of goods, services, people and capital in the EU's internal market so that governmental agencies and units involved in procurement in Europe can benefit openly from competition and make use of public funds in the best possible way. This means that it is entirely possible to take into account health economic aspects and long-term treatment outcomes in a procurement. However, it is not common practice, instead the product purchase price has become the dominant criterion on which decisions are based. Nevertheless, a procurement should have been preceded by a decision for a certain method to be introduced. When such a position is taken, the decision should be based on an assumption about a future price.

An all too one-sided focus on reducing costs by, for example, focusing on unit prices can, paradoxically enough, also lead to an underutilisation of medical devices that could be cost-saving in terms of their whole life cycle or society as a whole. In many cases, cost-saving medical devices necessitate changes to care processes and to the relationships between patients and care providers. We can conclude that technological solutions, often called telemedicine or e-health, in which the patient may be more involved and which could be cost-effective, or even associated with a cost saving, have probably been available for some time, but are not yet used to any great extent in the current healthcare system. 13.

Although procurements focus largely on the given selection, costs and, above all else, the price, there is agreement that consideration should be shown to the need for renewal. Examples of this are innovation-friendly procurements and innovation procurements. Innovation-friendly procurement involves the governmental agency conducting the procurement being open for and making use of the suppliers' ideas about renewal. This can be realised through actively observing that there may be goods and services on the market that are based on innovations or which have been developed so as to constitute an alternative to established products in procurements.

Procurement of innovation is used to take on problems or challenges in the longer-term. A governmental agency that conducts procurement has identified a need for which no appropriate product is available on the market, but where it still seems reasonable that such a product could be developed. New solutions are developed in such cases by suppliers in conjunction with well-informed clients and purchasers. However, none of these forms of procurement are carried out in practice when it comes to medical devices .

3.4.3 Development and use of medical products

Good conditions for innovation in the healthcare system are an important factor in the pursuit of better and more cost-effective care. The county councils and governmental agencies involved, seldom place explicit value on innovation. This can by extension lead to a difficulty in disseminating new innovative products, particularly where there is no antecedent (or where the alternative for comparison is not a medical device, but, for example, a drug).

One example of new medical technology radically changing health services is the development within surgery, where less invasive methods are used thanks to new medical devices. This has mainly involved endovascular, endoscopic and laparoscopic methods being used in place of open, invasive surgery. As a result of this technological-clinical driven development, the number of complications associated with care and care times have also been reduced in many cases.

Despite the contribution from new innovative medical devices, it is generally considered that better management and improved processes are required in the care system to reduce treatment errors and thus also, in fact, the costs of healthcare. This has been noted increasingly in the last decade, since the publication of the book *To Err is Human* by the Institute of Medicine, in which it was noted that treatment errors in American healthcare involve at least 44,000 patient per year dying as a result of incorrect decisions in healthcare. 15.

4 How Methods Involving Medical Technology are Evaluated and Prioritised Today

4.1 Introduction

Society's resources are limited; consequently, it is not possible for society to satisfy all needs and wants. This is becoming increasingly clear within the healthcare system, as medical technologies become increasingly advanced and thus require more resources, at the same time as the demand for care is increasing. In addition to the effectiveness and benefit to patients of various interventions, the need for better knowledge of the costs has been noted. It is possible, with the help of economic models, to evaluate various health interventions and in that way gain better data that can be used to prioritise the various alternatives

Health economic evaluations can be used to decide whether the cost of an intervention or method are reasonable in relation to the health benefits. There are several different health economic methods; what they all have in common is that they at least analyse the costs that arise as a result of the intervention (more on this in Chapter 5). Health economic evaluations are often part of a wider approach, health technology assessment (HTA).

There is an increased requirement, both nationally and internationally, for transparent evaluations to enable prioritisation in decisions regarding the introduction of healthcare technologies other than pharmaceuticals. Several countries are moving in the direction of conducting health economic assessments of medical technology in general. Every system is, however, still in development and has not yet taken shape. 6.

4.2 What is an HTA?

The term health technology assessment (HTA) can be interpreted to encompass a systematic evaluation of methods in healthcare. The word methods is used here in the broader sense and includes measures for prevention, diagnosis, treatment and nursing. The evaluation has a broad perspective, in which it is not simply the evidence of medical benefit that is reviewed, but also the cost-effectiveness and other relevant aspects.

HTA can be defined as a multi-disciplinary systematic way of evaluating the consequences of a medical technology and can provide support when making policy decisions. An HTA involves, primarily, methods in care being evaluated from a combined medical, economic, ethical and societal perspective. In general, an HTA is thus a broader approach than both the

health economic evaluation and the systematic overview. The SBU believe that the systematic HTA overview of effects, risks and costs is complemented by also encompassing the ethical and social aspects. In practice, the term HTA contains a mass of partial evaluations, in which not all of the relevant aspects are taken into consideration.

The idea of HTAs is to support decision-making in healthcare when it comes to issues related to both the introduction and withdrawal of medical methods such as pharmaceutical, diagnostic or surgical methods. HTAs have also been given a clear connection to decisions about resource allocation, which has also meant that health economic evaluations have become an increasingly central aspect of HTAs, especially in conjunction with decisions on subsidies for pharmaceuticals and on clinical guidelines.

Despite the medical technology industry having a very high turnover, regular cost-effectiveness assessments of medical devices are not conducted. Systematic evaluations of medical devices and methods have not been as comprehensive as those of pharmaceuticals, instead they have taken place sporadically.

4.3 HTAs at the national level

4.3.1 The Swedish Council on Health Technology Assessment (SBU) Evaluation with a broad approach has been conducted at the national level in Sweden since 1987 when the SBU was established. The SBU evaluates methods that are used in care, both those that are established and those that are new. Their role can be said to consist of working out, based on the published research data, what medical effects various methods have and whether there is any risks associated with them, as well as whether the measured provide the best possible benefit for the money. The evaluations are used to support decision-makers at various levels who determine how the healthcare system will look. 19.

Based on current, quality research, SBU works out what medical effects various methods have and whether there are any risks associated with them, as well as whether the measured provide the best possible benefit for the money. Since the SBU began operating, it has regularly conducted evaluations of various medical technologies clinical results. In 2010, a report from the Centre for Medical Technology Assessment (CMT) compiled all of the methods that the SBU had evaluated within its SBU Alert system from its establishment until 2009. The results was that the majority of the technologies that have been reviewed consisted of medical devices rather than drugs. 6.

The independent evaluations of SBU can be used as support by all those who, at different levels of society, decide how the healthcare system will look. They can highlight the opportunities for further improvement, so that the

healthcare system can use its resources in the best way and the population can become more healthy.

The SBU has explicit requirements for scientific evidence. SBU adheres to a systematic working practice, where the base consists of all relevant studies. Cost-effectiveness is included as one aspect.

SBU coordinates and publishes results from the local HTA activities that take place at local authorities including Stockholm County Council, Region Västra Götaland, Örebro County Council and the South-eastern Healthcare Region.

4.3.2 The National Board of Health and Welfare

The National Board of Health and Welfare draws up national guidelines that support prioritisation within the healthcare system. They also provide guidance on which treatments and methods different organisations within a certain area should devote resources to. The goal of the guidelines is to contribute to patients receiving good care and the allocation of resources according to the needs of the population for the best possible benefit. The guidelines are drawn up based on current research and proven experience, and they show the benefits and risks of different interventions. 20.

The National Board of Health and Welfare's guidelines are drawn up for the various areas within the healthcare system that encompass a large group of patients who have a severe chronic disease that lays claim to extensive resources. The guidelines are demarcated by defining conditions or problems where there is a need for guidance, and connecting these to measures in “condition and measure pairs”. Fact-finding groups composed of highly-qualified experts are put together and conduct methodical literature searches based on the condition and measure pairs. Health economics experts produce data about the cost-effectiveness.

A prioritisation group, consisting of experts with roots in healthcare, place each of the condition and measure pairs in order of precedence on a scale from one to ten, where the one is the highest priority and ten the lowest. The order of precedence will provide support to decision-makers in the healthcare system and social services when allocating resources. The idea is that the measure of the highest priority will gain a larger proportion of the resources and the lowest priority measures will gain a smaller proportion. The prioritisation group base their order of precedence on how serious the condition is, what effect the measure has and its cost-effectiveness. How strong the scientific support for the measure's effectiveness and cost-effectiveness are also significant in setting the order of precedence. Moreover, ethical considerations have an impact on the prioritisation group's order of precedence.

National guidelines also contain recommendations about measures that the healthcare system and social services should not carry out at all – “*Do not*

implement” – because these measures either have no effect or lead to a risk for the patient. The recommendation "*R&D*" (research and development) is given for measures that the healthcare system and social services should not carry out routinely as they are insufficiently evaluated and about which ongoing or future research may provide new information.

4.3.3 The Swedish Dental and Pharmaceutical Benefits Agency (TLV)
Since 2002, TLV has used health economic assessments as an important part of the data used to decide on subsidies for pharmaceuticals and consumables. It is important to point out that the principle of cost-effectiveness is not the only factor taken into account in the decision-making process, instead the other two principles, of human dignity and of need and solidarity, must always be weighed up when making decisions.

4.4 HTAs at the local and regional level

Since the middle of the 2000s, several county councils have begun to take an interest in systematic evaluations of medical methods. Such evaluations primarily take place in local organisations within the county councils. 17.

4.4.1 The county councils' HTA activities

Stockholm County Council, Region Västra Götaland and Region Skåne are responsible for approximately 45 per cent of the total use of medical devices. The other 18 county councils are thus responsible for about 55 percent. What resources that are available for the management and evaluation of medical technologies differs to a great extent. The county councils that have achieved the most in their work with evidence-based governance have their own or closely connected HTA units; primarily Stockholm County Council, Region Västra Götaland and Örebro County Council. Collaboration between the different local HTA units takes place via the SBU. The County Council of Östergötland utilises the Centre for Medical Technology Assessment (CMT) at Linköping University for health economic evaluations.

Health economic evaluation is, however, used to only a limited extent to guide decision-making. Normally, the cost of a new technology or method is compared from the perspective of a clinic or hospital. 17.

4.4.2 The municipal's medical technology activities

The municipalities have responsibility for a large proportion of the patients who are using medical devices. Consequently, municipalities also procure a large amount of medical technology, often in the form of consumables of assistive devices. It sometimes happens that a patient moves between care provided by the county council and that provided by the municipality depending on what care the patient requires that day. In practice, it is not at all unusual for a patient to be required to change device, depending on which organisation is responsible for the care/budget. There is a danger that this leads to unnecessary upheaval and inconvenience for the patient. There are 49 municipalities in Region Västra Götaland. The county councils and

municipalities have come together and solved the problem there using collective procurement.

As the county councils' prerequisites for conducting health economic analyses of medical devices vary, the differences will probably be even larger when it comes to the municipalities. However, the extent of the municipalities use of medical devices is limited to specific groups of products. This means that only a portion of the health economic evaluations that TLV is going to conduct will be relevant for them.

5 Health Economic Evaluation of Medical Technology

5.1 Medical devices and pharmaceuticals: different prerequisites for evaluation?

A question which should be asked initially is whether there is any difference in how a health economic evaluation should be conducted depending on whether it relates to a drug treatment or a medical technology. The general methods used in health economic evaluation are well-established and there are guidelines for how health economic evaluations should be conducted. The majority of international guidelines on how health economic evaluations should be conducted have been written with drug treatment in mind, which in itself does not mean that they cannot be used. However, there are some respects where pharmaceuticals and medical technology diverge. Drummond et al. point to six points that are of specific interest.⁵ However, these differences are less about how health economic analysis should be conducted than about disparities in how the effects and use of resources can be measured.

Many medical devices are used in diagnosis. This involves two challenges. The first is that the value or improved diagnosis can be hard to differ from the value of an improvement in patient outcome that results from the subsequent treatment. The second challenge is that an improved diagnostic technique often has several areas of use, certainly not completely different from drug treatment where a drug can have several indications. These problems are not insurmountable, but they do make the health economic analysis more complicated.

It can also be hard to conduct randomised controlled trials (RCT) of medical devices. When a drug reaches phase III, the dosage and mode of administration have both normally been determined. Even though it is well-known fact that the effect shown in a trial cannot always be translated into clinical practice, the results of the trial can still provide reasonable grounds for the ability to conduct a health economic evaluation. When it comes to medical devices the product often undergoes small stepwise changes of which some can have an impact on the effect. Drummond et al. indicate that it is unlikely that there will be any longer “steady-state” period during which the device can be evaluated in a multi-year trial in which the results are completely transferable to the technology in question. This is because

⁵ The following introduction appears in a later article: Problems in conducting clinical trials, Allowing for the ‘learning curve’ and user Characteristics, Accounting for the wider organizational implications of introducing devices, ‘Generalization’ and class effect, Price of devices and variations over time, Other methodological challenges.

medical devices have shorter life cycles that often make clinical trials quickly out of date. Another difficulty is of course that it may be difficult to conduct a blind RCT.

A further difference between evaluating pharmaceuticals and medical technologies is related to the skilfulness of the user. This can be said to apply in particular to surgical treatment. Furthermore, there is often a learning curve involved in the use of the medical technology which makes it hard to know whether the improvement observed is a result of the user's skilfulness or of the device or method itself. Clinical results are thus dependent on the users' knowledge and proficiency, as well as complimentary investments in education, training and equipment.

Medical technology also differs from pharmaceuticals in that the implementation of a new therapy involving a medical device can have greater financial consequences as a result of radical innovations. These innovations can shift the location the treatment takes place from, for example, the operating theatre to home healthcare with substantial consequences for the cost. There may then be a need for education, for example. Or if it leads to organisational change, it may be important to take this into specific consideration in order to utilise the improved cost-effectiveness of a medical technology method.

Medical technology also differs from drugs in that different manufacturers products with the same area of use can differ with regard to their function and associated complications, which makes it hard to draw generalised conclusions for an entire class of products. On top of that, there is perhaps no clinical evidence available for all of the products or methods, making comparisons difficult.

The prices of medical devices, as well as the costs of using them, are more likely to change over time than those of pharmaceuticals. This is because of the launch of newer products or as a result of procurement taking place in many healthcare systems. Innovations are often hard to protect with the help of patents, which makes it difficult to prevent imitation and the price changes that result when these imitations come onto the market. It is not rare for increased experience to lead to the cost of an operation becoming lower as a result of a decrease in the time spent on it. That which acts to prevent the price of drugs from decreasing is that when the price is set, it is more likely that the price will remain at a similar level until the patent runs out and competition on price appears.

Although the methods of economic evaluation can be similar with regard to medical technologies and pharmaceuticals, a number of specific methodological issues remain that require more attentiveness in order for reliable and informative evaluations of medical technologies to be conducted. There are important differences that must be taken into consideration in the assessment of the clinical and economic evidence base for medical devices,

but this should not be seen as a barrier to producing health economic evaluations or expressing an opinion on the cost-effectiveness of methods based on medical technology. The differences exist primarily in the licensing procedure surrounding the medical device, the medical technology method's interaction with the user and the incremental pace of innovation. 24.

Despite the dissimilarities, it is possible to conduct health economic evaluations of medical technologies with the help of the same methods used for pharmaceuticals and experience is required in order to resolve a number of the difficulties listed above. The following section provides an overview of the most common methods used for conducting health economic evaluations of both pharmaceuticals and medical technologies.

5.2 What is a health economic evaluation?

The health economic evaluation is a tool used to assess the costs and health effects connected with the use of healthcare resources. Health economic evaluations provide a means to learn whether or not a medical treatment is cost effective, i.e. whether the treatment costs society a reasonable amount of money in relation to the health benefits it provides. The goal is not primarily to save money, but to use the available resources in a way that keeps the population as healthy as possible. This is usually determined using a cost-effectiveness analysis, in which the cost associated with an intervention are weighed against its effects. 25.

Cost-effectiveness is a relative concept, determining whether a treatment is cost-effective or not requires an alternative to compare it with. The alternative for comparison may be, for example, a drug treatment, another type of healthcare or no treatment at all. In this way it is possible, with the help of a cost-effectiveness analysis, to compare a new, more expensive form of treatment with a traditional treatment and thus get an answer to the question of whether the new method is worth the increased cost, compared with the traditional treatment and also when compared with other approaches to care.

Working out what is cost-effective requires the willingness to pay for health improvements, expressed as quality-adjusted life years (QALY), to be determined. It is only in a complete cost-benefit analysis in which both the costs and the benefits (the effects) are quantified that an opinion can be expressed about whether the measure is economic or not. Otherwise, a threshold value must be set in order to conclude whether the treatment is cost-effective. How much society is willing to pay per achieved health effect (measured in SEK per QALY) also varies because consideration must also be given to the principles of human dignity and of need and solidarity.

It is common to differentiate between four different types of health economic evaluation. Each of these measures the costs in monetary terms, while the health effects can be measured differently. The method that is most

applicable or possible to use at all is governed by the purpose of the analysis and the availability of data.

The *cost-benefit analysis* (CBA) is the only one of the four methods that measures both the costs and the effects in monetary terms of the two treatment alternatives that are being compared. However, this is used to a relatively small extent as a result of the practical difficulties of evaluating the health effects in monetary terms. One method of estimating willingness to pay is to use what are called willingness-to-pay studies (WTP), see Chapter 5.3.3.

The three other methods of analysis are actually variants of the same method. In the *cost-effectiveness analysis* health effects are assigned a value, for example, as a number of trouble-free days or number of life years gained. Two problems are associated with this type of method. The first is that care interventions can impact on health in several dimensions concurrently, and a measure such as the number of life years gained or the number of days without worry or angst measures health quantitatively, but says little about the patient's perceived quality of life. The two different treatments that are compared can also impact on the patient in different ways (for example, one leads to increased survival, while the other provides an improved quality of life). The other is that it is hard in the cost-effectiveness analysis to compare treatments from different therapeutic areas with each other. For example, it is not obvious how the health benefit of a prevented myocardial infarction can be valued in relation to the health benefit of a year without pain for someone with rheumatoid arthritis.

The *cost-minimisation analysis* is a version of the cost-effectiveness analysis that can be used when the treatments to be compared have the same effect (whether positive or negative). What remains is a cost comparison, in which the treatment that has the lowest cost is the one considered to be the most cost-effective.

The *cost-utility analysis* is today the dominant type of health economic evaluation. This is similar to the cost-effectiveness analysis, but includes both lifespan and quality of life in a combined measure of effectiveness. The result therefore provides a more comprehensive picture of the total health effect of a treatment.

The most common measure of care effectiveness used in cost-utility analyses is the quality-adjusted life year (QALY). The measure is designed so that a year of life is multiplied by a quality of life between zero and one, where zero is equivalent to death and one is full health. For example, if a person lives five years with full health this is equivalent to five QALYs; whereas, if they live five years with 50 per cent quality of life, this is equivalent to 2.5 QALYs. In this way, both lifespan and quality of life are captured in a general measure, which also makes it possible to compare treatments from different therapeutic areas.

QALY weights can be based on either direct measurements⁶ or indirect measurements (where a health classification system such as EQ-5D is linked to QALY weights). QALY weights based on valuations of people in the health condition in question are preferred over weights that are calculated based on an average from a population that has valued a condition described to them (also called the social tariff). It is also common in a health economic evaluation to use weightings for health conditions from previous studies. 25.

The cost-utility analysis results in a cost-effectiveness ratio, also called ICER (incremental cost-effectiveness ratio), which is calculated based on the differences in cost in relation to the health outcome. The ratio is expressed in cost per QALY. This can be interpreted as the price society pays for one year of life for one citizen with full health, a year of life that the citizen would not have received without treatment.

Prioritisation decisions made in the healthcare system must not be based solely on cost per QALY. A complete appraisal must be performed that is based on an ethical platform in accordance with the Health and Medical Care Act's stipulations on the three main principles:

- Human dignity: Everyone has the same value and the same rights, independent of their personal circumstances and function in society.
- Need and solidarity: Resources should be allocated according to need.
- Cost-effectiveness: When choosing between different activities or measures, a reasonable relationship between cost and effectiveness, measured in improved health and quality of life, should be sought.

It is when the complete appraisal of the various principles is conducted that the willingness to pay for the care requirements the treatment satisfies is settled, that is, what level of cost per QALY will be accepted. The principle of human dignity implies that everyone has the same value. The principle of need and solidarity means that a higher cost per QALY is, as a rule, accepted for conditions that are more severe or where there are few other treatments to choose from. The complete appraisal also means that treatments for mild problems are sometimes prioritised out of the collective, tax-funded healthcare system in order to make room for more urgent treatments.

⁶ QALY weights can be calculated with other methods such as standard gamble (SG), time trade-off (TTO) and rating scale. In general, QALY weights based on the standard gamble (SG) or time trade-off (TTO) methods have the highest value as evidence. Following that come QALY weights based on the rating scale method (known as the visual analogue scale, VAS).

5.3 Other health economic methods

5.3.1 Cost of illness

In addition to the four evaluation methods listed above, it is common to another type of synthesis of costs of various diseases, called a *cost of illness study*, or a synthesis of the *disease burden*. These syntheses are often carried out from the perspective of the cost to society as a whole. These studies are not evaluations and do not provide answers to the question of whether a method is cost-effective, rather they tell us the extent of the health problem and how large the cost to society is. 26.

5.3.2 Budget impact

Another common analysis method is known as the *budget impact* analysis. The stakeholder's⁷ perspective is important in such an analysis. This analysis makes it easier for stakeholders such as those funding the introduction of a certain method, and often stretch over a given time-frame, for example, five years.

The analysis involves demonstrating how the budget is impacted by the introduction of a certain method, but can also be used in order to see how many patients a clinic or other stakeholder is capable of treating given a certain budget. A budget impact analysis thus focuses on the expected consequences for different stakeholders. It cannot answer the question of whether there is a reasonable relationship between cost and effect, i.e., the cost-effectiveness, and thus cannot be used in order to prioritise when it comes to society's resources.⁸

5.3.3 Studies of willingness to pay

A common method used to estimate the value of interventions and devices that do not have a market price or where there is no natural well-functions market is through what are known as willingness to pay (WTP) studies. WTP studies are common in the research sector, transport sector and environment sector, but are also used in marketing in order to estimate what individuals are willing to pay for a service or product and thus estimate the benefit in monetary terms. There have also been attempts to measure the value of the effects of healthcare with the help of WTP studies.

WTP studies are an alternative to capturing patient benefit by estimating how much the patients would be willing to pay for the product and the

⁷ The stakeholder may be the client; a county council, a hospital, a municipality, a company or the patient.

⁸ A good summary of these analyses can be found in the ISPOR guidelines for budget impact analysis. 59.

product's alternatives for comparison. In such studies, people take a position on a number of hypothetical alternatives they must allocate in different ways. Thus, this does not involve learning what they are actually willing to pay for a product or a medical service. If the WTP for the product is higher than the difference in cost, the product can be regarded as cost-effective.

It is primarily the WTP of patients who have experienced the product or products with the same basic function that should be estimated. It is important that the selection of people for the investigation is conducted in a way which ensures that the participants are representative of the total population. It is also important that the questions, to the greatest possible extent, measure the same behaviours as in purchases of normal consumer goods in order to capture WTP.

The advantage of WTP studies is that they provide a direct answer in monetary terms. This measure is a concept that is more easily grasped than cost-effectiveness, which is a relative measure and says nothing about the extent of the cost; a high ratio can be the result of a low cost and very little effect. The disadvantages of WTP studies are primarily methodological. It may be hard for the respondents to keep track of too many parameters and aspects, which is why it is important that the studies are not too extensive.

There are several different methods and techniques used in order to study WTP. These can be differentiated by how the answer has been arrived at; through observations or through direct questions. A common method in marketing is to observe actual behaviour to see what choices individuals actually make (revealed preferences). Another method is to ask individuals how they would choose in a given situation under certain conditions (stated preferences).⁹ Questions about WTP may be open, "how much would you be willing to pay for a certain measure?", or a value is provided and raised or lowered until the individual accepts the value, as in a bidding process, to arrive at the maximum value the individual is prepared to pay.

Choice of method and how the questions are formulated is of utmost importance to the reliability of the result. For various reasons, the method has been considered to work specifically well for the valuation of healthcare. One reason for this is that despite the questions being hypothetical, real ability to pay can be reflected in the answers given by the individuals, as is there a risk of strategic answers in order to, for example, promote a certain use of resources. Consequently, it is almost always chosen to relate the costs in health economic evaluations to measures of health-related effects, for example, the number of life years gained (LYG) or QALYs. When carried out

⁹ The most common methods used to estimate the WTP are contingent valuation methods (CVM) and discrete choice experiments (DCE), sometimes also called conjoint analysis, however, there is a range of different variants and interpretations of the term conjoint analysis and it is not recommended in the economic literature.

correctly, the cost-utility analysis and WTP studies should give the same result.

It has been suggested that the WTP methods are better than cost-effectiveness analyses at taking opportunity cost into consideration. The cost-effectiveness analysis takes opportunity cost into consideration via an incremental cost-effectiveness threshold, while WTP methods do this by providing the respondents with the opportunity to weigh up all the alternative measures.

In their review of the published WTP studies, Olsen and colleagues state that WTP is a superior measure of outcome to the use of QALYs. Their opinion is that WTP makes it possible for a more extensive valuation of the benefit that do QALYs, but that there appears to be prevailing practical difficulties in conducting WTP studies that deal with all of these more extensive aspects.
27.

5.4 Health economic evaluations can be conducted in different ways

Several initiatives have been taken with the aim of standardising the methods for conducting HTAs and health economic evaluations. This has resulted in guidelines and check-lists being drawn up for what is considered to be good technique. Many are published on, for example, the ISPOR website.¹⁰ These general guidelines are primarily directed towards how the question of the treatment's cost-effectiveness should be answered and then it is drugs that are the focus.

One subject for discussion concerns the costs and health effects which may be included in health economic evaluations. Those which are used is determined by the perspective that has been chosen for the analysis. A healthcare perspective includes only those cost and effects that are relevant to healthcare, while all cost and effects are included when coming from the perspective of the economy of society as a whole, regardless of who or what these apply to (county council, central government, patient, relatives).

In the case of pharmaceuticals, this involves the analysis, in addition to the direct costs such as drug costs, also taking into account the indirect costs and benefits such as loss of production caused by sickness absence or increased productivity caused by the health benefits of the treatment when the patient goes back to work.

¹⁰ ISPOR, International Society for Pharmacoeconomics and Outcomes Research. This organisation “promotes worldwide the science of pharmacoeconomics (health economics) and outcomes research (the scientific discipline that evaluates the effect of health care interventions on patient well-being including clinical, economic, and patient-centred outcomes) and facilitates the translation of this research into useful information for healthcare decision-makers to increase the efficiency, effectiveness, and fairness of health care to improve health”. 22.

In Sweden, a perspective covering society as a whole is generally sought. One advantage of this perspective is that the benefits of healthcare interventions can be weighed against possible interventions in other sectors of society. Another advantage is that sub-optimisation within a system can be avoided when the entire healthcare system is surveyed. 17.

A perspective that covers society as a whole takes both static effects (how things look right now) and dynamic effects (when changes and innovations are accounted for) into consideration, which provides a stimulus for decisions to be made or recommendations to be given that optimise the allocation of resources for maximum benefit in a broad perspective. 28.

In academic circles there are worries that the current basis for decision-making does not give sufficient consideration to the perspective of society as a whole and that the focus of cost-effectiveness analyses reflects the perspective of whoever is paying. The majority of the guidelines for evaluations of medical technology innovations encourage or demand a narrower, budget-based perspective. As a result of this narrow perspective, the decision is often sub-optimal, both for the healthcare system itself and for the population as a whole, which tells us that an economic evaluation should always be based on a societal perspective. 29.

Taking the societal perspective as the basis does not, however, exclude the possibility that the consequences for various organisations can be analysed. A consequence analysis with a budget-based perspective may be seen as a complement to the economic evaluation and can be reported separately. 29.

It is important to take all of the health and cost consequences into consideration from the social perspective in order to effectively allocate the limited resources of the healthcare system and of society as a whole.

The costs resulting from treatment and illness that arise within the healthcare system (e.g. drug costs, outpatient care and inpatient care) and outside of the healthcare system (e.g. loss of production and the cost to relatives) should be included in order for prioritisation to be conducted in a transparent way. It is thus important that the entire healthcare system can be monitored and that all the relevant costs of treatment and illness are included, regardless of who or what is liable for them (county council, municipality, central government, patient, relative).

When consideration is given to such costs, this must always be based on the principle of human dignity, which states that everyone is of equal value. No group of patients will be, for example, disadvantaged by costs outside of the care system or whether a treatment has an impact on the opportunity to work being taken into consideration.

If all of the costs are not included in the analysis, there is danger of sub-optimisation, which can mean that methods that, from a social perspective, should be used are not introduced onto the market or that methods that should not be used are not phased out.

5.5 Which costs and effects are of interest in a health economic evaluation?

5.5.1 Costs and price

Cost is defined in business economics as a periodised expense. An expense arises at the point of acquisition, while a cost arises in the use of resources. When it comes to products that are used over the course of several years, it is common to distribute the cost over several years, as with depreciation in accounts.

It is important in a health economic evaluation that all relevant costs are identified and taken into account in the analysis. The perspective of the analysis must be set out in order to know which costs and prices should be collected for use in the evaluation. The general advice provided by TLV on economic evaluations when applying for subsidies for a drug states that the health economic analysis should be conducted based on a perspective of the economy of society as a whole. This means that all relevant costs and benefits of the treatment and illness, regardless of who or what is liable (county council, municipality, central government, patient, relative) should be taken into account, and that the information included will describe Swedish conditions. All of the relevant costs associated with a treatment or disease should be identified, quantified and ascribed a value. Loss of production for treatment and illness should also be included (estimated with the human capital method). Unit prices and quantities should be presented separately as much as possible, so that a distinction is made between price and quantity. Which year the prices represent should appear. Apoteket's sales price (AUP) should be used for pharmaceuticals.

When a product is sold, its purchase price becomes a cost. This means that a price is the sales price that the supplier offers for the product. The sales price may be known, more or less. There may be official price lists detailing the cost of various products, or it may appear in the documentation submitted by a company in a procurement situation or direct procurement. The TLV uses the drug's AUP in health economic evaluations of drugs. What prices TLV should be using as a basis is not as clear in the case of medical devices. One product may, for example, be included in a benefit system with one price, but has been the subject of a procurement by the county councils and has in that respect a different price to the official TLV list price.

From the text above, it appears that we are seeing total costs as necessary in order to carry out an evaluation in which the sales price of different products constitutes part of the calculation.

When it comes to other healthcare costs, there are several different sources that are grounded in the introduction of diagnosis-related groups (DRG) as a system for describing inpatient care and as a basis for the calculation of resource consumption. DRG presently constitutes a basis for compensating the hospitals in many of the county councils and regions, with the total payment being made up of a combination of several different compensation principles. The compensation system thus constitutes a technique for financially compensating the care providers. It also contains tools that both affect and govern the direction of the various parts of the operation. In Sweden in recent decades, there has been a conspicuous interest in the compensation system's ability to contribute to controlling costs. 33.

DRG not only constitutes a part of the compensation system, but is also connected to the costs of setting regional prices and compensation levels. The development of DRG has been very strong and now covers, in principle, every possible type of care via NordDRG. The National Board of Health and Welfare presents national DRG weights, which constitute reference materials, and also weight lists that can be used when providing compensation for healthcare. The DRG weight is a measure of the care and treatment cost for an average patient in the respective DRG group. For the weights to be usable, the cost calculations must be conducted on a large amount of patient data. The weights are produced using a national cost database, the cost per patient (KPP) database. The database is compiled and managed by SALAR through a collaboration with The National Board of Health and Welfare. 36/37

A common method of classifying costs is into direct and indirect costs. Direct costs are the value of the resources used or saved as a direct result of the patient getting the device instead of its alternative for comparison. Direct costs include the cost of the device (normally the price of the product), the increased or reduced cost of healthcare as a result of the altered risk of side-effects, complications etc., as well as changes to the patients' travel costs to and from healthcare facilities and pharmacies. It is important that the costs of the entire healthcare system are estimated.

Indirect costs are primarily the loss of production in conjunction with treatment and illness. If the device or method, when considered against its alternative for comparison, changes the patients' ability to conduct their job or day-to-day duties, the value of the change in ability to work is included in the analysis. The value of lost leisure time should also be included in the analysis to ensure that the perspective is for the economy of society as a whole.

When consideration is given to such costs, this must always, as stated previously, be based on the principle of human dignity, which states that everyone is of equal value. No group of patients will be disadvantaged by

costs outside of the care system or whether a treatment has an impact on the opportunity to work being taken into consideration.

5.5.2 Effects

Patients health-related quality of life can be measured in QALYs. The QALY captures both length of life and quality of life, as well as personal valuations of health status, i.e. benefit (see Chapter 5.2).

The advantage of QALYs is that they enable a comparison between different disease areas and between different methods of treatment.

There are a range of methodological questions that have yet to be investigated, despite QALYs having been used more or less systematically for several decades. In this report we will not focus on these methodological questions. For an overview of the current research, we direct you to Bernfort and colleagues. 31.

Instead, one of the questions posed by this report is whether there are other measures that could be used when it is not possible to produce QALYs, and which may provide answers in an evaluation and when choosing what to prioritise?

5.6 Advantages and disadvantages of QALYs

The literature points out several deficiencies of QALYs . For example, it can be difficult to capture the significance of a technological development for the patient using QALYs. As an example, it is possible that a new medical device provides the same health outcome, but is significantly easier to use or carry around than a relevant alternative for comparison; but how can this be ascribed with a value?

Sorenson and colleagues indicate that there is a need to develop the method and the majority of current guidelines, as noted above, are designed to work with pharmaceuticals. The authors are also of the opinion that if there is a requirement for the effects to be measured in QALYs, then there is a danger of innovations that could be of benefit to society not being implemented . However, the authors provide no guidance on alternative measures that could be used in such cases as a complement to or instead of QALYs. It is easy to see how evaluating WTP studies could be one possibility. WTP studies can take into account a larger number of dimensions that QALYs and research is underway to develop methods related to this area. (27) (41) (42) (43)

One conclusion drawn by Svensson and colleagues is that the benefit of an aid should be measured using a common metric. 44.

Although it is hard to produce a figure in QALYs this should always be the goal. Other metrics can constitute a complement to the analysis, but cannot be used to compare the costs in relation to the benefit. From the perspective of the economy of society as a whole, where the question is how society's resources will be prioritised, it is of vital significance that the costs in relation to the benefit can be compared on horizontally.

5.6.1 Alternative approaches

The simplest method of showing the health-related patient benefit, regardless of whether it involves pharmaceuticals or medical technologies, is to use a standardised language to describe the product properties and how these properties affect the patients' health and health functions. This method may be sufficient in those cases where it can be presumed that there are no large differences in the effect and cost between the product and its alternative for comparison. One example of such a metric is the general classification system "WHO International Classification of Functioning, Disability and Health" (ICF), or a quality of life instrument that is based on the ICF. The aim of the ICF is to cover all aspects of human health, as well as a number of other health-related conditions.

To conduct this analysis of the health-related patient benefit, one begins by describing all the positive and negative properties of the product that differentiate it from the alternative for comparison. All assertions are built up, as much as is possible, with references to scientific studies. How these positive or negative properties impact on different aspects of health are then described in words. Only those aspects of health that are affected are covered. The question of what this may be worth in monetary terms is, however, left unanswered and accordingly does not go any further in cases where decisions or recommendations are to be made about what the cost-effectiveness is. However, the metric can contribute to systematically differentiating between products and demonstrating that a technological development contributes to patient benefit.

5.7 Models and cost-effectiveness

Health economic evaluations are built on data about the costs and effects of the treatments performed by the healthcare system. However, there is often a lack of data, for example, when the evaluation concerns a new method or when there is a desire to incorporate costs and effects in a longer-term that it is possible to infer from a clinical trial. A model analysis is often applied in order to express an opinion on cost-effectiveness in these cases. Assumptions are made, based on the available data, about the future course of events and a mathematical model is then constructed based on these assumptions.

The aim of model analysis is not to replace empirical studies, rather it is to shine light on a decision-making problem using the best available information. In its *General Advice on Economic Evaluations* the TLV recommends that model analysis be used in order to attempt to predict the

course of events following the point in time at which clinical trials' follow-up has been stopped. 30.

A health economic model means that various scenarios can be simulated based on the best available data about costs and effects. Different analyses can be conducted in order to investigate how the results of the model are affected by, for example, changes in the costs or the effects (known as sensitivity analyses). Models also make it possible to estimate the expected health effects across the patient's entire life, which is especially important in cases of chronic disease.

It goes without saying that new, more expensive treatment methods that do not lead to any health improvements are not regarded as cost effective. However, this does not mean that a new, more expensive treatment method that also leads to health improvements cannot be cost-effective if the increased cost is reasonable in relation to the improvements in health that the treatment creates, i.e., added value. Naturally, the greater the benefit a new treatment leads to in the form of health improvements, the more it may cost.

A cost-effective use of the healthcare system's resources involves implementing not only measures that result in cost savings, but also sometimes those that are more expensive on the condition that society's valuation of the health benefits outweighs the increased costs.

5.8 Cost-effectiveness and cost reduction

A health economic evaluation has two dimensions (1) a choice between at least two alternatives, A and B, where A is the new treatment and B is the alternative treatment, i.e., an incremental analysis and (2) consideration being given to both the input and the output of the treatments, i.e., both the costs and the effects (benefit measured in QALYs) of the treatment.

Cost-effectiveness is, as previously described, a relative measure. In order to answer the question of whether a new and better, but more expensive treatment is cost-effective, an incremental cost-effectiveness ratio (ICER) is calculated. The ratio indicates the marginal cost of producing one additional QALY (health effect measured as an additional health year of life). However, it is not sufficient simply to calculate this based on the relevant alternative for comparison. Whether the measure is regarded as cost-effective or not depends on the value society places on one QALY, i.e., the willingness to pay for one QALY.

The willingness to pay for one QALY (WTP) is also called the threshold value (λ). This value may vary depending on the disease severity and available range of treatments, and thus need not be a fixed exact value. As a rule, if the ICER is the same or less than the as the WTP (λ), a positive decision or recommendation is made.

The analysis can be summarised in the following equation:

$$(\text{Cost A}-\text{Cost B})/(\text{Effect A}-\text{Effect B}) = \text{ICER} \leq \lambda$$

The analysis can give rise to four different scenarios (see Figure 1). The outcome may be that the new alternative is less effective and costs more (not cost-effective, no cost reduction), the new alternative is less effective and costs less (cost reduction, may be cost-effective), the new alternative is more effective and costs less (cost-effective, cost reduction) or the new alternative is more effective and costs more (may be cost-effective, no cost reduction).

Therefore, it is not necessary for something to result in a cost reduction in order for it to be cost-effective.

Figure 5.1. The four outcomes of the analysis

| | Kostar mindre | Kostar mer |
|---------------|--|---|
| Bättre effekt | Kostnadsbesparande Kostnadseffektivt | Ej kostnadsbesparande Kan vara kostnadseffektivt |
| Sämre effekt | Kostnadsbesparande Kan vara kostnadseffektivt | Ej kostnadsbesparande Ej kostnadseffektivt |

6 Analysis and Ongoing Work

6.1 Why medical technology should be reviewed

Summary

The scientific basis for medical devices has commonly been of a poor quality. Currently, there are other governmental agencies that evaluate medical technologies. However, these do not conduct health economic evaluations if they believe that the scientific data are of a poor quality. This means that the agencies often conclude that there is a lack of evidence and that no health economic evaluation will be conducted, resulting in the county councils receiving no guidance for their decision-making.

The county councils have expressed a requirement for national health economic evaluations. There is a pressing need for better support to be provided in advance of decisions about the acquisition and utilisation of medical technologies, and area which has a turnover of SEK 23–25 billion every year.

It is important to ensure that the county councils receive usable support in decision-making that concerns medical technologies. The review has been conducted at the national level by an organisation that has the opportunity to provide for the needs that the county councils have, fast evaluations at an early stage, even in cases where the scientific basis is not yet sound. Furthermore, the health economic evaluations must be based on the best available data and support uniform, equivalent care throughout the nation.

The ambition is to fill the gap that currently exist between the existing reviews and the needs of the county councils using TLV knowledge bases on medical technologies. The TLV trial period conducting reviews of methods based on medical devices should be developed successively and made permanent in the long-term.

6.1.1 Who evaluates medical technologies today?

As indicated in previous chapters, there are local HTA organisations associated with county councils, as well as two governmental agencies, the SBU and The National Board of Health and Welfare, that conduct health technology evaluations (HTA) of, for example, methods based on medical devices. When it comes to national evaluations, however, it is clear that existing activities are not sufficient.

The HTA groups associated with county councils are organised in a way which is better at identifying early on which medical devices should be evaluated. However, there are only four county councils that conduct HTAs.

There evaluations are based on the healthcare perspective and those only take into consideration the costs and benefits that arise in the county council.

The National Board of Health and Welfare's work on national guidelines compiles all the measures for a certain condition. The National Board of Health and Welfare does not normally review individual medical devices. This means that if a new medical device is released onto the market it can take a long time, sometimes several years, before it is included in The National Board of Health and Welfare's guidelines, if it is even taken up as a separate measure at all. The National Board of Health and Welfare makes an assessment of the healthcare system's need for guidance and then chooses whether to provide recommendations for individual measures or for all the relevant alternatives. When new products are introduced and there is the danger of a disorganised introduction, The National Board of Health and Welfare has the opportunity to draw up limited, quick guidelines. For example, the agency published limited recommendations for percutaneous aortic valve replacement in 2011, and stated that the prioritisation was made against the background of the method being associated with a high level of risk and a widening of its indications.

When SBU evaluates methods it does this based on the published research results and places the same requirements on evidence for medical devices as, for example, pharmaceuticals. This often leads to SBU not providing any assessment of the overall evidence base as the scientific data for the medical device is rarely of the same quality as that for pharmaceuticals. This difference is even greater for medical devices that are used in the healthcare system to only a limited extent or not at all.

However, SBU and The National Board of Health and Welfare do not conduct health economic evaluations if they believe that the scientific data are of a poor quality. In practice this means that no opinion is expressed on the cost-effectiveness of a large proportion of the products that are evaluated. Neither do the agencies take unpublished data that the manufacturer may have provided into consideration.

6.1.2 Medical technology in healthcare today

TLV makes the assessment that products and technologies are sometimes introduced based on very insufficient documented clinical benefit and without health economic calculations and considerations having been made. A large number of medical devices are procured by municipalities and county councils without any health economic data that takes into consideration the future effects from a societal perspective. In addition to procured medical technologies, medical devices may sometimes be introduced into the healthcare system on the initiative of individual clinics or doctors. There is a high likelihood that this leads to a number of sub-optimal decisions being made, in certain cases as a result of more easily calculated short-term effects on costs.

In practice, it is the case that a hospital receives many of proposals about products that members of the caring professions wish to buy in. Neither the members of the caring professions, those who have to pay nor the company have, in general, sufficient knowledge about how good the product is, and above all about how much of a priority it is in relationship to other products or measures for other diseases. In practice, the decision-makers in the healthcare system are faced with a large number of proposals from various disciplines, often with the requirement to prioritise one specific product ahead of another. With an insufficient evidence base, this is of course a difficult decision.

6.1.3 Conclusions

Against a background of the experiences that have been gathered over the course of commission, it can be established that the review of medical technologies that is conducted today does not sufficiently live up to the requirements and needs expressed by the healthcare system.

In this context, it should be noted that the county councils conduct a certain amount of their own HTA activities. However, all county councils do not have the opportunity to conduct their own HTA activities and it is hardly reasonable to consider a system in which 21 different organisations review the same things. The review has been conducted at the national level by an organisation that has the opportunity to provide for the needs that the county councils have, fast evaluations at an early stage, even in cases where the scientific basis is not yet sound. Naturally, there are situations when there is no knowledge about effects and costs, in which it is impossible to produce reliable analyses. Early health economic analyses will be set against an approach that is based on a requirement for evidence. Furthermore, the review should be conducted by one and the same authority in order to ensure uniformity and a cost-effective utilisation of resources.

The review of medical effectiveness that is supplied by SBU and The National Board of Health and Welfare is a necessary foundation, but is not sufficient. As it stands, the practical results seem far too often to stop with a conclusion that there is a lack of evidence, which leave the county councils without further support in the face of their decision. At the same time, decisions are made in the county councils on acquisition and use in an area that is judged to be worth SEK 23–25 billion per year.

A concrete example that illustrates this is the county councils' request for an evaluation of implantable cardiac defibrillators, despite SBU and The National Board of Health and Welfare having already conducted such an evaluation.

It thus appears that there is a distinct gap in the current system between the reviews conducted by the SBU and The National Board of Health and

Welfare and the practical reality that the county councils find themselves in. It is clear that this gap may be closed by health economic knowledge bases that are based on the best available evidence. This type of evaluation is then a complement to the SBU's and The National Board of Health and Welfare's respective reviews and adds a new element that is currently lacking. This new element consists of guidance that is also drawn up in situations where there is a lack of evidence.

TLV has worked on this commission for about a year and can conclude that the points listed above have been confirmed and even reinforced over the course of this project. At the same time, it is important that the coordination between the governmental agencies concerned continues to be developed and that the roles and responsibilities of each of the agencies can be clarified. SBU and The National Board of Health and Welfare have stated their concern that the TLV review of medical technologies risks leading to the work being duplicated or different assessments of the evidence etc. It is thus important to clarify that TLV's work with the field of medical technologies involves adding something that neither of these agencies provide. In this way, the resources and expertise in each of the agencies may be used in a cost-effective way, with TLV filling the hole that currently exists in situations where it is concluded that there is lack of evidence, at the same time as the county councils are conveying their great need for guidance in decision-making on acquisition and utilisation.

TLV assess that the conditions are good for continue developing such reviews of medical technologies, making use of over ten years' experience of prioritising and reviewing within the fields of pharmaceuticals and consumables. TLV also has extensive experience of working with companies within the life sciences sector, which is significant to enabling a good dialogue and a good process with regard to medical technologies.

The TLV's activities are covered by Chapter 30, Section 23 of the Public Access to Information and Secrecy Act (2009:400), which means that information is secret, including that relating to business and operating relationships and, in certain cases, for other financial or personal relationships if it can be presumed that the individual will come to harm if the information is revealed. In practice, this means that TLV can classify sensitive information from businesses as secret, for example, prices, market calculations and health economic models. This involves the opportunity to benefit from, for example, unpublished data from the company. There is no equivalent regulation for the county councils, The National Board of Health and Welfare or SBU.

Against this background, TLV should, in the long-term, gain the permanent commission to review medico-technical methods that are based on medical devices.

6.2 What should be reviewed?

Summary

TLV should review and value applications of methods that are based on medical devices. The evaluations should not be primarily a comparison of individual products with one another, rather they should cover entire classes of products or new product functions.

One motivation for the TLV's work is to contribute to gaining as much health as possible for the tax money that is spent in the area in question. Against such a background, the evaluations of medical technologies need to have the opportunity to take place pragmatically across various sectors and areas of use. It is thus important not to simply analyse the technology itself, but also its organisational and clinical context, which can often be the decisive factor in determining whether a technology is used in a cost-effective way. A narrow review of physical products would limit TLV's chances of identifying health economic improvement opportunities.

The TLV's review activities and contribution to a prioritisation within Swedish healthcare should therefore take place at a more general level. This means that the review should not encompass individual products such as one insulin pump compared with another, which it performed better by the county councils in conjunction with procurement. The focus should instead lie on studying device-based methods where one of more medical devices have a crucial significance.

The reviews may also involve completely new classes of products that can appear to be cost-effective, but with great uncertainty and where their selective initial use can be recommended in order to gain improved clinical and health economic data. For example, if the use of robotic surgery had been evaluated from the perspective of the economy of the whole society before the purchase had taken place, the allocation of robots across the country would probably have looked very different. Furthermore, this can involve products that are already being used in healthcare, but which should have been rejected in favour of newer and better devices or methods. A new device or method can lead to a requirement for care to be provided in an entirely new way, it is thus also important to be able to evaluate the process surrounding the device or method.

6.3 Selection criteria

Summary

The criteria for selecting the methods based on medical devices that will be evaluated:

- Impact on resources

- Disease severity
- Epidemiology (Burden of illness)
- Insufficiently satisfied clinical need
- High/low clinical effectiveness (Innovation/Phasing-out)
- Inequality of use
- The device cannot be included in the benefits system

The question of which medical devices TLV will review must be considered against a background of the proposals for devices to review that can be expected to be received. All interested parties, that is the healthcare sector, private individuals and organisations, should have the opportunity to submit proposals in order to maintain transparency and openness. However, this will probably lead to more proposals being received than we have the capacity to review.

Therefore, clear selection criteria are required in order to choose devices and methods for review in a systematic, predictable and transparent way. A natural starting point in the formulation of such criteria is that they should relate to the guidelines for ensuring cost-effective, equal and need-based care that already exist for the Swedish healthcare system.

We have identified seven different criteria that are proposed as the basis for prioritisation of what will be evaluated.

1. Impact on resources

A device or method's expected impact on resources. A large impact on the healthcare system's limited resources can be a reason for a health economic evaluation.

2. Disease severity

In cases where a device or method addresses a serious disease there is greater cause for a health economic evaluation.

3. Epidemiology

In cases where a device or method is intended to be used for a common disease there is greater cause for a health economic assessment (disease burden/cost of illness). In certain cases, even uncommon diseases may constitute grounds for reviews.

4. Insufficiently satisfied clinical need

If a device or method's patient benefit is expected to be better than that of a given established device/method at addressing an insufficiently satisfied clinical and/or medical need, this would have significance for decisions about what will be reviewed. Clinical need does not just mean medical need, but also technology's chances of improving working processes to provide better results or lower costs.

5. **Expected high or observed low clinical effectiveness**

High expected or observed low clinical effectiveness (innovation/phasing-out) will both be reasons for a review. In the first case, the initial, uncertain information and presumption about high impact constitute reasons to initiate an evaluation.

6. **Inequality of use**

There is cause to carry out a review if there are large differences in the use of a medico-technological method, whether geographically or between age groups and sexes, without a medical motivation.

7. **If the device can be included in the benefits system as a consumable**

Devices that can be included in the benefits system as a consumable should not be reviewed under this commission. This is because these devices should only be reviewed from this perspective.

Table 6.1.

| | Human dignity | Need and solidarity | cost-effectiveness | cost impact |
|---|---------------|---------------------|--------------------|-------------|
| Impact on resources | | | X | X |
| Disease severity | | X | | |
| Epidemiology | | | | X |
| Insufficiently satisfied clinical need | | X | | |
| High or low expected clinical effectiveness | | | X | |
| Inequality of use | X | | | |

The list of criteria reflects the ethical platform and has no relative order of precedence. All of the criteria may be important in given situations. For example, a new device designed to alleviate or cure a severe disease is probably interesting to review if it is also the case that there is no good treatment alternative already on the market already. When it comes to new devices and methods, the initial information about treatment effectiveness or cost impact is often uncertain which can constitute grounds for initiating an early evaluation. In this context it is also important to identify which of the older, established methods and devices should be phased out on the basis of an analysis.

A general principle for selecting what will be evaluated should be that the value of additional information is high. If the cost of the evaluation is greater than the expected gain as a result of the review, then the review should not take place.

In the extended trial period, however, the selection of which medical devices for review will take place in consultation with the organisations responsible for healthcare, as well as the patient and trade organisations concerned. This is a consequence of the commission. If TLV is given a permanent commission to review medical technologies, this list of technologies should be developed further.

6.4 Collaboration with stakeholders

Summary

TLV should work closely with the organisations responsible for healthcare as these are the recipients of the health economic evaluations. Furthermore, good collaboration with the governmental agencies concerned is of great importance in order to, for example, ensure the connection to initiatives that promote innovation and a coordinated approach from central government to evidence-based governance.

In order to provide the conditions for mutual understanding, it is important that patients and service users are involved and can contribute to the TLV's evaluations of medical devices from their perspective. TLV should also be involved in a close dialogue with the companies involved in order to gain access to available information.

The TLV should also work toward creating international collaboration between bodies that conduct HTAs of the applications of medical devices.

6.4.1 Collaboration with those responsible for healthcare

One aim of the commission is to promote good and equal care. It is the organisations responsible for healthcare that are tasked with providing for this care. In order to satisfy the need of organisations responsible for healthcare for an evidence base, it is important to be involved in an ongoing collaboration, partly to ensure that TLV conducts reviews of those methods based on the medical devices that the county councils have the greatest need to know more about, partly to ensure that the documents produced by TLV answer the questions and meets the needs of the county councils. An ongoing collaboration between the TLV and the organisations responsible for healthcare to develop cooperation and collaborative forms is also of great significance.

6.4.2 Collaboration with other governmental agencies and HTA organisations

There are several different agencies, but also different county councils, that produce knowledge bases. One challenge that results from this is that it becomes hard for the healthcare system to know in all situations which knowledge base is available within a certain field. In certain cases it may also be the case that there are several, conflicting knowledge bases. The organisations responsible for healthcare have asked for a more coordinated knowledge base from central government.

Against this background, it is important that TLV collaborates with other agencies and also with HTA organisations that produce knowledge bases.

This is partly so that they will have the opportunity to submit proposals about areas for evaluation, and about what they have done within the areas that the TLV evaluate, as well as gaining the opportunity to provide points of view on the knowledge bases that the TLV produces. It is the TLV's intention that the ongoing work to further investigate and clarify the boundaries between the agencies' areas of responsibility, partly in order to avoid duplicating work, partly to make things easier for the recipients of the information.

TLV has already begun collaborating with VINNOVA to promote innovation within the medical technology field. This collaboration will be further developed in the ongoing project.

6.4.3 The companies' role

The companies that market medical devices or methods that are reviewed by TLV should have the opportunity to submit data to the TLV. The data should be covered by the same secrecy as other cases that are administrated by the agency. This provides the companies with the opportunity to share data that has yet to be published or which the companies for some other reason do not wish to make public, for example, prices, expected turnover or health economic models. It is important that TLV has clear criteria covering the type of data and documentation we accept for different approaches and models. The companies will have the opportunity to see our proposals for knowledge bases and to submit points of view before we publish the result.

6.4.4 Collaboration with patients and service users

In this work, TLV will have the benefit of a well-functioning collaboration with patients and service users. Patients and service users can provide their perspectives and, in many situations, their knowledge about what it is like to be affected by a certain condition.

Primarily, TLV will want to have patients and service users' points of view about the draft recommendation that the agency has produced. In situations where there is limited evidence available, it will be especially important to have a good relationship with patients and service users.

There are grounds for TLV to set out in the ongoing project, a procedure for organising this collaboration with the patient and service user organisations. It is important that patient and service user organisations are involved at an early stage. It is also important to produce clear guidelines for the contribution they are expected to make.

6.4.5 International collaboration

Sweden has a relatively large number of medical technology companies, but is a small market in relation to the rest of the world. Introducing a system that leads to increased costs and more stringent demands risks leading, in the long-term, to companies avoiding introducing their devices in Sweden. It

can also lead to small Swedish companies finding it harder to compete with larger companies that have more resources. Many companies have highlighted the difficulty of selling the product in other countries is the company cannot show that the product has been successful in its home country.

It has been pointed out in many contexts that there are half a million medical devices, as well as a very large number of different methods. TLV will only be able to evaluate a fraction, regardless of the approach taken. The question of cost-effectiveness is probably similar in all countries, even though the prioritisation is conducted nationally. Therefore, there are probably synergies that can be found by collaborating across national boundaries, mainly within the EU.

One method for collaboration on HTAs between different countries has been developed within the scope of EUnetHTA (38), in which a minimum level of data that can be shared between countries has been defined and in which all cost assessments take place nationally as a result of healthcare being organised differently. This type of international collaboration leads in the long-term both to new technologies that it is relevant to evaluate being identified earlier (horizon scanning) and with greater accuracy, and to cost savings for the agency. Medical technology companies also benefit from the evaluations as they can achieve better quality in each of the involved countries through this collaboration.

TLV should also work toward creating international collaboration between bodies that conduct HTAs of medical devices, similar to EUnetHTA.

6.5 Access to data for decision-making

Summary

A given starting point for this work is that which the SBU and The National Board of Health and Welfare already do. TLV will not be repeating or contradicting this, but instead will be adding to it that which is currently lacking.

The TLV should strive to produce assessments that are based on the best possible evidence. However, the requirement for evidence cannot be formulated in such a way that it becomes impossible to make an assessment. TLV should therefore continue to develop a process for assessment and valuation of documentation that is based on the best available knowledge.

In order to create predictability, the TLV should offer an information service that is able to provide guidance on the expectations with regard to documentation, for example, that exist in connection to the TLV's evaluations.

As noted on several previous occasions in this report, the access to documentation with good evidence (high evidential value) in the medical technology field is significantly worse than for drugs as a result of, for example, differing regulatory requirements.

Being able to work with the best available knowledge is thus necessary in health economic analyses of medical technologies. It is rare for a decision on a device's cost-effectiveness to be based on individual studies, which is why model analyses in which cost data, clinical data and quality of life data are used. As a result of factors such as the lower grade of clinical evidence that is generally available for medical devices, it is sometimes necessary to use estimates that have a relatively high uncertainty in these models.

The initial uncertainty in the assessments of a device's cost-effectiveness can be reduced through successive updates of the evidence that is used in decision-making models. The benefit of using uncertain evidence that is updated over time as opposed to simply limiting oneself to evidence of the highest grade has been emphasised by many health economics researchers, (11). This approach is interesting and there are grounds for TLV to test and develop the method with model analyses when there is limited available data. The TLV should work with the best available knowledge and make as good an assessment as possible, in which the uncertainty in the estimates is explicitly stated. In this way, the TLV's health economic analyses can provide guidance at an early stage when it is most needed for decision-making in the healthcare system. A given starting point for this work is that which the SBU and The National Board of Health and Welfare already do. TLV will not be repeating or contradicting this, but instead will be adding to it that which is currently lacking. Today there is a gap between existing reviews, which often conclude that there is insufficient evidence, and the county councils' requirements for guidance in advance of making decisions on the acquisition and use that takes place within an field that turns over about SEK 23–25 billion each year.

6.5.1 Data for assessments

The requirement to use the best available knowledge in those cases where there is insufficient evidence was discussed in the previous section. This is very important because, in many cases, new technologies are introduced into the healthcare system before there is sufficient high quality scientific evidence.

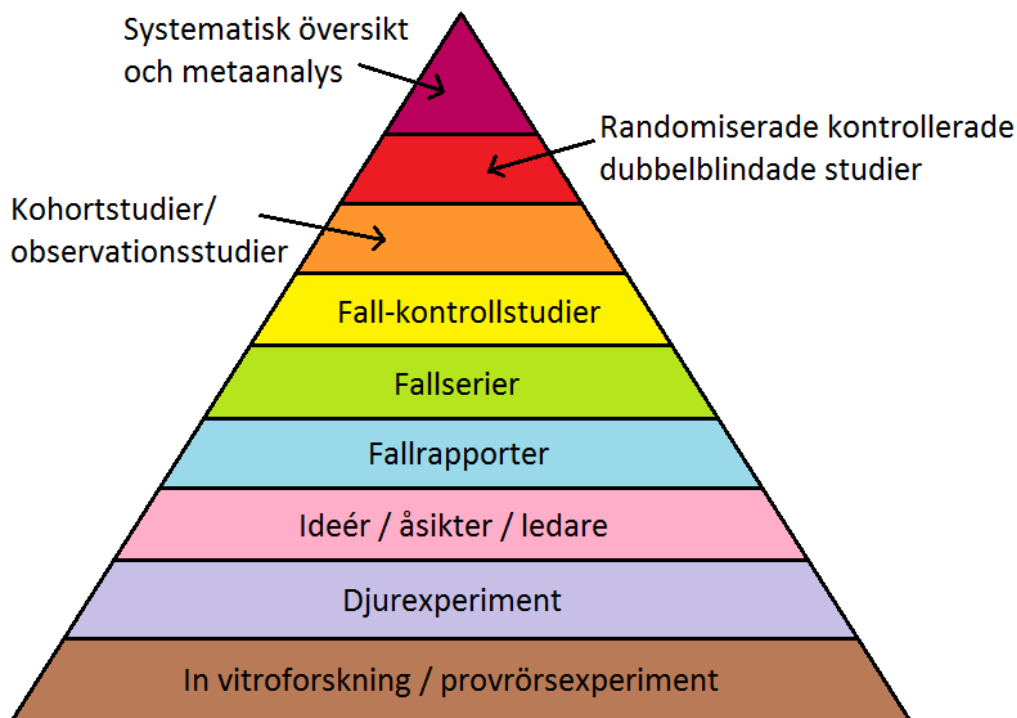
Consequently, TLV believes that it must be possible to conduct health economic analyses of the best available material. This is because decision-making in the healthcare system about whether or not to introduce a new technology will need to have as strong a foundation as possible. It is rarely the case that the healthcare system waits until there is sufficient data, rather the decision is made before a health economic evaluation with the best available data has even been attempted. However, the health economic

assessment cannot be better than the initial data allows for. The reliability of the health economic evaluations depend, above all, on the quality of the data and the method that is used. Nevertheless, decisions must be made even though the evidence base is missing. It may then be applicable that the best available data is compiled into some form of health economic model analysis. A model analysis is not a replacement for trials, rather the aim is to shine light on a decision-making problem using the best available information.

What is considered high quality or low quality evidence will be discussed in the next chapter. In order to explain simply how different types of study can be placed in order of precedence with regard to the quality of their evidence, there are grounds to introduce the evidence pyramid (Figure 6.1).

According to this order of precedence, systematic reviews and meta-analyses are the studies with the highest quality evidence, followed by randomised, controlled, double-blind studies. However, the majority of studies of medical devices require the active participation of a medical doctor, which, in practice, can make it difficult to conduct double-blind studies.

Figure 6.1. Evidence pyramid



Source: <http://library.downstate.edu/EBM2/2100.htm>

In reviews within the field of pharmaceuticals, TLV has previously graded evidence in the following way:

1. Identify existing systematic reviews.
 - a. General starting points for systematic reviews:
 - Reviews from all organisations that are members of INAHTA (International Network of Agencies for Health Technology Assessment) are considered.
 - Reviews from the SBU are considered first.
 - TLV conducts no further examination of the results of the existing systematic reviews.
 - b. Searches for reviews are conducted in the PubMed, Cochrane and INAHTA databases.
 - c. Supplementation of systematic reviews.
 - If the review is more than two years old it is supplemented with independent searches.
 - The searches take place in PubMed and Cochrane with the same or a relevant selection of the keywords that were used in the systematic review.
 - Studies with evidence grade 2 or better are added to the original systematic review.
2. Identification and compilation of the relevant meta-analyses – meta-analyses are used when there is no systematic review and in those cases where there is a systematic review, but it does not cover the whole of the treatment area that it relevant to the TLV's work. Meta analyses are also used if the existing systematic reviews do not look at individual substances.
 - a. Searches for meta-analyses are conducted in the PubMed, Cochrane and INAHTA databases.
 - b. The evidence of the meta-analyses is graded (according to a model from a relevant SBU report).
3. Synthesis of relevant, published documentation from the Swedish Medical Products Agency and The National Board of Health and Welfare, such as product monographs, therapeutic recommendations, background materials for workshops and national guidelines.
4. Synthesis of effects reported by the companies.
 - a. Review of all abstracts and, in general, entire articles.

- b. If there are no systematic reviews or meta-analyses, the evidence in the form of effects reported by the companies is graded (according to the SBU template).

This system has worked well for drugs, but may need to be adapted in order to better reflect the requirements of evaluations of medical devices and medico-technical methods.

The governmental agencies have requirements for evidence in conjunction with approval within the field of drugs. Drug companies must demonstrate in a meticulous way the effectiveness of the drug before it can be approved for sale. This leads to new pharmaceuticals having data that is of a higher quality when they reach the approval stage. There is no equivalent requirement for medical devices. The starting point is thus different for pharmaceuticals than for medical devices.

It may also be difficult for practical and/or ethical reasons to conduct, for example, a double-blind study of medical devices.

Experts can contribute to strengthening the knowledge base with their proven experience. Experts can express their opinions on the advantages that exist, but which are not easily measured (see the progress report concerning insulin pumps and CGM).

However, there are problems with engaging experts. It is often that most prominent and experienced doctors that are proposed. These experts have sometimes collaborated with the drug companies, which is not consistent with the requirements placed on TLV to, as an agency, take an objective and impartial approach. TLV may, in certain cases, get by without experts for this reason.

6.5.2 Swedish Standards Institute (SIS)

If the commission to review medical technologies becomes a permanent part of the TLV's operations, it is intended that a technical committee be established at the SIS. The committee's main aim will be to produce a standard for the grading of documentation of a low evidential value. Thanks primarily to the work of the SBU, there are well-accepted methods for dealing with documentation of a high evidential value, but there is a prevailing lack of unity on how an agency can and should grade and value documentation of a lower evidential value. The way in which TLV values the data is of vital importance to the outcome of the evaluation. This could be regulated in the form of general advice or regulations about how the data should be valued. However, TLV assess that a standard would be more suitable in this case. The process of producing a standard is open and inviting for many parties. This is important because the activity is totally new. An additional aspect that makes a standard applicable is the

opportunity, in the long-term, to harmonise a standard across the rest of Europe.

6.5.3 Information service

There is no tradition of conducting health technology assessments of medical devices, which means that the medical technology companies are normally less prepared than, for example, drug companies. In order to prepare the company for these increased requirements and provide them with the opportunity to submit relevant data, TLV should establish an information service that can be used to provide the companies with information and guidance.

An information service will be able to provide the companies with guidance on what documentation they are expected to provide in conjunction with the TLV's evaluation, about previously resolved situations, what data the company needs to acquire in order to demonstrate cost-effectiveness, discuss the alternatives for comparison, study set-up etc. This will enable the companies to better focus their research initiatives and avoid conducting clinical trials and producing documentation that answers questions that are irrelevant to governmental agencies, healthcare staff, patients etc. It is thus positive if this type of expenditure can be minimised (because, in general, this will end up being factored into the sales price). An information service can also provide all companies, regardless of their size, with conditions that are more similar.

The information service can be seen as an educational initiative in the first year. It may also be possible to expand the information service to encompass stakeholders, other than companies, who could be interested in how to select, based on a cost-effectiveness perspective, which methods or devices to use.

6.6 Ethical assessment of the use of medical technologies

Summary

The ethical platform that is a consequence of the Health and Medical Services Act forms the basis of the TLV's work with medical technologies. In addition to this there needs to be further support for the ethical judgements that must be made in conjunction with such an assessment. TLV intends to work with these questions by using a check-list when reviewing medical technologies.

There are, as a rule, a large number of factors that need to be taken into account when decisions are made about which methods should be implemented in the healthcare system. What is often focused on in this context is the extent to which a given product or method is cost-effective.

The ethical platform that is a consequence of the Health and Medical Services Act forms the basis all healthcare. In the context of prioritisation there may however be a requirement for additional support in ethical deliberations.

When assessing new devices or methods, it is important to consider whether they raise other ethical questions that should be regarded as relevant to prioritisation. The international literature includes a number of general instruments for such assessments. The problem with these is that they are not always applicable for Swedish conditions.

An important basis for these ethical analyses is that the ethical attitude that is taken should be as consistent as possible. If there are certain reasonable reasons for introducing a device or method for a certain group of patients, then other devices or methods that are justified for the same reasons should also be introduced. Another important aspect of the ethical analysis is that it is done at the group level. Hence, the assessment considers a device or method in relationship to a given population and thus not in relation to individual patients.

Check-list for ethical questions

A check-list that could form the basis of the TLV's work is presented in Appendix 2. The check-list has been adapted from a more extensive check-list. With the help of ethicist Lars Sandman, the SBU has adapted this to Swedish conditions in various steps¹¹. The check-list thus takes the Swedish circumstances of a publicly-funded healthcare system into consideration.

The check-list consists of 16 questions and may be divided roughly into four categories: questions related to the goals of the healthcare system, questions related to the ethical framework of how the healthcare system's goal may be achieved, questions related to other ethically relevant effects of the intervention, and conclusions.

The check-list is designed to make it easier for people other than professional ethicists to make a preliminary ethical assessment.

When should the check-list be used?

There are a number of grounds for beginning the ethical assessment at the same time as the analysis regarding the effectiveness and cost-effectiveness commences. The first is that there are often people who are clinically active involved in the literature review. The knowledge and experience of these people can play an important role, not just in the assessment of effectiveness, but also in the ethical assessment. The second is that it is often valuable to identify the ethical questions early on in the process. In certain cases there may arise especially severe adjustments that may require an more in-depth

¹¹ The SBU is currently in the process of validating and checking the reliability of the check-list.

ethical analysis. The latter reason is thus one which is mainly of a practical nature which prevents the processes becoming drawn out.

6.7 Design of the knowledge base for the organisations responsible for healthcare

Summary

The aim of the TLV's knowledge bases is to ensure that the county councils have support for their decision-making that is usable in practice. The knowledge bases will, as do the TLV's other decisions, encompass the entire ethical platform and in thus not just cost-effectiveness. Furthermore, they will support care that is uniform and equal across the entire country.

They will be formulated quickly and flexibly, will be based on the best available knowledge and will contain an overall assessment. The overall assessment will provide guidance to the county councils, but will not be considered to constitute a binding recommendation.

TLV will base its work on the assessments by SBU and The National Board of Health and Welfare of the evidence and add to this an assessment based on the best available evidence.

The government commission states that the TLV will make a health technology assessment. Over the course of the project, the TLV has come to realise that this is not sufficient as we have identified that the needs of the county councils are larger. The TLV should therefore produce a knowledge base with an overall assessment concerning whether a device or method should be used or not. The aim of the TLV's knowledge base is to provide the county councils with support that they can use in practice when making decision concerning medical devices. The knowledge base should encompass the ethical platform that appears in the Health and Medical Services Act. Other ethical aspects, the consequences of the new technology, the patient's privacy and autonomy, as well as organisational and financial impact should also be taken into account. Any potential environmental impact should also be considered.

TLV will be sensitive to the needs of the county councils and will be able to produce documents quickly and flexibly. The TLV's documents will be based on the SBU and The National Board of Health and Welfare's assessment of the evidence and will add to this an assessment that is based on the best available evidence and which contains an overall assessment. The overall assessment will provide guidance to the county councils, but will not be considered to constitute a binding recommendation.

TLV propose that the knowledge bases will be put together in the same way as the overall assessments, in accordance with a set template that is used for

all knowledge bases. The TLV believes that it will be most practicable to have a report structure in which all knowledge and uncertainty is highlighted and that the evaluation will be based on this (see table 6.2)

Table 6.2. Proposed report format

| Report format knowledge base medical technology | |
|--|---|
| Preface | |
| Contents | |
| Summary | |
| Overall assessment <i>Conducted in line with a description of the measures that the method or device, condition and target group, and the alternatives for comparison that are available. The severity of the condition, patient benefit, quality of the evidence base for both the medical and health economic sections, and also which ethical aspects may be applicable flow into an overall assessment for decisions on prioritisation. That is to say, based on Part I of the knowledge base.</i> | |
| Part I. Knowledge base and assessment | 1. Background <i>Short description of the device or method, its indications and level of innovation.</i> |
| | 2. Condition/disease <i>A description of the condition or disease that the device that TLV is investigating is intended to be used for. In addition there is a description of the current treatment and the severity of the condition.</i> |
| | 3. Method/device <i>A more detailed description of the device</i> |
| | 4. Patient benefit <i>Background information on the available data, materials submitted by companies, what clinical studies there are and what they indicate. A description of the effectiveness of the treatment, the patient's perspective and expert opinion. An overview of the uncertainty in the data and an overall assessment of the medical evidence base.</i> |
| | 5. Health economic evaluation <i>Background of the available data, which approach has been used in the evaluation, which health economic evaluations have been conducted and which are the most reliable. A description of the costs and price. A discussion of the uncertainty in the health economic models and an overall assessment of the health economic evidence base.</i> |
| | 6. Ethical consequences <i>Are there specific ethical aspects that should be highlighted, are there environmental aspects that should be highlighted?</i> |
| | 7. Points of view received <i>The company's points of view The service user organisations' points of view The county councils and municipalities' points of view The caring professions' points of view The trade organisations' points of view Concerned governmental agencies' points of view</i> |
| | 8. Organisational structure and educational programmes <i>An analysis of the consequences for county councils' organisational structure and educational programmes that may be affected by the method or device.</i> |
| | 9. Budget impact <i>An analysis of the consequences for the county councils' budgets.</i> |
| | 10. Procurement parameters <i>A list of the important procurement parameters and what should be considered in a procurement situation.</i> |
| | 11. Evaluation <i>Are further evaluations, clinical trial etc. required?</i> |
| | Part II. Consequence analysis and use of the method |

The structure above has been used in each of the knowledge bases that have so far been presented. In Part I, TLV presents the evidence and makes an overall assessment. Going forward, the ambition is to add another part, namely a consequence analysis that the county councils have requested. This part will cover the impact that the method will have on, for example, organisational structure, budgets, evaluation and follow-up.

The idea is for the knowledge bases to support care that is uniform and equal across the entire country. This is achieved by the county councils having the same data on which to base their decisions. It is important that we monitor how the knowledge bases are used in the healthcare system and what impact they have. This is to develop our knowledge bases and overall assessments so that they meet the needs of the county councils.

6.8 Who will make the decisions about the knowledge bases and overall assessments?

Summary

The TLV's director-general should, under normal circumstances, make the decisions about whether to approve knowledge bases and overall assessments of medical technologies. In specific cases, however, the director-general will have the opportunity to place specific questions before the Board for Pharmaceutical Benefits, such as willingness to pay.

As described previously, one of the main aims of reviewing medical technologies is to bridge the gap that currently exists, where it is concluded on the one side that there is insufficient evidence, and on the other decisions are made that lead to a cost of about SEK 23–25 billion per year. The TLV knowledge bases and overall assessments aim to, in spite of insufficient evidence, provide the county councils with improved support for acquisition and use than that which is currently available.

The production of this type of knowledge base is, especially in the initial development phase, associated with a number of challenges. In part this is because it is by definition hard to create a structure with predictable and transparent criteria within an area with insufficient knowledge. In part, because it is only when there is practical experience of the production and use of such documents that the conditions exist to come to conclusions about what will have the desired effect.

It is important that the knowledge bases that are produced are made as user-friendly as possible, from the point of view of both the content and how quickly they are prepared. At the same time, the knowledge bases must support a development towards nationwide equality and uniformity and, to

the extent possible, promote innovation and ensure that the use of medical technologies becomes as evidence-based as possible.

There are two main alternatives when it comes to who will make decisions to approve the knowledge bases: the director-general or the Board for Pharmaceutical Benefits.

One of the current duties of the Board for Pharmaceutical Benefits is making decisions to approve knowledge bases concerning medical technologies. The director-general decides on those cases that will not be decided by the TLV's boards in accordance with Section 6 of the Ordinance with Instructions for the Dental and Pharmaceutical Benefits Board (2007:1206). However, the director-general has the opportunity, in accordance with Section 5 of the same instructions, to place other questions before the board if it is deemed necessary.

In favour of the board making the decisions on the knowledge bases relating to medical technologies is that the board prioritises and approves willingness to pay concerning pharmaceuticals and the same willingness to pay should also apply to medical technologies. This may, however, be achieved by the director-general placing questions about medical technologies before the board in those cases where it is deemed appropriate.

In favour of the director-general making decisions on the knowledge bases is that this, especially in the initial development phase, would facilitate an increased speed and flexibility in the production of the knowledge bases.

In the case of an overall assessment, it appears that the most practicable solution is for the director-general to make the decisions about the knowledge bases, and when necessary take advice from or place questions before the board in those cases where it is deemed appropriate.

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Appendix 1. The Medical Technology Market

The medical technology industry is characterised primarily by its wide range of products. Everything from simple single-use products to complex diagnostic imaging systems or very advanced active implants such as implantable cardiac defibrillators or nerve stimulators. The characteristics of the companies also varies. There are large multi-national companies involved in a large number of product groups. There are also more specialised medical technology companies. A large number of them are very small or even one person companies.

The global medical technology industry

There are a large number of American companies among the largest multi-national medical technology companies. For several years, the medical technology journal Medical Product Outsourcing has been publishing a list of the largest medical technology companies in the world, which takes into account only the part of the company that covers medical technologies. The combined turnover of the 30 largest medical technology companies was in excess of USD 216 billion in 2010 (see Table 1). This is equivalent to close to half the estimated turnover of the medical technology industry. In most of the medical device categories, according to the GMDN (Global Medical Device Nomenclature) standard, the market is dominated by three or four of these companies.

Table 1. The 30 largest medical technology companies in the world in 2010

| Ranking | Company | Turnover | Ranking | Company | Turnover |
|---------|----------------------|--------------|---------|-------------------|-------------|
| 1. | Johnson & Johnson | US \$ 24.6 B | 16. | 3M Healthcare | US \$ 4.5 B |
| 2. | GE Healthcare | US \$ 16.9 B | 17. | Zimmer | US \$ 4.2 B |
| 3. | Siemens Healthcare | DE \$ 16.7 B | 18. | Danaher | US \$ 4.1 B |
| 4. | Medtronic | US \$ 15.8 B | 19. | Smith & Nephew | UK \$ 4.0 B |
| 5. | Baxter International | US \$ 12.8 B | 20. | Care Fusion | US \$ 3.9 B |
| 6. | Philips Healthcare | NL \$ 11.4 B | 20. | Hospira | US \$ 3.9 B |
| 7. | Abbot Laboratories | US \$ 9.3 B | 20. | Olympus Medical | JP \$ 3.9 B |
| 8. | Cardinal Health | US \$ 8.8 B | 23. | Synthes | CH \$ 3.7 B |
| 9. | Covidien | US \$ 8.4 B | 23. | Beckman Coulter | US \$ 3.7 B |
| 10. | Boston Scientific | US \$ 7.8 B | 25. | Terumo | JP \$ 3.4 B |
| 11. | Beckton Dickinson | US \$ 7.4 B | 26. | Alcon | US \$ 3.2 B |
| 12. | Stryker | US \$ 7.3 B | 27. | Fresenius medical | DE \$ 3.0 B |
| 13. | B. Braun | DE \$ 5.9 B | 28. | Biomet | US \$ 2.7 B |
| 14. | St. Jude Medical | US \$ 5.2 B | 28. | C.R Bard | US \$ 2.7 B |
| 15. | Toshiba | JP \$ 4.6 B | 29. | Varian Medical | US \$ 2.4 B |

As a result of the large differences between the different medical device areas when it comes to technology, business models and customer groups, the

concentration of the companies is not as significant as in the pharmaceuticals industry. However, there appears to be a similar division of labour in the medical technology industry between large global groups and smaller innovative companies as between the pharmaceutical industry's "Big Pharma" and "biotech" companies.

The global accountancy firm Ernst & Young monitor a number of industries. They have a specific focus on the global life sciences and medical technology industries. Their industry analyses of listed medical technology companies is published annually and it also includes an assessment of the size of the industry, its profitability, the number of companies it contains etc. According to the report from 2011 (2), the total turnover of listed European and American medical technology companies was USD 316 billion in 2010, i.e., USD 100 billion more than for the 30 largest global medical technology companies (see Table 2).

Table 2. Listed American and European medical technology companies

| Listed American and European companies according to Ernst & Young | 2008 | 2009 | 2010 |
|---|---------|---------|---------|
| Turnover in USD (billions) | 289.4 | 303.6 | 315.9 |
| Conglomerates | 169.578 | 116.5 | 122.3 |
| Non-conglomerates | 119.814 | 187.1 | 193.7 |
| R&D Expenses | 10.609 | 11.6 | 12.4 |
| Net income | 11.444 | 12.2 | 17.4 |
| Liquid assets | n.a. | 35.8 | 42 |
| Number of employees | 663 870 | 739 531 | 764 355 |
| Number of listed companies | 460 | 443 | 436 |

Source: Ernst & Young Pulse of the Industry, 2011

The global medical technology market

The European (Eucomed) and the American (Advamed) trade organisations are relatively good sources that provide supplementary information about the size of the medical technology market. In 2011, Eucomed published an estimate of the size of the European medical technology market. This assessed that the market amounted to EUR 99.8 billion in 2009 (3). Eucomed estimated that this constituted at least 30 per cent of the global market and about four per cent of total healthcare expenditure in Europe. These data do not include the *in vitro* diagnostics (IVD) industry, which is represented by the trade organisation EDMA and whose market in Europe amounted to EUR 10.5 billion in 2010 (4).

In order to recalculate the size of the market for medical devices, excluding IVD, for 2010 in USD, we first assume a growth rate of five per cent from 2009 to 2010 as, according to Eucomed, the average growth of the industry

has been something over five per cent for several years, and also an average exchange rate for 2010, according to the exchange rate website OANDA, of USD 1.3267 per EUR (<http://www.oanda.com/>). This gives a size for the European market of USD 132 billion in 2010. If IVD products are included, an additional USD 14 billion is added to the size of the market, i.e. a total of USD 146 billion in 2010.

The publication "Estimated of Medical Device Spending in the United States" from Advamed calculated the total medical technology market in the USA in 2009 as worth USD 147 billion. This calculation did not include dental or IVD products, which both constitute a relatively large proportion of the medical technology industry (5). A calculation using the average growth rate of 5.6 per cent provides a figure of a market worth USD 155.3 billion in 2010. The estimated American market for dental products is about USD 4 billion (6) and for IVD is about USD 18 billion (7), adding a further USD 22 billion to make the total figure of USD 177 billion for 2010.

The combined American (USD 177 billion) and European (USD 146 billion) market for medical devices is a total of USD 323 billion. This is a significant proportion of the total world market. A conservative assumption is that these markets together constitute about 70 per cent of the world market, which is worth at least USD 450 billion.

If the estimated market for medical devices is compared to the pharmaceuticals market, for which there is significantly better data, a general relationship between medical technology and pharmaceuticals can be calculated. As a large proportion of medical practice takes place in accordance with professional guidelines, it may be assumed that this relationship on a global, European or American level should also be similar on a Swedish level. Generally accepted and relatively easily accessible data for the pharmaceutical industry is published regularly by the consulting firm IMS Health. According to IMS Health, the global market was about USD 875 billion in 2010 (see Table 3).

Table 3. The pharmaceutical market turnover by region in 2010.

| Region | Turnover 2010 | | CAGR 2006-2010 | CAGR 2011-2015 |
|-----------------------|----------------------------|---------------|----------------|----------------|
| | Turnover in USD (billions) | 2010 Growth % | | |
| North America | 335.1 | 1.9% | 4.6% | 0-3% |
| Europe | 253.2 | 2.4% | 5.6% | 2-5% |
| Asia/Africa/Australia | 129.7 | 14.0% | 14.5% | 11-14% |
| Japan | 102.3 | 0.1% | 2.6% | 2-5% |
| Latin America | 54.3 | 14.2% | 12.1% | 11-14% |
| Global | 874.6 | 4.1% | 6.2% | 3-6% |

Source: IMS Health Market Prognosis, March 2011

By comparing the relationship between pharmaceuticals and medical technology at a global level, we can work out a relationship that can be used to estimate the size of the Swedish medical technology industry. According to Table 4, the relationship is about 1.7–1.9. The relationship globally is a little bit larger for pharmaceuticals relative to medical technology, compared to Europe, which may be considered reasonable given the regulation of pharmaceuticals that exists in Europe.

Table 4. The relationship between pharmaceuticals and medical technology in different regions in 2010

| Year - 2010 | Turnover Pharmaceuticals in USD (Billions) | Turnover Medical technology in USD (Billions) | Relationship Pharmaceuticals/Medical technology |
|-------------------|--|---|---|
| USA/North America | 335.1 | 177.0 | 1.89 |
| Europe | 253.2 | 146.0 | 1.73 |
| Global | 874.6 | 452.0 | 1.93 |

According to Statistics Sweden (SCB), the combined expenditure on pharmaceuticals and other non-durable goods or consumables was SEK 39.4 billion in 2010 (8). This total includes over-the-counter pharmaceuticals, and also other medical consumables, which is why the total is somewhat too high to constitute a good measure of the Swedish pharmaceuticals market. Nevertheless, if you use the higher value as a basis and assume a similar relationship to pharmaceuticals as in Europe in general, the Swedish medical technology market can be estimated at SEK 22.8 billion.

The Swedish market for medical devices

The public Health Accounts of Sweden that are published by the SCB (see Table 5) can be used to gain a complimentary perspective. It appears from the Health Accounts of Sweden that durable medical devices in outpatient care and the retail trade amount to SEK 9.3 billion (Table 5). A large proportion of this item probably consists of glasses and contact lenses, which are also counted as medical devices. In addition, medical devices also hide within the category of medical consumables included in the pharmaceutical benefits system, as well as in a proportion of investments and in the hospitals' material usage. According to Apotekens Service AB, SEK 1.2 billion worth of medical devices are prescribed (consumables for diabetes, stomata and devices related to pharmaceuticals) within the benefits system every year.

Table 5. Cost items from the Health Accounts of Sweden

| Statistics from the Health Accounts of Sweden | 2007 | 2008 | 2009 | 2010 | 2011** |
|--|---------|---------|---------|---------|---------|
| Total healthcare expenditure | 278 754 | 295 706 | 308 683 | 316 023 | 331 307 |
| Total current healthcare expenditure | 266 984 | 281 968 | 294 345 | 299 338 | 312 614 |
| Hospitals | 123 911 | 131 007 | 135 575 | 136 721 | 143 814 |
| Outpatient healthcare providers | 56 326 | 60 252 | 62 860 | 64 624 | 66 495 |
| Medical products that are distributed to outpatients | 44 832 | 46 720 | 48 140 | 48 532 | 49 271 |
| Pharmaceuticals and other non-durable medical products/consumables | 36 481 | 38 151 | 39 347 | 39 443 | 40 014 |
| Prescription pharmaceuticals | 26 953 | 27 906 | 28 369 | 28 597 | 28 916 |
| Therapeutic aids and other durable medical products | 8 351 | 8 569 | 8 793 | 9 089 | 9 257 |
| Healthcare providers' investments | 11 770 | 13 738 | 14 338 | 16 685 | 18 693 |

Source: SCB, Health Accounts of Sweden (8)

The county councils' summary accounts indicate that the county councils' use of medical devices amounts to SEK 6.9 billion (9). Use in private hospitals and in municipal organisations is not included. This value is therefore somewhat too low.

In addition to the use of medical devices that has been calculated, consideration must be given to the healthcare system's investments in medical devices. This can involve everything from hospital equipment to medical information systems. The latter item has been counted as medical technology since 2012, but details on investments are relatively rough as these investments are not reported separately in the Health Accounts of Sweden.

In order to reach an estimate of the proportion of the investments item reported in the Health Accounts of Sweden totalling SEK 18.7 billion that is corresponds to medical technology (Table 5), statistics for investments from the county councils' summary accounts published by SCB are used . According to these statistics, it appears that the county councils' investments in medical technologies and other inventory amounted to SEK 2.8 billion in 2010 and SEK 2.6 billion in 2011. This constitutes 30 per cent of the total healthcare-related investments made by the county councils. If it is assumed that about 30% of the investments item listed in the Health Accounts of Sweden of SEK 18.7 billion consists of medical technology, this means that there were investments in medical technology of SEK 5 billion in 2010 and SEK 5.6 billion in 2011.

Table 6. Estimate of the total costs for medical devices

| Medical technology cost items | Source of the statistics | 2010 | 2011 |
|--|---|---------------|---------------|
| Therapeutic aids and other durable medical products in outpatient care and the retail trade (e.g. glasses) | SCB – Health Accounts of Sweden (HAS) | 9 089 | 9 257 |
| Medical technology and other equipment's proportion of healthcare providers' investments (estimated at 30 % of the total) | SCB – HAS and the county councils' summary accounts | 5 006 | 5 608 |
| Estimate of medical technology's proportion of other medical consumables (diabetes, stomata, devices related to pharmaceuticals) | Apotekens Service | 1 289 | 1 179 |
| The county councils' purchasing of materiel which corresponds to healthcare articles and medical materiel | SCB – The county councils' summary accounts | 6 536 | 6 866 |
| Total cost of medical devices | | 23 929 | 24 921 |

When we add together the items in the public statistics that relate to medical devices, we find a market worth about SEK 25 billion in 2010 (see Table 6).

In summary, we can conclude that the earlier estimates of the total value of the medical technology market at around SEK 23–25 billion per year can be supported by the statistics showing the actual costs in the healthcare system. However, uncertainty prevails as to the exact size of the medical technology-related investments.

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Appendix 2. Model for Ethical Assessments in the Evaluation of Medical Devices

Question 1: What is the severity of the population's condition?

Based on the ethical platform, the severity of the population's condition should have an impact on how much of a priority the method in question should be. Interventions directed towards populations with conditions that are very severe should thus be prioritised ahead of interventions directed towards population with a low level of severity. Consequently, the condition's severity will have an impact on what level of effectiveness and cost-effectiveness are considered reasonable. For example, this could mean that the requirements for evidence are reduced on interventions directed towards populations with very severe conditions.

Question 2: How does the intervention impact on the population's health, quality of life and lifespan?

This question concerns the patient's perspective. The important aspect here is whether the intervention has an effect that is relevant to the patient. Potential side-effects and considerations surrounding these are also an important aspect of this. Consequently, this considers aspects that are not covered by the effectiveness metrics that are reported in the literature search. For example, this can consist of indirect effects such as worry of disease experiences that sometimes arise during screening of clinically healthy patients.

Questions related to the ethical framework for how the healthcare system's goals can be achieved.

Question 3: Can the intervention have any effect on equality or on respect for human dignity?

This specifically actualises those aspects that are highlighted in the ethical platform by the principle of human dignity. This also deals with aspects that can have an impact on whether people's health outcomes will be the same. Specific consideration is given to whether different groups' access to care is reduced as a result of factors such as chronological age or social function. That is to say, differences that are not justified based on the severity of the condition or biological age.

There is a further question of whether there is a danger that the intervention places in question or makes it harder to respect everyone's equal value. For example, will the intervention have an impact on the incidence of certain groups in society in a way that is perhaps undesirable. This could take place

through, for example, pre-implantation genetic diagnosis or completely curing certain conditions.

Question 4: Can the intervention have an impact on the population's identity and self-worth?

This question thus actualises whether the intervention has an impact on the population's self-image in a way that, from an ethical perspective, may be regarded as problematic. Whether the intervention contributes to changes in the body or consciousness of the patients in the group can have an impact on the patients' self-image and their self-worth and also to the value that other people apply to this population. Whether the intervention contributes to the population maintaining a positive sense of self is thus central to this question. One example could be side-effects that have an impact on a person's mental health.

Question 5: Can the intervention affect the population's ability and opportunity to express their autonomy and are special measures required in order to respect the population's autonomy when the intervention is to be used?

An important aspect of the intervention in relation to the population's autonomy is whether it affects the patient's ability and opportunity to express their autonomy. Thus, what is particularly important here is whether the intervention has an impact (positive or negative) on the population's cognitive ability and hence its autonomy. Consideration should also be given to whether the intervention carries with it specific information requirements in order for the patients' informed consent to the intervention to be respected. Whether the intervention brings with it problems caused by the patients' inability to provide their consent for various reasons should also be taken into account.

Question 6: How does the intervention affect the population's physical integrity?

There are three main important aspects related to the patient group's physical integrity that must be included in the analysis. The first is whether the physical body is an important part of physical integrity. How invasive or damaging to physical integrity the intervention in question is in relation to alternative interventions that are available for the same condition has become an important aspect. In the second, the population's physical integrity includes an additional relevant dimension. This involves the spatial sphere of geographical space that surrounds the patient. An example of this may be that the patient desires a certain distance between themselves and other people even though they do in fact come into contact with the physical body or that they want a protected zone that they have control over. It may, for example, be regarded as annoying if the intervention involves the home becoming cluttered with people. The third aspect considers the use of information about the patient that they consider sensitive. There can be consideration given to whether any potential damage to the integrity of the patient group is unavoidable and perhaps reasonable in order to achieve the

goal of the intervention. Consideration can also be given to whether the intervention contributes positively to the patient group's integrity. For example, the patient group may gain increased or maintain a greater control of their physical bodies and their functions.

Question 7: How does the intervention affect the population's privacy?

The patient group's privacy is mainly connected to whether the intervention requires information about the population to be disseminated or gathered. That is in such a way that is over and above that which normally takes place in the healthcare system. For example, this could involve the intervention requiring collaboration and information sharing with professional groups outside of the healthcare system. An important aspect in relation to using information that the patient considers sensitive is whether this use is reasonable given the goal of the intervention. As in relation to physical integrity, an additional aspect is whether the intervention has an impact on the population's opportunity to take control of the information that is sensitive.

Questions related to other ethically relevant effects of the intervention.

Question 8: Does the assessment of the intervention's cost-effectiveness involve any ethical problems?

Ethical aspects about whether, and to what extent, it can lead to discrimination or inequality become important in relation to the assessment of the cost-effectiveness. For example, this would be realised if a certain population need more support in order for the intervention to be effective or if it involves small groups where the cost-effectiveness mainly depends on the high costs depending on the size of the group. Similarly a consideration of the indirect effects, in the form of production and consumption impacts, can be examples of such aspects.

Question 9: What effects does the intervention have on allocation?

This examines whether the introduction of the intervention can lead to other essential care being suppressed. This is especially relevant in relation to the suppressive effects of limitations on financial or skills resources. Furthermore, it is possible that the intervention may lead to other types of suppressive effect. For example, older alternative interventions are no longer offered or not offered as extensively. Additional aspects in this respect are whether there are difficulties in the implementing the intervention which in turn could lead to allocation inequalities when it comes to the access to the intervention.

Question 10: Does the intervention conflict with professional values?

This is used to examine whether professionals who will be working with the intervention have values that can make it more difficult to use the intervention. For example, it is relevant here to take into account other ethical codes that may offer guidance to professionals.

Question 11: Does the intervention involve a change to professional roles in relation to the patient?

In relation to roles, an important aspect is whether the intervention leads to transfer of responsibility from the professionals to the patient. This makes it relevant whether the intervention in question involves the patient assuming greater responsibility. For example, this could relate to a the population have a greater personal responsibility compares with older, alternative treatments.

Question 12: Does the intervention involve an impact on or place demands on the involvement of a third party?

This examines whether there are other groups that are affected by the intervention or if the intervention is dependent on, for example, the participation of relatives in the care. The relevant aspects to highlight here are whether the intervention involves a greater responsibility for close relatives, for example. Whether the intervention will have an impact on the rest of society should also be included in the analysis. For example, that the use of certain antibiotics may lead to resistance problems.

Question 13: Are there laws, regulations, guidelines or other governance documents that are of relevance to the intervention?

This deals, for example, with how the intervention relates to Swedish legislation, international agreements, national and regional guidelines etc. An important question here is whether the intervention conflicts with the applicable legislation. It is also possible to contemplate a situation in which there is good reason to change the applicable legislation in order to introduce the intervention. In relation to this question, it is not just Swedish legislation that is of interest, but also EU legislation and human rights (EU, UN), for example.

Question 14: Is there a risk that the values of society, groups or individuals may come into conflict with the intervention?

This deals with the established values of society in general or of certain groups that may lead to the intervention being questioned. The intervention may also come to be questions for other reasons. For example, it may be questioned on environmental grounds even though it is in line with the ethical values and norms of the Health and Medical Care Act. An additional aspect of this is that certain interventions can reinforce values that we feel are problematic in society, for example, that they reinforce a fixation on appearance. There may also be groups or individuals that oppose the intervention because of their cultural or religious values, for example.

Question 15: Are there different special interests that may have an impact on or be affected by the introduction of the intervention?

This deals with whether there are different special interests that may have an impact on or be affected by the introduction of the intervention. There may be special interests, for example, scientific, professional, commercial and

other interests, that can have an impact on/be affected by and/or have views on the introduction of the intervention.

Question 16: Based on the overall ethical analysis of the above factors, is there a risk that the introduction of the intervention can have more far-reaching consequences and also affect public trust in the healthcare system?

This deals with whether the intervention can in the long-term have an impact on public trust in the healthcare system. This brings to light questions such as whether the intervention extends the lives of patients in situations where they cannot give informed consent and where there is a risk of future side-effects or harm. It can also deal with interventions that may involve the patient's live ending prematurely. An example of this may be active and intentional help to die.