This document presents a common understanding of how research, development and innovation can more efficiently support the goals of the Estonian health system.
This strategy was prepared for the Ministry of Social Affairs from November 2013 to January 2015. The process was coordinated by the Estonian Academy of Sciences and funded by the Ministry of Social Affairs and the Estonian Research Council from the European Union Structural Funds.
FOREWORD

Research and innovation will serve health

We have completed the preparation of the Research, Development and Innovation Strategy for the Estonian Health System 2015–2020. This document is a result of extensive cooperation and the input of hard-working contributors. Past lessons and future trends have been discussed to set objectives and make choices. It is now up to us whether we can consistently and effectively implement what has been agreed.

This may be called the third attempt to plan R&D in the health sphere. In 1998 the Government of the Republic approved the National Research Programme for Research and Development in Public Health for 1999–2009, the implementation of which, unfortunately, halted due to the first serious economic crisis. In 2011 the Government of the Republic approved the Estonian Health Programme 2011–2015 as a part of the National Research, Development and Innovation Strategy 2007–2013. The programme has been continuously financed with help from the European Union Structural Funds and has contributed to health research and a number of new initiatives. This strategy has been prepared as a part of the programme.

On behalf of the Ministry of Social Affairs, we would like to thank our colleagues from the Ministry of Education and Research and the Ministry of Economic Affairs and Communications for inspiring us to use research, development and innovation as a means toward a health policy. According to the document “Knowledge-based Estonia 2014–2020”, ministries have to be smart in their commissioning and initiation of R&D for a better realisation of the potential of R&D for the benefit of Estonian society and the economy. They also have to be able to organise research in their respective areas efficiently and systematically. These guidelines were followed in the preparation of this strategy.

We would also like to thank the Estonian Academy of Sciences for drawing up the strategy and its Standing Committee on Medical Science and Health Strategy and others for their tireless contribution.

The task of the Ministry of Social Affairs is to now create and maintain a favourable environment for the implementation of the principles of the strategy. To that end, we will integrate this strategy into the National Health Plan and plan for the sustainable funding of health R&D and innovation in the State Budget Strategy.

Ivi Normet
Head of the Strategy Steering Group
Deputy Secretary General for Health, Ministry of Social Affairs
It can always be asked what ambitions a small country like Estonia should have. Is it merely the quick implementation of knowledge and skills created by the major research countries for the benefit of the people of Estonia, or do we perceive a need to be competitive in the big game and to be in the forefront of modern medical science? Betting on the first option would probably be more cost-effective in the short run, but there came a moment when we realised that we would no longer have enough medical scientists who would be able to understand the developments in the rapidly changing world of research. It has been suggested that a complete exclusion of research would ensure health care at a level that lags about seven years behind the state-of-the-art level.

Alongside other unfavourable tendencies, there is a concern that our universities are not attractive enough for young people who have finished secondary school. A considerable proportion of young people do not even consider entering a university in Estonia. If our local educational institutions are not attractive for local youth, can we expect talents from other countries to come and study here? Certainly not. Therefore, advanced scientific thought should be available for both the preparation of young doctors and for guiding the actual health care practice throughout Estonia.

This strategy has made a very serious contribution to building up an ecosystem. The considerable improvement of scientific literacy among doctors and the finding of funds to support the research conducted by scientifically competent doctors are certainly ideas whose implementation would yield a positive effect on the development of our health system. The implementation of science studies would mean the recognition of a far more radical understanding than before – namely, the creation of a legal basis for scientific studies concurrent with professional education and training. This is, first and foremost, an important challenge to those talented young people who feel that their abilities are not entirely engaged during their university studies. Naturally, the issue is not that of research units providing pre-clinical knowledge being short of people with medical education, but the opportunity for young people interested in research to become a part of clinics and daily health care practice.

Creating a development fund for clinical research should not be unaffordable to our state. Estonia’s two largest hospitals (Tartu University Hospital and North Estonia Medical Centre), the Estonian Health Insurance Fund and the Ministry of Social Affairs could make a joint effort to that end. With a view to the considerable financial turnover of these organisations, it should not be impossible to grant five or six research scholarships to motivated doctors every year. The scholarships could be granted for periods of up to four years on a strictly competitive basis. The Estonian Research Council would be a valuable partner in this field as it has the required experience to ensure impartial and transparent processing of scholarship applications.

We have come to a point where we have to make important decisions for the future. The worst option is to acknowledge this strategy and continue as before. Against the background of the
powerful development trends of modern health sciences, Estonia would, in such case, be guaranteed to increasingly lag behind developed economies and research countries. Stopping the decline and returning to the present level would require much more effort and investment than keeping the existing system running.

This is why we have to move forward with determination and find the means to reasonably implement the strategic proposals. The Ministry of Social Affairs can realistically set up an advisory body based on the people who contributed to this strategy in order to begin preparing an action plan under this strategy on how to best tackle the problems identified herein. It is also important that the positions of the strategy are regularly reviewed and reasonably changed where necessary. This would allow for guiding the development processes and preparing new health strategies in the future.

The importance of the human factor in the completion of this strategy cannot be overlooked. This is why I would like to highlight the work of Kitty Kubo and her team in the development of this document – it has been extremely efficient and provided inspiration for the involvement of valuable people. Acknowledgements are due to Ivi Normet and Liis Rooväli, who helped build a very understanding attitude and the complete support of the Ministry of Social Affairs. A crucial creative intensity was added to the discussions by Indrek Reimand, representing the positions of the Ministry of Education and Research in the process. I would also like to thank everyone else who has made larger or smaller contributions to the completion of this weighty document.

Professor Eero Vasar
Chairman of the Standing Committee on Medical Science and Health Strategy (ATSAK)
of the Estonian Academy of Sciences
Head of the University of Tartu Institute of Biomedicine and Translational Medicine
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INTRODUCTION

The Research, Development and Innovation Strategy for the Estonian Health System 2015–2020 “Research and Innovation for Health” presents a common understanding of how research, development and innovation (hereinafter “research and innovation”) can more efficiently support the goals of the Estonian health system.

The strategy was prepared on the initiative of the Ministry of Social Affairs (MSA). The MSA has the duty to organise and fund the R&D required for its area of governance. The strategy is necessary for defining this duty in the field of health.

In a situation of limited resources, an ageing and shrinking population and increasing expectations, the health system has to change, develop, and constantly learn and look for innovative solutions in order to better achieve its goals. This strategy was necessitated by the growing common understanding of the participants of the health system that the current system is not sustainable without the support of targeted research and innovation. An external impulse for discussing research and innovation in the health sector came from the Estonian Research, Development and Innovation Strategy 2014–2020 “Knowledge-based Estonia”, which aims at increasing the social and economic benefit of research.

The points of departure of this strategy are the future challenges of health care in Estonia and the focal areas of health system development, which define the direction of the efforts of research and innovation (Chapter 1, Annex 1). At the core of the strategy is innovation supporting the renewal and development of the health system, and its aim is to boost it particularly within the health system, but also to partner with research and business (Chapter 2).

Until now, the health system has not valued research and innovation to a sufficient extent, which is why the system has a poor ability to conduct research, seek innovation or shape the demand for these. Cooperation with research institutions and health technology businesses is also an unused potential for the Estonian health sector (Chapter 3). The future vision sees research and innovation as an integral part of the daily work of everyone in the health system, an indispensable source of vitality for the future of the system (Chapter 4). The roadmap of key actions that was outlined for initiating the desired developments marks the primary steps in the four courses of action for the strategy (Chapter 5). The organisation supporting the implementation of the strategy corresponds to the leading role of the MSA in organising health research and innovation and creates preconditions for a fruitful partnership between authorities and sectors. The roadmap also serves as a basis for planning detailed activities and resources in the implementation plans of the strategy and in drafting the state budget (Chapter 6).

This strategy document is a result of a year-long discussion process between interested parties from the health, research and business fields. The process was steered at the request of the MSA by a core team at the Estonian Academy of Sciences and supported with expert knowledge by the Standing Committee on Medical Science and Health Strategy (ATSAK) of the Academy of Sciences. The strategy steering group at the MSA consisted of high-level representatives of the authorities that shape health, research and innovation policies (Chapter 6 and Annex 2).
1. DEVELOPMENT NEEDS OF THE HEALTH SYSTEM AS THE POINT OF DEPARTURE OF THE STRATEGY

The Estonian health system is facing great challenges resulting from the interaction of various socio-economic, technological and health trends (Figure 1, details in Annex 1). In order to continue providing accessible health services of measurable quality in the face of limited resources, an ageing and shrinking population and increasing expectations, the system has to be able to adapt to changing circumstances and develop. It should also constantly learn and seek research-based, but innovative solutions for a better achievement of its goals and improvement of its operation.

![Figure 1. Developments with the highest impact on the future of the Estonian health system in the 2025 time frame](image)

Health expenditure is much lower in Estonia than in developed European countries\(^1\). The Estonian health care system is centred round health insurance based on the principle of solidarity (contributions according to possibility, use according to need), which depends on the number of contributors to the system and their income level. The total annual health expenditure is about 1 billion euros, of which 80% is covered from the state budget. Two-thirds of the total health expenditure goes through the Estonian Health Insurance Fund with medical treatment being the largest expense article. The future health system must pay much more attention to prevention and to the maintenance and preservation of health.

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\(^1\) Total health expenditure relative to GDP (%) in 2012: Estonia 5.9; Finland 9.1; Sweden 9.6; Denmark 11.2; Germany 11.3 and the Netherlands 12.4.
Analyses of the sustainability of health insurance show that the Estonian health system, which is recognised for its cost-effectiveness, is not financially sustainable in the long run. If the current cost profile were to continue, and taking into account the ageing of the population and the macroeconomic trends, the gap between health income and expenditure will increase (the reserves of the Estonian Health Insurance Fund will be negative by 2022)\(^2\). Therefore, there is an urgent need for new solutions. Increasing efficiency is a limited means of controlling costs. Progressive solutions require an essential renewal of the health system and a revaluation of the current paradigm and principles. Otherwise said, just like the Estonian economy has to move from its efficiency-based stage to a knowledge-and-innovation-based stage of development, so does the Estonian health system.

### What is a health system?

The health system encompasses all the resources, actors and activities whose primary duty is to promote, restore or maintain health. This covers health care in its traditional sense as well as public health. The health system consists of various levers, such as service provision (services to individuals and the population, and intervention), the labour force, health information, medical products and technology, and funding plus leadership and governance. These levers can be used to influence the main goals of the cost-effectiveness, quality and accessibility of the health system, so as to eventually achieve an improvement in the health of the population, satisfaction with the system and protection against financial risks. **The benefit of research and innovation for the health system can be manifested on the level of these levers.**

From the strategy documents\(^3\) shaping the future of the health sphere in Estonia, the following four focal areas of development can be derived for the health system, which also define the need for research and innovation.

1. **Development of a human-centred health system relying on the principles of research-based personalised medicine.** The point of departure is a focus on the specificity (i.e. risks) and preferences of a person or group of persons and the provision of more targeted services and intervention activities on that basis. Such an approach allows for a flexible distribution of health care roles and responsibilities between people themselves and service providers. As a weighty change, it also implies, in addition to an illness-based approach, the dynamic linking of healthy people to the health system and related services and intervention activities. However, this also renders the health system much more complex compared to a system aimed at an “average user”.

The following intended development principles will help achieve a more human-centred and precisely targeted health system:

- development of health-related services and intervention activities especially based on the undivided needs of people, and redesigning services, organisation and funding to that end where necessary;
- enabling of personalised or stratified services and intervention activities based on a joint analysis of various health data (i.e. health, illness, genome, environmental and other data relating to human health) using the possibilities of modern information and communication technology (ICT);
- facilitation of R&D and innovation in order to seek solutions based on the personalised or stratified approach.


2. Increasing the value of services by setting performance and quality targets. The point of departure is the setting and measurement of quality and performance targets equally to increasing the number of volume units or input indicators when developing health-related services and intervention activities. The Estonian health system is currently financed with a focus on specific services, service providers and interventions; the funding depends on the volume or amount of services offered or intervention activities carried out, not on the result or quality. The performance-and-quality-based approach implies the monitoring of results on all levels from the providers of individual services to the long-term planning of the system. Special attention has to be paid to collecting feedback from people. It is important to define the desired quality and performance level for all health issues for an undivided process by linking health promotion, illness treatment, health restoration and welfare services. This is the only way to avoid hampering greater integration and human-centredness.

The following intended development principles will be of practical help in achieving services of higher quality and effectiveness:

- all providers of health services intended for individuals or the population monitor their service quality and base their management decisions on that;
- the state establishes performance and quality requirements for services and takes an active role in guiding their implementation;
- the government monitors the performance of the health system and the results of health policy implementation based on the development of the quality of health-related services and intervention activities, and bases its planning decisions on that;
- the state and all participants in the health system develop the competences and abilities required for the implementation of the performance-based principle, including for digital data management.

3. Improvement of interaction and efficiency by greater integration of services. The point of departure is the creation of conditions and motivation for smooth cooperation between various service providers in the complete solution of every health issue on a single level of service (e.g. primary level health services), between the health and welfare systems and even across borders. It should be guaranteed that responsibility remains on the appropriate level and the focus should be more on prevention and health maintenance, as this distinguishes integration from simple consolidation. On the other hand, this will render the health system much more complex compared to a system focusing on individual service providers. The incentives for organisation and funding of services should be changed from the perspective of an undivided and consistent approach to health issues, taking into account the increasing share of patients with chronic illnesses and the objective of supporting the needs of healthy people in maintaining their good health status.

The following intended development principles will help achieve integrated services and intervention activities:

- integration of preventive services and intervention activities supporting healthy people with various primary health care services;
- the integration of providers of health-related and welfare services on various levels into a single system with clear organisational and financial responsibility management;
- seeking integrated solutions for people by flexibly combining various organisations and intervention activities.

4. Improving the accessibility of services and the economical use of time by intelligent remote solutions. The point of departure is an active development of mainly remote services (e.g. telehealth, telemedicine and telecare, e-services) and their rapid introduction in the system to counterbalance the inevitable decrease in the number of health professionals and the increased complexity arising from the networking of services. It is therefore important to implement (digital) data-based decision-making and service provision principles in parallel with traditional intervention activities (relating to physical
contact and location). The principles of mobile service provision also support the assumption by people of greater responsibility for managing their own health by using the possibilities provided by the smart devices at their disposal.

The following intended development principles will help achieve the introduction of intelligent remote solutions:

- the introduction of principles of reasonable use of (digital) data-based decision-making and e-service provision as a part of the traditional service provision process;
- the creation of conditions for growth by facilitating the introduction of technology and developing service funding methods, taking into account new service models;
- the creation of quality and financial incentives to integrate health-related and welfare services, taking into account the possibilities of remote solutions;
- the integration into the service provision process of health data collected by people themselves with the devices at their disposal.

We are a long way from acknowledging the need to change the health system and the direction of the change to the introduction of new solutions in the system. Research and innovation can make a great contribution to this task and speed up the process by providing the knowledge base needed by system participants to make the changes and by developing and testing new solutions, demonstrating their operation and facilitating a rapid introduction on the system level. **However, this requires that the needs of the health system and research and innovation as a tool for responding to them are closely interrelated up to the point where research and innovation become an integral part of the daily activities of everyone participating in the health system.**
2. FRAMEWORK FOR THE GOALS OF THE STRATEGY

The central issue of the strategy is how research and innovation can better respond to the development needs of the health system. R&D strategies aimed at socio-economic benefits usually have social concerns as their starting point and R&D solutions to these at their core. Such a solution-centred angle makes it possible to mobilise resources across various areas, technologies and disciplines. Depending on the issue at hand, the scope of strategies extends from scientific research to the market, with a focus on innovation, i.e. the testing, introduction and support for implementation of new solutions. Innovation in this context does not mean a linear path from basic research to a new product or service, but is an interactive process shared between various actors with feedback chains, which begins from the identification of needs.

The centre of gravity of the research and innovation strategy supporting the objectives of the Estonian health system is at innovation supporting the renewal and development of the health system. The goal of the strategy is to boost innovation within the health system and cooperation with research and business.

Figure 2. The role of research and innovation in the health system and its relations with the R&D system and business
The innovation of the health system is primarily manifested by changes and constant development of the system. This implies the openness of the system (including regulations, funding and management models) to changes and innovation and a constant improvement health system participants (especially the state; the Estonian Health Insurance Fund; the National Institute for Health Development (NIHD); and hospitals, doctors and patients) and the services provided, including by improved integration and cooperation between the participants and services. These changes must be aimed at a more sustainable health system and increasingly better quality, and more accessible, convenient and cost-effective health services and public health measures. Innovation of the health system means the development of new knowledge, approaches and models for all the aspects of the system such as management, service provision models (including service and process design), funding and payment approaches, the development of more effective intervention activities, etc.

An important facilitator of health system innovation is R&D based on the needs and challenges of the system. This means closer cooperation and coherence between the health and research systems. Research activities should focus not only on issues relating to the challenges of the health system in the field of medicine and technology, but increasing involvement of social scientists and economists. At the same time, a health system that clearly formulates its developing needs and is open to cooperation offers a good platform for the research system for new issues of basic and applied research and for the application of research results.

Openness to business can considerably aid the innovation of the health system. Links between the health system and business are mutually beneficial. Business can complement the health system with new skills, increased capacity and greater risk propensity (e.g. in the development of IT solutions), bring additional investments to the sector and help create an output for placing on the market innovations generated in the health system. A health system open to innovation will in turn offer, in Estonian terms, a proper internal market for businesses and a testing platform for the development of new products and services, which may have export potential considering the similar health care concerns of developed countries.

The socio-economic benefit of innovation in the health system will thus be manifested in two mutually supportive dynamic processes. This will result in an innovative and more sustainable health system with increasingly high-quality, accessible, convenient and cost-effective health services, while contributing to economic development by (indirectly) supporting an increase in business capacity.
How should innovation in the health system be understood?

Innovation is traditionally (e.g. in OECD definitions) understood as the implementation of a new or significantly improved product (good or service) or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

As the development of the health system is largely related to the choices of the public sector as the regulator and market actor (largest purchaser), innovation has a broader meaning in health care and public health. Innovation in the health system covers both the above traditional definition and public sector innovation, which refers to the use of new products, services and processes to improve the cost-effectiveness, efficiency, efficacy and quality of and/or satisfaction with public sector activities.

In systems centred in the public sector, such as the health system, innovation should be understood as a dual dynamic process: 1) innovation within the public sector, focusing on the development and renewal of the sector’s own internal activities, and 2) innovation through activities supporting innovation in the public sector (e.g. R&D support and procurements supporting innovation that influence the development of other participants in the system).

Innovation in the health system can thus be manifested on various levels and through the activities of and cooperation between the various parties to the system:

- **product or service innovation** (e.g. new medicines, equipment, analysis and treatment methods, public health intervention activities);
- **internal process innovation of product or service providers** (e.g. new or improved business models of service providers, new or improved organisation and management models);
- **innovation of service provision** (e.g. new or improved services in partnership between one or many service providers, new or improved forms of communication between service providers and patients);
- **innovation of health system management (policy)** (e.g. new or improved visions and approaches to service provision as a whole, funding and the structure of the network of health care institutions);
- **systemic innovation**, i.e. radical reorganisation of the health system covering many of the above elements and having an impact on all the participants in the health system.

Prepared by: Karo, E. Tallinn University of Technology Ragnar Nurkse School of Innovation and Governance, 2014.
3. THE CURRENT SITUATION AND ITS CHALLENGES

3.1. The health system as a driver of demand, implementer and partner for research and innovation

- Research and innovation are not valued in the health system. These activities are random and non-formalised on policy and practice levels.
- The internal resources of the health sector – health professionals, modern infrastructure and patients – are not empowered for research and innovation.
- The situation of national databases related to the health of the population does not support their use for research and innovation. Databases on the level of health care providers are fragmented and not sustainable.

Health policy does not acknowledge research and innovation as a means of achieving its objectives. The umbrella document for health policy, the National Health Plan 2009–2020 scarcely mentions research and innovation. The mentioned value of evidence-basis implies the principle that policy decisions rely on studies and analyses, while research supporting decision-making is not conducted or commissioned in a sufficient volume or with a sufficient consistency. Newer policy documents contain signs of the emerging acknowledgement of research and innovation in health policy. For example the “Health Care Development Trends in Estonia for 2020”, approved by the Government of the Republic on 21 August 2014, serves as a basis for activity and investment planning and includes an increased use of IT and innovative solutions and support for R&D as one of the main ways of developing the hospital network and specialised medical care. According to the health section of the Government of the Republic Action Plan for 2014–2015, orientation to personalised medicine based on genetic engineering and the development of the Tartu University Hospital (TUH) and the North Estonia Medical Centre (NEMC) into medical centres of excellence will create a demand for research and innovation in the health system.

Activities of the MSA in organising research and innovation and the related budget are modest and not linked to the objectives of the health system. The duty of the MSA to organise and fund the R&D required for its area of governance has been limited in the health sphere to the annual institutional funding of the NIHD, the University of Tartu Estonian Genome Centre and the Estonian E-Health Foundation, and the commissioning of a few applied research projects. According to the Health Services Organisation Act, state budget financing of health care through the MSA includes health care R&D, but unlike the common practice elsewhere in the world, this has not covered the targeted funding of the R&D activities of health care providers. According to the Public Health Act, the MSA also has the duty to coordinate scientific research relating to health protection, disease prevention and health promotion. In reality, research into health factors and public health intervention activities is fragmented between the agencies and areas of administration of various ministries without central coordination.

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4 The medical centres of excellence mentioned in the Government of the Republic Action Plan are, in the hospital network context, regional hospitals or competence centres that will concentrate on high-tech specialised medical care services. The Tartu University Hospital and the North Estonia Medical Centre are such centres of excellence.
5 From the Organisation of Research and Development Act. https://www.riigiteataja.ee/akt/83478i
The Public Health Act also prescribes the responsibility of the MSA for national databases or registries relating to public health, including those maintained for relevant research. The current eight national registries to which health care providers must submit data and the viability of which is guaranteed by state budget financing (the annual maintenance cost of one registry is 70,000–100,000 euros) do not meet the need for registries or satisfy the users, who consider the quality of data to be uneven, the updating of data to be slow, the handling process of applications for use to be indefinite and its linking to other databases, including non-medical ones, to be problematic. Although according to the law, four registries out of the eight should already receive health data via the health information system, this is not the case due to lack of development resources (funds and competence). Furthermore, national health registries in the e-state of Estonia still receive most of the data in printed form (the Myocardial Infarction Registry and Drug Treatment Registry are based on e-notices, but this is not related to the health information system). Registries imply additional work for data submitters (doctors, nurses), for which no resources have been provided and which are not valued by employers.

In addition to national registries, consent-based databases are maintained by health care institutions and medical professional societies. These have been created by doctors and researchers on their own initiative, often driven by research or other projects or the example of foreign colleagues. The sense of ownership and motivation for maintaining such databases are strong, while quality assurance, linking to other databases and viability are problematic.

It is reasonable to plan the future of the national registries and other databases in connection with the development of the next stage of the health information system (e-health) administered by the MSA. This would be reasonable even though there is room for improvement regarding the latter system. According to the State Audit Office, the e-health project that was launched five years ago has not met its goals: contrary to plans, the data cannot be used for treatment purposes, national statistics, registry maintenance or supervision. According to researchers, the data of the health information system are not usable for research because they are unstructured and have not been subjected to quality control. A study by Praxis emphasises that until now, e-health has been used as a database or infrastructure, while its potential for the development of new services has been greatly underestimated.

In summary, the current situation is very different from the future vision, according to which the health information system serves, among other things, as a platform for national registries, the databases maintained by health care providers and professional associations, and for companies developing innovative health services. However, the realisation of this vision could be one of the most influential and feasible developments for improving the efficiency of the health system and facilitating research and innovation.

Research and innovation are cognitively perceived by health policy makers as an immediate threat to the expenses and accessibility of the health system rather than an opportunity to improve the long-term operation of the system. Threats are perceived from three aspects: a) the rapid development of research and technology and innovation in medicine drive an increase in health expenditure regardless of origin; b) owing to the increasing shortage of health professionals, customers expect higher quality and more comprehensive services, which requires investment in the health system; c) since the MSA is the chief processor of all eight registries is the MSA.

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8 The NIHD is the authorised processor of six of the eight national registries (the Cancer Registry (1978), Causes of Death Registry (1991/2008), Medical Birth Registry (1992), Abortion Registry (1993), Tuberculosis Registry (1997) and Drug Treatment Registry (1999/2008)); the TUH processes the Myocardial Infarction Registry (2002/2012) and the Health Board processes the Communicable Diseases Registry (2004). The chief processor of all eight registries is the MSA.

9 According to the assessment of doctors and researchers, at least three more national registries should be launched for traumas, strokes and diabetes, respectively. This assessment is based on the burden of these diseases in Estonia.

research and innovation compete for this limited resource; and c) lobbying by research institutions in order to compensate for insufficient state funding from the funds of ministries (i.e. the funds intended for health services). It is important in this situation that health policy should signal the entire health system that research and innovation are recognised as an investment beneficial for the operation of the health system (the establishment of a “norm”). The benefit of research and innovation investments will be apparent only in the long run.

Important on the level of health care providers (hospitals, doctors, etc.) in the context of research and innovation is the trend to centralise high-tech specialised medical services to centres of competence. The related extensive investments in the modernisation of infrastructure in general and the development of the TUH (the only university hospital in Estonia) and the NEMC into high-tech medical centres of excellence in particular will create opportunities for considerable research and innovation activities, among other things. The existence of modern infrastructure is a necessary yet insufficient prerequisite for research and innovation to become a systematic and formalised activity on the level of health care providers. Alongside plans for infrastructure modernisation, at least the medical centres of excellence should be able to undergo the activities and have the resources and support structure for research and innovation. The purpose of a support structure is to assist health practitioners in research activities (e.g. support with research methodology, application for funds and finding of partners) and to be a contact point for innovation cooperation, including with businesses (see the example on page 19).

In a health system where cost-effectiveness is maximised and large investments are made in infrastructure, the leaders of health care institutions have other tasks more urgent than research and development, while doctors and other health care practitioners are overloaded with health care work. Research and innovation and related partnership with businesses and R&D institutions are not a first priority for hospitals. Although the basic documents (statutes, development and activity plans, etc.) of larger hospitals include research and innovation among their goals, there is a lack of management attention, resources and support for these activities. The small scale of R&D in health care institutions (according to the NIHD, health care providers spent about 600,000 euros on R&D in 2013, which was about 0.1% of their total expenditure) has not encouraged hospital managements to invest in an environment facilitating research and innovation, i.e. the formalisation of related processes, development of a doctor-researcher career model, creation of support structures, etc. Additional funding is hampered by insufficient awareness of funding possibilities (from national research and innovation measures and also EU programmes), insufficient capacity for using such funds (including skills and knowledge in preparing project funding applications compared to researchers), and also the lack of national research and innovation funding measures that would consider the specificity of the health sector. Other issues that managements of health care institutions would face if the scope of research and innovation were increased include the replacement of human resources for health care services and the project-based nature of research and innovation, which does not allow for long-term resource planning.

As opposed to developed countries where the doctors and other health professionals and patients of larger hospitals are involved in research and innovation on a routine basis, this is not common practice in the daily work of health care practitioners in Estonia. The duty of doctors is to treat patients, and their workload is large due to the shortage of health professionals. A considerable number of doctors with a PhD degree work in hospitals (19% of the doctors in the TUH hold a PhD, 4–6% in other larger hospitals), but only a few of the most enthusiastic of them are actively involved in R&D, as no time or resources have been provided for it. The Estonian Health Insurance Fund Act limits the use of health service funds for research activities among other things. Funding of the R&D activities of health care institutions and/or professionals from the state budget, which is practised in other developed countries, is not part of the health or research system in Estonia (see p. 37 for the organisation of state funding of the R&D activities of health care providers in Finland).
The innovation infrastructure of hospitals: The Innovation Centre at Karolinska University Hospital

The Innovation Centre at Karolinska University Hospital was established in 2011. The purpose of the Centre is to support the creation and implementation of innovative health solutions in one of Europe’s largest hospitals (1.5 million patient visits and about 50,000 foreign patients a year, with a budget of about 14 billion Swedish krona).

The Innovation Centre is part of the Development and Innovation (D&I) organised directly under hospital management. Two other units are organised under D&I: Biomedical Technology and eHealth and strategic IT. In total, 350 employees are organised under D&I, among which 30 are employed at the Innovation Centre. The Innovation Centre is the main contact point, both from inside and outside the hospital, towards all innovation and development work within Karolinska.

The Innovation Centre provides resources for legal procedures, contacts with clinical personnel, as well as routines for deciding on the value of projects. The centre is also developing resources for test beds within informatics, telemedicine, and radiation therapy, routines for establishing health care at a distance, and routines for bridging the gap between research and clinical practice within cell therapy. The centre also has strategic initiatives in, e.g. consultation at a distance, home care at a distance and the coordination of patient flow.

The critical success factors of the centre, which are also its main challenges, are management support and financial contribution, cross-organisational activities (within the hospital and across other institutions), functioning as a main entry point (compared to the earlier situation in which the clinical units conducted development and communicated with providers of innovative solutions individually), strong funding (for both infrastructure and projects) and offering developers access to resources from the clinical setting as well as providing for the implementation of new technologies within the clinical setting.

The Innovation Centre is co-financed by the county council (including in the establishment stage) and the Swedish national innovation agency VINNOVA (the equivalent of Enterprise Estonia), mainly on a project basis.


The most appreciable resource for the R&D activities of clinicians has not come from the Estonian state but from global pharmaceutical companies and contract research organisations (CROs) for clinical investigations. This has given medical professionals an understanding of research work, additional income for hospitals (e.g. about 500,000 euros to the TUH and 300,000 euros to the NEMC), which can be directed at the development of research based on individual needs and the creation of an environment supportive of such research, and has resulted in a number of positive impacts on the health system and the economy. On the other hand, this does not replace the R&D necessitated by Estonia’s own health system (analysis of the results and quality of medical treatment, integration of services, new treatment methods, including a more efficient use of ICT, more efficient public health intervention activities, etc.). To encourage such research, flexible targeted funding is required for health care providers that would free the time of doctors and other health specialists for R&D and enable the involvement and cooperation of researchers and businesses.

Estonian doctors are increasingly aware of the need to conduct research in order to excel in knowledge-based medicine, and also of the fact that medical centres of excellence abroad have flexibly integrated the three complementary functions of medical treatment, research and study. In
this context, if the research and innovation environment remains the same in Estonia, Estonian health care faces the risk of emigration of top doctors. However, contributing to a competitive ecosystem and offering broader possibilities for accomplishment may motivate doctors-researchers to remain in Estonia and motivate those who have left to return.

Despite the small scale of internal research and innovation, hospitals and clinics have been eager to participate in relevant external networks, such as competence centres and clusters. This has given valuable experience in cooperation with researchers and businesses and also mutual cooperation. However, participation has been a response to external initiatives rather than based on the definition and establishment of the hospitals’ and clinics’ own strategic interests.

In the current financing period of cooperation networks it is important that health care institutions link their participation to their strategic goals and thus guide the focus and scope of emerging and renewing networks so as to more directly support the arrival of new evidence-based solutions in the Estonian clinical practice.

Although private clinics hold a small share of the health services market, they and hospitals not favoured by the public sector investment plans have been under more pressure to find new niches in order to stay competitive or to stand out with new solutions in the existing market (introduction of new technology, new treatments, a more customer-friendly service provision process, better conditions for health professionals, etc.). This has made them more inclined to engage in innovation and relevant cooperation with health technology businesses for the testing and early introduction of new solutions (e.g. the telemedicine solution of the Dermato-Oncology Clinic and the R&D support system in the East Tallinn Central Hospital (ETCH). Learning from this experience will contribute to the broader spread of innovation culture in the health system.
3.2. R&D as a facilitator of renewal in the health system

- Research capacity and the needs of the health system are in discord. The state has made considerable investments in health-related R&D, but its impact on the Estonian health system is modest.
- The knowledge base supporting the development of the health system is weak. Little interdisciplinary applied research is conducted to translate research results into health system innovation.
- The health system as a commissioner of and partner for R&D can reduce the weaknesses of the research system (centredness on basic research, little focus on applications, etc.).

There is discord between the current knowledge base and the needs of the health system. This is partly due to the basic research centredness of the R&D system and partly due to the weakness of the health system, which shapes the demand for applied research, in defining its R&D needs, commissioning quality applied research and being a serious partner for R&D institutions.

Health-related scientific strength and critical mass lie in biomedicine; the challenge is for the Estonian clinical practice to benefit from research results. In health research, covering biomedicine, clinical trials and health science, resources are concentrated in biomedicine (45% of the traditional research funding for health in 2007–2013). As to the effectiveness of the research, the results of biomedical (basic) research have not been applied in clinical trials or practice.

The knowledge base of health science supporting the development of the health policy and system is modest. For example, a preliminary survey for the Estonian Health Programme emphasised that the human resources and competence required for cooperation and expected synergy are not available in the field of public health, which has used 8% of the total health research funding. The shares of other areas relevant to health policy, such as environmental, occupational health, nutrition and other sciences in the funding of health research have been even smaller.

Little multidisciplinary research is conducted to translate research results into practice. Health research is intertwined with biological and environmental sciences (genetics, biochemistry and biotechnology, molecular and cellular biology, etc.), while links with social sciences (in areas relevant to health system innovation, such as health care management and communication, design of health services) and natural and engineering sciences (e.g. health system innovation by improved ICT utilisation) are generally much weaker. More prominent links have been established with psychology in the area of behavioural sciences, and with medical technology in the area of engineering.

As in health care, considerable investments in infrastructure modernisation have also been made in recent years in research institutions. Nearly one-fourth of the state financing for research infrastructure was related to the health sphere in 2007–2013 (including IT research infrastructure). Both infrastructure and research financing have prominently centred around two subjects:

15 Includes the following measures: modernisation of small-scale research infrastructure, modernisation of scientific apparatuses and equipment, research infrastructure of national importance, and infrastructure of the work and study environment of R&D institutions.
translational medicine (12.2 million euros invested in infrastructure) and genomics (10.6 million euros). **Consistent contributions into applied research and innovation are required in order for the health system to benefit from these research investments.**

For example, the implementation of translational medicine as an innovation-centred approach (see also p. 23) would link a research laboratory with clinics and actively involve health practitioners with R&D. The strengths of genomics and the related bioinformatics could be used as an advantage of Estonia for the introduction of research-based personalised medicine in health care and in public health intervention activities.

**Issues of the future supply of human resources, in this context in health care and medical science, have been in the background in the research and development policy.** This topic should be approached with a view to the specificity of the area. The root of the problem is in medical training, where students are not encouraged to take an interest in research in parallel with professional training. Young doctors taking up jobs in the health sector lack the knowledge and skills for research and they have little motivation to enter doctoral studies after residency (considering the time it takes to get a medical qualification and the fact that the health system does not value or encourage research activities). This has led to an insufficient supply of medical practitioners with a PhD degree, which poses a threat to the survival of clinical science and to the transformation of research results to clinics. About 15 PhD theses a year have been defended in the medical science discipline over the past 20 years, while the need is 20–25 theses, meaning that 30–35 doctoral students should be admitted every year. In order to implement a research basis in practical medicine, to supply new generations of research-literate doctors (doctors-researchers) and to guarantee the academic continuity of medical science, the plan drawn up by the University of Tartu Medical Faculty to establish structured science studies (a “science module”) in the main medical curriculum should be implemented. At the same time, post-graduate training should be intensified, e.g. a MD/PhD programme should be launched for the flexible joining of residency and doctoral studies, and doctoral schools should be established to enable researcher mobility among other things. Considering that changes in the education system will only yield long-term benefits, medical practitioners should be offered relevant in-service training for faster results at the same time with the above measures.

**Financing of research and innovation in Estonia is mainly horizontal (i.e. without area preferences) and competition based.** The health sphere has been generally successful in obtaining financing under these conditions, which points to the relative competitiveness of researchers and businesses. During 2007–2013, an estimated one-third or 221.7 million euros of the total state funding for research and innovation was allocated to health-related areas (through the Estonian Research Council, Archimedes Foundation, and Enterprise Estonia). In traditional research funding measures, the share of health research has remained at just 14% for many years (as a comparison, the share is on the order of 25% in developed EU countries).

**The central issue of translational medicine is innovation and its braver application**

Translational medicine is innovation, for the success of which a change is required to occur in the general pattern of thought of the participants. This is the unanimous conclusion of the world’s leading centres of translational medicine on how to improve its efficiency, as published recently in the journal *Science Translational Medicine.*

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The pace of scientific discoveries is accelerating, while their practical application is increasingly lagging behind. For example, according to the US National Institutes of Health (NIH), 80–90% of research projects in biomedicine never reach the stage of human experiments and the few projects that do reach this stage take up to 15 more years until clinical introduction. Translational medicine is seen as a solution in this situation.

Translational medicine has the role of expediting the “translation” of basic knowledge in biomedicine and public health into health technologies promoting individual and public health, such as diagnostic tools, medicines and treatments as well as policy and educational reforms. In biomedicine, the focus of expediting is on the clinical introduction of discoveries through a multidisciplinary, collaborative, bench-to-bedside approach; in public health, it focuses on the implementation of proven treatment and prevention strategies as standard practice.

In the boom of translational medicine, the countries in the forefront of technological development and the European Union have vigorously contributed to infrastructure (trans-functional centres of translational medicine and other such cooperation networks) and to post-graduate education (master and doctoral curricula for translational medicine professionals). However, the concept of translational medicine has often been misinterpreted: it has been regarded as a separate science or mistaken for technology transfer, which is why the actual results often fail to meet expectations.

Translational medicine is innovation characterised by specified clinical practicality and the active participation of clinicians in the process. The definition highlights the thought that clinical benefit is the key to the process and stands higher than scientific or medical concepts. Effective translation in biomedicine points to a clear clinical need and is based on solid basic knowledge of the underlying biological mechanisms. Quality translation requires an iterative, not a linear bench-to-bedside approach (i.e. a clinical need, such as the hospital bed, can serve as a starting point, while the stages of basic research and clinical trials can alternate in the development process). The active building of such a conceptual, scientific and practical bridge between science and clinic is considerably different from the translational medicine in which the patient’s benefit is merely a remote and abstract goal of research.

Sources:

The generally insufficient scope of research funding (under traditional research funding measures) is threatening diversity, including the knowledge base supporting the health system and in the field of health research. In a situation where research funding is not increased while competition intensifies, financing is taking a direction toward convergence: a few large scientific groups are financed by institutional research grants, and very few personal research grants are awarded. Most research projects initiated by clinicians are thus not funded. This trend poses a threat to the quality of medical education and health care in the long run.

Estonia’s R&D policy is focused on strengthening supply, while the demand vector has not been developed. The decisive criterion for financing is scientific excellence, and success has been achieved in this area. The number of scientific publications per million inhabitants is higher in Estonia than the average for countries with a similar level of development18 and the quality of Estonian science is approaching the global average level of prestige (references per article). The flagships of Estonian science (that rise above the world’s average) in health-related areas are clinical medicine and molecular biology and genetics. Pharmacology and toxicology and psychiatry/psychology are on

a level below 10% of the world’s average. Perpetuation of the existing research base, inability to move into the research of emerging areas and to generate new ideas and approaches, and inability to respond to socio-economic issues have been considered the weaknesses of an excellence-based financing system. The latest analyses of the Estonian research and innovation system have emphasised the low local impact of research.

The attempt to link R&D with the needs of health care in the Estonian Health Programme (EHP) has provided a considerable additional resource for health research (for example, health research funding was about 14 million euros and EHP investments were about 9 million euros during the period 2011–2013), but has remained modest in terms of translation of research into practical solutions for the health system. Most of the EHP funds have been divided according to the usual routine of research funding: the grant awards process has been based on scientific excellence, not on applicability in the Estonian health system. Of the projects supported from the “TerVE” section of the EHP, the development of a system of evaluation for health technologies to control growth pressure in health care, and the establishment of an environmental health research centre in the increasingly important field of health policy, for which the knowledge base in Estonia is insufficient, should be mentioned as innovations relevant to the health system. According to the assessment of the MSA, experience from the EHP has clearly indicated a gap between the needs of the health system and the existing R&D capacity.

Most of the competence centres launched for cooperation between research and business (six out of eight) are directly or indirectly related to the health sphere. These are: the Competence Centre of Food and Fermentation Technologies, the Competence Centre for Cancer Research, the Bio-Competence Centre of Healthy Dairy Products, the Competence Centre on Health Technologies (formerly the Competence Centre on Reproductive Medicine), as well as the IT-focused ELIKO Technology Competence Centre in Electronics, the Information and Communication Technologies and the Software Technology and the Applications Competence Centre (total support 47.2 million euros during 2007–2013). The partners of these competence centres are 60 businesses (large and technology businesses), four major universities, three major hospitals (TUH, NEMC, ETCH), several private clinics and various associations and societies. According to expert assessment, the competence centres programme has had a positive impact on the activities of the partners. On the other hand, the competence centres are characterised by the more active role and leadership of the research partners, which is why the programme might not have the expected impact on the economy. Although the programme has the expected impact of boosting the export and productivity of businesses, the health system can, by formulating its development needs, make a clear contribution to bringing researchers and businesses closer to the needs of the home market.

In international R&D, it is important to contribute more consistently to the areas where added value and leverage for solving our own problems can be expected based on the development needs of the health system. A more proactive approach by the state is required to build capacity in the areas where Estonian R&D is still weak or passive. Special attention should be paid to research and innovation cooperation with the Nordic countries, whose ambition is to become the world leader in health research and innovation of the health system and technologies. In the near future, the Estonian health system will increasingly integrate with the Nordic (the market scope of whose health solutions was estimated by the OECD at 100 billion US dollars in 2010, with a population of about 26 million), especially the Finnish system. For Estonian businesses, Finland is the (culturally and technologically) closest wealthy market of substantial size that can be strategically entered in a public and private sector partnership. A platform for promoting Nordic cooperation in

19 Allik, J. Eesti teadus EssentialScience Indicators pilgu läbi 2013. aastal. (Estonian research in terms of Essential Science Indicators in 2013.)
research and innovation is NordForsk\textsuperscript{21}, the application rounds of whose health and welfare programme Estonia should reasonably join according to its interests and potential. Recent application rounds have concerned areas relevant to the Estonian health system, such as human-centred innovation in health care (the Estonian Research Council supports Estonia’s participation) and the development of a common Nordic infrastructure for health information\textsuperscript{22}.

The new Research and Development and Innovation Strategy 2014–2020 “Knowledge-based Estonia”\textsuperscript{23} is expected to increase the social and economic benefits of R&D. The increasing of social benefits is implemented by the R&D programmes of ministries (including the MSA), while economic benefits should arise from smart specialisation. Area-specific programmes (including in the health field) must increase the scope of applied research commissioned by the state and have socio-economic objectives, and create a systematic basis for the organisation of such research. Increasing the R&D capacity and responsibility of the ministries (including the MSA) is of key importance and covers the capacity to define research and innovation needs. The purpose of smart specialisation is to develop chosen growth areas (including e-health and biotechnology) at an enhanced pace so as to considerably boost the share of research-intensive business in the economy and the added value of export. For the health sphere, which encompasses both social issues and economic growth potentials, the above entails a promise of more resources and a diversification of sources of financing for the coming years. Turning these resources into benefits, i.e. improvements in health indicators and knowledge-based economic growth, poses a serious coordination and cooperation challenge to the “governors” of the research, business and health systems.

\textsuperscript{21} An organisation under the Nordic Council of Ministers that funds Nordic research and innovation cooperation, provides policy advice and implements strategic initiatives, acting on the common pot principle. [http://www.nordforsk.org](http://www.nordforsk.org).


3.3. The health technology business as an agent of health system innovation and a new driver of economic growth

- Health technology has a modest role in the Estonian economy, but this should change with the help of smart specialisation. Success will largely depend on the Estonian health system and its openness to innovation and partnership with businesses.
- Partnership between the health system and health technology businesses is still an unexplored territory where prejudice dominates over experience. Prejudice can be overcome by strengthening the point of contact and intensifying practical cooperation.
- The health market is complex and has high area-specific requirements, the non-awareness or complexity of compliance with which is a major obstacle especially to smaller businesses taking their first steps in this market.
- The state can boost health technology development by procurements supportive of innovation, the creation of test beds and strengthening of other substantive cooperation. Estonia is yet to develop such practice.

Health technology has a modest role in the Estonian economy, but this should change with the help of smart specialisation. The state has initiated a smart specialisation process to achieve structural changes in the economy and move toward activities of higher added value. The idea of the process is to concentrate research and innovation and other resources in the preferential development of the chosen growth areas. One of the three chosen growth areas is health technologies, among which e-health and biotechnology are regarded as having the greatest opportunities for Estonia. Currently these areas are marginal in economic terms (GDP, jobs and export). A critical mass in business is required for these health technologies to become a driver of future economic growth. The emergence and growth of e-health and biotechnology businesses depends on many factors and requires varied approaches. For example, while the scope of business opportunities in e-health largely depends on the activities and principles of the state in developing the health information system (including standards and access), biotechnology requires the bridging of research with the market (where the state is an important regulator and market participant) and the involvement of capital.

What is health technology?

The meaning of health technology varies in the economic and health sector contexts. In the economic context, health technology generally means a R&D-intensive pharmaceutical industry and life sciences sphere, the production of medical and diagnostic equipment and development of health information systems and other ICT. In the health sector, health technology is understood as any intervention used in health promotion, disease prevention, diagnosis and treatment and follow-up care, such as medicines, medical equipment and surgical operations, diagnostic investigations, therapeutic procedures and processes, programmed activities of health promotion and disease prevention, etc.

Specialisation in e-health is supported by Estonia’s international reputation as an e-state, including in e-health (which also has plenty of unused potential), and its growing reputation as the place of emergence of new technology businesses (especially those that innovatively apply the possibilities of ICT in various areas). Estonia’s innovative advantage lies in its small size, allowing for a quick introduction of innovation; the population is open to new solutions and to the use of personal health data. The Estonian ICT sector has long-term experience in cooperation with health care institutions in the development of information systems, which has given it an understanding of the specific characteristics of the health sphere. Estonia has the potential to become a globally competitive testing platform for e-health, provided that the public sector engages in the reduction of market failures.
Estonia’s small internal market does not motivate businesses to develop or tailor products specifically for the Estonian market, and the capital they can earn in Estonia is not sufficient for expansion. The specificity of the health area poses unexpected barriers especially to new businesses and those transferring to the health field from other areas, and achieving the expected business results takes more time. A large part of access to the services market is currently closed to e-health businesses. Therefore, the only way to participate in this business is though public procurements, but this does not facilitate private enterprise or innovation. The growth of business in the field of e-health depends directly on the national health policy (including the development of health information systems) and the behaviour and decisions of the health sector.\(^{24}\)

In biotechnology, the state has contributed for years to R&D and to spin-off business as a commercialisation strategy for R&D results (including through the Estonian Biotechnology Programme 2010–2013). The result is a strong and internationally competitive research base, especially in biomedicine. Technology-intensive start-ups emerging from research are usually small, their growth is anaemic and they strongly depend on state support\(^{25}\). The lack of smart capital and a local pharmaceutical industry are considered as the greatest obstacles to the development of these businesses. Businesses and R&D institutions conduct broader-scale research and innovation cooperation in the framework of competence centres (see section 3.2) and clusters, in which they partner with hospitals and clinics among others. In the five health clusters,\(^{26}\) the cell therapy cluster includes OÜ ProtoBioS, OÜ Cellin Technologies, Biolaborid OÜ, the Tallinn University of Technology, the University of Tartu, AS Taastava Kirurgia Klinik (the Hospital of Reconstructive Surgery), AS Ortopeedia Arstid, the TUH, AS Labas, AS EGeen, Medco Partners OÜ, AS Kevelt and AS Vähiuuringute Tehnoloogia Arenduskeskus (the Competence Centre for Cancer Research). The purpose of the cell therapy cluster is to create treatment possibilities, lay a basis for the research-intensive export of Estonian medical services and create jobs of high added value\(^{27}\). Simultaneously with financing this cluster, the state has invested through Enterprise Estonia in the establishment of the infrastructure of a cell therapy laboratory.

Although Estonia has almost no pharmaceutical industry (i.e. production and export of pharmaceuticals), global pharmaceutical companies are present here with clinical investigations. About 20 million euros of external R&D funding reaches Estonia every year through clinical investigations, which is many times more than the state invests in health research (about 4–5 million euros) or health care institutions themselves spend on R&D (about 600,000 euros). Over 200 doctors are directly involved in clinical investigations within the health system and thus keep at the forefront of global pharmaceutical development; they are supplemented by medical personnel assisting the investigations. This gives faster access to new and sometimes the only treatment options (e.g. in oncology) to about twenty thousand patients involved in the studies. On the other hand, the presence and continuation of clinical studies in Estonia cannot be taken for granted. In order to maintain and improve its position as a global competitor (mainly phase 3 clinical investigations), but especially in order to use new opportunities offering greater scientific challenges (phase 1 and 2 clinical investigations, academic research and opening cooperation possibilities with Estonian biotechnology businesses), Estonia has to pay more attention to developing the advantages of the local environment.\(^{28}\)

The most common barriers to health technology innovation and to cooperation with the health sector are universal and apply, among others, to Estonia: lack of flexibility in regulations (e.g.}


\(^{25}\) Ibid.

\(^{26}\) Clusters financed in 2007–2013 and related to the health sphere: medical services export cluster, healthtech cluster, sports medicine cluster, cell therapy cluster and health tourism cluster.

\(^{27}\) [http://www.celltherapycluster.eu/et/rakuraviklaster.html](http://www.celltherapycluster.eu/et/rakuraviklaster.html).

public procurements), inadequate economic conditions (lack of private venture capital, lack of policy measures to stimulate the private capital market, lack of support systems to enhance public-private collaboration), cultural barriers and lack of trust between the traditional public health care sector and the more risk-taking private sector, and complexity and costs related to standards.  

For health technology start-ups, the high technical barriers of the health care market present a problem (e.g. requirements for production, certificates, licences and environment). Quality systems, the introduction of which takes time, are a mandatory prerequisite for biomedicine businesses. In addition there are the costs of compliance, certification/licensing, hiring the appropriate human resources, etc. As there is no appreciable pharmaceutical industry in Estonia, there is a shortage of the industrial know-how and competence required for biotechnology development to move closer to the market. It would be easier for businesses to enter the market if information on requirements concerning health technology development, production and market placement were available from a single source and businesses could receive assistance in interpreting the information. For example, the Estonian Development Fund has proposed the creation of an information bank containing the requirements and rules of the health sphere for businesses, and/or information points with the relevant authorities (e.g. the R&D units of the Health Board, MSA and Estonian Health Insurance Fund). Likewise, information on research infrastructure (including laboratories and test bases), teams, contacts, etc. should be available through the Estonian Research Council. All the information on how to enter the health sector market could be concentrated in Enterprise Estonia, which requires the involvement and training of appropriate personnel. In addition to information, the training needs of businesses relating to the specific requirements of the health care market should be identified and relevant courses made available.  

The development of health technologies is hindered by the complexity of obtaining licences for investigations. This procedure should be rendered more efficient in order to facilitate innovation. Research and innovation projects in the health field often include clinical trials and patients and require information containing personal data on the process of collecting data on clinical activities and other sensitive information. Project heads are therefore required to obtain permissions from various committees and agencies such as ethics committees and the Data Protection Inspectorate. For developers, licensing procedures are often of unpredictable length and outcome.

Medical competence is required for the development of health technologies, but the health system is not ready for such involvement. It is difficult for technology businesses (especially those with a background in ICT rather than medicine) to establish contacts with health care institutions and professionals and the latter are not very willing to test new technologies and solutions and lack the time to get involved with developers. Contacts would be facilitated if the larger medical centres in Estonia, like their foreign counterparts, had an innovation unit or a chief innovation officer who would support innovation coming from inside the organisation and coordinate cooperation between the staff of the organisation and technology businesses.

In addition to contact points, financial incentives are necessary to free up health professionals to engage in innovative ideas, e.g. through a measure such as innovation voucher grants, which would allow technology developers to buy the time of a doctor or other health professional for the preliminary evaluation of development ideas or for participation in development as medical consultants.

Evidence-basis is a requirement for introducing new technologies in health care; the possibilities for related evaluations and testing can be improved by creating test beds. Test beds are experimental environments for the development and testing of technology, services, new business models, etc. They should also help eliminate bottlenecks relating to the introduction of solutions, which have been proven in the test phase, on the health system level. In the context of innovation in telemedicine services, Praxis has proposed a test bed model that can principally also be applied to other health technologies. It enables the testing of new solutions under controlled conditions with the involvement of experts and relevant parties in order to receive immediate feedback from users and decide on the benefits of the solution (Figure 3). The model distinguishes between two organisational forms that help support these activities. The objective of the incubation programme is to identify the potential benefits of and need for the new solution and to test it in the health environment under controlled conditions and in a limited scope. The objective of the interoperability model is to interface ex-ante evaluated and tested applications with the health system in terms of both information system interfacing and service processes; standards are chosen and agreements are reached with relevant parties on the content of the service process, and a connection is made for data exchange with the central health information system. In the second stage, a financing model is chosen or developed.32

The public sector as the largest purchaser in the health market can boost the development of innovative health technologies and solutions if it is smart in its commissioning activities. The public sector purchases goods and services in the health and social sphere for over 650 million euros a year (the average during 2007–2010), being the largest purchaser in the market. Public procurements are mainly used to purchase standard products or ready-made solutions; bidders are expected to demonstrate experience or previous sales and the lowest bid is preferred. Such conditions do not favour small start-ups or providers of innovative solutions.33

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Research and development and innovation policy, changes in the regulation of public procurements and initial experience have made it possible to support innovation by public sector purchases. This means the purchasing of innovative technologies and solutions by pre-commercial procurement (PCP), in which the public sector acts as the first demanding client for such solutions. Instead of ready-made solutions available in the market, R&D services are purchased and the related risks and benefits are shared. At the end of a pre-commercial procurement, an innovative solution or solutions are available for commercial procurement and scaling (Figure 4). In order to introduce innovation-supporting procurement in health care in Estonia, the purchasers should be motivated to conduct procurements in a way differing from the established practice and the first encouraging examples and practical experience should be created by pilot and demonstration projects.

In cooperation between the health system and technology developers, another step further from innovation-supporting procurements is public-private partnership and collaboration on innovation (Figure 5), which strengthens further the contact points between the two sectors for the formulation of needs and prioritisation of developments. For the solutions developed in health technology to be appropriate for the health sector and be introduced, they have to respond to the actual problems and meet the (future) needs of health care. It is a complex task to define and formulate these needs in the health sector in a way that would guide the activities of businesses and researchers. The process of defining needs should be continuous and increasingly based on partnership and the joint generation of innovation. Prerequisites for organising such cooperation and network exist in the support structures for business and innovation, an example of which in the health context is the Tallinn Science Park Tehnopol, the vision of which is to become the centre of the Estonian health technology innovation ecosystem.

Figure 4. The procurement process supporting innovation (adjusted from source: European Commission[34])

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35 The European Union has allocated 130 million euros to innovation-supporting procurements in 2014–2015 through Horizon 2020 and this includes application rounds in the area of e-health; the MEAC is launching a relevant programme of 20 million euros in Estonia with health technologies as one of the focuses.
Figure 5. The role of the public sector in health innovation and five types of public-private collaboration (adjusted from source: Nordic Council of Ministers\textsuperscript{36})
3.4. Joint conclusions

- The current health system does not regard research and innovation as a natural part or value it in its decisions or organisation. The main goal of this strategy is to change this situation.

- In order to make evidence-based, well-considered and forward-looking health policy decisions (including in health care, public health and the management and organisation of the health system), the base supporting applied research has to be strengthened. The health system should act as a smart and demanding client who commissions such research, thus having a positive impact on the development of the research system.

- The innovation capacity required for reforming the health system should be increased (including risk-taking and the pace of introduction of new solutions). A suitable method for this is pilot and demonstration projects that provide controlled conditions for prior testing of innovation that implies major changes in the system. Pilot and demonstration projects can also provide a cooperation platform for the research system, business, and policy makers of the relevant areas.

- Health care providers (hospitals and other health care institutions, doctors and other health professionals) should be motivated within the health system to participate in research and innovation in a systematic and targeted manner. Research and innovation should be a statutory obligation and not an option for medical centres of excellence.

- To assure the quality of medical care and increase the capacity for applied research, financing is required for investigations initiated by clinicians, the need for which arises from practice and which are guaranteed to have specific application interests.

- To ensure the supply of research-competent staff, the training of health care practitioners should be reviewed on all levels of education. In the current organisation of training, the health system does not value research and does thus not support the change proposed in this strategy.

- For quicker translation of the results of biomedical and other basic research into solutions improving the Estonian health system, the concept of translational medicine should be implemented. The common territory of basic research and practical medicine can be identified and increased only by facilitating active daily cooperation between researchers and clinicians.

- Decisive investments should be made in the development of integrated and easy-to-use health information infrastructure. The currently fragmented data should become a whole that meets the needs of the various users: health policy makers, health care providers, health researchers and companies developing innovative solutions.

- The public sector as the regulator and largest purchaser in the health care market has powerful levers to facilitate the development of health technologies and related business. These levers should be consciously used to serve this purpose.

- This strategy cannot be implemented without additional resources, a specific body liable for implementation, and efficient organisation. The Ministry of Social Affairs should assume the leading role by applying for funds from the state budget, initiating and coordinating actions, and conducting trans-institutional and trans-sectoral cooperation.
4. **VISION 2025**

Vision 2025 is a picture of the future where research and innovation are in the service of health. The purpose of the vision is to create a common perception of the future, to inspire and offer a joint reference point for the various parties on whose decisions and activities, and especially interaction over the next decade the realisation of such a future depends.

By 2025 research and innovation will be an integral part of the daily work of all the participants in the health system. This is valued as an indispensable source of vitality for the health system. The Estonian health system is a place where future solutions are actively created.

A spirit of active innovation is part of the daily routine of every person and organisation working for the health system. This means that constant monitoring of problems and possibilities, seeking out new solutions and measuring results occurs on the levels of health policy and practice. As opposed to the past when the cost-effectiveness of the existing system was the only focus, part of the resources are now allocated to innovation.

As a result, the health care approaches that are at the centre of global attention, such as human-centredness, quality focus, personality, etc. that were merely spoken about in Estonia in 2015, have found the best way into common practice through investigations and testing and have thus thoroughly redesigned the way the system works. Estonia has become a model of successful implementation in at least one of such “hot” areas (e.g. personalised medicine) and provided leverage for scientific research and business in broader terms. This has attracted international attention and additional resources in the form of foreign capital and human resources.

The research and innovation environment in Estonian health care institutions has changed beyond recognition: scientific research and the constant improvement of processes, services, etc. is an integral part of the medical work. Employees are motivated to do such work by allocating time, resources, and appropriate support. Demands for results are high, as research and innovation are part of the key indicators of the institutions to which both internal incentive systems and national financing decisions are connected.

**Medical centres of excellence**, for whom research and innovation is a statutory duty, have slowly begun to benefit from the investments made in the research and innovation support system during the initial years. Former infirmaries have become appreciable actors and valued partners for clinical investigations in Estonia and abroad. This has also helped the adaptation to the intensifying competition in the health market. In the competition for good staff and patients, research and innovation have become a new competitive advantage and quality label. They are appreciated by physicians, who are planning their careers more carefully in light of the shortage of health professionals, and by both healthy and health-compromised people who move about the health system without boundaries and make informed choices.

**Doctors, nurses, physiotherapists and other health care practitioners** are highly motivated to participate in research and innovation projects and appreciate employers who offer the best opportunities for such participation. The number of doctors actively conducting research and initiating
development projects is growing steadily. The trend is supported by the arrival on the labour market of a generation of young doctors whose professional training has provided them with research literacy, and by flexible opportunities for them to pursue research careers or implement innovation projects while working as doctors. Cooperation with technology businesses, researchers and patients is a natural part of developing new, cost-effective solutions.

**Research circles** have received a serious “industry partner” in the Estonian context in the form of a health system valuing research and innovation. Researchers of various disciplines are increasingly engaged in practical tasks based on the needs of the health care sector, and the other way round – the active participation of clinicians in translational medicine projects has accelerated the translation of knowledge and technology from research laboratories to benefits in the health system. This has shifted the research focus to multidisciplinary research of a more applied nature. It seems that the general vision of the Estonian research policy about the greater socio-economic benefit of research may become a reality in the health field.

Practical experience from cooperation has reduced prejudice and increased trust between the health system and **businesses**. Businesses highly appreciate the innovation-friendliness of the Estonian health system, which is quite exceptional in the world. The state as a smart client in the health sphere has become skilled in using its large market power and other levers to boost innovation. Good examples are the health big data infrastructure that is conveniently available for research and innovation, and the facilitation of business participation in the process of service provision and development, from which the health technology business and investment boom in Estonia once originated.

In 2015 the state, health care, research and business sectors support each other’s endeavours and a critical mass of activity and an effective ecosystem have developed. Estonia is a destination for medical studies, clinical practice and research, solutions development and testing or simply for improving health. Estonia teaches a lesson as it shows the future of a health system.
What steps should be taken to turn the above vision of the future into reality? **In order to start developing in the desired direction, a number of prerequisites have to be created simultaneously and systematically:** the research and innovation capacity of health care providers has to be increased; contributions have to be made into applied research based on the needs of the health system and into pilot and demonstration projects accelerating the introduction of new solutions; decisive investments have to be made into the development of an exemplary health data infrastructure, and a basis laid for the efficient and sustainable organisation of research and innovation in the health field. The roadmap of key actions highlights the crucial steps in these courses of action (Figure 6) and is the basis for the preparation of a detailed implementation plan and resource planning (see Chapter 6).

**Figure 6. General goal of the strategy and its four courses of action**
Course of action 1: increasing the research and innovation capacity of health care providers

In order to boost research and innovation on the level of hospitals, clinics, doctors and other health care practitioners, work has to begin by laying the foundation, i.e. targeted financing, support structure and competent human resources.

- **An R&D funding measure will be launched for health care practitioners** in order to provide them with time and resources for research within the health system. Combining clinical and research work will significantly help to improve the quality of medical care, increase innovation capacity and the applied research competence of doctors, and allow for state-of-the-art treatment decisions. The funding will be similar to personal research funding and its introduction should, in the long run, also improve the clinicians’ capacity to receive personal research funding (as well as other funding, e.g. under EU programmes) for research and innovation projects. It is feasible to begin with 5–6 grants a year on a competitive basis; the duration of projects should be 3–4 years. Funding would be granted for research of a clearly clinical nature conducted by research-competent clinicians (PhDs). A research grant of about 10,000–50,000 euros a year will cover labour expenses and the materials and means required for research. A requirement for self-financing by the applicant’s employer will guarantee that the research meets the organisation’s needs. In addition to health care practitioners with a PhD it is reasonable to allow funding for those who have not completed their PhD studies due to a conflict between research and clinical work (see p. 37 on how such funding is organised in Finland).

- **Funding is granted for the creation or strengthening of research and innovation infrastructure in major hospitals, preferably in their cooperation.** The funding measure would encourage institutions to invest in the creation of an environment facilitating research and innovation. In health care institutions valuing research and innovation, these activities are formalised and supported by the doctor-researcher career model and competent support units. The latter support R&D within the hospital and serve as the first contact point for cooperation with researchers and businesses. (See the example of the Innovation Centre at the Karolinska University Hospital in Sweden, p. 19).

- **A solution will be developed to support innovation by health care practitioners**, so as to free their time to engage in innovative ideas at an early stage (e.g. IT applications). This covers ideas arising from the practical work needs and ideas from the outside (companies or researchers) where the involvement of medical competence is required for the development project, such as for the initial evaluation of the idea. Consideration should be given to the extension of Enterprise Estonia innovation voucher grants (i.e. businesses should be allowed to use their voucher grants to purchase expert assessments from health care providers).

- **Changes are made in the training of health professionals to supply them with the knowledge and practical skills for clinical research and innovation projects.** As a first step, structured science studies will be introduced in the University of Tartu medical faculty, giving all first-year medical students an overview of the scientific approach in medicine, of ongoing research projects and research methods, good practice, etc. This would give all medical graduates an elementary level of research literacy and brighter graduates would have an opportunity to continue studying under a research module. The module would consist of selective subjects (e.g. formulation of research results and funding applications, design of clinical investigations) and a course in research (practical research in a clinic and laboratory environment under the guidance of a supervisor). This would be supported by classroom seminars and postgraduate subjects (trans-university, inter-university, in foreign universities, etc.). This would yield the immediate result of research skills and knowledge and co-authorship in scientific articles. The research module would serve as a hotbed for doctoral studies, whose flexible linking with
residency can shorten the length of doctoral studies and improve effectiveness. For faster results, the foregoing would be supplemented by in-service training in research methodology for health care practitioners.

State funding of R&D of health care providers in Finland

In order to guarantee clinical quality, the Finnish health and R&D system has developed **special funding measures for health care providers** for clinical investigations and for supporting the research career of doctors. The parties – fund providers and health care providers – are generally satisfied with this scheme.

Funding is based on **targeted financing by the Finnish Ministry of Social Affairs and Health for health care institutions** (in Finnish: *terveystieteellisen tutkimuksen erityisvaltionosuus* or *tutkimus-EVO*) and **personal research grants awarded specifically to doctors by the Academy of Finland**.

The bases for targeted funding from the state budget of the R&D of health care institutions are set out in the Health Care Act and its detailed organisation is established by a regulation of the Minister of Social Affairs and Health. The annual allocation of 20 million euros is intended for five university hospital regions providing specialised medical services (but is not limited to the university hospitals). The proportions of regional financing are defined for a four-year period based on the R&D results of the previous period. The hospital regions in turn divide the funds received from the ministry between health care providers’ projects on a competitive basis. Grants (55,000–100,000 euros a year) are paid to junior and senior researchers and doctoral students to cover the wages of the recipient and the research team, materials and supplies, research abroad, etc.

According to the regulation for 2013, **the funding objective** is to promote public health and welfare by high-level and effective health research in the health system, to enhance the quality of health services and the safety of patients and to generate new knowledge and ensure its application in health care. **There are eight focal areas:** 1) clinical and translational medical research in important areas of public health and health care, 2) research relating to the introduction of personalised medicine and biobanks, 3) research relating to especially hard-to-treat and rare diseases and health conditions, 4) clinical-epidemiological cohort studies, 5) studies on the impact of public health promotion and counselling measures and health-related inequality measures, 6) studies relating to the organisation of health care services, the efficiency and effectiveness of measures, changing of practices and knowledge management, patient safety and quality management, 7) intervention and impact studies relating to the rights and freedoms of choice of patients and clients and 8) studies relating to national development projects. At least 40% of the targeted funding is allocated to the focal areas, including 25% to focal areas 1–3 and 15% to focal areas 4–8.

The funding scheme is managed and supervised by a **national expert team for health research evaluation at the Ministry of Social Affairs and Health**. The team advises the ministry, including on fund allocation and evaluation criteria, monitors the progress of research in the focal areas, assesses the quality, scope and effectiveness of R&D and proposes changes in funding.

**The personal research grant awarded to doctors-researchers by the Academy of Finland** is a strategic funding instrument founded by the Research Council for Health in 2006 to encourage medical practitioners with a PhD degree to engage part-time in research. This is a small-scale measure compared to the Academy’s other research grants (about 1.5 million euros a year). In 2013, the average grant was 177,000 euros for a three-year period (from 2014 the grants are given for four-year periods). The grant covers the wages of the doctor-researcher and the materials required for research. The share of funding is 20–50% of the working time and wages of the medical practitioner and the rate of the grant is up to 70%.
Targeted funding has made it possible to integrate the R&D mission with the daily work of hospitals and other health care providers and has motivated young doctors and broadened their career choices. Personal research grants have encouraged medical practitioners with a PhD degree to continue research in parallel with clinical work and enriched their research career potential. In addition to these two measures specifically tailored for health care providers, hospitals and doctors can apply for funds for or be partners in horizontal R&D and innovation policy measures (through the Academy of Finland, Finnish Funding Agency for Innovation, etc.).

Source: R&D and innovation study tour of health policy makers to Finland, 4–5 November 2014.  
http://tervistaistrategia.ee/eesti-tervishoiu-tai-politika-tegijate-oppereis-soome-4-5102014
Course of action 2: organisation of research based on the needs of the health system and testing of innovative solutions

- An applied research programme will be prepared based on the development needs of the health system, the goal of which is to support the evidence and knowledge base of health policy through research, evaluation, and other coordinated organisation and funding. The programme will also contribute to the development of multi-disciplinary research capacity in the Estonian research system and support the specialisation of researchers in areas central for the Estonian health system. Purposeful development of knowledge and capacity takes into account the role/possibilities of various relevant methodologies in approaching health issues, including biomedical, clinical, health behaviour-related and environmental approaches. This research programme managed by the MSA will supplement but not replace other, general R&D funding measures. The preparation of the programme will be led by the MSA and research tasks will be defined jointly by the participants in the health system. The programme will be implemented on the basis of a research plan agreed by the participants and will be reviewed and supplemented annually according to the changing needs and possibilities and the results of research. The programme will combine continual or regular applied health research (including by evaluation of the current research) with *ad hoc* research to seek research-based answers to specific issues.

- Pilot and demonstration projects will be conducted to accelerate innovation in the focal areas of health system development. This is an experimental approach to contribute to complex innovation on the policy and system levels. Pilot and demonstration projects are initiated and managed top to bottom; they are proactive and mobilise various parties (the state, health care, research, business) and resources (education, R&D, health care, IT, business). If a project is successful, the new approach will be applied on the level of the whole system and the current practices will be changed where necessary, including the funding model. In 2015–2020, a total of 3–4 projects of 4–5 years’ duration will be implemented in order to test the implementation of, e.g. personalised medicine in health care, an evaluation and funding system based on treatment results and quality, and the innovation process of teleservices.

- An innovation award will be granted to recognise innovation in the health system and to highlight practices. Innovation can be manifested in the health system in various ways, on various levels, and through the activities and cooperation of various participants in the system. The award is an easily implemented yet effective way for the state to communicate a message of valuation of innovation throughout the health system, to enhance awareness of the meaning of innovation in the health system by introducing actual cases, and to publish success stories and inspiring examples. The innovation award will be granted once a year, for example at the Health Innovation Forum (see course of action 4).

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37 Lember, V., Tõnurist, P. Tervisesüsteemis innovatsiooni stimuleerimine konkursside ja auhindadega: teiste riikide praktikad ja soovitused. (Stimulation of Innovation in the health system by contests and awards: other countries’ practices and recommendations to Estonia) Tallinn: Tallinn University of Technology Ragnar Nurkse School of Innovation and Governance, 2015.
Course of action 3: development of an exemplary health data infrastructure

The basis for the development is a future vision where the health information system (e-health) is the backbone of various health-related databases and makes their creation, administration and use as easy as possible. This implies the further development of e-health and databases, but not independently from each other as it has been done so far, but by coordinating activities and investments according to the vision and by agreeing on the sequence of development activities. The activities and investments listed below will be elaborated in the course of preparation of the e-health strategy (see Chapter 6) and pilot and demonstration projects for this strategy (see course of action 2).

- **Systematic investments will be made in the updating of databases based on data collected in the course of provision of health services.** High-quality, sustainable databases regularly updated with information must meet the needs of various users. Health care practitioners and researchers are involved in defining the composition of the data. As the first step, the existing national registries are updated and an incentive is given for the systematic development of databases maintained on the level of health care providers. For linking databases to the health information system, ongoing pilot and demonstration projects, such as the creation of a cancer screening registry, provide information on the required development work and costs.

- **New possibilities are developed for collecting information on the health status of people, including from healthy people and as measured by people themselves.** Health disorders causing an increasing disease burden (depression, metabolic syndrome, dependence disorders) are largely influenced by health behaviour and the changing (social) environment. Studies on healthy people will allow for better guidance of individual health behaviour and a more precise understanding and guidance of changes in the health of the population.

- **A common health data infrastructure will be created to jointly address various datasets (including registries, databases, surveys and scientific research and biobanks).** Valuable health data are created by very different parties in Estonia. The objective is to gain an overview of what data is available where and to actively create research and innovation possibilities based on all these data.

- **Opportunities and capacity for the convenient and targeted use of data will be ensured.** The databases themselves do not create value regardless of their number or quality. Value is created by using them, in this context for research or innovation. Use can be facilitated by creating an appropriate legal environment. Databases have been little used so far because the procedures of applying for permissions to use personal data are lengthy and involve many different instances where approval is required. Furthermore the final decision about their permitted use is unpredictable. Mutual linking of various databases poses another problem.

The capacity to generate relevant information from big data also requires boosting. Training programmes are developed, in-service training is provided and the reasonableness of creating a competence centre advising users is considered for the health sphere to have the knowledge and skills to conduct analyses and research based on databases (big data analysis).
Course of action 4: efficient organisation of research and innovation in the health field

The MSA is responsible for organising the R&D necessary for its area of governance. However, this is a new area for health policy makers in which efficient organisation is yet to be created. This activity is focused on developing internal competences and external coordination and the intermediation of cooperation between the parties.

- **A chief innovation officer** is appointed in the MSA who organises, leads and coordinates the activity on a daily basis. It is important that the chief innovation officer should have great legitimacy and autonomy in the organisation, and also the initiative and competence to act as an agent of change who launches new development trends based on the idea of the strategy, monitors their progress and involves various parties to find solutions to specific issues.

- **A health research and innovation council will be set up** as a high-level permanent body advising the MSA on the organisation and funding of research and innovation in the health sphere. The council will be set up on the basis of the Organisation of Research and Development Act, Health Services Organisation Act and Public Health Act. The council will be established by a decree of the Minister of Social Affairs and led by the minister responsible for the health sphere and/or, considering the division of responsibility, the secretary general of the MSA responsible for health or research and innovation. The chairman of ATSAK will be the deputy chairman of the council for research. The council will consist of representatives of the health system and of health-related research and business, including relevant policy makers. The council will address strategic issues relating to research and innovation in the health field, develop the detailed priorities and criteria of the MSA for financing research and innovation, develop proposals for horizontal R&D and innovation policy based on the needs of the health sphere, process research and innovation proposals received by the MSA (e.g. under the health innovation forum, the goodwill cooperation agreement “Ensuring the Sustainability of the Health System”), etc. The council may involve experts to perform its duties and organise the solving of special tasks by temporary task forces.

In the context of organisation of health care policy, the council acts as the area-specific expert group under the National Health Plan (NHP) and has the relevant duties. In the context of organisation of Estonia’s overall research and innovation policy, this is an area-specific council for research and innovation policy that complements the so-far horizontal organisation of R&D and innovation policy in the form of the research policy and innovation policy committees of the Research and Development Council at the MER and MEAC. The council will also perform the duties of a subcommittee for the growth area of health technologies in the organisation of smart specialisation.

- **An annual health innovation forum will be established** as a networking and inspiration event for participants in the health innovation ecosystem. The forum will discuss health-related research and innovation trends, present instructive examples of health innovation and best practices of their support in Estonia and abroad, analyse the competitiveness of the ecosystem, generate new ideas, formulate proposals for changes and present the annual health innovation award. The ideas and proposals put forward at the event will be discussed by the health and innovation council. All interested organisations and bodies that have research and innovation for health as their mission may be partners at the forum. Three ministries will organise the event on the part of the state: the MSA, MER and MEAC with their agencies; the co-organisers are health businesses,
organisations, clusters, competence centres etc. One of the sources of inspiration for the forum is the similar event in the Netherlands, Innovation for Health\(^3^8\).

- **A basis is laid for the regular monitoring and analysis of health research and innovation** so as to be able to evaluate the results of actions and their impact on the health system and give the decision-makers a relevant overview of the situation in health research and innovation, the progress of implementation of the strategy, etc. Such monitoring and analyses have been prescribed in the Estonian Health Programme but they have not been implemented until now. The background analysis of state funding of health research and innovation conducted in the course of preparation of this strategy was the first attempt to delimit the area and collect data on this basis. Monitoring methods and key indicators (broader than the state funding of research and innovation) will be developed on the basis of the experience thus gained. In addition, thematic analyses will be commissioned, such as case studies on innovation practices in the health system, etc.

\(^{38}\) [http://www.innovationforhealth.nl/](http://www.innovationforhealth.nl/)
6. IMPLEMENTATION OF THE STRATEGY AND RELATIONSHIPS WITH OTHER STRATEGIES

The MSA will bear overall responsibility for implementing this strategy and prepare a detailed implementation plan in a 1+3 years’ perspective. To that end, the actions listed in the roadmap of key actions will be taken to the operative level, the organisation of their implementation will be elaborated (including the issues of what will be implemented by the MSA and/or what will be implemented through the measures and structures of the MER and the MEAC), and research and innovation funding will be applied for from the state budget allocation for the area of governance of the MSA on this basis. The implementation plan will be discussed and approved by the health research and innovation council.

Implementation of the strategy requires a considerable increase in research and innovation funding from the MSA budget (especially considering the current low level), for which the MSA shall:

- apply for additional funds from the state budget for 2016;
- apply to the MER for the funds allocated for the R&D growth and improvement of organisational capacity of the ministries under “Knowledge-based Estonia”;
- based on specific actions, involve the funds of smart specialisation measures (e.g. applied research programme or demand-side innovation policy programme) and horizontal measures (e.g. innovation voucher grants) in the areas of government of the MER and the MEAC;
- involve partners and their self-funding on the level of specific actions (the Estonian Health Insurance Fund, hospitals, universities, centres of excellence in research, businesses, competence centres, clusters, etc.);
- actively use opportunities for international cooperation in research and innovation to leverage the actions and resources of the strategy;
- elaborate on the involvement of charities – a little-used option in Estonia so far – in health research funding.

In the hierarchy of national development plans, the strategy is a sub-strategy supporting the implementation of the health policy umbrella document, the NHP 2009–2020 and its implementation plan will be part of the NHP implementation plans. The health research and innovation policy council will also have the functions of the research council specified in the NHP. The NHP converges and sets targets for the vertical development plans and strategies in the health field and integrates a wide selection of strategic documents from other areas that are in the implementation or drafting phase. The NHP has not covered research innovation until now.

The strategy has close links to the Estonian research and development and innovation strategy 2014–2020 “Knowledge-based Estonia”, the smart specialisation process and the national e-health strategy that is currently being drafted.
This strategy is guided by the objective of “Knowledge-based Estonia” to increase the socio-economic effect of R&D, which is why it can also be considered as a sub-strategy of “Knowledge-based Estonia” for the health field as a part of the implementation plan of this 2014-2020 R&D and innovation strategy. Implementation plans of “Knowledge-based Estonia” are approved by the Government of the Republic after discussion with the Research and Development Council. This is done in the state budget planning cycle. Once a year, R&D relating to socio-economic objectives is discussed with regards to the implementation plan by the ministries, including the MSA. Responsible for the implementation of “Knowledge-based Estonia” is the MER, which has at its disposal, among other things, the funds for increasing the R&D capacity of the ministries and financing the growth of R&D; the possibility to apply for such funds has been considered in the preparation of this strategy.

Coherence between the strategy and the smart specialisation process is important in order to ensure synergy from actions and the efficient use of funds in health-related growth areas, especially health technologies. In the health sphere, the state has a greater role in shaping the market compared to other branches of the economy, which is why the development of an environment facilitating the emergence and growth of health technology businesses depends to a large extent on the actions in the area of governance of the MSA.

The strategy has an important relation to the Estonian national e-health strategy\(^39\) being prepared by the MSA, considering that a majority of the scientific research and innovation whose purpose is to solve the issues of the health system contain some degree of ICT.

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\(^{39}\) An e-health task force was established at the Government Office by the decision of the Government of the Republic of 3 July 2014, the task of which is to prepare the Estonian e-health strategy 2020 together with a detailed implementation plan. The e-health strategy was still being drafted at the time of completion of this strategy in January 2015. More information: [http://etervis2025.ee](http://etervis2025.ee).
7. ABBREVIATIONS

ATSAK  Standing Committee on Medical Science and Health Strategy of the Estonian Academy of Sciences

EHP    Estonian Health Programme

ETCH  East Tallinn Central Hospital

EU     European Union

ICT    information and communication technology

IT     information technology

MD     Degree in Medicine

MEAC   Ministry of Economic Affairs and Communications

NEMC   North Estonia Medical Centre

NHP    National Health Plan

NIHD   National Institute for Health Development

OECD   Organisation for Economic Co-operation and Development

PhD    Doctor of Philosophy

R&D    Research and development

TUH    Tartu University Hospital Foundation
ANNEXES

Annex 1. Developments with the greatest impact on the future of the Estonian health system in the 2025 time frame

The cost pressure in the health system is increasing considerably. The lengthening life span and the decrease in the number of children and working-age people deteriorates the ratio of dependants to workers. Demand for services increases (including due to the earlier detection of illnesses and intervention) and changes (e.g. increase in chronic and lifestyle diseases, health awareness and prevention). Medical innovation arising from scientific discoveries (e.g. medicines, equipment, therapies) puts pressure on the price of services. This poses a great risk to the sustainability of the mainly publicly funded system (and to public finances in general) and the universal accessibility of services within the existing framework of solidarity-based health insurance and welfare.

The share of chronic and lifestyle diseases is increasing. This includes diseases related to ageing (e.g. Alzheimer’s and Parkinson’s diseases, chronic joint diseases and malignant tumours), largely preventable lifestyle diseases (e.g. cardiovascular and chronic lung diseases, diabetes, malignant tumours, depression, HIV) and environmental diseases (e.g. allergy, asthma). An increasing number of people live long with many diseases and their needs and expectations for services increase and drive an increase in costs. The complexity of use of services increases, as constant care of varying intensity has to be provided over decades by combining the activities of the patient, persons close to the patient and a number of various service providers.

The staff shortage in the health sector is intensifying. The ageing of medical professionals and their leaving the Estonian health and welfare sector, and the insufficient supply of new medical professionals is an acute problem that is likely to intensify in the future. There is a lack of personnel to perform the tasks traditionally related to human labour, and there is increasing pressure to replace such personnel with technology, but this is hindered by low investment capacity. The price of services and cost pressure increase may endanger the accessibility of labour-intensive services.

Technological innovation will accelerate and shift the boundaries of possibility in health care. The development and convergence of biotechnology, nanotechnology and IT accelerate development and open up increasingly new implementation prospects in health care. Opportunities arise for more individual (precise), non-intensive treatment and diagnostics with fewer complications and side effects, for greater treatment efficacy and for solution or alleviation of cases that have so far been incurable. Technology opens up more possibilities than the public health system can pay for, and this increases the risk of stratification in society. Greater pressure on health budgets puts the innovation focus on seeking cost-effective solutions. Considerable contributions are made to translational medicine in order to accelerate the introduction of research results and programmes intended for the rapid testing and scaling of innovation by the fund providers of health care (social insurance, public fund providers).

The wide spread of networked equipment will allow for gathering more and increasingly diverse health data. Doctors and other health professionals, but also health research and innovation will increasingly depend on information systems. The broader impact of health data is reflected, e.g. in the improved and more personal availability of health information, a holistic approach to health and improved accessibility of services (prevention, treatment and follow-up treatment). Furthermore, it will

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Based on the results of the strategy thematic workshop, see annex: [http://tervistastrateegia.ee/i624i84i7878](http://tervistastrateegia.ee/i624i84i7878)
make it possible to apply self-monitoring and remote diagnostics (including point-of-care) more extensively and to give feedback.

**Decision-making will become more precise and faster when supported by data analysis.** The increase in computer performance and the development of memory technology and data processing solutions help improve the efficiency of management processes and increase the role of decision support on all levels of the health system from self-monitoring of people to medical and public health decisions. Decisions based on the doctor’s authority will be supplemented by precise recommendations based on data analysis, which increase the opportunities for the patient (and other parties) to participate in his/her health management, and of process standardisation. Computerised management of decision-making risks makes it possible to delegate an increasing number of operations to lower qualification levels or to combine various decision-making levels. It will be possible to manage and plan health and welfare systems more efficiently and flexibly and to focus on results and quality.

**Information and communication technology will change the communication between participants in the health system.** The maturity of IT possibilities and the receptivity of people to their use will boost the spread of new ways of communication. A potential for improved cooperation between service providers and between people and service providers will be ensured by a higher quality and better organisation of communication through various channels. Owing to this, new business and service models and work processes will become more personalised, immediate, available, integral and efficient. On the other hand, the complexity of communication, the risk of information noise and the need to integrate information from different sources (for both individuals and organisations) will also increase.

**Personalised solutions will be common.** The rapidly increasing general volume of health knowledge along with increased technological possibilities, service innovation and patients’ awareness put pressure on the introduction of personalised or precision medicine instead of a mass solution by the health system. The implementation of more personalised solutions is a slow process with a great potential impact that would be revealed in more individual prevention, earlier and more precise detection of diseases, more personalised treatment plans and pharmacological schemes, fewer side effects and improved treatment efficacy and quality. The above in turn has an impact on service use patterns and system organisation, as it poses new risks that have to be controlled (e.g. increased demand for prevention services).

**Increasingly more people are taking an active role in their own health management.** Technological development (e.g. Internet penetration, self-measurement and home-use technology, social networks) have made health information more accessible and convenient to process, giving people a much greater potential to be involved in their own health management (both as regards prevention and treatment). An increasing number of people acknowledge their contribution to their own health management, presuming greater independence and involvement in the choices relating to health and illness. The traditional relationship between doctor and patient is changing: a person can be the best expert in his/her own health and illnesses, while the role of the doctor shifts from a monopolistic information channel to a provider of a second opinion. New health authorities (trainers, advisers, people with similar problems) arise in addition to doctors. In the long run, health-aware behaviour reduces the load of the health system (lesser need to visit a doctor, freeing up of resources), while it may increase demand in the short run, including demand for new services. On the other hand, this may also cause health information noise and an increase in the demand for and volume of unnecessary services. There will also be segmentation: some people will actively contribute to their own health while others will continue their health-threatening behaviour. The expectations of various segments to the health system are different.

**Innovative health services are growing and the organisation of services is changing.** In addition to improving physical health, people will increasingly appreciate a holistic approach to their health
status (including mental health and welfare services). Discontent with the current health system will put pressure on changing the service models. Service innovation, including among other things a broader introduction of technology, will reduce the barriers to entering the health care market (e.g. e-services, telemonitoring devices and sensors enable the provision of teleservices; new diagnostic tools support the transition of some services from hospital to home). Competition will increase and the boundaries between traditional state-sponsored and new service providers (including those who have entered the health care market from other sectors) will blur. New services will be less doctor-centred as people will increasingly act “outside the system” and use an increased number of and more diverse services. Expectations for the compatibility and interoperability of various applications will increase. This entails the risk of complexity of quality and safety assurance. Health systems will become more complex in order to meet the diversifying needs of people.

The cross-border market in health services will grow as specialised competence centres rise. People who are increasingly aware of their health and possibilities and increasingly more mobile are also more willing to receive health services abroad so as to compensate for the poor accessibility of quality health care services and/or to seek cheaper services (especially in the event of cost-sharing). Specialised regional centres will emerge for complex services or for narrower segments, which will serve patients across Europe. This will be leveraged by the lifting of restrictions on the EU internal market in health care services and the development of new technological opportunities for teleservices. There is a risk and possibility that countries and health systems will specialise in terms of both the volume and nature of services. Cross-border movement may result in the outflow of staff and a change in the supply and accessibility of health services for the population. As regards digital health data communication and the interoperability of databases, Estonia depends on the underdevelopment of the e-health solutions of other countries.
Annex 2. Strategy preparation process

This strategy was commissioned by the Ministry of Social Affairs (MSA) with a stimulus from the Ministry of Education and Research (MER) among others. The preparation of the strategy was financed jointly by the MSA and the Estonian Research Council from the EU Structural Funds under a project submitted to the “TerVE” programme by the Estonian Academy of Sciences.

The strategy steering group at the MSA consisted of high-level officials of the ministries (MSA, MEAC, MER) and implementing agencies (the Estonian Health Insurance Fund, the Estonian Research Council, Enterprise Estonia, the Estonian Development Fund) responsible for developing health policy and R&D and innovation policy, and a representative of the Government Office coordinating the various national policies.

The Standing Committee on Medical Science and Health Strategy of the Estonian Academy of Sciences (ATSAK), composed of the health R&D decision-makers and experts of larger hospitals and research establishments, was the expert group for the strategy. Research experts from the Academy of Sciences and universities were also involved.

The strategy preparation process was organised by a temporary core team at the Academy of Sciences, consisting of a project manager, analyst and assistant. In the last two stages of strategy preparation, the team included independent experts on health and research and innovation policy and a representative of the MSA to test the outcome of the development process and receive immediate feedback.

Figure. Strategy preparation process
The strategy preparation process (from November 2013 to January 2015) consisted of four stages: the preparatory stage (team building, identification of interested parties and issues, preparation of strategy framework), analysis stage (analysis of the ecosystem and key topics of health research and innovation), goal-setting stage (situation synthesis and concept of goals) and action-planning stage (preparation of the roadmap of key actions and the organisation of management and preparations for implementation). The process was open and discussion based and involved various interested parties. Source information was obtained from literature analysis, interviews, external experts and discussions. Broader forums were held at the beginning (7 February 2014) and end (16 January 2015) of the process; nine thematic workshops were held during the process: “The state as a smart client in the health sphere” (1 April 2014), “Challenges of resistance to antibiotics and R&D capability” (28 April 2014), “Financing of health R&D and innovation” (5 May 2014), “The doctor in research and innovation” (27 May 2014), “Lessons from the Estonian Health Programme” (30 May 2014), “Registries and databases” (17 June 2014), “Trends influencing the future of health care and their implications” (21 August 2014), “Development obstacles to innovative businesses in the health field and potential solutions” (21 August 2014) and “What to do to develop clinical investigations in Estonia?” (3 September 2014).

Available Estonian and international studies were analysed. Additional analyses were commissioned and conducted where needed, e.g. an analysis of the funding of health-related research and innovation and background analyses for the workshops. The strategy steering group and ATSAK had five joint meetings (11 December 2013; 10 April, 22 October and 1 December 2014, and 16 January 2015).

As strategy support activities, master classes were initiated to increase the research and innovation policy capacity of health policy makers, and a study tour was organised to the relevant institutions in Finland (the Ministry of Social Affairs and Health of Finland, the Academy of Finland, the Finnish Funding Agency for Innovation (Tekes), the Finnish Innovation Fund SITRA).

The strategy was prepared in coordination with two simultaneous processes: drafting of the National E-health Strategy (the MSA with the Government Office) and definition of smart specialisation (the Estonian Development Fund, commissioned by the MER and MEAC).

This strategy document, information on the strategy progress and all the materials created in its course are available on the strategy website http://www.tervistaistrateegia.ee