



# How can eHealth benefit rural areas - a literature overview from Norway

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## Foreword

This literature overview sheds light on the benefits of using eHealth in Norway. Its intention is to reveal if there is a relation between the distribution of health care services in rural areas and the use of e-Health. The overview reflects both documented benefits and potential benefits.

This overview is done within the Baltic eHealth project and is part of the Rural Report, which' aim is to reveal whether and how telemedicine can supplement the distribution of health care services in rural areas in the Baltic Sea Region. The Baltic eHealth project is financed by INTERREG IIIB for the Baltic Sea Region.

The National Centre for Telemedicine (NST) and Norwegian Centre for Informatics in Health and Social Care (KITH) have completed the report.

The literature overview study is done by Robert Myrvang (NST) and Thomas Rosenlund (KITH).

Tromsø/Oslo, April 2007

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# 1 SUMMARY

The overall goal of the Baltic eHealth project relates to meeting challenges connected to growth concentrated in urban areas in the Baltic Sea Region, to the detriment of the rural areas. The rural and outlying areas often experience a decline in population and falling employment. Norway, which is one of the countries that are represented in the Baltic eHealth project, has established a national healthcare data network (NHN)<sup>1</sup>, connecting all actors in healthcare including those in rural areas.

This report presents a literature overview that focuses on how eHealth solutions implemented in rural areas in Norway create new opportunities. It demonstrates how relevant solutions may boost opportunities for decentralisation of medical expertise in the Baltic states.

The report shows relevant results on how eHealth can supplement and possibly strengthen the distribution of health care services in rural areas, and how local inhabitants use and look upon the solutions. The results illustrate how eHealth has a potential of counteracting rural outmigration, and how jobs in health care in outlying areas can be made more appealing for health care personnel.

## ***Conclusions***

Several analyses of qualitative changes associated with telemedicine had Electronic Patient Records (EPRs) and electronic messages and their integration as study objects. The focus was both on general practice and specialist services. The home care sector was considered only to some degree.

The main benefits for professionals appeared to be more available time for other tasks and increased quality of data, including updated information, enhanced professional medical expertise and greater professional confidence

Benefits for patients are none or reduced travelling, better professional treatment, health benefits through faster professional evaluation where time counts, better selection of further treatment, better access to specialists and more effective use of specialist expertise. Within psychiatry and e-mail based communication between patient and health care workers, the patients experienced increased empowerment.

Economic studies mainly analysed specialist consultations employing telemedicine and to a less degree exchange of electronic messages and EPRs in care and nursing services. Most of these studies find that reduced travel costs are the major benefit. Some studies focus on economic benefits when admissions are avoided and time is saved for those offering treatment. For electronic message exchange, savings on paper and postage, as well as time saved are areas of benefit.

The report shows that eHealth has the potential to build a more trusted relationship between the patient and health care workers, which in turn will also give an increased patient satisfaction through an enhanced feeling of empowerment.

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<sup>1</sup> <http://www.nhn.no/tiki-index.php?page=InfoNorskHelsenett>

## 2 INTRODUCTION

This literature overview presents results from studies on eHealth projects in Norway that aim to solve challenges when information and communication technology is used to decentralise medical knowledge and expertise. The overall goal of the Baltic eHealth project is to meet challenges connected to growth and progress concentrated in urban areas in the Baltic Sea Region, to the detriment of the rural areas.

The rural and outlying areas often experience a decline in population and falling employment, trends which the Baltic States to some degree have in common with the Scandinavian countries. Norway is one of the players in the Baltic eHealth project and has established a national healthcare data network (NHN), connecting all actors in healthcare including those in rural areas and where experiences is no evolving.

In this report we present documentation on how eHealth systems implemented in rural areas in Norway gives new opportunities, and thereby demonstrates how relevant solutions can boost opportunities in the Baltics. The results from the Norwegian studies aim at answering the following questions:

- *If and how telemedicine can substitute (supplement and possibly strengthen) the distribution for health care services in rural areas?*
- *How does local inhabitants use and look upon the solutions?*
- *How can eHealth counteract out-migration from rural areas?*

The results from the Norwegian studies illustrates benefits or potential benefit of eHealth systems to decrease rural migration by raised health care provision and by making employment in outlying areas more appealing for health care personnel.

### 2.1 Background

The challenges in rural areas is manifest in the obvious geographic factors including isolation and small dispersed populations, limited public transport and road infrastructure, and the resultant, long distances to hospitals. There are also significant difficulties in recruiting qualified and experienced personnel in rural health care services. This is compounded by the increasing centralisation of specialist secondary care services and the increase in the proportion of the elderly population relative to the total population.

Rural areas in the Northern Periphery face specific challenges in the provision of high quality, coherent and comprehensive health services. Some of these relate to the characteristics of rurality: they are often isolated and with dispersed and low density populations, they offer limited public transport and road infrastructure. This adds to long distances to hospitals and primary healthcare services, and the significant difficulties in attracting and recruiting qualified and experienced personnel in rural health care services.

Norwegian health policy documents show how the aims for the use of ICT have expanded over the recent years and describe increasing expectations of positive effects.<sup>2</sup> At the same time, the policy documents describe a public health care sector with a range of services with

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<sup>2</sup> Norwegian Ministry for Social Affairs/Ministry for Health Oslo 2006.

complex management and financing systems. The complexity of the sector is described correspondingly by challenges in offering unified and compatible technological solutions.

One of the most central IT-strategical initiatives to meet these challenges has been the establishment of the Norwegian Health Network (NHN) in 2004. It is established as a closed network for electronic communication in the health and social sector in Norway, and is owned by the five regional health enterprises. NHN offers a secure basis for interaction between health care personnel and between health care personnel and patients. It safeguards data quality, information security and personal information protection in the exchange of sensitive information.

## 2.2 Key concepts

### ***Rurality***

Rural health and rural health services are expanding areas of research in many countries. There is extensive literature from USA, Australia, Canada and UK, and there are several specialised scientific journals.<sup>3</sup> Nevertheless - there is a lack of an agreed international definition of measuring rurality. According to The Institute of Rural Health in the UK<sup>4</sup> researchers have usually employed their own definition according to the study area of interest.

There have been a number of ways to define rurality when planning health policies. According to the Organisation for Economic Co-operation and Development (OECD), the definition of rurality is fewer than 150 persons per square km.<sup>5</sup> Some have focused on the distance to be travelled to key health centres [1]. Others use remoteness based on the number of miles per 1000 population to allocate resources, as demonstrated in the "Fair Shares for All" report commissioned by the Scottish Executive Health Department in 2000.<sup>6</sup>

Even if rural health research now is flourishing, there still is a lack of international definitions of measuring rurality, both in statistics, in the planning of health policies and in research issues [2]. It seems that a consensus definition of rurality is needed to help develop an evidence base of research. However, it is difficult to identify a definition that encompasses the many facets of rurality relevant to primary and secondary care.

### ***eHealth***

The term eHealth is here based on a broad definition:

*eHealth is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a*

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<sup>3</sup> See fx *Journal of Rural Health, Australian Journal of Rural Health, International Electronic Journal of Rural and Remote Health.*

<sup>4</sup> <http://www.rural-health.ac.uk>

<sup>5</sup> See Rygh 2006 p. 13.

<sup>6</sup> Scottish Executive Health Department: Fair Shares for All. Final Report. Edinburgh. 2000.

*commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology.*

For practical purposes we distinguish between the following two aspects of eHealth:

- Telemedicine systems: the use of different digital imaging technologies (video conference or image sharing, web based solutions for public or patient use)
- The use of standardized electronic message exchange integrated in electronic patient records (EPR using broadband or other networks)

The term telemedicine means work within professional medicine – diagnostics, treatment, supervision and monitoring – in which ICT is used to communicate relevant treatment information on certain patients. Furthermore, it also encompasses communication related to treatment between carer and patient, and self-help groups for patients.

### **Benefit**

The concept of benefit is used to mean a positive result - that is whether telemedicine has economic or other advantages compared to alternative solutions, without allowing costs or disadvantages to exceed the advantages. Even if benefit means a realised result, we also include potential benefit in quantitative or qualitative measures as a possible result that has not yet been realised, but remains latent in a certain telemedicine system available.

A benefit analysis is normally based on one or another form of effect analysis, where the analysis documents a positive result under certain premises. Effect analysis is a useful and adequate method of highlighting many issues. But an analysis of the potential can also reflect on what is not a reality at the moment, but is possible and can be realised in the future. Such analyses can be regarded as more or less speculative, just as they can be well-founded.

Most of the studies carried out in Norway document qualitative measures of benefits, while some document economic results in the form of monetary values. The qualitative categories may also include quantitative measures.

## **2.3 Methods**

We have chosen Norwegian results documented and published from the year 2000 to present. The date filter was chosen because the technology and knowledge basis is changing very quickly. We do not believe that any relevant information was excluded. Electronic searches are carried out in several databases, using controlled vocabulary and text words. Three main information resources are used:

- The HØYKOM<sup>7</sup> database of projects that concerns the use of eHealth i rural areas
- Publications on eHealth projects from R&D-institutions in Norway:

Norwegian Centre for telemedicine (NST)<sup>8</sup>

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<sup>7</sup> <http://www.hoykom.no/>

<sup>8</sup> <http://www.telemed.no/>

- Studies published in the journal for The Norwegian Medical Association<sup>11</sup>

The literature overview is based on several desktop searches and relevant literature searches from reference lists. The literature was found using several search engines: MEDLINE, PUBMED, Bibsys, Google. Here also English terms were used, with the search words Norway and Norwegian added.

The searches have used the following key words both in Norwegian and English: telemedisin (telemedicine), distriktsmedisin (rural health), e-helse (e-health), helse (health) + IT (IT), IKT (ICT). Teledermatologi (teledermatology), teledialyse (teledialysis), telepatologi (telepathology), telepsykiatri (telepsychiatry), teleradiologi (teleradiology), teleultralyd (teleultrasound), sykestuefunksjon (cottage hospital), intermediær (intermediate), desentralisering (decentralisation), videokonferanse (videoconference), egenmestring (empowerment), fjernundervisning (distance teaching), gevinst (benefit) + Internett (Internet).

### ***Inclusion criteria***

We have included studies only on Norwegian health care services, but have excluded preliminary projects in which the main project was not completed, and projects in which only a technology was tested. In total 95 studies were found and evaluated in regard to the problems addressed in the Baltic eHealth project. After a systematic appraisal, 45 studies were included. In order to be included, the study had to address a problem and to describe the telemedicine service as an alternative to other. Furthermore, the studies had to confirm their answers to a problem with empirical evidence and account for the methodology used.

Today the available documentation on eHealth and rurality can be said to be somewhat limited, both in Norway and internationally [3,4,5]. One reason may be that telemedicine is still a new research field, in which the use of technology and research are still under development. This report shows areas of benefits for rural areas that are more or less well documented.

### ***Generalisation of results in Norwegian studies***

Some of the results reported do not immediately lend themselves to generalisation. In some cases the premises for generalisation is not discussed or fully accounted for in the studies. Therefore considerations about potential benefits are included when they have been relevant and sufficiently substantiated. This is a method of expanding the relevance of the study's investigations.

Some of the overviewed studies on qualitative measures do not discuss their specific conditions and basic premises, and it is correspondingly difficult to generalise from the results. The possibility of transferral of conclusions from one place to another should be assessed in each case, because what is beneficial in one geographical context may not be beneficial in other circumstances. Situational conditions and the lack of studies where

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<sup>9</sup> [http://www.kith.no/templates/kith\\_IndependentWebPage\\_976.aspx](http://www.kith.no/templates/kith_IndependentWebPage_976.aspx)

<sup>10</sup> [http://sintef.no/content/page1\\_598.aspx](http://sintef.no/content/page1_598.aspx)

<sup>11</sup> [http://www.tidsskriftet.no/pls/lts/pa\\_lt.innhold](http://www.tidsskriftet.no/pls/lts/pa_lt.innhold)

generalisation is possible make it difficult to draw conclusions that telemedicine is cost-effective or reaches qualitative aims. This literature overview shows clearly that there are potential benefits; however the realisation of these benefits for rural areas requires a certain scope of use of the services.

### **3 TRENDS IN RURAL E-HEALTH**

#### **3.1 Trends outside Norway**

Telemedicine is now a comprehensive concept regarding the supply of health care and health education over distance, empowering populations, patients and health professionals regardless of where they live [2]. Much of the literature on telemedicine is about rural questions. Telemedicine can facilitate interaction between healthcare professionals and enables a rural practice to link with a larger hospital, usually in an urban centre [6]. But providing telemedicine in rural areas also presents particular challenges. If patients in rural areas have difficulties accessing healthcare services, they may also have difficulties getting to where the telemedicine service is available [7]. Still the quality of a consultation is very dependent on the quality of the system being used and a poor quality link may mean that images and sound are fragmented and distorted. In GP-patient teleconsultations, the patient often cannot be palpated or subjected to physical examination by the GP [7].

However, methods of addressing such difficulties are now considered. While the initial consultation with a patient may need face-to-face interaction, follow-up consultations usefully benefit from telecommunication. As the distance to alternative healthcare services increases, telemedicine obviously becomes a more attractive option. Isolated rural GPs may particularly benefit from contact with colleagues. Interprofessional working involves professionals collaborating to work together more effectively to improve the quality of patient care. It allows for flexible and coordinated services and a skilled and responsive workforce [8].

Collaborative and interprofessional working is now seen as an important element in improving rural health service delivery. Mutual understanding and collaboration allows professionals to work across the boundaries of traditionally defined roles, and enables effective role substitution, for example nurse practitioners and pharmacists [9]. This is particularly beneficial in rural areas where healthcare professionals often have to provide a broader range of services than those in urban areas.

In the USA success histories of telemedicine are described from the state of Maine where there has been a rapid growth of state-wide telemedicine systems in rural, economically disadvantaged areas [10]. The use is in a broad array of interactive videoconferencing applications, including mental health, diabetes management, primary care, specialty paediatrics, genetics, and dermatology. However, although the great strength of using telemedicine is that it can improve access to health services, one weakness is the lack of evidence supporting any clinical and cost advantages relative to traditional services. Major barriers are reluctance to use telemedicine services and absence of infrastructure and resources to sustain them [11].

In Tennessee an integrated telehealth network links three hospitals, a health care clinic and patient homes. Here results from disease management programs for congestive heart failure and diabetes, as well as crisis telehealth and teledental health, are reported [12].

Telemedicine may contribute to acceptable services in palliative care and cancer treatment programmes in remote and rural areas. This is illustrated in a overview study from the USA

about published evidence of programmes that have set out to provide oncology services in remote and rural areas in order to identify evidence of effectiveness and problems. Fifteen papers reported evaluations of oncology outreach programmes, tele-oncology programmes and rural hospital initiatives [2]. All studies were small and only two were controlled, so evidence was suggestive rather than conclusive. There were some indications that shared outreach care was safe and could make specialist care more accessible to outlying patients. Tele-oncology, by which some consultations are conducted using televideo, proved to be an acceptable adjunct [13].

In Canada the use of telemedicine in interdisciplinary education and training is addressed, enhancing team building, as in one mental health project [14]. This paper reports on a demonstration project that examined the role of telemedicine in providing interdisciplinary mental health training and support to health professionals in a rural region. The results suggest that telemedicine can be used to facilitate mental health training and promote interdisciplinary collaboration among professionals in a rural setting.

The challenges in the handling of stroke patients in rural areas are also reported. This is a growing patient group, and the latest development in diagnostic and treatment call for expertise care. Telemedicine for stroke, use of state-of-the-art video telecommunications may be a potential solution to maximize the number of patients given effective acute stroke treatment [15].

Results from a diabetes disease management program increased the number of diabetics who brought their blood sugar under control. Another example of successful use is remote nurse practitioners accident and emergency services, supported by telemedicine [16]. There was a high acceptance and satisfaction level by professionals and patients when local emergency services in community hospitals got telemedicine advice from a regional hospital by a videoconference system. A document camera allowed transmission of still images of wounds and radiographs. Important lessons learnt were that it is essential to back up the training programme by written instructions and to allow extensive practice with the equipment. It is also pointed out that increase in local management has staffing consequences, but will probably reduce congestion in the main centre[16].

A suggested sustainable long-term solution is a move towards a more integrated primary and secondary care service, with healthcare professionals working in a more coordinated way. GPs with specialist interests such as surgery and consultants with community interests such as care of the elderly are pointed at [17].

### **3.2 Rurality in Norwegian health policy**

In the years to come changes in the presentation of ill health will have a profound impact on health care service. Especially the elderly and disabled with compound health problems, people with chronic diseases, the handicapped and psychiatric patients will represent increased pressure on specialised hospitals, and calls for the transfer of care to the primary sector and the home based sector. Hence there will be a growing demand for tailored eHealth solutions.

To meet such challenges, Norway is now establishing Rural Medical Centres combined with telemedicine and ambulatory specialised teams to strengthen the service at the interface of primary and secondary care. The aim is to provide more care locally and relieve pressure on the secondary sector [18]. Improving of the interface between primary, secondary and tertiary care by eHealth in combination with outreach programmes, establishment of different

intermediate services is today associated with improved quality and access to care, more efficient and guideline-consistent care, and less use of inpatient services.

As in the Baltic area the rural parts of Norway faces that current service provision is fragile due to difficulties in recruiting and retaining healthcare professionals. Increasing medical specialisation, long working hours and a lack of support structures for key staff are found to have negative effects on recruiting and retaining healthcare professionals in rural areas. The report 'From fragments to a whole; a coherent healthcare' by the Health Department of Norway states that large groups of patients are depending on the community and the specialised healthcare functioning as a coherent chain of care [19]. The interaction is often not good enough. This can lead to treatment failures, unnecessary hospitalising, too early discharges from hospital, and inadequate follow-up from the community nursing care and the general practitioner.

In Norway proposals are further developed in a report where the main objective is to deliver more of the health services closer to where people live [20,21]. It recommends the use of ambulatory services combined with enhanced use of telemedicine systems for better counselling from specialists to primary care workers. The Norwegian health authority plans for the expansion of hospital and day surgery or "one-stop clinics" includes travelling radiology units providing MRI, CT and ultrasound scanning, outreach dialysis clinics and oncology services. The further development of "the missing link" in variants of community hospitals will act as resource centres and provide locally accessible integrated care in one place, and where potential problems regarding the staffing of community hospitals also are addressed.

## **4 OVERVIEW OF NORWEGIAN DOCUMENTATION: RESULTS**

There is a demand for information about the benefits of telemedicine, but in relation to the demands the documentation can be said to be somewhat limited. This may be due to the fact that telemedicine is a relatively new research field, and that both use of technology and research are under development. Furthermore, the current appraisal of benefits is influenced by the fact that it is mainly pilot programmes and small-scale services that have been evaluated. The expectations and aims of the new technology have increased. This makes it more complicated and costly to both realise and analyse the benefits. At the same time this may lead to several more institutions experience benefits of using the services and that potential benefits are thus realised. Currently, the focus is not only on the technology in regard to development of telemedicine services, but also on organisational and social challenges.

### **4.1 Telemedicine systems**

#### ***Telemedicine solutions for specialised services***

Radiology is the oldest telemedicine service, and today most hospitals in Norway now have digitised this service. It is now fully possible to send images to radiologists for overview, so that the patient does not have to travel. A study on teleradiological transfer of images in neurosurgical cases between local hospitals and neurosurgical specialist units shows a reduced number of journeys and has led to better professional treatment of patients. For

teleradiology, a major benefit is the reduced need for meetings and reduced response time from radiology units and more readily available information [22].

One study deals with a newly installed X-ray lab at a GP's office as a perceived success. Patients and the local people in general are very satisfied with the measure [23]. A larger number of injury treatments can be taken care of within primary healthcare with telemedicine based surgery guidance. This will save travelling and lower thresholds for examinations and in this way equalize any differences in access to healthcare between urban and rural areas. At a GP's office X-ray examinations can be included in the clinical work from the beginning. At present staff at the GP's office is working at improving the service in case of emergency examinations. The author states that this measure shows good rural policy and expects that more establishments of X-ray labs in rural areas will follow [23].

In a cost-effectiveness study of teleradiology the service shows to have sufficient volume to be more cost-effective than the alternative method of providing the service in certain specific cases. In this service the patient is examined within the primary health service and therefore the cost of travel to a specialist hospital is avoided [24].

In another study of mobile radiology examinations of hospital patients in the Oslo region it is documented that cost-effectiveness depends on the distance from the hospitals to nursing homes. The larger the distance to the hospital, the better the cost-effectiveness [25]. In yet another study exploring cost-effectiveness using x-ray images for follow-up in cardiology no monetary benefit was found. In this study other benefits, such as increased security for health care personnel and saved time at the hospital, were found [26].

In treatment of skin diseases (dermatology) based on video conferencing the patient and his GP together consult a specialist. Here the consultation provides an instant result, and the treatment can begin immediately [27]. In the case of still image solutions, the GP sends images and a written referral, and the images and text can be evaluated at different times. GPs experience that this system contributes to a better method of selecting patients that need to go to hospital, and that GPs enhance their expertise in dermatology. The users reports that it inspires confidence to be able to get a second opinion [27]. Tele dermatology is also anticipated to have considerable potential for treatment benefits for patient groups with chronic skin diseases, for example via equipment located in nursing homes and for sore treatment in homes [28].

Yet another study on video consultations in dermatology shows that the service had sufficient volume to make the telemedicine service more cost-effective than the alternative method of providing the service in certain specific cases. In this service the patient is examined within the primary health service and therefore the cost of travel to a specialist hospital is avoided [29]. Still image referrals in dermatology are even more cost-effective if software, digital camera equipment and the Norwegian Health Network also are used for other services in general practice [30].

study on still images in electronic referrals for skin disorders show that the benefits are associated with a reduction in patient journeys and the service will therefore be more cost-effective in municipalities with high travel costs to specialist hospitals. The use of still images in an electronic referral makes it possible for patients with uncomplicated skin disorders to receive treatment at their local health clinic by their own physician. The results demonstrate that whether the use of still image telemedicine is cost-effective or not, depends on distance and annual workload. 18 out of 44 municipalities had a sufficient number of patients with a dermatological problem to make telemedicine cost-effective. Less than half of the municipalities in the two northernmost counties in Norway had an efficiency potential in using still images. However, telemedicine is here justified because it saves time for patients and increases equal access to care [31].

Another study examines distant diagnosing via videoconference-sessions on weekly consultations between general practice and to a hospital based dermatologist. The service used a close-up camera for detailed examination of skin lesions and photographs of skin areas were transmitted directly to the specialist screen. The studio physician wrote prescriptions and sick leave notes, and the specialist wrote a reply to the referring physician. The study showed earlier diagnosis, time saved, reduced costs, and less need for patient leave from work as important advantages. Having a physician in the studio makes patients feel safer, and they understand the specialist better. The study concludes that videoconferences are well suited in everyday dermatology, when follow-up by specialist is necessary, and for patients in regular treatment at local clinics for skin disease [32].

In emergency medical care, diagnosis using telemedicine via pre-hospital echo-cardiogram (ECG) has reduced the time used before percutaneous coronary intervention. Especially for patients that are in hospitals that do not have the possibility to perform the treatment, it is a benefit that the patient can be sent directly to a hospital that has the capacity to perform percutaneous coronary intervention. Normally, two of three patients that are in hospitals without this form of treatment must go there first [33]. In a similar study on pre-hospital thrombolytic treatment the results show that the benefit of early treatment is greater the further the patient has to travel to hospital [34].

In the project Virtual Emergency Medicine Interaction (VEMI) video-conferencing have been established between emergency teams at different hospitals. Images of patient, working teams and vital signs (e.g. blood pressure, heart rate, oxygen saturation, temperature) are visible at both sites. The team working with the patient can concentrate on clinical work, as the cameras are remotely controlled from the other site. A qualitative human factors analysis concludes that the system may improve the interaction between emergency medical teams and strengthen clinical decisions. The project report that critical decisions are made quicker and more correct, and that communication improves regarding cooperation and enhanced local competence [35].

In diabetes care fundus photography via telemedicine is used as a control measure in regard to potential blood clots in the eye. It is estimated that approximately 2.3% of the population suffer from diabetes [36]. If retinopathy is not treated it can lead to blindness. Medically, there is agreement that it would be favourable to undergo annual checks in the form of fundus photography. In a study based on interviews, both patients and health service personnel express greater satisfaction in the use of telemedicine instead of more traditional service [37]. This service can be expanded to include other fields of vision controls, images of the optic nerve and pressure control for other groups of patients. The service improves the accessibility of eye examinations for diabetics that live in rural areas with long distance to eye specialists. One benefit can be that the capacity of an ambulant specialist is employed more efficiently, whilst newly referred patients are given priority when the specialist is ambulant [27].

A related service offers the transfer of blood sugar readings in cases of child diabetes, from the child's mobile telephone to the parent's for monitoring of their state of health. A study of the service illustrates that even though the users (in this case the parents) demand this kind of solution because it gives confidence vis-à-vis the health of the child, it cannot be documented that there are any immediate benefits in the short term – these benefits will only show in the long term through reduced delayed effects for diabetes patients [38]. In a health economic analysis fundus photography was shown to be cost-effective if a critical number of diabetic patients in the municipality used the service. The benefits for this service were associated with a reduction in patient travel [39].

Telemedicine based dialysis to patients with kidney failure is now offered on a regular bases, located in a rural setting and manned by specialised nursing staff. A video conference with the specialist hospital unit replaces the communication that previously was conducted by letter, telephone or in person. The monitoring information is continually available to the specialist during the treatment, and it is especially the quality of treatment that is increased with this type of service [40].

Yet another study on this service reports that the advice from the specialist hospital is given with greater confidence. The personnel that perform the dialysis have greater confidence because they receive faster and better quality information in return [41].

A study on the monitoring of suspicious heart murmur in children concludes that referrals that utilise telemedicine reduces travelling and use of time [42]. One such project has demonstrated how the close relatives of a child with autism and the teachers at the child's school could make contact with professional groups elsewhere in the country via videoconference. This illustrates how current technology has potential benefits in connection with rare medical conditions, since specialist personnel are located in only a few places [43].

A study on net-based hearing aid adjustment concludes that even if the evaluated services are not cost-effective, the cost-effectiveness will improve if the video conference equipment is shared with other municipal services. This study demonstrates that the coordinated use of equipment and other services can improve the cost-effectiveness of the telemedicined based services [44].

### ***Telemedicine for home based care***

A model for the use of telemedicine in the primary health and community care sector in Tromsø was developed in the "Ses@m-Tromsø" project. The project also involved the University hospital in Tromsø. Telemedicine and ICT were employed in different services: virtual wound clinic, electronic lab results, electronic discharge letter and e-mail for questions and answers. The virtual wound clinic made it possible for nurses in the community care sector to communicate with the wound clinic at the hospital using images and text. One of the effects is that the patients don't have to travel to the hospital. The service can become cost-effective, but then there is need for more patients using this service than today [45].

The other services in this project are secure message services (e-mail) involving nurses in the home care sector and general practitioners, and hospital and long-term care institutions (lab results and discharge letter). One if the advantage of e-mail and electronic lab results is that time is saved. The advantage of electronic discharge letter is that the care institutions can receive an electronic version of the discharge letter, but very seldom is the discharge letter sent before the patient leaves the hospital. To utilize the potential benefits of electronic discharge letter the hospital has to produce and send the document before the patient leaves the hospital [45].

In the project Healthcare@home a prototype of a broadband connected system for home-based self-management for patients was designed and developed. The project has developed a solution for training and follow-up of patients with diabetes and chronic pulmonary disease (COPD). The solution supports interaction between patients and healthcare personnel and is available to the patient by using his/her TV and a remote control. The result of the evaluations with regards to user experience shows high user acceptance for both the system and the services [46].

## ***Internet and e-mail based solutions for self-help and empowerment***

The use of the Internet for health purposes is now increasing in the Norwegian population, more in some demographic groups than in others. In a study on the use of internet to communicate with their general practitioner, nearly half of the population claim that they would like to use this in the future. A web-based system complied with Norway's strict statutory requirements for the processing of personal data was developed and tested in an effort to assess the implications of this mode of communication. The 48 patients who used the system sent on average 3.3 messages, the six doctors sent between nine and 65 messages each. Traditional inquiries (visits, telephones) to the doctor averaged 3.2 and 4.5 for the intervention and control group respectively. 41 % of the messages were inquiries about health issues, 22 % were about renewals of prescriptions and sick leave notes, while 13 % were requests for an appointment. Patients and doctors were both positive to this mode of communication. Patients who did not use the service said that they expected to use it in the future. Electronic communication appears to replace some consultations and telephone inquiries. The study gives reason to expect that communication between patients and general practitioners over the internet will be more important in the future [47].

Some Internet based telemedicine systems are meant to contribute to medical self-help and social empowerment of patients. Currently, this category involves mainly psychiatry and the use of the Internet. Two studies examined whether the Internet is helpful for persons with serious psychological illnesses [48,49]. These studies point to positive experiences that correspond with available literature on the Internet as "net-based self-help". The positive effect of the use of the Internet that is especially emphasised is the establishment of contact with other people on their own terms. The focus is also on the question as to whether such services contribute to greater openness concerning psychological problems [49].

In a similar study, the use of net-based discussion groups for people with psychological problems was examined, i.e. who uses this type of service and which health related implications there are in regard to participation in these groups [50]. The majority of respondents said that it was easier to discuss sensitive problems online than face-to-face. An important element for most was that they were able to use a pseudonym. Here the discussion groups were perceived as a supplement to traditional therapy. The majority would like to see professionals taking a more active role in these types of forums.

In a questionnaire based study the use of the Internet for such purposes was explored [51]. 1007 Norwegians aged 15 years and older were interviewed by telephone in October 2005. 58 % of the respondents in 2005 had used the Internet for health purposes, compared to 31 % in 2001. Having visited the GP last year, being female, being young, living in a urban area, and having a white-collar occupation were positively related to the use of the Internet for health purposes. 37 % of the respondents considered the Internet to be an important or very important source of health information. 72 % considered face-to-face communication with health care personnel to be important or very important. Nearly a quarter of the users reported that they had felt reassured by health information found on the net, whereas 10 % experienced increased anxiety from the same type of information. Norwegians' use of the Internet for health purposes continues to grow, but doctors and other health care personnel remain the most important sources of health information in the Norwegian population.

In a study of a service in which patients used e-mail to contact their GP, both the patients and the GPs were on the whole very positive [52]. Patients that did not use the service said that they expected to use the service in the future. Electronic communication seems in this case to replace some consultations and telephone enquiries. The patients report that it is easier to remember and to communicate their health-related questions and problems using text-based communication. It was found that the service made the way for a trusting relationship between the patient and doctor, which in turn will also give an increased health

benefit through an enhanced feeling of empowerment. The introduction of information and communication technology in the patient-doctor relationship represents a significant change in modern health care. Furthermore, patients' constructions of trust in this relationship can be understood in light of basic mechanisms in modern society. The writers of the study warn against increased medicalisation as an undesirable result. This is an aspect that should be regarded when this type of service is introduced [52].

### ***Videoconference facilities for distant teaching and cooperation***

In distant teaching the pilot project Orhtopol@r is an example of a centrally organised and performed orthodontist education program that is also performed at distant locations by using video conference [53]. The education was given by using auxiliary equipment like a personal computer and a document camera and by using digital X-ray pictures. Besides the educational programs, the video conference equipment was also used for patient treatment planning. The results show that students, who used the video conference education program, had the same learning effect/output as the students, who attended the face-to-face program. However, the respondents suggested that the learning effect/output can be improved by a better preparation and organisation of the distant learning program. It was also reported that professional discussions and presentations in case of video conference were more challenging and required a better, clearer chairing of the sessions. Finally, both groups of students believed that use of video conference in education programs does not hinder professional development, compared to traditional face-to-face education. The over-all results show that all participants were professionally challenged and in addition experienced use of video conference as an innovative means to possibly improve competence in rural areas [53].

In a cooperation project between a rural psychiatric centre and a municipal healthcare centre, video conferencing over a broadband network was used. Here five different activities were tested: meetings dealing with common patients, consulting meetings (coaching) with single persons or groups, education, short-notice meetings and meetings with patient and staff. A clear benefit using video conference was saved travel costs for the regional psychiatry team. Additionally more qualitative benefits were reported, like to have meetings earlier and have these easier organised and done. The municipalities get also easier access to a broader competence. Normally it is only a selection of specialist staff that travels to the municipality healthcare centres. The involved parties were very positive and reported willingness to continue use of video conference [54].

## **4.2 Electronic messages and EPR**

In Norway there still are challenges associated to the exchange of electronic messages and the integration for more seamless technical solutions. The NHN is supposed to carry large information volumes. Today more than 20 million patient contacts with GPs per year result in approximately 1.9 million referrals to hospitals. More than 3.9 million discharge letters are sent from hospitals to GPs, and more than 7 million requisitions for tests to laboratories - plus a corresponding number of results are returned. 1.3 million requisitions for images to hospitals, 1 million requisitions for physiotherapy and 17 million prescriptions to pharmacies are transported and exchanged through the NHN.<sup>12</sup>

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<sup>12</sup> Figures for information exchanges in the Norwegian Health Network can be found at: <http://www.shdir.no/samspill/indikatorer/>

The figures illustrate some of the volume of information involved in the communication processes within the health care sector in Norway. There is also a considerable amount of information passed within hospitals and in communications with the municipal care services. Obvious there is a great potential for benefits in reducing errors and delay in medical documentation.

A survey of electronic messages and conditions for co-operation in the nursing and care services show that time-saving benefits in this case must be seen in relation to the amount of time spent on the telephone, time used for registration and documentation, and also time spent transporting patients that have been to doctors' appointments or have been discharged from hospital. The introduction of electronic systems contributes to the exchange of more information and makes better routines possible. A daily challenge in traditional practice for nursing staff is the accumulation of incomplete telephone enquiries to other co-operating institutions. In this case, benefits are gained in the form of faster and completed exchange of information, which in turn leads to faster and better co-ordinated follow-up of patients in the nursing and care services [55].

At GP-offices the use of EPRs has led to a situation in which gradually more of the traditional medical secretarial duties, primarily writing doctors' notes or dictation, have been eliminated. This has released resources for other tasks, and medical secretaries have been delegated other, more interesting duties [56,57]. There is an attempt to find solutions that satisfy the hospitals' requirements for information that also can free up resources [58,59].

An examination involves the use of mobile EPR solutions for documentation of medical treatment in home nursing services, where the nurse is granted mobile records access for making reports. This solution contributes to keeping the patient's journal updated [60]. Another study documents benefits when upgrading EPRs at the GP-offices. The original version was replaced with broadbandbased access to the Internet and e-mail from the same PC that contains the records system. This service led to simpler routines both for preparatory and post-examination work, as well as faster communication with the outside world [61].

There is currently a certain amount of integration between EPRs and other documents that is exchanged between primary and specialist health services. The two most important documents in regard to volume are referrals and discharge letters. The potential for benefits lies mainly in that institutions avoid duplicating tasks and reduce the probability of errors, as patient information is not entered manually several times. Studies that have examined practices concerning referrals and discharge letters show that there are challenges presented in current work practices, mostly related to organisational issues and internal company culture [62,63]. These would appear to be important for the potential to realise benefits, both in relation to quality of treatment and professional benefits [64].

One health economic study on electronic message exchange document that electronic referrals will be cost-effective for GP-offices and for the hospitals in the Northern part of Norway if 51% of all referrals are sent electronically. The benefits are gained mainly through less time spent on each case and lower postage costs [65].

A project on electronic messages has analysed health economic benefits when the paper-based messages are replaced with electronic messages between the primary health services and specialised hospital units. The project has made assessments of the most cost-effective form of information exchange and has calculated potential and realised benefits of adopting this form of information exchange. The measures show that the health care sector can save 297 million Norwegian kroner over 15 years by sending referrals and discharge letters as electronic messages instead of ordinary letters by traditional postal service [66].

## 4.3 Discussion of the findings

This report presents documentation on how eHealth systems implemented in rural areas in Norway generates both economic and qualitative benefits. In addition it demonstrates how relevant solutions can boost opportunities, possibly also in the Baltic states. How do the findings from the Norwegian studies relate to the questions that initially were formulated for the Baltic eHealth project?

The presented studies relate mainly to distant healthcare services and conclude mainly on benefits for patients and healthcare personnel with regard to travelling time and costs, economic benefits and quality of service. However, the results of the Norwegian studies show in general that rural areas profit from telemedicine services and show that healthcare professionals feel more secure and comfortable with professional support, either in the form of second opinion or coaching. This may contribute to counteracting professional centralisation. Telemedicine services may even make employment in outlying areas more appealing for health care personnel. It seems therefore reasonable to assume that eHealth for the same reason counteracts out-migration of professionals from rural areas.

The observation that the involved local inhabitants in general have a positive view on the evaluated eHealth solutions supports the assumption that eHealth could counteract out-migration of citizens to some degree, even if there is no clear evidence yet.

The listed results say less on how telemedicine can substitute the delivery of healthcare services in rural areas.

## 5. CONCLUSIONS

In Norway telemedicine obviously has contributed to the realisation of the authorities' strategy for modernisation of the public healthcare service to serve the Norwegian people better, more efficient and more cost-effective. This overview shows that there are monetary and qualitative benefits, as well as areas where potential benefits can be realised. The economic benefits depend mainly on the volume of use of the services. If use of the services reaches a certain scale, the benefits will become apparent and can more easily be estimated.

However, it is more difficult to measure quality than monetary value in a meaningful way. In case of qualitative benefits, the ability to reveal advantages of certain solutions depends on analysis of complex social processes in certain social contexts.

There is obviously a demand for more evidence based research on the benefits of telemedicine for rural areas. Documentation of evidence based research is however limited. This may be due to the fact that telemedicine is a relatively new research field and its use still in a development phase. The studies done so far satisfy only a few of the methodological requirements that make generalisation possible. Generally, in these studies, the evaluation of small populations and/or low volumes of services impair drawing of statistically significant conclusions.

There is a number of definitions of rurality also when planning health policies. Although the concept of rurality may still be vague, rural health research is now flourishing. Since Norwegian rural geography and demography is not unquestionable comparable to these items in other countries, it is uncertain to what extent Norwegian evidence is transferable to other regions.

Based on the reported findings one can not draw firm conclusions on three possible relations as questioned in the beginning of this overview. Although substantial experience has been gathered and documented, too many evaluations are based on pilot and small scale projects, which puts limits to extrapolation of the results to real life situations. Research in telemedicine is still a relatively new area, however expanding while generating more and better data and research methods. With a continuous increase of telemedicine services this will improve over time.

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Relevant internet links:

Norsk Helsenett: <http://www.nhn.no/tiki-index.php?page=InfoNorskHelsenett>

British Medical Association: [www.bma.org.uk](http://www.bma.org.uk)

Norwegian Centre for telemedicine (NST): <http://www.telemed.no/>

Norwegian Centre for Informatics in Health and Social Care (KITH):  
[http://www.kith.no/templates/kith\\_IndependantWebPage\\_976.aspx](http://www.kith.no/templates/kith_IndependantWebPage_976.aspx)

SINTEF Health Research (SINTEF HELSE): [http://sintef.no/content/page1\\_598.aspx](http://sintef.no/content/page1_598.aspx)

Rural Health UK: <http://www.rural-health.ac.uk>

