Kristina Eriksson-Backa
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Exploring the Abyss of Inequalities

4th International Conference on Well-Being
in the Information Society, WIS 2012
Turku, Finland, August 2012, Proceedings

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Volume Editors

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Foreword

The Well-Being in the Information Society (WIS) conference series witnessed its fourth event this year. Yet the key concepts were already introduced 8 years ago, as the conference is biannual. This raises the question of whether the conference is like a 4-year-old child learning basic things about life or has it already reached school-age, learning new things systematically and with professional guidance.

This works as a metaphor for the special topic of our conference this year: disabilities, access to resources, impairment and asymmetric capabilities. What do you do when you look like an 8-year-old and are expected to behave like one, but for one or another reason you have only some of the expected capabilities?

The WIS conference series was established to discuss topics around health and well-being, the information society, and an urban (maybe also as a metaphor for modern) way of living. The conference is clearly multidisciplinary in its nature. Keynotes and accepted contributions of the conference program deal with at least two of the main topics of the conference, at best with all of them. As far as we know the brand of the conference is unique in its nature in the world.

Our current topic, unequal access to information society resources, is continuously gaining importance. Two big trends should especially be mentioned. First, the empowerment of individuals is a central topic, not least in medicine. Individuals must take the lead and manage their lives, including their health and well-being. This puts pressure on them and demands good access to information society resources. Second, society is in transition toward self-service at all levels and it is not possible to simply lean on the support of others when performing your daily activities. This is witnessed in the emergence of e-everything: e-health, e-business, e-service, e-government, etc.

What then are these information society resources that we refer to? They are simply all services and resources people need for a normal life, but the key issue is that they are all solely or most easily available through computer interfaces and networks. These include, for example, banking services, health information, entertainment, education, contacts to other people, say, through social media, and public services of almost all kinds.

Both trends put special pressure on people who have disabilities in one way or another. Those with health-related and functional problems with senses such as vision and hearing impairments are the hardest hit when it comes to information processing, but also problems related to moving from one place to another or motor coordination can heavily influence the use of information society resources. To take full advantage of, say, modern computer user interfaces, one should have complete vision, hearing, and motor coordination.

One important issue, however, is to understand that we are all influenced: we are all disabled in one way or another. To take a simple example: we are not all able to speak and communicate (we are deaf and mute) in 99% of the

world's languages. Actions taken to improve the life of disabled individuals are supportive also toward the life of "normal" people, they very seldom, if ever, are in contradiction with the needs of the general population.

Information technology must not simply be regarded as a problem and challenge for the impaired. On the contrary, it provides a plentitude of solutions and possibilities for all, including those with disabilities. The challenge is to make demand and supply meet, and this work must often be very detailed and professionally supervised. To make this happen, conferences like WIS are needed.

We are well aware of the fact that we are discussing a very sensitive topic in this year's WIS conference. Many people are at the very core of the phenomenon discussed, and might have a sensitive and personal connection to the topics at hand. We recognize that the conference material might include opinions and thoughts that are not accepted by everyone. We apologize already in advance should this occur. However, it must be accepted that we are all learners even here and that things never improve unless we initiate discussion and actions, even when not being fully routinized and, hence, in this respect also impaired.

We want to express our gratitude to all those who contributed to the organization and establishment of the conference this year. The authors and Program Committee members were in the central role, through contributing and further elaborating the scientific contents of the conference. Scientific conferences could not take place without a huge group of supporters. A great number of individuals contributed by personal work, and dozens of organizations placed their resources and valuable time to the disposal of the conference organization even this year. Your number is too great to allow individual acknowledgment here, but we wish to thank you all very much!

An academic conference is like life itself: the key is to meet people and interact with them. As this obviously is not always possible for all of us, reading the proceedings is the second best option. In this we wish you educative and illuminative moments.

Reima Suomi
Sakari Suominen

Editors' Preface

Health and well-being are for most people one of the most highly valued things in life, and even more so when we are unhealthy or do not feel well. Today, there are numerous possibilities to maintain our health or to manage in the world, as modern information society offers so many possibilities and tools that were not even present as recently as a decade ago. Still, it is a fact that many people either do not have access to or cannot profit from the available information.

Some trends that are more or less directly connected to health and well-being are clearly visible, not least in the Western world: the society is ageing, the number of people with non-communicable diseases is evermore growing, and more and more people live in urban areas. Since its start in 2006, the biannual conference Well-Being in the Information Society (WIS) has gathered researchers and professionals focusing on topics like health, information, and urban living to discuss these important issues. In 2012, the focus of the 4th WIS conference was on *exploring the abyss of inequalities* in our society. The world we live in is far from equal, and even if we only look at a small geographical area there are many inequalities: people of different ages, in different socio-economical or health situations, or with different kinds of disabilities and impairments have different needs, skills, and abilities to master information in the context of health and well-being. Health service providers, information providers, and designers of information systems and technological solutions all aim at minimizing these inequalities. The goal of this conference is to let these professionals meet and thereby support this work.

These proceedings contain 14 of the full papers that were accepted for presentation at the WIS 2012 conference. They cover five of the themes that are at the core of the conference: e-health, measuring and documenting health and well-being; empowering and educating citizens for healthy living and equal opportunities; governance for health; safe and secure cities; and information society as a challenge and a possibility for older people. The papers, authored by researchers originating from different parts of the world, contain both theoretical and practical approaches to the themes. Whether describing the current situation, addressing gaps, or suggesting solutions, the papers hopefully give the reader new insights and open up new ideas on how to tackle the abyss of inequalities in the rapidly changing information society. In doing so, yet another small piece is added to the gigantic puzzle.

Kristina Eriksson-Backa
Annika Luoma
Erica Krook

Organization

WIS 2012 was organized by the University of Turku (Turku School of Economics and Faculty of Medicine) and Baltic Region Healthy Cities Association (WHO Collaborating Centre for Healthy Cities and Urban Health in the Baltic Region) in cooperation with Turku Centre for Computer Science, Åbo Akademi University, Social Insurance Institution of Finland, and Turku University of Applied Science.

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Table of Contents

E-Health

Measuring and Documenting Health and Well-Being

Empowering and Educating Citizens for Healthy Living and Equal Opportunities

Governance for Health

Safe and Secure Cities

Information Society as a Challenge and a Possibility for Aged People

A Viewpoint for More Ethical Approach in Healthcare Information System Development and Procurement: The Four Principles

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Abstract. Healthcare is a field where the influence of ethics needs to be strong. It should also cover the area of information system development in healthcare. Great amounts or research about ethics, healthcare and information system development and combinations of those can be found. However, the actual development of healthcare information systems has a serious lack of understanding of ethical codes of healthcare and it seems that financial values may bypass ethical ones. Several examples of the consequences to healthcare information systems, in which financial values in conjunction with technological determinism are controlling the decisions, are presented and critiqued.

The four principles of medicine: beneficence, non-maleficence, autonomy and justice are seen as a promising basis for analysis of information system development in healthcare. The four principles seem to be suitable for healthcare professionals and – as discussed in this paper - for information system developers. Hence these principles could be held as the common ethical ground for both. If these principles could be put into actual use in information system development of healthcare sector many problems faced would be solved, or at least some of the main problems in it can be revealed.

Keywords: e-Health, e-Government, healthcare system development, medical ethics, information ethics, information systems.

1 Introduction

Ethics has had a strong influence and connection to western medicine. The Hippocratic Oath is still widely known and it is considered the foundation of western medical ethics, although the modern ethical view of healthcare is much more complex and pluralistic. Likewise, from the beginning of nursing, the ethical nature of the work of the profession has been emphasized. Ethical codes define the duties of nurses, give guidelines for ethical actions, express the virtues of nurses and provide nurses with core values and standards [1]. Thus, ethical reflexivity towards the work process

has a major role in the field of healthcare and is – or at least should be – the standard position in the field.

There are four principles of medical ethics which have been the basis of medical ethics: respect for autonomy, beneficence, non-maleficence, and justice [2-4]. These principles should be considered as a simplification of the codes of ethics – as a necessary but not as a sufficient condition.

Medical professionals and organizations are bound to follow the ethical codes and standards when treating people. If the public intent is to keep the healthcare systems ethically justified, it is mandatory to extend this thinking also to the healthcare information systems in more extended rate than it appears to be currently. Thus the medical ethics as a field should cover not only the healthcare professionals, but also the developers of healthcare information systems.

However, this has not been the situation in the current way in procurement, development and implementation of healthcare information systems. The healthcare information systems are a tool for achieving better health and quality of life for citizens and, as with any other healthcare tools, it must function in the maximum quality achievable within reasonable limits. If – and when – these systems are created without the aid of ethical analysis and guidelines, the whole purpose of the dependant field, i.e. healthcare, is compromised.

This paper proposes that the four principles of medical ethics is a promising ethical basis for healthcare information system development. It is simple and, when more deeply inspected, it covers quite well the needs of healthcare information systems as well as healthcare as a field. It does not solve all possible problems but its strength is that it can be used as a common ethical basis. Hence, different professionals can derive and sharpen their own, more specific ethical codes and rules and still have common ethical basis for discussions and analysis of actions. To summarise, the usage of the four principles does not remove all the problems, but the usage is a huge ethical leap compared to current procurement, development and implementation of healthcare information systems.

What kind of practical changes are needed in the current way of developing and procurement of information systems must be analysed in more detail in future research. Nevertheless, the four principles of medicine should be used not only as an optional guideline but as an ethical requirement specification for healthcare information systems.

2   The Four Principles of Medicine

Respect for autonomy, beneficence, non-maleficence, and justice are the basis for medical ethics [2], [4]. Ethical codes or principles for medicine and for medical informatics where the number of principles are extended or varied when compared to the four principles of medicine exist (see e.g. [5], [6]). The four principles cover those other principles, which usually are more specifically defined ethical codes or principles. Hence, the four principles of medicine could in a more general manner bind those other codes together and prevent the fragmentation of ethical codes – if

chosen to be as the basis for the procurement, development and implementation of the healthcare information systems at large.

This concept of the four principles as the basis does not remove the need for more specific ethical approach in specific areas of healthcare. Moreover, this approach enables a common discussion ground for the different specialists in healthcare organizations, information system developing and for authorities who make the decisions of procurement process or development of healthcare information systems.

There has been criticism toward the four principles. It has been argued that the four principles-approach is too narrow to solve all the ethical problems faced by the healthcare field [7]. This criticism is focused against the four principles of medicine, but it can be generalised against the whole field of medical and healthcare principles of ethics, including those in healthcare information systems. In this paper is argued that like Gillon [8] mentioned, the four principles of medical ethics provide a widely accepted moral basis and does not exclude more detailed codes or professional codes. Even though the four principles have been criticised; they have none-the-less been kept as the basic principles for healthcare. Thus, these principles should be implemented in the procurement, development and implementation of healthcare information systems as well, as a mandatory but not a sufficient requirement and to be extended with more specific guidelines for specific professions of healthcare.

2.1 Autonomy

Autonomy – "To be autonomous is to be a law to oneself; autonomous agents are self-governing agents." [9].

Autonomy is seen in different ways by different philosophical views. Both Utilitarian and Kantian ethics address the importance of a person's autonomy. The difference between the Utilitarian and the Kantian view is that the Kantian view regards autonomy as a constituent property of a person – as does Hermeneutic philosophy – whereas the Utilitarian view emphasises more the patient's freedom of action. However the Kantian way of thinking about violating of autonomy as violating of ones humanity and not treating one merely as means is a stronger and more uncompromising position than the Utilitarian position[10]. The Hermeneutic view of health and being a patient also emphasises the person's rights and individual experiences of health [11-12].

The Hermeneutic view could be seen as supporting the Kantian view by pointing out the meaning of the patients personal and unique experience over their life, while the Utilitarian view sees that autonomy is good for its outcomes. Even though the starting positions of this paper are the Kantian view and the Hermeneutic philosophy, and thus autonomy should be seen as an intrinsic value and it must be fulfilled to have ethical medicine or healthcare, nevertheless, this chosen view is not in conflict with the Utilitarian view of patient freedom, for the patient's experience and decisions must be respected in both the Hermeneutic and the Kantian views as well.

Four main points are defined for patient autonomy. First, human rights and values in healthcare have to be taken into account. Second, patients have rights to information about healthcare services available to them and they must have access to

their own health information. Third, informed consent of the patient is a prerequisite for autonomy. Fourth, confidentiality and patient's privacy must be respected. [13] These four main points need to be fulfilled by the system or problems for autonomy exist.

2.2   Beneficence and Non-maleficence - Two Sides of the Same Coin

Beneficence and non-maleficence – "Thus, the traditional Hippocratic moral obligation of medicine is to provide net medical benefit to patients with minimal harm - that is, beneficence with non-maleficence" [2].

These two principles must be considered together when aiming at producing net benefit over harm. At the same time they must be kept separated for circumstances when beneficence is recognised to assure that the contents are derived from both principles. There is still the obligation to do no harm even when it is not known what (if any) the benefits are. [2] The outcome must be beneficent and worthwhile for the patient. Practice should always produce substantial beneficence for being ethically justified. [14] To achieve non-maleficence, one must pursue the goal of not harming the patient in any way [3].

When the goal of not harming at all is only ideal and sadly not always possible, the effect of action must be analysed such way that we can be sure that predictable outcome is beneficial and the harm is lesser than the benefit. That means that shibboleth [see 15] "Primum non nocere" — "First (or above all) do not do harm", is not valid for healthcare, because in healthcare usually some harm (pain, minor harm etc.) must be caused to prevent greater harms and thus the avoidance of harm(s) is not fully possible. By analysing beneficence and non-maleficence we can better analyse the advantages and disadvantages of the chosen action(s). After both sides are inspected, analysis of the worth of action is possible and better justified.

There is a clear Utilitarian justification for beneficence and non-maleficence, whereas the Kantian and the Hermeneutic views ensure that people are not forgotten to the status of mere subjects of healthcare which could too easily occur on a pure Utilitarian approach. Kant's categorical imperative's second formulation states: "Always act so that you treat humanity, whether in your own person or in another, as an end, and never merely as means." [16]. Patient autonomy (likewise Justice in the next chapter) must be taken in account even if some action or treatment is beneficial and non-maleficent. Thus, the persons should not be treated as mere targets of the operation, but always as individuals, who have their own needs and requirements. Their opinions should always be respected, even when those opinions are not followed in order to fulfil the demands of humanity.

Systems should always increase the effectiveness of healthcare, that is, make the treatment better. If the systems do not increase beneficence compared with the previous way of action, there is a problem of beneficence. Thus, only systems that actually improve the functioning of our healthcare are acceptable from the beneficence perspective. If the resources are used to something which is not increasing beneficence, it actually produces a malefic action, for thus limited resources are away from some other need. Therefore, when healthcare uses its

resources poorly, a problem of non-maleficence does not occur only when we are directly harming patients but also indirectly when wasting resources better used elsewhere.

2.3   Justice

Justice – it is not easy to say what kind of healthcare would be just. Gambell et al. [14] state that: "if we care about people regardless of their worth, the basis of this should probably be need".

It is obvious that there usually are needs in excess of the resources of healthcare. Thus, there will be conflicts of interests and different opinions for the responsibilities of healthcare organisations, but those opinions should always be reasoned and justified. Justice as fairness by John Rawls [17] is kept as the definition of justice in this paper. Thereby fairness is what binds the healthcare and thus the systems of healthcare must be endorsing fairness at all levels.

Besides the ethical justification, there is also a legal obligation for healthcare. For example, every person living in Finland has a right to receive treatment based on their health within the boundaries of the healthcare resources [18]. To maximise the overall benefit, limited resources should always be used as effectively as possible. This is a challenging task to achieve, but it should be taken very seriously without just yielding to the challenge. The healthcare system should aim for delivering fairly allocated care for all the people in need of care.

The main point in healthcare is to maintain people's health or getting their unbalanced health back to balance [11-12]. If healthcare is not directly or indirectly fulfilling this goal, there is a problem with justice. If healthcare is not based on peoples' needs, people are treated as means only and Kant's categorical imperative's second formulation is harmed. Without an ethically acceptable reason healthcare has no justification for its existence. Thus, healthcare must fulfil the demands of fairness in order to be justified. Equal and fair treatment of people when they are in need of help justifies the existence of healthcare. People should have access to care which they need and which healthcare can arrange with allocation of its limited resources [19]. Thereby, healthcare systems must fairly deliver care for people and justifying the use of its limited resources is a necessity for having an ethically justified healthcare system.

3   The Problem

Four main points are defined for patient autonomy. First, human rights and values in healthcare have to be taken into account. Second, patients have rights to information about healthcare services available to them and they must have access to their own health information. Third, informed consent of the patient is a prerequisite for autonomy. Fourth, confidentiality and patient's privacy must be respected. [13.] These four main points need to be fulfilled by the system or problems for autonomy exist.

Information technology has been developed with a fast pace during the last decades. Possibilities for how and where information technology can be utilised are numerous. Last years have been a time of development for national electronic health records in many countries [20]. When analysing modern healthcare systems, it seems obvious that information technology has a huge impact for how these systems work. Because of the ethical demands for healthcare, technology should be supporting the fulfilment of those demands. Information technology should be used efficiently and it should add value in healthcare. An alarming sign in the development of healthcare information systems is that they seem not to have fulfilled the expectations placed on them and – as a more alarming sign – there is no clear idea how these expectations could even be achieved [21]. However, Himmelstein et al. [22] have given reasons why the technology has not produced the excepted efficiency: Firstly, acquiring and using systems create so great costs that the system cannot return the investment in benefits. Secondly, efficiency takes place only in some parts of the implementation. Thirdly, the suppliers of these systems do not deliver systems which are optimized for the user organizations. Heeks [23] again presents seven design–reality gaps in healthcare information systems which are seen as sources of problems. Those gaps are: information, technology, processes, objects and values, staffing and skills, management systems and structures, and other resources. Problem is that ethical codes, which are vital part of healthcare professionals work and very centre of healthcare, are given so little focus on the healthcare information system development. Hence, the common ethical basis must be brought forth for both, not just healthcare professionals but also for developers of healthcare information systems.

The main set of problems with eHealth systems are related to security, privacy, functionality and (ever rising) costs; where the cutting of costs tends to be in contradiction with the previous three. Most eHealth systems are considered as critical systems (for a more thorough definition of critical systems, see e.g. [24]) sustaining patients' health, well-being and privacy.

These systems are mainly acquired from private information system providers, whose main interests are financial, and thus can often be in contradiction to the interests of the healthcare field. Therefore clear codes of ethics must be produced for eHealth information system development processes.

If the ethical demands for healthcare are not expanded to providers of healthcare information systems, healthcare's ethical position is endangered, because information system cannot separated from the environment in which it is used. Healthcare information systems (eHealth systems) are a part – as any information system is an inseparable part of the work for which it is used [25] – of healthcare, affecting the whole healthcare work system. Making a change in the eHealth system changes the whole work process and thus the whole healthcare environment which is in relation to the particular system and thus has inevitably the ethical aspect and consequences.

The aforementioned healthcare information systems share one common criterion: there are no clear ethical standards in either procuring or developing them. This actualises one of the greatest problems in all healthcare information systems: they are created with only the standard moral of their creators and procurers. Thus these

systems – even when they retrospectively analysing are done right – have no ethical justification for their existence, the ethical viewpoints in procurement, development and implementation are not visible.

4 Discussion and Future Work: Why to Implement Four Principles of Medical Ethics in Healthcare Information Development?

The four principles could be used as a tool for ethical evaluation of information systems procurement, development and implementation in the healthcare sector. Thus, these principles should be fulfilled in systems which are designed and implemented in healthcare. When the ethical codes have been developed to fulfil the idea of medical healthcare but are implemented for only a part of the modern healthcare process, the values of security, privacy, functionality the aforementioned codes are developed to protect is compromised.

eHealth applications and systems are easily comparable with other critical eGovernment solutions [24]. Numerous U.S. and European eGovernment solutions share the similarities of poor system design and implementation. These solutions have caused danger, death and other outright unjustifiable consequences [24], [26-32]. Some decisions in critical eGovernment systems can make a slippery-slope against the privacy of the citizen [31-32] and thus these kinds of possibilities should be kept in mind while developing eHealth applications. The system functionality in critical eHealth applications is a key not only to success, but a requirement for the society's critical services. Lack of a proper ethical implementation can compromise the values that are the foundations of healthcare.

Our argument – which is brought out for debate – is that the four principles could be used as common ethical ground for healthcare professionals and healthcare information system developers. The four principles cover the main needs of healthcare's ethical demands and if they were used and internalised by information system developers when implementing information systems, problems could be analysed or even prevented, through a common ethical language.

Our next step is to further analyse the field of healthcare and to generate new methods in verifying the implementation of the four principles of medicine in healthcare information systems in such manner that the ethical guidelines are visible for not only in the development phase, but in the whole life chain from the IS pre-analysis, procurement, development, implementation and usage to the replacement of the system with more modern one.

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Social Media's Potential in Improving
the Mental Well-Being of the Unemployed

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Abstract. This article presents research into the compensating potential of social media for the psychological consequences of job loss. In particular the questions to be answered are whether subjective well-being as well as perceived exclusion are influenced by involvement in social media, and whether age as a context variable may moderate these influences. We demonstrate, based on 2,400 telephone interviews with unemployed persons in Germany, that the use of social media may indeed increase well-being for the unemployed, if they can transfer their online contacts in real social life activities. This transfer is, curiously, easier for older participants. Digital Immigrants display a different relationship structure in their online social networks which allows them to alleviate the more exclusionary effects, whereas Digital Natives are in jeopardy to feel more excluded due to their social media usage.

Keywords: Well-being, perceived exclusion, social media, unemployment.

1 Introduction

Losing employment and becoming unoccupied can certainly be an unpleasant experience. The negative effects of unemployment stem out of material deprivation, and many unemployed individuals drop out of their previous social networks, lose contact with their work colleagues, and risk becoming socially isolated, which results in a severely decreased state of mental well-being. In this contribution, we ask whether social media, in particular social networking sites and online communities, which witnessed a meteoric rise over the last decade, may exert an effect on the mental well-being of the unemployed. With their altered communicative and social predispositions, social media networks might open up new potentials to cope with the psychological consequences of social isolation that often are prevalent for those recently rendered unoccupied. Thus, our research looks whether social media might be instrumental in compensating for the psychological consequences of job loss. In particular, this study looks at the questions of whether subjective well-being and perceived exclusionary states are influenced by an individual's involvement in social media. This study also investigates whether age as a context variable may moderate these influences. Overall, our research intends to shed light on the possible spill-over effects from social media activities onto real life attitudes and cognition.

The four key interrelated constructs for answering these questions, unemployment, well-being, perceived exclusion, and social media involvement, were operationalised according to the social psychology and Internet sociology literature. These constructs were subsequently subjected to a structural equation model based on the data of 2,400 unemployed individuals.

2   Literature

A number of studies on unemployment have demonstrated the influence that holding a job has on psychological well-being and social inclusion (e.g. [1-3]). Conversely, a considerable amount of literature has been published on the psychological consequences of unemployment, noting that the loss of employment and (long-) lasting unemployment usually go hand in hand with the deterioration of people's social inclusion and an increase in mental illnesses [3-7]. In particular, unemployment is linked to anxiety, depression, unhappiness, lower self-esteem, a lower level of life satisfaction, and stress-related physical symptoms (e.g. [2], [8-16]). Furthermore, the loss of employment, the accompanying loss of the circle of colleagues, and possibly the loss of other supportive social networks may result in an altered feeling of inclusion or even change into social isolation [17]. The feeling of no longer being relevant in society may cause one to depart from social interdependence structures and may therefore lead to a general feeling of uselessness and banishment into a world of exclusion [18]. These life breaking points may show an individual's limits in their ability to control their own life circumstances. However, not every precarious position must lead to a subjective feeling of exclusion. Rather, the perception of an individual's position depends on how he or she may think he or she can successfully face the situation with his or her own resources.

In our research, we hypothesise that one of those resources is social media. We argue that social media may have an effect in alleviating the mental negative effects of unemployment. Prior research in Internet sociology found that the Internet offers a new way of addressing social isolation. Internet applications may alleviate social isolation by providing a point of contact, especially for socially inhibited people such as the unemployed. Some of the causing factors may be the Internet's anonymity and congeniality, the amount of interaction control, and the opportunity to communicate with like-minded others, which increases the feeling of safety and emotional closeness [19-21]. The Internet may serve as a third place where the unemployed may find social support and initiate or participate in (online) activities complementing real life, where they may want to hide the parts of their identities that promote the stigma of unemployment. This raises the question of whether a difference exists between the involvement in online and offline contacts and how these interactions are related, i.e., whether they are mutually reinforcing, leading to a general increase of inclusion [19], or whether they impede each other, leading to exclusion or isolation of the individual from real life [22], which diminishes the individual's well-being.

Sensitivity to context variables is important in eliciting the question of whether new technologies affect mental well-being in adverse situations. A number of studies have found that the involvement of the individual in his or her social networks – online and offline – depends on other social demographic factors (e.g. [18], [23]). The

effect of age in particular is discussed in terms of Internet usage [22], access [24], and participation in social media groups [23], [25]. Furthermore, social demographics may have an effect on the perceived negative consequences of unemployment [26-27]. Particularly, the context variable age is associated with the duration of unemployment and therefore also with subjective well-being [28].

To what extent Internet applications have an actual impact on the individual and the social life of the unemployed remains unanswered in the literature. Furthermore, it remains open whether involvement in social media groups has the potential to compensate for social isolation and exclusion and, consequently, improve an individual's well-being. To model those effects, we tried to incorporate them as best as possible in our empirical investigation and in subsequent modelling, as will be explained in the following sections.

3   Method

Based on the identified relevant issues, we used a two-step mixed-methodology design. In the first step, the method of qualitative interviews was chosen to examine the object of study from the participants' perspective and to prepare for the actual telephone survey by fine-tuning the questionnaire, adjusting the items to meet the target group, and directing the hypotheses.

Next, the hypotheses were tested with quantitative data analysis. The data for this step was derived from 2,400 telephone interviews with unemployed persons, who may or may not be users of social media; these interviews were conducted from February to April 2012. Participants were drawn from the pool of the German Federal Labour Market Authority via random sampling. In addition, a disproportional sampling was applied, using three characteristics that were subsequently combined to form twelve cells in total: age (up to 25 years, 26-50 years, over 50 years), gender (male, female), and urbanity (urban areas, rural areas).

3.1   Hypothesis Development

The derivation of the hypotheses is based on both the results of the literature review and on the results of the qualitative semi-structured interviews, which were conducted with 28 unemployed individuals selected by a contrasting sampling method.

In our interviews, we found that the longer and more frequently an individual used social media, the more secure they felt within these websites and other new Internet applications. This can be attributed to the importance of the peer group regarding self-esteem and developmental tasks [29-30], which in the context of social media, are important not only for the development of a general media literacy (e.g., locating, accessing, processing and appropriately applying information) but also for the ability to mentally cope with the ever-increasing technological novelties [31]. Therefore, we hypothesise that:

> *H1: How an individual feels when using the Internet, the well-being in the web, is dependent on the involvement of the individual in social media.*

According to our interview partners, social networks such as Facebook were the predominant means to cultivate current contacts. The possibility of establishing new contacts that expanded the social network was rarely perceived. However, the literature goes further by pointing out that because of Internet applications, users may not only have more frequent contact with their family and friends [32], but people using Internet applications may also visit friends and talk to them (on the phone) more frequently than non-users [33], which leads us to the next hypothesis:

> *H2: There is a positive effect from a person's involvement in social media on their involvement in real life.*

Because the subjective well-being of a person is composed by several factors, as stated above, we assume that:

> *H3: Well-being in the web influences an individual's general well-being.*

Our interviews showed that the loss of personal contacts and the concomitant feeling of exclusion were not only ascribable to the loss of the circle of colleagues but were also due to being marked with the status of unemployment (e.g. [3], [17]). Therefore, we postulate the following:

> *H4: Involvement in real life has an influence on the feeling of exclusion.*

Furthermore, our interview partners stated that they felt emotionally supported discussing their feelings with close friends or family. However, a positive relationship between a social environment and personal well-being is not the only relationship that can be estimated. Jordan et al. (2011) [34] hypothesise that people have a tendency to overestimate the pleasantness of another's emotional life compared to theirs, which may have serious consequences for their well-being. Therefore, we propose the following:

> *H5: Involvement in real life has an impact on well-being in real life.*

Regarding the involvement in social media, we found in our interviews that social media can not only compensate for but can also enhance unemployment's negative effects. For example, social media can be used not only for emotionally distancing but also as a distraction. In this context, social media use can even be associated with a decrease in communication (in a real life context) and therefore an increased feeling of loneliness [22]. This view is strongly expressed in the literature about Internet addictions, which assumes that the excessive time spent online leads to feelings of loneliness, isolation, low self-confidence, and low self-esteem [35-37]. From this, we argue the following:

> *H6: Involvement in social media has an influence on the feeling of exclusion.*

The feeling of no longer being part of a society can be linked on the one hand to objective dimensions, such as precarity, and on the other hand to more subjective feelings [3], [18]. Therefore, we hypothesize the following:

> *H7: The general well-being depends on the individuals feeling of exclusion.*

Among other factors, in our interviews, we also analysed the relationship between socio-demographics and the involvement in online and offline social networks. While we cannot affirm that young adults are more likely than older generations to create content [see 38], we recognised a difference regarding the chosen communication channel. Whereas young adults (19-30 years old) mainly communicated via social networking sites, the age group of 25-39 years preferred e-mail. Those who were 40 years and older preferred forums. Furthermore, we found age differences regarding different attitudes towards (new) technologies. The older the interviewee was, the more reservations they had. Regarding a person's general well-being, previous research stated that the negative psychological effects of unemployment are stronger for middle-aged adults than for younger adults [28], [39-44]. Therefore, we deduce the following hypothesis:

H8: All effects (H1-H7) are moderated by age.

An overview of the hypotheses H1-H7 is given in Fig. 1.
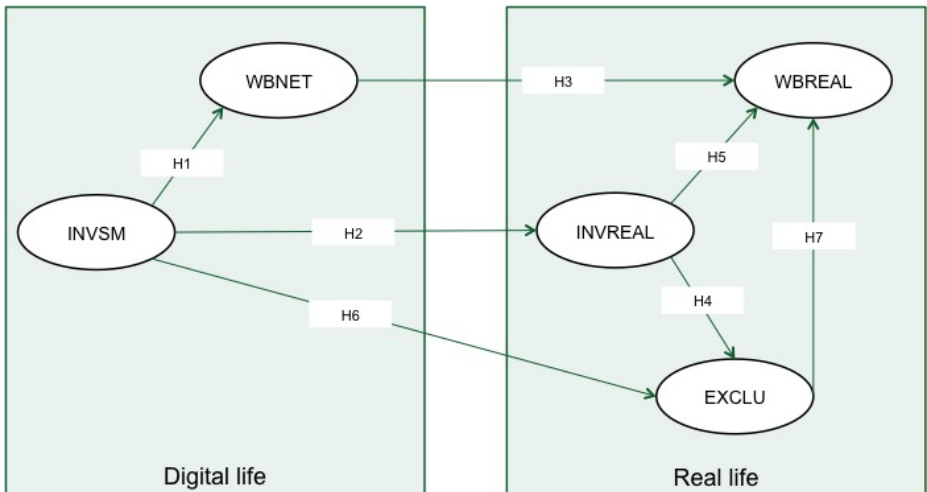
Fig. 1. Overview of H1-H7

3.2   Measures Development

In the first step, we operationalised our latent constructs. To this end, existing scales were used, or when necessary, similar scales were adopted. The quality of belonging to a social media group and being involved (INVSM) was measured by adopting the scale of private and collective membership self-esteem [45]. The items for measuring social media well-being (WBNET) were adapted from the Davis, Flett, and Besser [46] social comfort scale. The scale of involvement in real social life (INVREAL) was captured with items originally suggested by Howard, Rainie, and Jones [32]. Following Bude and Lantermann [18], we measured the general feeling of exclusion by four items (EXCLU). Furthermore, 3 out of 5 items of the Mental Health Inventory [47] that account for anxiety, a general positive effect, and depression were selected

to develop a scale for general well-being in real life (WEBREAL). The definition of each construct is summarised in Table 1.

Table 1. Definitions of the used constructs

Construct	Definition
INVSM	An individual's view of their own social media group and their own value as a member of this group.
WBNET	The degree of social comfort while being online.
INVREAL	The degree of an individual's involvement in real social life activities.
EXCLU	General feeling of being excluded from society.
WBREAL	An individual's well-being status concerning anxiety, general positive effects, and depression referring to general real life.

An initial version of the questionnaire was conducted by four experts in the field of communications and sociology to evaluate the relevance and validity of these items. Within the final pretest, the questionnaire was tested by 43 unemployed respondents of different gender, age, and urbanity level to check for the item comprehensiveness and manageability for telephone interviews. Based on these results, the questionnaire was simplified and shortened. Although all of the scales have been used in previous studies, we conducted principal component analysis to ensure internal consistency. The final item set is shown in Appendix A.

3.3   Sample

To generate a representative sample of unemployed persons in Germany, 16,455 individuals from the pool of the German Federal Labour Market Authority were invited to take part in the 30 minute telephone questionnaire conducted by a CATI studio. Overall, the study involved a representative German sample of 2,414 people. The majority (79.4%, N=1917) used several Internet applications. Only 11.6% are non-users, and 8.9% quote an infrequent use of one application, at most. These minimal users were also treated as non-users. A total of 1,133 stated that they were involved in at least one social media network and named the most frequently used one (see Table 2). Within the group of social media users, slightly over-represented were men (51.4%) and individuals from urban areas (53%). Overall, the majority of social media users (83.7%) have used the Internet for more than four years. A summary of the social media users' descriptions is shown in Appendix B.

Table 2. Most frequently named social media applications

Name of social network	Description	Percentage of social media users	Percentage of all participants
FACEBOOK	International social network www.facebook.com	71.4	33.5
XING	Professional social network www.xing.com	4.9	2.3
Wer Kennt Wen	German private social network www.wer-kennt-wen.de	3.6	1.7
MEINVZ	German private social network www.meinvz.de	2.6	1.2
STAYFRIENDS	International private social network www.stayfriends.com	1.8	0.8
JAPPY	German private social network www.jappy.de	1.7	0.8
STUDIVZ	German social network for students www.studivz.de	1.5	0.7
Others	-	11.3	5.3
No answer	-	1.2	0.5
No social media use	-	-	53.1

Of the 1,133 social media users, 913 answered all items. Thus, the following analysis is based on this reduced subsample without any missing values.

3.4   Data Analysis

To evaluate our results concerning convergent and discriminant validity, we first conducted an exploratory factor analysis. In the next step, we used principal component analysis. Finally, we applied a Varimax rotation. The results (Appendix B) show acceptable factor loadings and no cross-loadings between the several factor items. Overall, 58% of the variation can be explained. On the construct level, we used Cronbach's alpha (α), composite reliability (C.R.), and the average variance extracted (AVE) to assess the internal consistency of the scale. Discriminant validity can be assumed if squared multiple correlations with any other construct are below the constructs' AVE. This criterion is slightly breached by WBNET. Nevertheless, the

measures, except INVREAL, have acceptable levels of reliability. These results are shown in Table 3. Based on the postulated hypothesised model, we ran a structural equation modelling with Maximum-Likelihood estimation to test H1-H7 using Mplus 6. After that, multiple group analysis was employed to evaluate H8. Following Palfrey and Gasser's (2008) [48] definition of 'Digital Natives' as those generations born after 1980, the subsample was categorised in two groups: Digital Natives who were born after 1980 (N=557) and Digital Immigrants who were born before 1980 (N=247). Following the three step procedure suggested in the literature (e.g. [49-53]), we then tested the model for configural, metric and scalar invariance to assess the moderator effects of age.

Table 3. Descriptive statistics, AVE (bold values) and squared multiple correlations

	α	Mean	S.D.	C.R.	WBNET	INVSM	INVREAL	WBREAL	EXCLU
WBNET	0.76	3.21	0.23	0.73	**0.36**	0.40	0.05	0.00	0.01
INVSM	0.78	2.87	0.17	0.79		**0.49**	0.04	0.00	0.02
INVREAL	0.55	1.80	0.88	0.44			**0.21**	0.00	0.02
WBREAL	0.74	3.34	0.31	0.70				**0.43**	0.27
EXCLU	0.83	3.87	0.25	0.83					**0.55**

4   Results

As shown in Fig. 2, involvement in a social media group is a significant and strong predictor for well-being in the Internet (β=0.633, p<0.001) and of involvement in real social life activities (β=0.217, p<0.001). Surprisingly, the direct effect from the degree of belonging to a social media group on the subjective feeling of exclusion is significantly positive (β=0.177, p<0.001), whereas the effect from involvement in real social life activities is negative (β=-0.168, p<0.001). Nevertheless, H7 was also supported (β=0.530, p<0.001), suggesting that an individual's well-being status is highly interrelated with their perception of exclusion. The well-being status in real life is not significantly affected by either the social comfort while being online (p> 0.05) or by real social life activities. Thus, H3 and H5 were rejected. Within the model, a significant portion of the variance on well-being while being online (R^2=0.401) and the general well-being status (R^2=0.275) were explained by the suggested relationships. Due to the complexity of the constructs, the values of explained variance on involvement in real life social contacts (R^2=0.047) and the general feeling of exclusion (R^2=0.047) are very small. As observed in Table 4, all model fit measures are excellent.
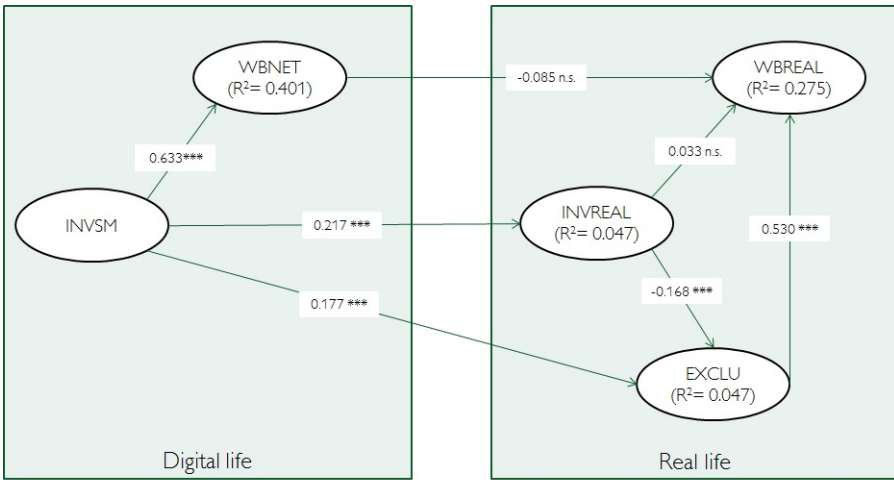
Fig. 2. Results for H1-H7: Standardised loadings and latent variance explained

Table 4. Model fit

Value (Chi-squared)	385.662
Degrees of Freedom (df)	145
P-Value	0.0000
Chi-squared/ df	2.66
RMSEA	0.043
CFI	0.945
TLI	0.935
SRMR	0.042

The most striking results to emerge from the data are that belonging to a social media group directly increases the general feeling of exclusion and that well-being in the Internet does not significantly affect well-being in real life. To assess this relationship more in-depth, the indirect effects are reported in Table 5. Interestingly, the indirect effect on exclusion from belonging to a social media group mediatised by real social life activities is negative (β=-0.036, $p<0.05$). Further, the indirect linkage of social media group belonging and an individual's status of well-being via well-being in the Internet is weakly significant.

Table 5. Indirect effects

Relationship	Indirect effect (standardised)
INVSM->INVREAL->EXCLU	-0.036 *
INVSM->WBNET->WBREAL	-0.054*

To assess the measurement model's equivalence for Digital Natives and Digital Immigrants, we tested 3 model variations as reported in Appendix D: an unconstrained model, M1; M2 with constrained factor loadings; and M3 with constrained intercepts. All model fits are excellent. Thus, the multiple group analysis conforms to the requirements. The results of multiple group analysis in Table 6 illustrate that several of the identified effects are moderated by age. The effects of H1 and H6 are particularly stronger for Digital Natives compared to Digital Immigrants, whereas the relationships within H2 and H7 are stronger for older users.

Table 6. Summary of moderation effects (H8)

Hypothesis Number	Independent Construct	Dependent Construct	Moderator	Explanation
H1	INVSM	WBNET	Age	Effect is stronger for Digital Natives
H2	INVSM	INVREAL	Age	Effect is stronger for Digital Immigrants
H3	WBNET	WBREAL	None	Nonsignificant effect
H4	INVREAL	EXCLU	Age	Effect is weaker for Digital Natives
H5	INVREAL	WBREAL	None	Nonsignificant effect
H6	INVSM	EXCLU	Age	Effect is stronger for Digital Natives
H7	EXCLU	WBREAL	Age	Effect is slightly stronger for Digital Immigrants

5   Discussion

We expected to cover the viability of several hypotheses related to the inclusionary and well-being potentials of social media in situations of unemployment. Obviously,

increasingly more people, not only Digital Natives, belong to a social media group and quote this as a relevant effect for their perception of well-being in the Internet. Nevertheless, communicating with friends online and belonging to an online group is a strong predictor for subjective well-being in the Internet, especially for Digital Natives. While for Digital Immigrants, other aspects such as skills and maybe applications for seeking information are further important predictors. Surprisingly, Digital Immigrants feel more comfortable on the Internet and evaluated their social media group as more important. A possible explanation for this might be that the decision making process for registering in a social media group is more intentional for Immigrants, whereas it is a common practice for the younger generation. Consequently, the elderly individuals have a clearer and more positive view of their own social media group and their own value as a member of this group. Regarding the question of how social media influences feelings of exclusion, this study found that social media groups are a double-edged sword: in the direct way, without integrating real social life activities, social media increases feelings of exclusion. However, if unemployed people can manage to integrate social media group contacts into real social life activities, it reduces the general sense of exclusion from society. In comparison to Digital Natives, Immigrants belonging to social media groups is closely tied to their real social life activities. As a result, younger unemployed individuals are at a higher risk of feeling excluded, which strongly influences an individual's general well-being. Very little was found in the literature on the effects of social media on real life activities in situations of unemployment. As the results indicated, belonging to a social media group is helpful for real social life activities.

Overall, as our model demonstrated, social media constitutes a relatively small impact on real life, as an individual's general well-being is not directly affected by online feelings. Moreover, the results shed light on the question of whether an individual that is objectively disadvantaged may compensate for this status with social media. In sum, we note that using social media can lead to an increase in the well-being of the unemployed if they can transfer their contacts into real social life activities.

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Appendix A. Used Item Set

Construct	Variable	Name	Scale
WBNET	WBNET1	I feel comfortable when I am online.	1 (strongly agree) to 5 (strongly disagree)
	WBNET2	I can be myself online.	1 (strongly agree) to 5 (strongly disagree)
	WBNET3	I feel appreciated by other users.	1 (strongly agree) to 5 (strongly disagree)
	WBNET4	I don't feel lonely when I am online.	1 (strongly agree) to 5 (strongly disagree)
	WBNET5	Sometimes I can't stop browsing.	1 (strongly agree) to 5 (strongly disagree)
INVSM	INVSM1	I am proud of my friends in the network.	1 (strongly agree) to 5 (strongly disagree)
	INVSM2	It feels good to have these friends in the network.	1 (strongly agree) to 5 (strongly disagree)
	INVSM3	I can find support in the network.	1 (strongly agree) to 5 (strongly disagree)
	INVSM4	The network is important to me.	1 (strongly agree) to 5 (strongly disagree)
INVREAL	INVREAL1	How often did you visit a friend or an acquaintance during the last week?	1 = daily; 2 = 2-3 times; 3 = once; 4 = never
	INVREAL2	How often did you talk to a friend or an acquaintance on the phone during the last week?	1 = daily; 2 = 2-3 times; 3 = once; 4 = never
	INVREAL3	How often did you send messages (e.g., letters, e-mails, text messages) to friends or acquaintances during the last week?	1 = daily; 2 = 2-3 times; 3 = once; 4 = never

WBREAL	WBREAL1	How often have you been anxious during the last three months?	1 = daily; 2 = frequently; 3 = sometimes; 4 = infrequently; 5 = never
	WBREAL2 (reversed)	How often have you been pleased and easy-going during the last three months?	1 = daily; 2 = frequently; 3 = sometimes; 4 = infrequently; 5 = never
	WBREAL3	How often have you been depressed and sad during the last three months?	1 = daily; 2 = frequently; 3 = sometimes; 4 = infrequently; 5 = never
EXCLU	EXCLU1	Since I have been out of work, I am often afraid of falling behind.	1 (strongly agree) to 5 (strongly disagree)
	EXCLU2	Since I have been out of work, I often feel like other people have already given up on me.	1 (strongly agree) to 5 (strongly disagree)
	EXCLU3	Since I have been out of work, I often feel like I do not belong to society	1 (strongly agree) to 5 (strongly disagree)
	EXCLU4	Since I have been out of work, I often feel useless.	1 (strongly agree) to 5 (strongly disagree)

Appendix B. Profile of Social Media Users

Variables	Distribution	Percent
Gender	Male	51.4
	Female	48.6
Age	Below 30 years	59.8
	30-35 years	9.5
	36-40 years	6.5
	41-45 years	6.4
	46-50 years	6.2
	Above 50 years	11.5
Urbanity	Urban areas	53.0
	Rural areas	47.0
Educational level (according to the German school system)	No school-leaving certificate	4.4
	Hauptschule school-leaving certificate (after 9 years)	29.7
	Realschule school-leaving certificate (after 10 years)	35.3
	Advanced technical certificate	12.2
	Abitur certificate (Higher school certificate)	15.6
	No answer	2.8
Internet experience	Since 6 months	1.8
	Since 1 year	1.7
	Since 2 years	2.6
	Since 3 years	4.7
	Since 4 years	5.6
	For more than 4 years	83.7

Appendix C. Factor Analysis with Varimax Rotation for Multi-item Principal Constructs

	WBNET	INVREAL	INVSM	EXCLU	WBREAL
WBNET1	0.664				
WBNET2	0.647				
WBNET3	0.526				
WBNET4	0.624				
WBNET5	0.547				
INVSM1			0.706		
INVSM2			0.833		
INVSM3			0.603		
INVSM4			0.609		
INVREAL1		0.453			
INVREAL2		0.564			
INVREAL3		0.554			
WBREAL1					-0.634
WBREAL2					-0.595
WBREAL3					-0.752
EXCLU1				-0.625	
EXCLU2				-0.798	
EXCLU3				-0.841	
EXCLU4				-0.802	

Only values above 0.45 are shown. Variance explained 58 %.

Appendix D. Model Fit of 3-Step Procedure for Multiple Group Analysis

		M_1	M_2	M_3	Criterion
	Constraints	unconstrained	factor loading	intercepts	-
Chi-squared Test of Model Fit	Value (Chi-squared)	524.22	542.183	592.984	-
	Degrees of Freedom (df)	290	304	318	-
	P-Value	0.000	0.000	0.000	-
	Chi-squared/ df	1.81	1.78	1.86	**≤ 3**
RMSEA	Estimate	0.045	0.044	0.046	**<0.05**
CFI/TLI	CFI	0.940	0.939	0.930	**≥ 0.90**
	TLI	0.929	0.931	0.924	**≥ 0.90**
SRMR	Value	0.049	0.052	0.054	**≤0.05**

Virtual Health Check and Coaching: Insights from the Consumers and Implications for Persuasive Design

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Abstract. The lifestyle that people adopt directly influences their health and wellbeing. In recent years, there have been calls to action regarding the global burden of lifestyle-related non-communicable diseases (such as cancer, diabetes and heart disease). There is an opening for design solutions that allow people to manage and/or change their lifestyles, and address their health conditions. Persuasive technology has the potential to be in the forefront of novel health related prevention services, applications and products. The objective of this study is to investigate consumers' perceptions of Virtual Health Check and Coaching, which is a non-clinical web- and mobile-based system for personal lifestyle and health management. Specifically, we examine the consumers' insights through a persuasive systems design lens. Implications for persuasive design are discussed.

Keywords: behavior change support systems, eHealth, persuasive systems design, virtual health check and coaching.

1 Introduction

On a global level, chronic non-communicable conditions such as cancer, complications of diabetes, and cardiovascular diseases have become the primary causes of death. The World Health Organization's[1] projections of mortality and global burden of disease forecast that by 2030, more than three quarters (77%) of all deaths in the world will be because of such diseases. Eight risk factors (alcohol use, tobacco use, high blood pressure, high body mass index, high cholesterol, high blood glucose, low fruit and vegetable intake, and low physical inactivity) account for 61% of cardiovascular deaths [1]. These same risk factors combined account for over three quarters of ischaemic heart disease (IHD), which is the predominant cause of

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[1] http://www.who.int/healthinfo/global_burden_disease/projections/en/ (Last accessed: January 7, 2012)

mortality [1]. The major risk factors in question are usually associated with economically wealthy countries, but over 84% of the total global burden of disease they cause eventuates in low- and middle-income countries [1]. Admittedly, the lifestyle that people adopt directly influences their health and wellbeing. Importantly, the aforementioned risk factors are few and are lifestyle modifiable, and preventable to a great extent [2]. In recent years, there have been calls to action regarding the global burden of lifestyle-related diseases. The above discussion underscores the call for design solutions that allow people to manage and/or change their lifestyles, and address their health conditions. Persuasive technology [3] has the potential to be in the forefront of novel health related prevention services [4], applications and products.

The objective of this study is to investigate consumers' perceptions of Virtual Health Check and Coaching, which is a non-clinical web- and mobile-based system for personal lifestyle and health management. Specifically, we aim to examine the consumers' insights through a persuasive systems design [5] lens. The remainder of the paper is organized as follows. Section 2 presents related research. Section 3 discusses the research setting. Findings are presented in Section 4. Section 5 is for discussion and Section 6 concludes the paper.

2   Related Research

In the beginning of this century, Eysenbach [6] stated that the primary challenge in developing comprehensive systems for consumers is that there is modest knowledge of how individuals interact with consumer health informatics and how they process and act on information. Even now, several years later, the argument made by Eysenbach seems to be valid. In a more recent report by Jimison and colleagues [7], the most frequent barrier to consumer use of interactive health IT across studies was the lack of perceived benefit; lack of convenience was another important obstacle. Furthermore, subjects were less likely to use systems if they did not fit seamlessly into their regular daily routines. Other major hindrances to the use of the interactive consumer health IT were burdensome data entry and the lack of trust of the information provided. Unsurprisingly, technical issues often averted consistent system use. It is obvious that technologies cannot have the capacity to help facilitate self-monitoring and self-management or improve consumers' health outcomes if the consumers do not accept the technology [8].

According to Payton and colleagues [9: vi] there has been "a shift in the role of the patient from passive recipient to active consumer of health information and active user of healthcare devices, logging, and monitoring systems". Indeed, by providing consumers with access and tools to their own health information, we can begin to influence how they manage their health and well-being. Ultimately, consumer health IT applications and systems enable individuals to manage their health better and maintain a healthier lifestyle. Examples of consumer health IT include various technologies such as web- and mobile-based applications, social health technologies, and portable devices such as accelerometers and sensors.
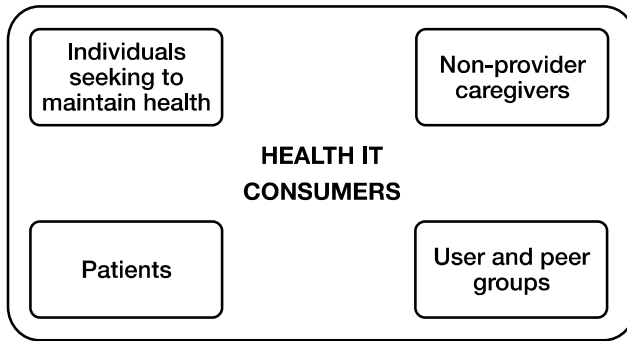
Fig. 1. Consumers of health information technology (adapted from Peyton et al. [9])

Regarding consumer health IT, Oinas-Kukkonen [10] has proposed a related generic concept: behavior change support systems (BCSS). BCSSs highlight autogenous and voluntary approaches in which people use information technologies to change their own attitudes or behaviors through building upon their own motivation or goals [10]. Behavior change support systems harness either technology-mediated persuasion or technology-to-individual persuasion. Technology-to-individual persuasion is fully automatized, whereas technology-mediated persuasion means that people are influencing other people through e.g. discussion forums, instant messages, blogs, virtual environments, or social network systems. Oinas-Kukkonen [10: 6] has defined a behavior change support system as follows: "*A behavior change support system (BCSS) is an information system designed to form, alter or reinforce attitudes, behaviors or an act of complying without using deception, coercion or inducements.*"

Evidently, the design and development of BCSSs consists of many different and connected parts. According to Oinas-Kukkonen[10], it links to technological services, applications, systems, platforms, and functionality, the quality and content of information, and social networks/environments, among other issues. Generally, the BCSSs must always be available, they have to address global and cultural issues with a multitude of standards, habits, and beliefs. Furthermore, they have to be adaptable into a variety of domains (e.g. healthcare, safety, energy conservation, education) and business models [10]. The key research areas in BCSSs include not only human-computer interaction and computer-mediated communication, but also approaches, methodologies, processes and tools to design and develop such systems and means for examining their individual, social, and organizational impacts [10]. The research highlights software qualities and characteristics, information systems analysis and design, and individual behavior and perceptions. From a technological perspective, the research may address socio-technical platforms, systems, services or applications, or the software features in them, developed for persuasive purposes [10].

The system under investigation, virtual health check and coaching, can be seen as an instantiation of a behavior change support system.

3   Research Setting

3.1   Description of the Behavior Change Support System under Investigation

Virtual Health Check and Coaching has been developed by Duodecim Medical Publications Ltd. The behavior change support system in question is based on the best available information regarding health enhancing lifestyle, and the impact of lifestyle on quality of life and life expectancy and also the possibilities of changing to healthier habits. The estimates for life expectancy and disease risks are based on several studies conducted by two national health institutes. Modifiable life style factors taken into account include nutrition, physical exercise, alcohol use, smoking, sleep, mental stress, and life skills. Also respondent's blood pressure, blood cholesterol value and parents' IHD morbidity are included in the estimation algorithms. Except for diabetes, chronic diseases are not taken into account in the virtual health check.
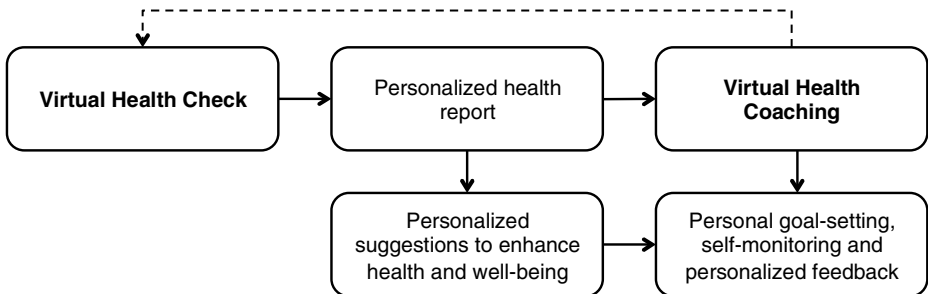

Fig. 2. Overview of Virtual Health Check and Coaching

After completion of the virtual health check, the individual starts using the virtual health coaching. The virtual health coaching provides personalized exercises, suggestions and feedback on a regular basis via e-mail and/or installable mobile application. The main topics of the coaching are: alcohol use, exercise, mental well-being, nutrition, sleep, and smoking. Coaching programs are based on evidence-based cognitive behavioral exercises. The program is not meant to be used to diagnose a disease or to predict falling ill with particular disease, but its estimates are statistical averages for a given age and gender group with a defined health behavior pattern. The advice given by the program is meant to support individual's health and well-being. Individuals who are concerned about their health and/or well-being are encouraged to consult a doctor.

3.2   Data Collection and Analysis

In November 2011, an online survey was conducted for the users of the Virtual Health Check and Coaching. Participants were recruited through an e-mail invitation to the survey. Data was collected over a period of a week using an online survey software tool (Webropol). The survey instrument consisted of demographic questions, five-point Likert scale items, and open-ended questions. Overall, 91 responses were obtained. In this study, we concentrate on the open-ended questions. The respondent characteristics are presented in Table 1.

Table 1. Respondent characteristics (N=91)

Characteristic	Value	Frequency (%)
Gender	Female	53 (58.2)
	Male	38 (41.8)
Age	Mean age 43.4 (± 9.7)	
	Range 19–71 years	
Education	Basic education	2 (2.2)
	Upper secondary education	15 (16.5)
	Specialist vocational qualification	9 (9.9)
	Polytechnic bachelor's degree	24 (26.4)
	Polytechnic master's degree	6 (6.6)
	University bachelor's degree	4 (4.4)
	University master's degree	28 (30.8)
	Other	3 (3.3)
Occupation	Working	80 (87.9)
	Retired	3 (3.3)
	Student	3 (3.3)
	Other	5 (5.5)

Majority of the respondents are "white collar" workers as most of them were working (87.9%) and had a university degree (35.2%). Only 6.6% (n=6) of the respondents were under thirty years old, and 3.3% (n=3) of the sample was over sixty years old. Thus, the sample mainly represents highly educated employees aged between 30 and 59 years. In general, this group might be considered as one of the prime target populations for consumer health information technology.

We interpreted the data through the Persuasive Systems Design Model (PSD) [5]. It is a recent conceptualization for analyzing, designing, developing and evaluating persuasive systems. The PSD model consists of a set of persuasive systems design principles under four categories: (i) primary task support; (ii) dialogue support; (iii) credibility support; and (iv) social support. The design principles in the primary task category focus on supporting the user's primary activities and goals. Design principles related to human-computer dialogue aid in achieving the goal set for using the system. The credibility support principles relate to how to design a system so that it is more credible and thereby more persuasive. The design principles in the social support category describe how to design the system so that it motivates users by leveraging social influence [5].

4   Findings

In this section, we present our findings with respect to the predefined and emerged themes. The predefined themes were based on the PSD model's [5] categories on persuasive system features: primary task support, dialogue support, credibility support. In addition to these themes, the emerged themes from the open-ended responses were: usefulness, ease-of-use (with technical issues), and compatibility to daily life (unobtrusiveness).

4.1   Primary Task Support

Primary task support encompasses reflecting on one's behavior, personal goal setting, and tracking progress toward them. It also deals with essential issues such as reducing disorientation and cognitive load towards system use, and adapting to individual user's tasks.

Several respondents gave negative feedback regarding the rather generic and non-tailored health-related advice:

> *"I do not smoke, but still the health coaching sent me information regarding health dangers of smoking. Is it not possible to find more suitable range of themes based on the person's basic information?"*
> (Female, 58 years old, upper secondary education)

> *"Some of the messages are too generic and there is repetition in the content nearly every week."*
> (Male, 38 years old, polytechnic bachelor's degree)

> *"Too generic. For example, there is no point informing a 51-year-old female that being overweight at twenty years old predicts weight problems later on."*
> (Female, 51 years old, university master's degree)

Harjumaa et al. [11] found out that tailoring and credibility are closely related. In their study, users were more motivated to follow the training program, because they knew that it had been tailored based on their personal data. Due to the perceived tailoring, the users perceived the system as more credible. As a related issue, Segerståhl et al. [12] argue that suggestions do not work if they are not up-to-date (e.g. tips to avoid gaining weight during Christmas in summer time).

The users are clearly more willing to engage with the system if the system reduces complex tasks into smaller subtasks. Some of the users reported that using the system was "nerve-wrecking" or even stressful. Also, many users mentioned burdensome data entry as an obstacle to fully interact with the system:

> *"Boring and detached from existing coaching and exercise applications. Unable to integrate well to daily routines, such as calendar."*
> (Female, 31 years old, university master's degree)

> *"If the service would provide me with an electronic food diary I might continue using the service, but in its current form I find the service to be more frustrating than helpful in my battle against my weight. Regarding personal goal-setting the coaching could be useful, but since the service does not provide me with everything that I would need, I have to use several different systems."*
> (Female, 38 years old, polytechnic master's degree)

Unobtrusiveness (as a design requirement) has also been identified by Consolvo and colleagues [13]. They suggest that the data should be presented and collected in an

unobtrusive manner, and the data should be available when and where the user needs it, without unnecessarily interrupting or invading users' daily routines:

> *"In my opinion, Sunday morning was not a very good time to ask for feedback."*
> (Male, 50 years old, university master's degree)

> *"When you are filling in your information regarding your exercise, one option could be that you are ill. If you are ill, you should not move too much, and if you just look at the weekly exercise goal, somebody might be pushed to do exercise, even if ill, just to meet the weekly goal."*
> (Male, 44 years old, university Master's degree)

> *"I got frustrated because of the too frequent monitoring."*
> (Female, 58 years old, upper secondary education)

> *"I was on a sick leave, so I was not able to fill in my information. Due to the illness I was not able to exercise actively."*
> (Female, 53 years old, polytechnic bachelor's degree)

Unobtrusiveness is also highly related to *Kairos*, the opportune moment. According to Fogg [14], timing has been overlooked in behavior change. In his opinion, the right moment for behavior performance is when motivation and ability put people above the behavior activation threshold [14].

4.2   Dialogue Support

It is generally accepted that IT artifacts are social actors [15-17]. Accordingly, people consider their interactions with IT artifacts as interpersonal in nature. Moreover, people tend to react to IT artifacts as if they were interacting in social situations. For instance, in an experimental study by Looije and colleagues [18] the subjects experienced the virtual and physical character as more empathic and trustworthy than the text-based assistant, and expressed more conversational behavior with the characters. Indeed, supporting the dialogue between the IT artifact and the individual users is essential. Dialogue support defines the key principles in keeping the user active and motivated in using the system and, ideally, helping the users to reach their intended behavior. In dialogue support, system-to-user prompts, praise and reminders play an important role [5]. The dialogue support may be further enhanced, for instance, by providing users with virtual rewards upon accomplishing certain tasks/goals. Providing appropriate feedback and suggestions to the user is also important. Finally, dialogue support promotes users' positive affect or feelings, which will likely influence users' confidence in the source (credibility).

The users requested for more reminders in order to keep them motivated in their endeavors:

> *"At first, I was waiting to be reminded via e-mail. When I did not receive the reminders, I forgot about the whole thing."*
> (Female, 50 years old, polytechnic bachelor's degree*)*

"I feel that the coaching stopped. Or is it because I did not update my information so actively any more?"
(Male, 49 years old, university master's degree)

According to Consolvo et al. [13] a key issue in system-to-user dialogue is being positive. They suggest that positive reinforcement should be used in order to encourage change. The user should be rewarded for carrying out the desired behavior and succeeding in achieving his/her goal, but should not be punished when the target behavior is not performed [13].

"The program did not provide me motivational support me in any way and did not remind me if I had missed something."
(Female, 37 years old, university master's degree)

"Unfortunately, I feel that the virtual health coaching is too rigid and distant."
(Female, 51 years old, university master's degree)

4.3   Credibility Support

Credibility and trust are important, related constructs. According to Everard and Galletta [19] the apparent difference between trust and credibility is that "trust is an attribute of an observer (to have trust), whereas credibility is an attribute of another person or an object of interest (to be credible)" [19: 60]. In their view, trust is a manifestation of credibility, which could be considered to be trustworthiness. Labels such as accepting the advice, trusting the information, and believing the output are seen as conveying computer credibility [19: 59]. Prior research on online trust has favored dividing the trust component into various subcomponents, such as knowledge-based trust, institution-based trust, and cognition-based trust. According to Sillence et al. [20] various factors are likely to govern the extent to which individuals feel they can trust health advice online: (i) credible and aesthetic visual design, (ii) branding of the site or presence of familiar images or trusted logos; (iii) quality of information (perceived expertise); and (iv) personalization. In this study, credibility issues did not arise from the responses.

4.4   Social Support / Influence

Admittedly, our social relationships are increasingly maintained through technology-mediated communications. Using social networking systems and applications is a part of daily lives (both leisure and work) and routines of billions of individuals. Technology-mediated communications can aid in forming and maintaining online relationships that can facilitate social support. It is generally acknowledged that social support has multiple levels: emotional, instrumental, appraisal, and informational.

Surprisingly, only few responses touched upon the issue of social support. Here is one extreme example:

"The sharing option in the mobile application seems absurd, at least I would not want others to know how much I weight or how I have slept, let alone what I have eaten today. Well, fortunately you can always opt-out."
(Female, 28 years old, university bachelor's degree)

Evidently, especially regarding personal health information, social sharing is a sensitive matter. Clearly, it is also a matter of culture. There are successful services like PatientsLikeMe (https://www.patientslikeme.com/), which facilitate peer support for different medical and health-related conditions.

4.5   Perceived System Success and Use Continuance

It has to be emphasized that in this paper we have concentrated on uncovering the shortcomings of the system. However, there were a lot of users who had favorable impressions toward the system:

> *"A very innovative way, fits to the modern way of life, provides a sufficient amount of signals for personal health management. The coaching is also thought-provoking. I am a fan and have been marketing the coaching to my friends."*
> (Female, 46 years old, university master's degree)

We measured perceived system success with positively and negatively anchored items. As can be witnessed from Table 2, the respondents had rather favorable impressions towards the system.

Table 2. Perceived system success (N=91)

Positive anchor	1	2	3	4	5	Negative anchor	Mean (S.D)
Interesting	51	26	4	7	3	Boring	1.74 (1.07)
Persuasive	18	49	16	7	1	Unconvincing	2.16 (.87)
Successful	19	45	20	6	1	Failure	2.18 (.88)
Useful	32	40	12	6	1	Useless	1.95 (.92)
Functional	17	45	22	7	0	Non-functional	2.21 (.84)

Table 3. Intention to continue using the system (N=91)

Cronbach's alpha	Minimum	Maximum	Mean (S.D.)
.97	1 (strongly agree)	5 (strongly disagree)	2.08 (1.02)

Moreover, we examined use continuance intention with a three-item scale. As can be observed from Table 3, the respondents were willing to continue using the system.

5   Discussion

It seems that the Virtual Health Coaching, at its present form, does not provide sufficient primary task support and dialogue support for its users. Many of the respondents gave negative feedback regarding the general and non-tailored health-related advice. This finding emphasizes the need for designing and developing tailored health-related services. Also, the users requested for more reminders in order to keep them motivated in their endeavors. Many of the users mentioned burdensome data entry as an obstacle to fully interact with the system. Furthermore, people are

clearly more willing to engage with the system if the system reduces complex tasks into smaller subtasks. Some of the users reported that using the system was even "nerve-wrecking" or stressful. None of the respondents explicitly mentioned credibility issues. We believe that institution-based trust boosts the perceived credibility of this particular service. Another key issue is the unobtrusiveness of the system. The system has to fit into the regular daily lives of the users. Also, the system has to take into account unpredictable occurrences such as illness of the user but also adapt to more mundane events such as a holiday season or a long work trip. Rather low amount of respondents gave feedback regarding technical issues averting the use of the system. This might be partially explained by the fact that the majority of the respondents were "white-collar" workers with a university degree. Usefulness (or value-for-user) was mentioned quite a few times. Some of the people did not see the point of continuing using the coaching system. Also, many users were already operating different applications or systems to maintain their well-being. Since many of these systems are not communicating with each other, the user might have to input the same data into several locations, thus diminishing primary task support (also ease-of-use and usefulness) significantly. Surprisingly, regarding social and peer support, very few respondents expressed their wish for social support through the service.

Implications for Designers. The results from this study suggest means in which designers might think differently about how to address shortcomings in the design of software for personal health management. We argue that most of these findings are applicable in a broader context. See Table 4 for design propositions**.**

Table 4. Design propositions based on the findings of this study

Proposition	Description	Mapping to PSD [5]
Maximize reduction	Automatize trivial tasks, avoid unnecessary repetition	Primary task support
Provide tailored and timely content and feedback for the individual users	Consider user profiling and personas in the design and development [21]; adapt to differences in individual susceptibility to different influence strategies [22]	Primary task support, dialogue support
Aim at unobtrusiveness	Do not require data entry when e.g. ill, or during holiday season. Integrate (not invade) into daily routines.	Primary task support, dialogue support
Provided positive and encouraging feedback	Give virtual rewards, praise; do not punish users for not achieving their goals [13]	
Provide periodic prompts and reminders	In order to reach the desired goals, the user needs to be prompted, suggested and reminded of the tasks.	Dialogue support
Provide means for social connectivity	Social sharing is highly dependent on the context. Sharing (especially) health information is a sensitive matter. Respect users' privacy, and let them "opt-out" if they wish.	Social support

On top of these propositions, credibility support category incorporates trust, believability, reliability, and perceived quality. Credibility issues are crucial, especially within the eHealth context, as users will more likely abandon systems that they do not perceive credible and trustworthy.

6   Conclusions

Studying the adoption, use and impact of consumer health information technology is worthwhile as it will guide future implementations of such consumer-centric technologies. The present study examined consumers' insights on a particular behavior change support system, and adds up to the body on knowledge on understanding the factors contributing to successful engagement with consumer health IT. Consumer health IT takes advantage of the web and mobile technologies, and social networking. The application area is full of promise, for both the consumers and producers of related applications, products, and services. Much of the theory and approaches in HCI and IS apply to the field of consumer health IT. However, there is a need to shift the focus from traditional approaches when striving for effective consumer health applications and engaging user experiences.

Conflicts of Interest. Two of the authors are working for the company that developed the system under investigation.

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Design of a Web-Based Information System for Sleep Deprivation – A Trial Study

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Abstract. Appropriate sleep patterns are essential for health, efficiency and balanced emotional state. While sleep-related problems are rigorously studied in medical and psychological sciences, there is a gap when it comes to research into the design of Information Systems (IS) for health interventions. This particular gap provides a unique opportunity to instigate research into this all-important direction. We have designed a web-based persuasive system, Soothing Sleep, which we envisage would help people improve their sleep behaviors gradually. The system draws its functionalities from the Persuasive Systems Design (PSD) model and socio-psychological theories are utilized as the background for the research setting. At present, we have implemented selected persuasive design features, i.e. reduction, tunneling, self-monitoring, reminders, rehearsal and social learning. We acknowledge that addressing sleep-deprivation as research domain is a perplexing task. Nevertheless we are poised that persuasive systems could play a significant role in bringing awareness among people and lead to improved sleeping habits. The paper provides design implications for persuasive systems.

Keywords: Persuasive systems, sleep deprivation, scenarios, rehearsal, PSD model.

1   Introduction

Adequate sleep supports people in realizing a healthy routine however the subject is relatively under-studied in the field of information systems (IS). While sleep-related problems are rigorously studied in medical sciences there is still a gap when it comes to improving sleep habits in IS research community. Generally, there is a vast population that suffers from sleep problems, for instance, 9-12% of Americans suffer from acute insomnia[1]. According to Alhola and Polo-Kantola [1], chronic sleep deprivation could potentially bring adverse affects on an individual's cognitive abilities. Taheri et al. [2] add that chronic sleep disorders could lead to fatigue, weight

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[1] Report published in 2010. Information available at
http://www.umm.edu/sleep/adult_sleep_dis.htm

loss and / or weight gain. Research in medicine and psychology likewise provides evidence of insomnia as one of the contributing factor for depression [3].

Although there could be numerous reasons for poor sleep habits, available evidence indicates that unhealthy lifestyle also add to the problem [4]. According to Kim et al. [5], to have an overview of an individual's general well-being, sleep can provide a fairly accurate measure. According to Choe et al. [6], diseases such as diabetes and heart-conditions are correlated to situations where people sleep either less than six hours or more than nine hours per night. To further explain the importance of adequate sleep, Choe et al. [6] underline that poor sleep habits could adversely affect an individual's memory and cognitive performance. According to Kraus and Rabin [7], people suffering from chronic sleep disorders such as insomnia are treated through various modes of treatments including behavioral therapy, pharmacotherapy, anti-depressant and sedative drugs and other dietary supplements. Backhaus et al. [8] outline that physicians have a tendency to treat patients with sleep deprivation through prescribed drugs with a relatively little emphasis on behavioral interventions. Morin et al. [9] outlined an intriguing finding, and reported that individuals with sleep disorders such as insomnia aim for self-help and are willing to try different treatments available before they seek help from medical professionals. Such findings from contemporary literature highlight very important premises, and we foresee this as an opportunity for the IS research community to play a part to overcome the identified gaps. Additional research findings imply that people who suffer from sleep disorders do not necessarily seek medicinal remedies and are motivated to experiment other options.

We, therefore, decided to design and evaluate a persuasive system [10] that could potentially support people to overcome unhealthy sleep habits. It should be noted that the research focus here is on software design, and not on the psychological program as such. We aimed to evaluate whether persuasive features could help people with sleep problems resulting from conditions such as stress, anxiety, lack of physical activity etc. We acknowledge that our research endeavor is challenging nevertheless the emergent drift in research community to encounter sleep deprivation inspires us.

Soothing Sleep, a web-based persuasive system aims to support people to improve upon poor sleep habits primarily through *virtual rehearsal* that has been pointed out as a persuasive software feature in the Persuasive System Design (PSD) model [10]. To our knowledge, information systems and/or computing devices have not been utilized to address the problems associated with poor sleep habits. However, there are a number of projects that focus on different ways to monitor sleep patterns, for instance, Ballistocardiography [11]. Persuasive systems have gained a great deal of attention in recent years and such ISs have been used to bring a desirable change in peoples' behaviors. Available research confirms the potential of such technologies with regard to bringing a desired change in peoples' behaviors [4]. People could benefit from this system and other similar types of systems by learning about healthy behaviors that would help them to overcome poor sleep patterns. This optimism is supported by [6] who suggest that there is a potential for persuasive information technologies to promote adequate sleep habits.

2   Theoretical Setting

There is an extensive amount of socio-psychological and behavioral literature available that explicates factors influencing behavior change in people. In the design process, we reviewed behavior change theories as well as conceptual design models for designing persuasive systems.

2.1   Socio-psychological Theories

We first incorporated the Goal-setting theory [12] for it depicts how people behave in reaction to diverse forms of goals and in what way pre-defined goals and tasks could become a motivating factor. It is imperative that challenging goals are supported through fitting feedback to sustain motivation. In addition, goals need to be meaningful for the individuals so that there is a stirring desire to fulfill the tasks. Secondly, we incorporated the Social Identity theory [13] in our research setting. One of the implications of the Social Identity theory is that it promotes inter-group cooperation. We assume that the effect of inter-group solidarity upon the users will be such that they will encourage each other to conform to the task.

2.2   Persuasive Systems Design Model

The persuasive software strategies and features of the Soothing Sleep system are predominantly drawn from the Persuasive Systems Design model [10]. The model outlines a comprehensive framework for designing and evaluating persuasive information systems. It promotes synthesis of explicit persuasive features and exposes four distinctive categories for designing persuasive information systems; 1) primary task support, 2) dialogue support, 3) system credibility and 4) social support.

The primary task support features aim to help users complete their goals and pre-defined tasks, dialogue support feature focus on improving dialogue between users and the IS, credibility and social support features address issues relating to overall observed credibility of information and social support features highpoint the prominence of social interaction amongst the users of a given information system. Each category portrays an in-depth explanation of feasible persuasive features.

While feedback (systems provide praise in textual format and virtual rewards to motivate users) [14], social sharing (system provide means to watch other users performing similar target behaviors) [15] and self-monitoring (system provides means to track users' performance) [16] are fairly well studied, we decided to implement and evaluate virtual rehearsal (system facilitates practicing a target behavior) [13] as a persuasive feature from the primary task support of the PSD model. Rehearsal as a persuasive software feature has not been studied much in the IS discipline. One of the motivations behind implementing a relatively under-studied persuasive software feature was that a larger endeavor aims to further our work to a fully operational behavior change support system (BCSS). Oinas-Kukkonen [17], [18] delineates BCSSs as, "IS designed to form, alter, or reinforce attitudes or behaviors or both without using coercion or deception". Further, BCSSs are persuasive in nature and are capable of generating computer-mediated and/or computer-human persuasion [17], [18].

3   Prototype Design

According to the PSD model it is essential to understand the problem domain and related issues before designing and implementing persuasive information systems [10]. Further, the context has to be scrutinized followed by a comprehension of the intent, event and the design strategies as proposed by Oinas-Kukkonen and Harjumaa [10]. Following the aforementioned principles, we designed the Soothing Sleep system in a way that users would have 24/7 access to it, it would support behavior change incrementally, be unobtrusive and easy to use. Using the principles from the PSD model [10], the Soothing Sleep system is currently incorporated with the following stages of interaction for the users:

- **Registration:** Users will have their first interaction with the web-based system. A selected variety of facts and figures are provided about the sleep deprivation problems. Users will be required to register with the system providing basic information including demographics.
- **Goal setting:** For the first period, which will be a seven-day trial study, users will have a pre-set goal to complete one scenario[2] each day. Each scenario has been crafted keeping in mind everyday issues that lead to sleeplessness or inadequate sleep behaviors. For instance, study related stress, watching TV or playing video games till late, and so forth.
- **Completing a Scenario:** The users will be expected to read the scenario and respond to the question subsequently. Upon submission of the answer, the system would prompt whether the answer was correct or incorrect with an explanation for either case.
- **Self-monitoring:** The system includes self-monitoring as a persuasive software feature. There is a progress bar that represents completed (Green), skipped (Red) and To-be-done (Grey) scenarios. In addition, the interface displays textual information for the users to see how far they have progressed.
- **Feedback, reminders and reward:** The system employs feedback and reward as persuasive features [10]. It is a key strategy to keep the users' interest for an extended interaction with the system. Feedback is moderately generic and could also be perceived as subtle reminders. For example, the user interface displays information about skipped scenarios by prompting, "You have skipped a/some scenario/s. How about completing it/them now?" Reward is presented in the form of textual praise, for example, upon completion of a scenario, the system will prompt, "You have completed a scenario today. Well done".
- **Social learning:** During the registration process, the users have an option to enable/disable a feature that allows them to share their progress with other users. This feature is drawn from the social support category of the PSD model [10]. Generally speaking, social support is analogous to recognition and provides a mean to know how other users are performing. Research

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[2] Scenarios were designed to serve as Virtual Rehearsal feature.

indicates that people enjoy being recognized and encouraged from their social contacts [19].

- **Rehearsal:** The objective of the system is to facilitate the process of practicing a desired behavior. As discussed by Oinas-Kukkonen and Harjumaa [10], rehearsal refers to "providing means with which to rehearse a behavior can enable people to change their attitudes or behaviors in the real world".

Fig. 1. Screen shots from the Soothing Sleep system

4   Research Setting and Evaluation

The goal of the trial study was to examine persuasive functionalities of the Soothing Sleep system. We advocate trial studies of novel artifacts before piloting since such practices provide an opportunity to learn by practice and understand various aspects of an IS including usability issues and incorporated persuasive features. Further, initial findings could help improve the design and functionalities prior to pilot testing. For this purpose, we conducted a seven-day trial to appraise the artifact. In all, eight (N=8) users were involved in the evaluation process where four were IS researchers and the remaining were graduate students from the University of Oulu, Finland. All the eight participants were recruited through emails and a brief description of the system was specified. The system was published on Google App Engine Server and hyperlink (as an access point) was sent out via email. For anonymity and data

protection, participants were encouraged to register with the system using pseudo-names/nick names.

The trial study was conducted with an aim to identify incorporated persuasive software features from users' perspective. Further we wanted to evaluate the potential effectiveness and feasibility of persuasive design to promote effective self-help strategy for individuals with poor sleep habits. The evaluation process was carefully subdivided into four main steps as briefly mentioned below:

4.1   Scenario Completion

All the eight participants were required to register with the system. They were required to carry out tasks in accordance with predefined scenario completion package i.e. one scenario per day for seven days of the trial. All the participants were advised to note down their observations (if applicable) relating to the design and functionalities of the system. They were also advised to evaluate the impact of incorporated persuasive software features on potential change in their behavior and the effectiveness of rehearsal feature (learning through scenarios). Upon completion of each scenario session, participants were presented with a short online structured questionnaire mainly aiming at the perceived usefulness of the system. All the eight participants completed the seven-day trial study and provided useful feedback that will be discussed later.

4.2   Semi-structured Survey

Upon completion of the trial study period, a semi-structured survey was distributed amongst the participants (with seven closed and one open question) to obtain their feedback with regard to the usability, UI design and persuasive software features. The closed/structured questions were designed to obtain information about UI, engagement, ease of use, influence of rehearsal and self-monitoring and goal-setting features. Seven statements using Likert Scale with a range from "Strongly agree" to "Strongly disagree" followed each question. Finally, the participants were provided an opportunity to give feedback and remarks about their experiences with the system through an open text field. Table 1 shows the content of the closed questions. (Likert Scale included seven degree of response options i.e. Strongly disagree, Disagree, Disagree to some extent, Not sure, Agree to some extent, Agree, Strongly Agree).

Table 1. Post-trial survey for system evaluation

Statements/themes	Measurement
The user interface was appealing	Likert Scale
The system was easy to use	Likert Scale
The scenarios helped me improve my sleep patterns	Likert Scale
The scenarios were engaging	Likert Scale
The progress bar feature motivated me to continue completing the scenarios	Likert Scale
It was motivating to see how other users performed	Likert Scale
I had clear goals and knew what to expect from the system	Likert Scale
Your suggestions and comments	Open text field

4.3   Expert Evaluation

The IS researchers performed expert evaluation (where one or more specialists evaluate a system against a defined list of design principles). It is similar to heuristic evaluation that is commonly applied in usability engineering with an aim to identify usability issues/problems and testing interactive information systems [20]. The PSD model was used while the artifact was evaluated since the model provides a framework for designing as well as evaluating persuasive systems. Previously several researchers have used the PSD model in various contexts, for instance, Derrick et al. [21].

4.4   Focus Group

Finally, the participants of the trial study were invited to partake a focus group. In all, five participants volunteered to participate. A 20-minute focus group was conducted where comments and discussions were audio recorded with informed consent. The purpose of the post-trial focus group was to gather insights and feedback about the overall usefulness of the system, the overall perceived persuasiveness and design implications. We opted for conducting a focus group based on our previous research experience and for the reason that they are similar in nature to individual interviews as reported by Walji and Zhang [22]. Focus groups have a light edge over individual interviews since concurrent participation stimulate relatively rigorous and in depth discussions.

5   Results

All the eight participants completed the post-study survey and provided valuable feedback. Table 2 presents participants' responses to the seven structured questions (closed questions).

Table 2. Summary of participants' responses to post-study survey where "1" represents Strongly agree and "7" represents Strongly disagree

	User1	User2	User3	User4	User5	User6	User7	User8
Q1	5	3	3	5	4	6	6	5
Q2	5	4	5	5	3	6	7	7
Q3	2	4	4	4	4	2	4	6
Q4	3	5	5	4	5	5	5	6
Q5	6	-	6	5	4	4	7	7
Q6	3	4	6	4	5	4	6	4
Q7	5	4	3	6	4	5	6	6

Given the small data size, we opted to calculate the central tendency of each response. For this purpose, we measured the median to establish the middle score of the data set. The reasons for selecting median at this point of the research study were, 1) we had predefined continuous data set on a scale of 1-7, therefore using other measures such as modes would not provide appropriate results and 2) median is an

appropriate measure [23] for ordinal data set (what have managed to gather during the trial study). Table 3 summarizes the final score for each response as presented below.

Table 3. Summary of the final scores for Likert Scale closed questions

Question Theme	Median Score (central tendency)
Q1: Appealing User Interface	5 (Agree to some extent)
Q2: Ease in using the system	5 (Agree to some extent)
Q3: Were the scenarios helpful/useful	4 (Not sure)
Q4: Were the scenarios engaging	5 (Agree to some extent)
Q5: Motivating affect of progress bar	6 (Agree)
Q6: Motivating affect of social support	4 (Not sure)
Q7: Clear goals	5 (Agree to some extent)

Table 3 outlines the overall rating for key aspects (design, functionality and usefulness) of the Soothing Sleep system. Based on the scores, we propose that the Median score for the system after the trial study was 5. Six out of the eight participants filled out the open-ended "text-field" and provided useful comments relating to the interface design, scenarios and perceived persuasive features. For instance, almost all of the participants showed satisfaction with the ease of use and design of the self-monitoring feature (progress bar). It was noted that most of the participants did not find the goal-setting feature to be very clear. This could be for the reason that the system was incorporated with pre-set goals where users could not set their own goals.

The results from the expert evaluations focused on the intent, the event and the persuasion strategy of the Soothing Sleep system. This was in accordance with the PSD model where formulation of persuasion context is narrated as central to designing persuasive system. It was agreed that the intent of the system developer (the persuader) were clearly specified however a little more detailed explanation of the system and its intended use was proposed. The event relates to understanding the user, the technology and the context of the use. It was agreed upon that the system was aimed for individuals with sleep problems and has the potential to provide users with tools such as reminders, self-monitoring and social learning. According to the PSD model, message content and the route formulate the persuasion strategy. While content focuses on augmented information and data, route highlights the significance of the mode through which a persuasive message is conveyed. It was proposed that in its current form, the system has decently compact presentation of messages however; there is room for further improvements. In terms of identified persuasive features, all the four participants identified reduction, tunneling, self-monitoring, rehearsal, suggestion, and a degree of social support in the system.

All the participants of the focus group generally approved the system with encouraging remarks. Persuasive software features such as self-monitoring and rehearsal was highly approved. There were several valuable comments with regard to persuasive features that could be incorporated to enhance the persuadability of the system. For instance, while all the participants agreed that "subtle" reminders are already there in the system however it would bring greater adherence if well-designed and clear reminders were incorporated via email and mobile phones. There were a few reservations about the user interface especially with regards to internal links and

"button labels". All the comments were taken seriously and essential amendments were made to make the interface user-friendly for future studies.

6   Discussion

The results from the trial study indicate that participant had little if any difficulty in carrying out desired actions. Majority of the participants found the information and feedback to be useful and engaging leading to user satisfaction. The aim of this study was to rigorously evaluate the Soothing Sleep system before launching the pilot study. We adopted a multi-step and mixed approach to evaluate various design and usability aspects of the system including real user interaction as well as expert evaluations.

   Participants' comments and feedback was found to be of great significance both in terms of design improvements and theoretical settings for the actual pilot study. For instance, most of the participants identified goal-setting feature in the system, however it was suggested that a functionality that would empower the user to set their own goals would be advisable. This finding is in parallel with the Goal-setting theory. In addition, most of the participants provided thought-provoking comments about the social support features, which justifies adoption of Social identity theory in our research setting. Understandably, seven-day trial study was not intended to identify actual affect on sleep related habits. Nevertheless, participants' feedbacks encourage us to improve upon the current system with more or less subtle amendments.

   With the limited number of participants and given the short period of the trial study, strong statistical analysis could not be performed. Nevertheless, the entire process of evaluation provided comments and valuable feedback that could not be disregarded. Further, the gathered data provides valuable propositions to augment the system in terms of design, usability and persuadability. These remarks and suggestions will be taken on board and improvements will be made before launching a 14-day pilot study.

   The contribution of this paper is manifold:

   o   It introduces a novel software artifact that aims to address a vital health related problem,
   o   It shows for the IS research community that rigorous evaluation of IS artifacts can be performed by conducting trials prior to piloting, and
   o   It provides an opportunity for IS researchers and system designers to use PSD model as a systematic framework to develop and evaluate persuasive IS aimed for enhancing well-being.

It has to be noted that the aim of the trial study was indeed not to measure actual change in sleep patterns. On the contrary, we wanted to investigate the scope and potential of the system in terms of usability and persuadability.

7   Concluding Remarks and Future Research

This paper describes design and evaluation of an information system that was built upon the theoretical construct of Goal-setting and Social Identity theories and the

PSD model. The system was devised in a way that it was easy to use and supported users to overcome unhealthy sleep behaviors mainly through rehearsal and additional features such as self-monitoring as well as social learning and social comparison.

We are encouraged by the findings of this work and will continue our investigation and research. In future, we aim to conduct a pilot study to gather and analyze additional data. We also aim to refine the system based on users' feedback and with psychological experts to conduct a longitudinal study with real users.

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Lower Incidence of Hypertension among Swedish Speakers as Compared to Finnish Speakers in the Helsinki Birth Cohort from Finland – An Example of Early Programming of Disease?

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Abstract. The Swedish speaking population (circa 5%) is healthier than the corresponding Finnish speaking population in Finland. The aim of the study was to explore whether registry based incidence of hypertension, approximated by initiation of antihypertensive medication in 1971-2002, varies between the language groups by using the prospective Helsinki Birth Cohort data. The data comprises 13 345 men and women born in Helsinki University Central Hospital from 1934 to 1944. In a multivariate logistic regression model having a Swedish speaking mother predicted significantly a decreased incidence of hypertension even when adjusted for a number of potential confounders as father's socioeconomic status at birth, adult BMI, birth size as well as age and sex. Many of the confounders also predicted significantly incidence of hypertension in the same model. Cultural factors characterizing the Swedish speaking minority but concomitantly biomedical factors related to early growth play a role in the origin of these differences.

Keywords: Minority Health, Hypertension, Follow-up Studies, Data Linkage.

1   Introduction

According to previous studies, the Swedish speaking population can be considered being healthier than the corresponding Finnish speaking population in Finland. This is substantiated at least from mortality [1], [2] and disability pension studies [3] and

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from some studies on perceived health of school aged children [4]. The causes for these health differences are largely unknown. In a historical perspective, the Swedish speakers have been somewhat socioeconomically privileged but the differences have decreased and nowadays Swedish speakers can be characterized as at the most, having moderate middle-class overrepresentation [5]. The Swedish speaking population is concentrated to the Southern and Western coastal areas of Finland and comprised in 2009 5.4% whereas the corresponding share in 1900 was 12.9% [6]. In a recent study the health behavior of Swedish speakers was more favorable than that of Finnish speakers but the differences were most clearly related to smoking and intoxication oriented alcohol consumption and did not involve e.g. dietary habits. Instead the consumption of dairy products was even higher among Swedish speakers [7]. Some genetic differences between the language groups have been detected but how this influences health prospects remains unclear [8], [9].

On the other hand, low birth weight is associated with increased rates of at least hypertension, coronary heart disease and type 2 diabetes in later life [10-12]. Persisting physiological and metabolic changes that accompany slow growth in utero are hypothesized being responsible for the adverse health outcomes [13], [14].

2   Aim of the Study

To explore whether the incidence of hypertension, approximated by initiation of antihypertensive medication, varies between the adult Swedish and Finnish speaking population in Finland and to explore whether parameters related to prenatal life might mediate these differences.

3   Individuals and Methods

The cohort comprised 13345 men and women who were born in Helsinki University Central Hospital from 1934 to 1944 and attended child welfare clinics in the city. Most of them also went to school in the city. Details of the birth records, child welfare clinic records, and school health records have been previously described [10]. A postal survey was directed to all living cohort members in the year 2000.The clinical and survey records were linked with register data of the Social Insurance Institution from the 1971 to 2002 of medication from the special reimbursement category by using the unique Social Security Number from Finland.

3.1   Definition of Hypertension

We identified 2567 men and women who took antihypertensive medication during 1971 – 2002. In Finland, the costs of this medication are partly reimbursed by the Social Insurance Institution, subject to the approval by a physician who reviews each case history. Therefore, we defined hypertension by the use of medication. For simplicity, the variable is from here on called hypertension.

Also linkage to census data on socioeconomic status, and household income in 1980 and to mortality data provided by Statistics Finland was carried out. The linkage was performed with the appropriate authority consent and made anonymous. The ethical committee of the concurrent National Public Health Institute approved the study.

The statistical analysis was performed by logistic regression modeling with SPSS software for Windows.

3.2   Study Variables

The response variable was new cases of antihypertensive medication in the special reimbursement category. Language group was derived from the language of the mother's concurrent church congregation. Other explanatory variables used in this study were sex, age, reported body mass index (BMI) in 2000 (<25, 25-29, >=30), socioeconomic status (SES) of father at time of participant's birth (upper and lower official, manual worker, self-employed, and others) from birth or child welfare records, registered SES of the responder in 1980 (upper and lower official, manual worker, self-employed, and others), and birth size as ponderal index (birth weight/length^3, <=25, >25-27, >27-29, >29) abstracted from birth records.

4   Results

The prevalence of hypertension was significantly lower among Swedish speakers. This group also showed a higher ponderal index at birth. The language groups did, however, not differ from each other measured by socioeconomic position of father at the time of birth but the Swedish speakers had a significantly higher SES in 1980.

In a multivariate logistic regression analysis (Table 2) having a Swedish speaking mother predicted significantly a decreased incidence of hypertension when simultaneously sex and age were included as explanatory variables. Naturally, age also showed a significant positive association with the response variable whereas sex did not. Father's SES showed a significant inverse association of its own when it was added to the model as a predictor and the previously mentioned associations were also kept significant. However, still adding SES in 1980 to the model turned the association between the language variable and the response variable to an insignificant one whereas higher SES in 1980 was in that model significantly associated with a decreased incidence of hypertension. Still adding BMI in 2000 turned SES in 1980 to an insignificant predictor whereas mother's language again became significant which remained even when ponderal index at birth was added to the model. Ponderal index itself as well as BMI in 2000, age, male sex, and socioeconomic status of father were independent significant predictors in the final model whereas SES in 1980 was not anymore.

Table 1. Demographics of the participants and the straight distribution of the explanatory variables of the study and according to the incidence of new cases of antihypertensive medication in the special reimbursement category according to registry data from the Social Insurance Institution. Follow up of 13345 individuals from 1971 – 2002.

Explanatory variable	Entitlement to antihypertensive medication in the special reimbursement category					
	yes N	yes %	no N	no %	Total N %	Total %
Sex						
Women	1186	18.6	5184	81.4	6370 100.0	47.7
Men	1381	19.8	5594	80.2	6975 100.0	52.3
Total	2567	19.2	10778	80.8	13345	100.0
Age in 2002						
54-59 y	775	30.2	3685	34.2	4460 100.0	33.4
60 -64 y	1274	49.6	5395	50.1	6669 100.0	50.0
65-69 y	518	20.2	1698	15.8	2216 100.0	16.6
Total	2567	19.2	10778	80.8	13345	100.0
Mother's language at participant's birth						
Swedish	413	17.8	1903	82.2	2316 100.0	17.4
Finnish	2154	19.5	8875	80.5	11029 100.0	82.6
Total	2567	19.2	10778	80.8	13345	100.0
Register data on socioeconomic status in 1980						
Upper official	613	20.0	2454	80.0	3067 100.0	23.0
Lower official	969	22.3	3370	77.7	4339 100.0	32.5
Self-employed	125	20.3	492	79.7	617 100.0	4.6
Manual workers	660	24.8	1998	75.2	2658 100.0	19.9
Other	200	7.5	2464	92.5	2664 100.0	20.0
Total	2567	19.2	10778	80.8	13345	100.0
Socioeconomic status of father at participant's birth						
Upper official	173	14.1	1054	85.9	1227 100.0	9.2
Lower official	478	17.2	2302	82.8	2780 100.0	20.8
Self-employed	44	17.7	205	82.3	249 100.0	1.9
Manual workers	1724	20.9	6522	79.1	8246 100.0	61.8
Other	148	17.6	695	82.4	843 100.0	6.3
Total	2567	19.2	10778	80.8	13345	100.0
Body mass index in 2000						
< 25	351	13.7	2215	86.3	2566 100.0	37.8
25 -29	670	22.8	2268	77.2	2938 100.0	43.2
>=30	532	41.1	763	58.9	1295 100.0	19.0
Total	1553	22.8	5246	77.2	6799	100.0
Ponderal index						
<=25	652	22.6	2227	77.4	2879 100.0	21.7
-27	862	19.3	3595	80.7	4457 100.0	33.7
-29	723	18.5	3176	81.5	3899 100.0	29.4
>29	312	15.5	1695	84.5	2007 100.0	15.2
Total	2549	19.2	10693	80.8	13242	100.0

Table 2. Multivariate logistic regression model on the incidence of new cases of reimbursed antihypertensive medication (yes/no) in the special reimbursement category from 1971 to 2002. Totally 13345 men and women born in Helsinki University Central Hospital from 1934 to 1944. Odds ratio (OR), 95% confidence interval (95% CI), NI=explanatory variable not included in the model.

Odds ratios (OR) for new cases of antihypertensive medication in the special reimbursement category										
Explanatory variable	**OR**	**p value**	**OR**	**p value**	**OR**	**p value**	**OR**	**p value**	**OR**	**p value**
	95% CI		**95% CI**		**95% CI**		**95% CI**		**95% CI**	
Sex men = reference	0.93 0.85-1.01	0.08	0.94 0.86-1.03	0.163	0.96 0.87-1.06	0.414	0.83 0.73-0.94	0.004	0.85 0.75-0.96	0.009
Age (54,59, 60-64, 65-59 y) 65-69 = reference	0.95 0.94-0.97	<0.001	0.95 0.94-0.97	<0.001	0.95 0.93-0.97	<0.001	0.95 0.93-0.97	<0.001	0.95 0.93-0.97	<0.001
Mother's language at participant's birth (Swedish - Finnisch) Finnish = reference	0.88 0.78-0.99	0.027	0.85 0.76-0.96	<0.001	0.91 0.80-1.03	0.143	0.81 0.68-0.95	0.012	0.82 0.69-0.98	0.024
Socioeconomic status of father at time of participant's birth (Upper official, Lower official, Self-employed, Manual worker, Other) Upper official = reference	NI		1.21 1.14-1.29	<0.001	1.22 1.14-1.31	<0.001	1.25 1.14-1.37	<0.001	1.24 1.14-1.36	<0.001
Register data on socioeconomic status in 1980 (Upper official, Lower official, Self-employed, Manual worker, Other) Upper official = reference	NI		NI		1.05 1.00-1.10	0.029	1.02 0.96-1.09	0.435	1.02 0.96-1.08	0.47
Reported body mass index 2001 (<25, 25-29, >=30) < = reference	NI		NI		NI		1.14 1.12-1.16	<0.001	1.14 1.13-1.16	<0.001
Ponderal index (<25, 25-27, -29, >29)<=25 = reference	NI		NI		NI		NI		0.94 0.91-0.96	<0.001

5   Discussion

Swedish language of the concurrent congregation of the mother at birth of the participant was a significant protective factor for incidence of hypertension even when adjusting for a number of potential confounders as father's SES at birth and participant's SES in 1980, BMI in 2000, birth size as well as age and sex. The only model in which the mother's language became insignificant was the case in which adult BMI and birth ponderal index were not yet included as explanatory variables. We interpret the principal finding as supporting the view that partially, in spite of the clear influence of environmental factors, hereditary factors could also lie behind the better health of the Swedish speaking population, here studied in the context of new cases of antihypertensive medication. The predictive power of mother's language remained robust even after adjusting for all these previously mentioned potential confounders. However, even the historically clear socioeconomic advantage among the Swedish speaking population compared to the Finnish speakers might play a role

for the present health disparities between the language groups since father's higher SES remained in all models a significant protective factor for the incidence of antihypertensive medication.

In Finland, the Swedish speakers live mostly along the coastal region where coronary heart disease incidence is low compared to the eastern part of Finland. In our cohort, the difference in incidence of hypertension between the language groups is unlikely to be explained by regional differences in cardiovascular risk factors since all children were born and went to school in the same city.

The incidence of antihypertensive medication in the special reimbursement category was chosen as response variable due to its rather high prevalence in Finland with e.g. 509463 individuals in the year 2008 [13] receiving this medication. Moreover, in the light of mortality studies [2] cardiovascular diseases are more prevalent among the Finnish speaking population compared to the Swedish speakers and hypertension is a known risk factor of virtually all diseases of this category. However, the authors recognize that this response variable covers only a small share of morbidity variance.

We chose the language of the mother as the variable indicating language group, since this variable probably covers best both cultural as well as the ethnic dimensions of belonging to a certain group. As indicated in the Introduction the share of the Swedish speaking population is declining and the trend towards becoming a Finnish speaker, e.g. via bilingual marriages, is clearly stronger than in the opposite direction. A further argumentation for this variable is that it deals with early stages of life that might play an important role for future risk for hypertension [13] and is also a critical period for passing on cultural norms and traditions.

The participants of the study were born and lived in the capital city in the early thirties and forties. At that time the upper class Swedish speaking families from that region, mostly used private health care. This explains why the language groups did not socioeconomically differ from each other although the Swedish speakers at that time doubtless were socially somewhat privileged compared to Finnish speakers. Hence, one could say, that lower socioeconomic classes are somewhat overrepresented among the Swedish speakers in this sample whereas this does not apply to the complete sample. This overrepresentation of lower social classes is likely to underestimate the health advantage of the Swedish speakers. Therefore, there is no reason to believe that this phenomenon would have biased the main results. Even in this sample the Swedish speakers showed on average higher ponderal index (p=0.0003) which is linked to a lower morbidity in later life [10-12]. Hence, part of the historical health advantage of Swedish speakers could be explained by prenatal factors such as better maternal nutritional state leading to a higher ponderal index. Ponderal index is higher in the higher social classes which have healthier lifestyle and better nutritional status. When adjusting for ponderal index and social class maternal language still remained an independent predictor of hypertension, unexplained by nutritional state and social class in early life.

In Finland, the granting of a medication in the special reimbursement category requires a medically confirmed illness. Hence, the time period from initial stage of the illness to the granting of the specially reimbursed medication can vary considerably

individually. Due to this, survival analysis was not considered treating all the participants equally since for 150 cases the date for the start of the antihypertensive medication was missing and hence the statistical analysis was carried out with logistic regression models with a dichotomous response indicating only whether a person at some point of the follow up had become entitled to antihypertensive medicine or not.

5.1   Strengths and Limitations of the Study

A considerable strength of the study is that the prospective data covers an unselected sample of approximately 60 % of the children [11] born in Helsinki University Central Hospital from 1934 to 1944 and who were carefully followed up by the health care system already before birth and in early childhood. Thus, most of the variables are not self-reported but are based on clinical observations or registry data. The only exception is the BMI which is calculated from the respondents' own reports on height and weight. A further strength, without doubt is the length of the follow up covering virtually the time preceding birth to the year 2002 when even the youngest participants were beyond the age of 55 years.

A limitation is that exact dates on the initiation of the antihypertensive medication were available only from the year 1971 onwards. Hence, we had to rely on a more robust statistical method, namely logistic regression since use of survival analyses would have excluded 150 cases. Another limitation is that only one measure of adult SES and BMI were available and that for a substantial share of cases they were collected after a potential medication was initiated. For completion, the analyses were also carried out by using survival analysis which yielded basically the same results as previously described. Since it is known that gestational age correlates positively with ponderal index a final multivariate logistic regression analysis was carried out where also gestational age was included as an explanatory variable. Gestational age showed an own weak but statistically significant inverse association to the initiation of antihypertensive medication (data not shown) but it did not alter the principal results of the study. A final limitation is that the response variable, i.e. new cases of antihypertensive medication, is only a proxy for true incidence of hypertension and susceptible to cultural factors as the quality of communication in the patient - doctor relationship and the efficiency of health care. The assumption of no such systematic differences between the language groups was made, however such differences would influence the present results.

6   Conclusions

Swedish language of the concurrent congregation of the mother at birth was a significant protective factor of incidence of hypertension for the child in the adult period even when the analysis was adjusted for a number of potential confounders as father's SES at birth, adult BMI, birth size as well as age and sex.

The authors conclude that specific cultural factors characterizing the Swedish speaking minority in Finland here approximated with the language of the mother's

congregation partially might be responsible for the differences of the incidence of antihypertensive medication observed. Cultural features are passed on via learning and transferable from an individual to another and thus the knowledge might in the future also be applicable in health promotion. However, biomedical factors related to early growth doubtlessly also play a role in this context.

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Heart Rate Variability Measurements in Mobile Work

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Abstract. There are new complexity and workload factors related to mobile working mode. One main thing to be considered is the work-life balance, especially from the adequate recovery point of view. Heart rate variability (HRV) reflects the functioning of the autonomic nervous system (ANS). Thus stress and recovery of the ANS can be evaluated with HRV analyses. The objective of this study was to find out how the HRV measurement serves the aims of occupational health care. Ten globally mobile employees were measured by a HRV recording procedure. The experiences of the measurement execution were collected by semi-structured interviews. Through HRV measurement occupational health care professionals gain valid information on mobile employees' ANS stress and recovery reactions. When connecting the diary information entered by the employees to this, knowledge of working conditions could also be reached. However, the measurement procedure is time consuming and expensive to execute. Therefore the HRV measurement should target those mobile employees, who have difficulties on controlling their work–life balance.

Keywords: Mobile work, Stress, Recovery, Heart Rate Variability.

1 Introduction

New developments in information and communication technology (ICT) have changed the way people approach their life and work. Mobile virtual work is no longer bound to fixed locations, as utilising ICT allows people function freely in various environments. An employee is considered mobile when he/she works more than ten hours per week away from his/her primary workplace and uses ICT for collaboration [1], [2], [3]. One has to distinguish the concept of mobile work, mobile workers and mobile technology. In a stricter sense by mobile work we may mean documents and tasks that move. In this article the concept of mobile work is used in a wider sense i.e. referring to the work and working mode of an employee. Thus, mobile employees work at and move between different work places. [see 4.] According to Lilischkis [5], this type of working in many places could also be called 'multi-locational work'. The Fourth European Working Conditions Survey [6] shows that in 2005 only 50 per cent of the working population in the EU worked at their place of work all the time and that a total of 21 per cent never worked at their primary workplace. This shows indirectly the increased portion of mobile working in multiple

locations. Furthermore, 9 per cent of workers always worked in locations outside the home and company premises.

The available research on mobile virtual work argues that there are new complexity and workload factors related to this kind of working [3], [4], [7], [8], [9]. One main thing to be considered in this "anytime and anywhere" work is the work–life balance, especially from the adequate recovery point of view. E.g. Vartiainen and Hyrkkänen [3], [7], [8] have reported how globally mobile employees synchronously working over time zones experience the effect of changing the hours and rhythm of their work and how this 'timeless' continuous working and collaboration is a very strongly negative mental workload factor. It breaks down the normal rhythms of working and rest periods. Mobile employees do not have uninterrupted working days starting at a particular time and ending at another, but instead altered rhythms of the days, as well as the weeks, according to the demands of their tasks. Working periods could take place early in the morning, in the afternoon, and in the evening. Work might be done to some extent every day of the week. All this causes an inclination towards unconventional working hours, also with evening and weekend work. The need to be constantly available also affects the experiences of strain.

Better understanding of the work load factors of mobile work is needed not only by employees, but managers, HR personnel and occupational health care professionals as well. They all need to cope more effectively with the work demands of mobile work to enhance well-being. However, it is difficult to gain understanding about the load of mobile work if the paths of the mobile employee and his/her superior cross only occasionally. Occupational health care professionals meet the same contradiction: they should be able to analyse the load of mobile work as well as stress and strain of a mobile employee and to give adequate instructions for optimising and controlling the load.

Heart rate variability (HRV) reflects the functioning of the autonomic nervous system (ANS). Thus, stress and recovery of the ANS can be evaluated with HRV analyses [10], [11], [12], [13]. Measuring HRV has usually needed laboratory conditions, but lately new applications, which allow measurements in the field and analysis made by corporate health care professionals, have emerged. In this preliminary study, the usability of HRV was tested in assessing the stress and recovery of mobile employees. The usability assessment was made from the occupational health care practitioner's point of view.

2   Objectives

The objective of this study was to find out how the HRV measurement serves as a tool for occupational health care professionals in analysing the stress and recovery reactions of ANS of the mobile employees during their business trips. According to the Finnish Occupational Health Care Act [14], occupational health care activities should be based on careful analysis of work and working conditions at work places of the organisations involved. The knowledge of work and working conditions should be gained through repeated workplace visits [14]. In mobile multi-local work it is impossible for occupational health care personnel to directly observe the working conditions and therefore the information should be gathered in an indirect way. HRV measurement producing information about the stress and recovery of ANS during business trips may be a valid tool for the purposes of occupational health care.

The research questions were:

What do the HRV measurement and the measurement related diary tell about the mobile employee's recovery during the business trip?

What are the demands of the HRV measurement procedure met by occupational health care practitioners?

3   Methods

This pilot study with the HRV measurement procedure was carried out in collaboration with two occupational health care corporations (clinics). Ten globally mobile employees needing occupational health care services were measured by a First Beat HRV recording procedure. The selection of the measured employees was made purposively: occupational health care professionals were instructed to select the employees that they thought would benefit from this assessment. The other inclusion criteria were that the employee often has to travel abroad to meet the objectives of his/her work and the working mode is "mobile" [2], [3]. Of the selected employees 2 were female and 8 male; all were managerial employees.

Ten mobile testees were given a "body guard" heartbeat recording system which they carried for three business trip days. The flow of the days was not strictly defined beforehand and therefore there are three different travelling and working procedures: 1. the first day includes travelling and working, the second day working abroad, the third day working and travelling back; 2. the first day travelling and working and the second two days working abroad; 3. working abroad two days and then working and travelling back to home during the third day. Before starting the measurement, the testees were instructed on how to use the heartbeat recording system and how to carefully enter all their actions and the places they had been to into a diary. After recording the data, the variables of HRV were analysed using the FirstBeat programme. After the analysis, the stress and recovery chart was shown to the testee and his/her experiences of the results/findings were discussed in detail. This discussion was recorded and analysed with the help of the AtlasTi programme.

For assessing the demands of the HRV measurement procedure, the time used by occupational health care practitioners for one measured employee was counted and the problems met during the procedure were entered into the measurement diary. The experiences of the measurement procedures were collected also by interviewing (semi-structured interview) those (health care professionals, researchers) who conducted the measurement procedure.

4   Results

4.1   What Does HRV Measurement Tell about the Mobile Employees' Recovery during the Business Trip

There are three main procedures in the First Beat application which could be used for the clinical assessing of recovery: the diagram of fluctuation of sympathetic and

parasympathetic activation during the measured days (Fig 1.), the diagram of recovery (Fig 2.) and the diagram showing the root mean square of successive differences, i.e. RMSSD (Fig 3.). RMSSD is a measure of parasympathetic cardiac modulation, which could also be used for assessing the quality of sleep [e.g. 15]. The First Beat application produces estimations of the quality of sleep based on the analysis of RMSSD during sleeping time. These sleeping time related RMSSD averages were also used when analysing the recovery during the business trip.

The diagrams of fluctuation as well as the diagrams of recovery showed that during business trips, the mobile employees' sympathetic activation of the ANS dominates and parasympathetic activation phases remain relatively short (Fig. 1). Mobile working days were long and filled with sympathetic activation. Seldom during the working period were there breaks for recovery. Added to this, the evening times were usually spent in work related social events e.g. having dinner with a customer or colleague. That lengthened the period of sympathetic activation. In most cases the amount as well as the quality of sleep was inadequate for reaching sufficient recovery. The average sleeping time was 6.5 hours during the business trip nights and the average of RMSSD during sleep was 17.8 (sd 5.6) pointing out the bad quality of sleep.

Of the ten followed people, only two exercised during the business trip days. Usually, the days were full of work activities only. The HRV shows also the minor physical activity periods of the day, i.e. climbing the stairs, running to a train or bus, walking form the work place to the hotel etc. However, according to the analysis, these periods were so few and so short that health enhancing physical activity levels were not achieved during the business trip days. In Figure 1 the blue part shows physical activity. In this example case, the employee was hurrying frrm the ferry to the airport.
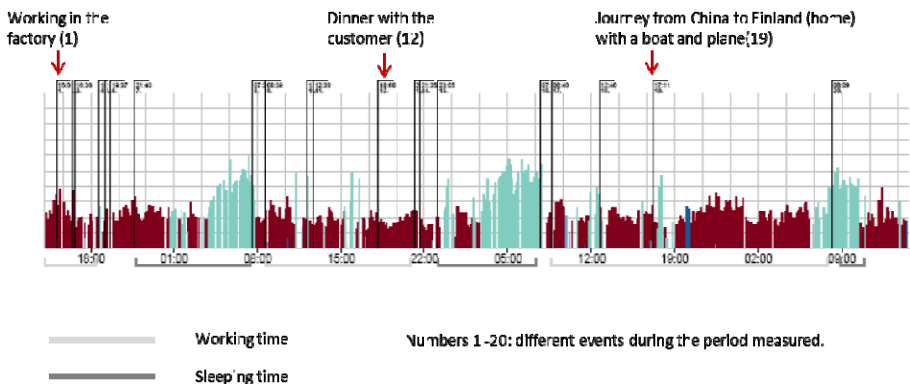

Fig. 1. An example of the fluctuation of sympathetic and parasympathetic activation during a business trip (three days, testee 5, two days working abroad and the third working and travelling)
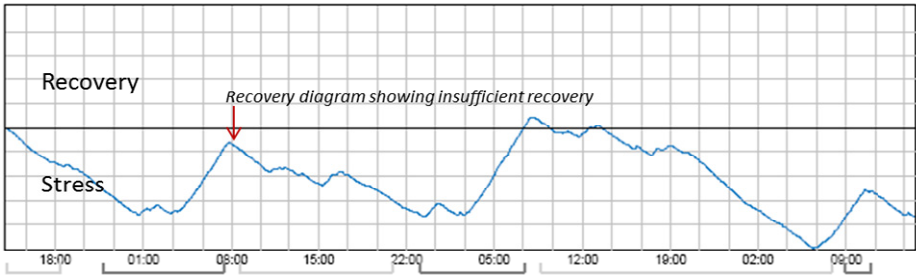
Fig. 2. The diagram of recovery – an example of the reduction and accumulation of a mobile employee's resources during a business trip, testee 5
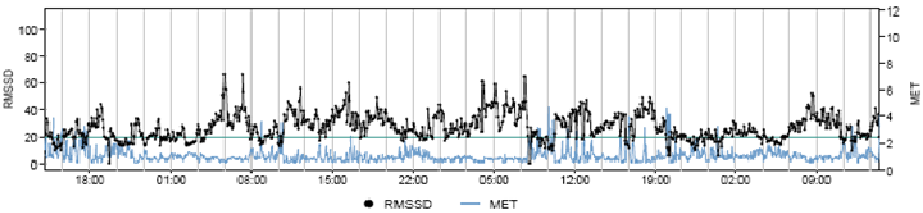

Fig. 3. The diagram of RMSSD (testee 3)

4.2   What Are the Demands of the HRV Measurement Procedure Met by Occupational Health Care Practitioners?

For assessing the demands the HRV measurement procedure laid on occupational health care practitioners, the time used for the employee measurement procedure was calculated by writing down the spent time per each employee step by step. The flow of actions and the average time spent on each step is presented in Figure 4.

Except the time spent there are many other costs related to the measurement procedure: occupational health care organisations should invest in the tools and applications as well as in education of the professionals.

Concerning the measurement procedure, occupational health care practitioners should be able to motivate and instruct the mobile employees to use the measurement tools properly. The pilot showed that the mobile employees were very motivated to this kind of measurement and keen on knowing how their body reacted during the business trips. Because the pilot group members were used to using different technical solutions for their work, they were not afraid to test this HRV solution and they quickly learned the main idea of using the body guard system and followed the measurement quite properly. The exception was the diary. Some of the testees made only a few entries in their diary (sleeping, working, travelling). Thus, the feed-back discussion was essential in order to complete the events of the business trip days and thus improve the validity, depth and quality of the analysis.
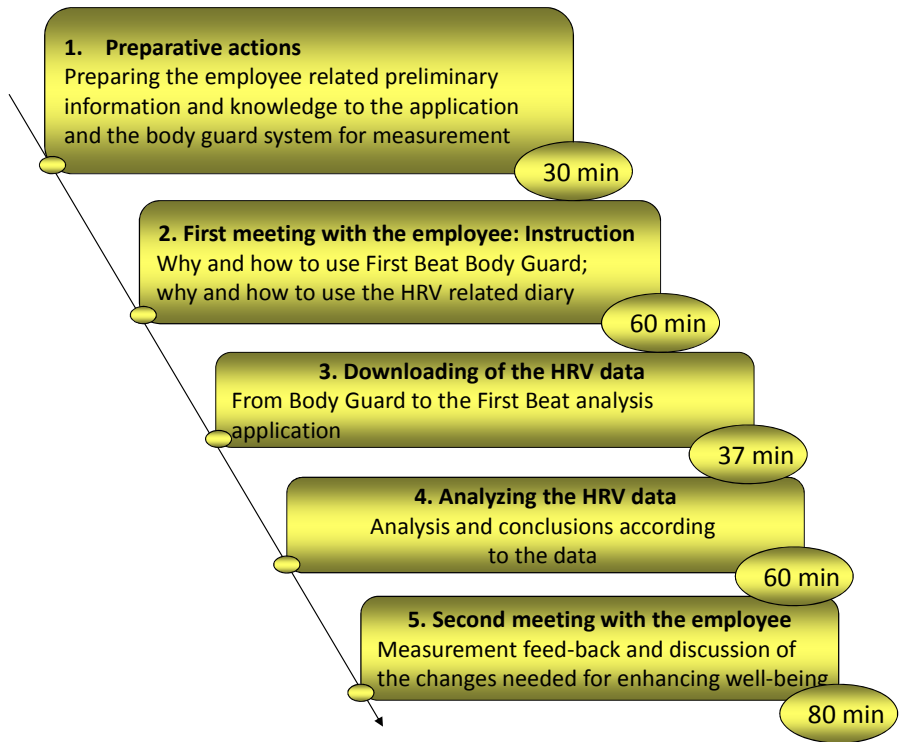
1.   Preparative actions
Preparing the employee related preliminary
information and knowledge to the application
and the body guard system for measurement

30 min

2. First meeting with the employee: Instruction
Why and how to use First Beat Body Guard;
why and how to use the HRV related diary

60 min

3. Downloading of the HRV data
From Body Guard to the First Beat analysis
application

37 min

4. Analyzing the HRV data
Analysis and conclusions according
to the data

60 min

5. Second meeting with the employee
Measurement feed-back and discussion of
the changes needed for enhancing well-being

80 min

Fig. 4. The HRV measurement phases and used time

The occupational health care professionals find the analysis phase of the HRV data the most difficult. For adequate analysis not only the demographic parameters (age, gender) but also the health status related issues as well as the medication should be taken into account. How these factors affect the fluctuation of sympathetic and parasympathetic activation was not simple to conclude.

The feedback meeting was considered a beneficial learning situation for a mobile employee. At the sight of HRV results the mobile employees started to discern the demands of their work, the work–life balance as well as the recovery enhancing possibilities. As this feedback situation was significant to the measured mobile employee, it really was essential for the occupational health care professional for ensuring the clinical reasoning. The tables of the HRV parameters as well as the diary filled with work and other events act as a stimulus to health related discussions.

5   Conclusions

An extensive amount of business travelling with a large area of operation embodies work load factors, which can be made visible for employees by the help of the HRV measurement procedure before they produce symptoms in mobile employees. Due to the long working days almost without rest periods and evening time filled with social

events, the recovery phases with adequate parasympathetic activation may remain short during business trips. Not having enough time for recovery and relaxation may be a concern for those mobile workers whose job requires constant business trips.

HRV measurement is considered as a good tool for studying the physiological effects of work-related stress [16]. However many of these studies have been made in laboratory settings. It is essential for occupational health care practitioners to gain new and valid tools for assessing the work stress and strain of those employees whose work is mobile and multi-local. Through HRV measurement, occupational health care practitioners gain valid information of mobile employee's ANS stress and recovery reactions. When connecting the diary information entered by each employee to this, knowledge of working conditions and work load factors may also be reached. However, the measurement procedure is time consuming and expensive to execute. Therefore it is not reasonable to assess the stress and recovery reactions of ANS of every mobile employee by the HRV procedure. Instead the HRV measurement target should be on those mobile employees, who have difficulties on controlling their work–life balance and who are suffering from symptoms assumed to be due to their mobile working mode. The other question to be considered came up with the studies, which e.g. point out the association between work stress and HRV to be the strongest in middle-aged workers and to be weaker in younger and older workers [12] or which argue that work stress might be associated with lowered HRV in women, but not in men [17]. As the tools of occupational health care professionals should be practical they should definitely guarantee ethically high-quality service: there is no room for conclusions that might mislead the customer.

There are many limitations in this study because of the very preliminary nature of it. Because the aim was very practical i.e. to test the HRV measurement procedure during a business trip and as a tool for occupational health care practitioners as well, we did not gather any baseline measurements or comparison material e.g. from "normal office days". During the next phase of our study, we are going to collect data from three business trip days as well as from home office days. Because the measurement procedure will then take six days instead of three, many new challenges in executing the measurement will definitely rise. There is also a need to tighten up the measurement procedure, i.e. the definition of the 'three-day business trip' to gain accurate and comparable data for analysis.

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Impact of Online Agro-technology Diploma Program and Its Future Perspectives for Improving Socio-economic Well-Being of Farmers in Sri Lanka

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Abstract. Agriculture is the mainstay of the rural sector of Sri Lanka. Farmers are resource-poor and face constraints in gaining access to information and knowledge not only to improve crop productivity but also to compete in business environment. To expose farmers to knowledge and information, University of Colombo has built an Online Diploma in Agro-technology in local languages as the first-ever attempt by Sri Lankan university system. Course lessons developed by agriculture experts were converted to an interactive digital form in online Learning Management System in Moodle. A prototype was developed and implemented with farmers all around the country. This study investigated the impacts of the program on the socio-economic improvement of farmers. Fifty farmers who are following the course were randomly selected as subjects of the study. The results showed positive impacts of the program on farmers' income generation, entrepreneurship ability, marketing capacity, social mobilization and agri-business.

Keywords: ICT-based farmer education, Socio-economic well-being, Farming Community.

1 Introduction

1.1 Present Status and Need of Farmer Education in Sri Lanka

The agriculture sector is the cornerstone in Sri Lanka's economy with more than 70% of the population living in rural areas depending on agriculture for their livelihoods. Currently this sector contributes to about 18% of the Gross Domestic Product (GDP) and 30% of the employment. The agricultural productivity has remained relatively stable, except for rice which has reached near-self-sufficiency in the recent years.

However, the growth in this sector has been sluggish. Rapid agricultural productivity growth is fundamental for reducing poverty in Sri Lanka as nearly 90 % of the poor live in the rural agricultural economy. Therefore, rapid development in food production while protecting the environment, water resources, and bio-diversity, needs to be given high priority in the development strategies [1], [2].

The role of agriculture in economic development has long been recognized in most developing countries [3]. Agriculture can play a unique role in reducing poverty and serve as an important engine for growth in developing countries and it is estimated that 70 % of the labor force in sub-Saharan Africa, and 67 % of the South Asian labor force work in agriculture [3].

Sri Lankan farmers concentrate in rural areas in the country and their contribution to agricultural sector is very high. Most of them are poor people with low facilities for further education and professional development. Provision of other facilities (rural credit, infrastructure and access to information communication technology) is also at low level. Agricultural activities are the main income generating source of rural farming community that gets little income from non-agricultural activities.

Sri Lankan farmers do not get good profit from agriculture products mainly due to lack of updated knowledge on new techniques and lack of information to develop their production. The present agricultural advisory services are not functioning well and farmers have little or no opportunity to gain updated knowledge and new technology.

Farmers are resource-poor and face tremendous constraints in gaining access to information and knowledge that could improve their livelihoods. Even though farmers have the aspiration and potential to pursue further education on new approaches, skills and techniques development has been negligible due to lack of opportunities and other constraints. Online and distance learning with appropriate information and communication technologies could serve as a means of effective transfer of knowledge, information and technology, while farmers are engaged in their cultivations. This may enable farmers to apply the knowledge directly to improve their cultivations and products.

It appears to be clear that farmer education plays a major role to ensure the socio-economic well-being of farmers, improve the quality of life and increase the standard of living. Therefore it is necessary to direct its practices in a manner that ultimate objective of self-sufficiency in food is attained. This can be achieved through gradual but consistent induction of the youth into agriculture and increasing production capacities of agricultural labor force. Full-time learning program are not that much effective for them as they are already cultivating or dealing with some agriculture related activities.

At present, the involvement of young generation in to agriculture sector is very low. They have little self-confidence as a farmer due to low socio-economic status. So it is needed to change their attitudes towards agriculture sector, as this is an economically viable, entrepreneur-oriented and high social status gaining sector. People who are involved in agriculture need to be educated in their desired fields. So, introduction of new education venture is required where farmers can enroll while engaging in cultivations. Therefore, University of Colombo Institute for Agro-technology and Rural Sciences started an online Agro-technology Diploma Program for farmers and agricultural professionals in 2009 as the first and the only case in Sri Lanka.

The program provides agricultural education to rural farming communities to uplift farming as a prestigious occupation. This is done through e-Learning, which utilizes appropriate information and communication technology (ICT). This program offers good strategies to improve rural people learning, thus enabling them to improve the quality and quantity of agricultural production and increase their income.

1.2   ICT and Agriculture

According to the findings of previous researches, ICT offers the ability to increase the amount of information provided to all participants in the agricultural sector and to decrease the cost of disseminating the information [4]. Also ICT in the agriculture sector facilitates knowledge sharing within and among a variety of agriculture networks including researchers, exporters, extension services and farmers. ICT enables vital information flows by linking rural agricultural communities to the Internet, both in terms of accessing information and providing local content. And also factors like lack of ICT proficiency, lack of ICT benefit awareness, too hard to use, lack of technological infrastructure, cost of technology, confidence level in the ICT system, lack of training, system integration and software availability limit the use of ICT by farmers [5].

The numerous factors that influence IT adoption and use in agricultural organizations can be grouped into five categories such as access to IT, demographic, IT training/education, trust, and time [4]. The most important limiting factors in terms of infrastructure and cost of technology in developing countries are no longer a threshold for ICT adoption in developed countries [4].

From the perspective of agricultural knowledge and information systems (AKIS), ICT can be seen as useful in improving linkages between research and extension sub-systems. The experience of rural tele-centers in the developing world shows that ICT can help in enabling rural development workers to gather, store, retrieve, adapt, localize and disseminate a broad range of information needed by rural families [6]. The ICT in agriculture education can lead to the emergence of knowledge workers, which will result in the realization of a bottom-up, demand-driven paradigm for technology generation, assessment, refinement and transfer [7], [8].

New information technologies are critical factors to open new information channels to the information-poor rural areas of developing countries [9]. According to the findings of Reddy, 2005 proposed a framework of a cost-effective agricultural information dissemination system (AgrIDS) to disseminate expert agriculture knowledge to the Indian farming community to improve the crop productivity. He explained, "*The proposed system aims to improve agricultural productivity by disseminating fresh expert agricultural advice to the farmers both in a timely and personalized manner. In AgrIDS, the agricultural experts generate the advice by using both the available agricultural technology related to the crop and the latest information about the crop situation received through internet in the form of both text and images*" [10: 1913].

According to the findings of Vijayaragavan [11], a wide gap remains between potentials of new technology and the actual yield in agricultural fields. Today agriculture has become more agribusiness where farmers need varieties of information not only to produce more, but also to compete in business environment. Agriculture information (various sets of information and messages that are relevant to agricultural production activities of farmers) is crucial to the farmers for increasing agricultural productivity and income. This clearly shows the need for timely and relevant agriculture information. Distance education thorough information and communication technology offers a scope in providing timely agriculture information at national and international level and offer solutions to problems and emerging challenges in farmer education [11].

The needs of the farmers in rural areas have not been addressed by existing extension programs.[1] The extension agencies in most of the states continue to remain weak. The organizational efficiency and professional competencies of extension workers[2] are poor. The use of ICT will give new impetus to extension organizations and if properly managed will result in effective transfer of knowledge and information to the rural people [11]. A number of ICT-initiatives for farmers have already been undertaken in India by government and non-government organizations. Some of the exclusive agricultural portals are Krishiworld.net, Agriwatch.com, Plantersnet.com, and Haritgyan.com [11].

According to the Council of Agriculture Research Policy, Sri Lanka, the traditional methods of information dissemination have become less successful and less cost-effective due to various reasons. The average number of farm families to be served by a single agriculture instructor (AI) has exceeded 4000, which is an extremely large figure to achieve. The withdrawing of grass root extension workers from extension activities and the overburdening of the remaining extension workers with other duties are some of the other constraints [1]. Therefore it is clear that there is a need to introduce an innovative way of disseminating knowledge and information for farmers in Sri Lanka. The introduced program described in this paper is a one of good examples for providing solutions for that.

The objective of this study is to describe the impacts and future perspectives of the farmer education program in Sri Lanka on socio-economic improvement of farmers who are involving in the program.

1.3   Implementation of Agro-Technology Diploma Program

The online Diploma in Agro-technology program consists of eight Certificate Courses on diverse agriculture subjects. Since it was envisaged that the farmers may have difficulties with online education in English language, the course was developed in local language. Learning Management system (LMS) was developed in local language using Moodle and online discussion forums and chat sessions were also designed in LMS to discuss their day-to-day issues in agriculture with their colleagues and teachers. Solutions and advices given by them would allow farmers to solve problems in cultivations easily. The courses and lessons were developed based on learner needs. With the exponential growth of online courses in higher education, retention is an area of great concern. Online student retention has been suggested as one of the greatest weaknesses in online education [12]. Studies show that the failed retention rate for online college and university undergraduates range from 20 to 50%. In an effort to improve retention and quality of learning of farmers, a number of steps were taken in preparation of study materials to enhance guidance and advice. Learner support is also provided through learner guides, print material, CDs and DVDs, face-to-face discussions, computer assisted instruction and video-conferencing in local language. To

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[1] Agricultural Extension is a service or system which assists farm people, through educational procedures, in improving farming methods and techniques, increasing production efficiency and income, bettering their levels of living and lifting social and educational standards.

[2] Extension workers have the task of bringing scientific knowledge to farm families in the farms and homes. The object of the task is to improve the efficiency of agriculture.

encourage peer interactions, online learning groups based on agriculture interest of student farmers have been facilitated. The courses can be accessed through any one of the National Online Distance Education Service Access Centers and the Government ICT centers located throughout the country, or through student personal computers.

1.4   Key Challenges Faced While Implementing the Program

One of the key challenges faced is the heterogeneity of farmers such as age, schoolings and computer skills. Therefore, it was a big challenge to introduce ICT for people who never touched a computer. An orientation course for ICT and learner support starting from the beginning was succeeded to train farmers for ICT. Also, majority of them were able to learn only in local language. Therefore, Learning Management System (LMS) and lesson contents were developed in local language. When starting the course lack of connectivity in remote areas was a big challenge for giving access to the course. For this Ministry of Higher Education has established NODES (National Online Distance Education Service) Access Centers (NACs) in every district with all ICT infrastructures. Farmers can access the lessons through those centers located in all districts in free of charge. After starting the using of computers by some of these student farmers bought their own computers and Internet facility and access. At the beginning the ability of interaction with others of farmer was very low. To avoid that, online learning groups were created and students were supported through online discussion forums with tutors /mentors.

2   Methodology

2.1   Data Collection and Analyzing

Randomly selected fifty student farmers who are following the course were investigated. Data were gathered on a pre-tested questionnaire, formal, informal discussions and participatory observations. Results were analyzed using statistical methods (Percentile and Wilcoxon Signed-Rank Test).

The Wilcoxon Signed-Rank Test is nonparametric statistical test that does not assume normality of the distribution of the population from which the sample is drawn. The test is applicable to the repeated measures experiment when the researcher wishes to compare two conditions in order to find out if they are different or if one condition is greater than the other. The null hypothesis of the test is that the distributions of scores in two matched samples are equivalent. The alternative hypothesis is either that they are different or that the score of one sample is greater than the others [13].

The individual is assessed on a measure on two occasions or under two conditions. Each individual is a case in the SPSS data file and has scores on two variables, the score obtained on the measure on one occasion (or under one condition) and the score obtained on the measure on a second occasion (or under a second condition). The goal is to determine whether participants changed significantly across occasions (or conditions) [4]. In this study two occasions are before the program and after the program.

Student farmers were asked whether they have any change in knowledge, income, entrepreneurship, marketing ability, social mobilization, and agri-business creation after following the course by using questionnaires, discussions and participatory observations, and those covered the four categories of variables presented in Table 1.

Table 1. Four categories of variables

Knowledge and information	Empowerment of farmers	Organizing ability	Socio-economic improvement
knowledge in agriculture	improvement of farming status	leadership qualities	income increment
knowledge in ICT	income increment	communication ability	social contacts
usage of ICT facilities	job satisfaction	decision making ability	social status
way of getting information	respect towards job		

3   Results and Discussion

3.1   Overall Impacts of the Program

The results showed positive impacts of the program on the farmers' income generation, entrepreneurship ability, marketing capacity, social mobilization and agri-business creations.

Most of the farmers (85%) have improved their cultivations and started new agribusinesses. Income of most student farmers (57%) generated from agriculture was poor and not sufficient before following the course. But after following the course majority of their income (75%) was increased up to level of good. Motivations towards the job and job satisfaction of student farmers both have significant improvement.

3.2   Knowledge and Information

This program has had a significant impact on the agriculture knowledge as well as the ICT knowledge of the students.

Knowledge in Agriculture. With the improvement of their knowledge on agriculture, farmers were able to increase their income while modernizing their farm enterprises with technical and entrepreneurship skills.

Initially there was a keen interest of the students to improve their knowledge on agriculture (Table 2). All criteria related to knowledge on agriculture (crop management practices, post-harvest technology, agricultural marketing, agribusinesses, and agricultural entrepreneurship) were significantly improved in the

Wilcoxon Signed-Rank Test with 5% level. Strength (mean value) of the improvement is 1.174. It is investigated that there is a significant improvement of the students' knowledge on agriculture.

Table 2. Knowledge in agriculture

* Significant at 5% level

Subject areas	Value of Wilcoxon Signed-Rank Test *	Mean value (Strength) of Wilcoxon Signed-Rank Test
Management practices on crops	5.43	1.174 (knowledge improvement in Agriculture)
Post-harvesting technology	5.90	
Knowledge on agricultural marketing	5.21	
Knowledge on agribusinesses	5.19	
Knowledge on agricultural entrepreneurship	5.68	

Knowledge in ICT. In Table 3, we can see all values of criteria for knowledge on information technology (Basic computer knowledge, Internet and E-mail usage, usage of E-calling and video conference) were significantly improved in the Wilcoxon Signed-Rank Test. Mean value of Wilcoxon Signed-Rank Test for the improvement of knowledge on ICT is 2.44. So, there is a significant improvement of knowledge on information technology with the course.

Table 3. Knowledge in ICT

Criteria	Value of Wilcoxon Signed-Rank Test *	Mean value (Strength) of Wilcoxon Signed-Rank Test
Basic computer knowledge	5.705	2.44 (knowledge improvement in ICT)
Internet Usage	5.771	
Usage of E-mail	5.771	
Usage of E-calling & video conference	5.836	

* Significant at 5% level

Usage of ICT Facilities. Most of students (59%) use Nodes Access Centers (NAC) established in all districts in Sri Lanka by Ministry of Higher Education to get the lectures and only 22% use home computers for that. 17% use both NAC centers and home computers.
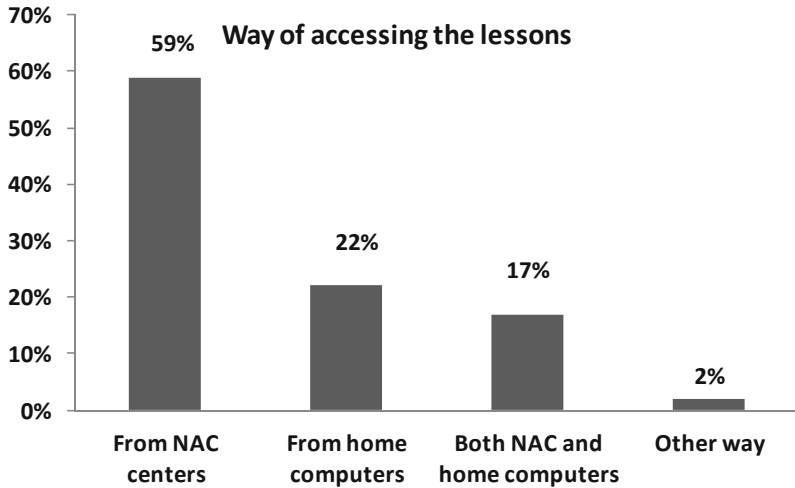
Fig. 1. Way of accessing the lessons

Way of Getting Market Information. In the way of getting information on agriculture marketing a high improvement can be seen. Before following the course most of farmers (54%) got information from other farmers in the area and 35% of farmers got information from village markets. Only 11% farmers get them from intermediaries and buyers which meet to farmers to buy their harvest. No one used ICT for that before following the course. But after following this course majority of farmers (72%) use ICT. This is a very good sign of improvement of information exchange of farmers.
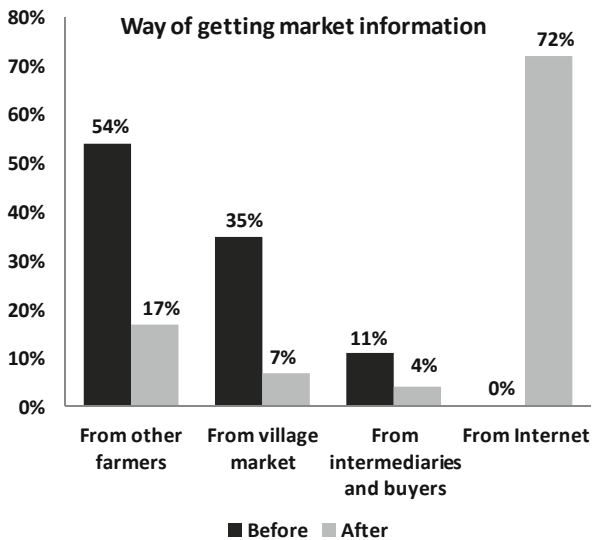
Fig. 2. Way of getting market information

3.3   Empowerment of Farmers

Empowerment of farmers as measured by the status of farming, social recognition, and income increase and job satisfaction also increased with the course. The study revealed that some of the personal characters of the students, especially organizing ability and social contacts were improved.

Improvement of Farming Status. Due to empowerment of farmers towards their farming, majority of them (85%) have improved their cultivations and 4% are already have started livestock management. Also, 4% of farmers have started new agribusinesses (Table 4).

Through the program students have improved their knowledge on agriculture and that improves their cultivations or agro-based industries. So, they have been empowered towards both learning and their occupation (farming).

Table 4. Improvement of farming status

Criteria of improvement	Number of farmers	Percentage (%)
Improved the farming	39	85
Started live stock management	2	4
Started agribusinesses	2	4
Have an idea to improve the farming	3	7
Still no idea	0	0

All values of Wilcoxon Signed-Rank Test for all criteria were significant at 5% level. Therefore, motivations towards both the job and job satisfaction of the students have significantly been improved and strength of them was 1.93 and 1.26 respectively.

Empowerment of farmers as measured by farming status, others' respect towards the job, income increment, and job satisfaction also increased due to this program. (Table 5)

Table 5. Empowerment of farmers

Criteria	Value of Wilcoxon Signed-Rank Test *	Mean value (Strength) of Wilcoxon Signed-Rank Test
Status of the farming	5.705	1.93
Income	5.078	(Persuasion towards the job)
Respect towards the job	5.572	
Job Satisfaction	5.836	1.26

* Significant at 5% level

When considering the strength of improvements, there is a highly improvement observed in motivation towards the job when compared to job satisfaction. (Figure 3)
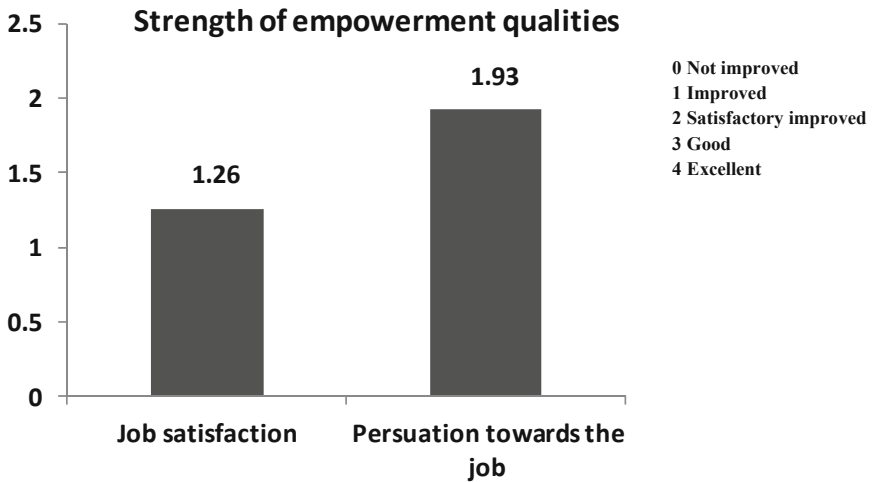
Fig. 3. Strength of empowerment qualities

3.4   Organizing Ability

Leadership Qualities. The variable includes improvement of their leadership qualities, decision making ability, communication ability, development of personal skills and their team working ability.

Under leadership qualities all criteria (empowerment of others, experience on societies and organizations, wish to get the leadership in group work, represent on difficult situations) were improved significantly at 5% level in the Wilcoxon Signed-Rank Test with a mean value of 1.33 (Table 6).

Table 6. Leadership qualities

Criteria	Value of Wilcoxon Signed-Rank Test *	Mean value (Strength) of Wilcoxon Signed-Rank Test
Empowerment of others	4.927	1.33
Experience on societies, organizations	4.927	(Improvement of
Wish to get the leadership in group works	5.000	leadership
Represent on difficult situations	3.914	qualities)

* Significant at 5% level

Communication Ability. When considering communication ability of students all criteria were also significantly improved in Wilcoxon Signed-Rank Test at 5% level and strength of that 2.2 (Table 7).

Table 7. Improvement of communication ability

Criteria	Value of Wilcoxon Signed-Rank Test *	Mean value (Strength) of Wilcoxon Signed-Rank Test
Communication with others	5.435	2.20 (Improvement of communication ability)
Communication through Internet	5.836	
Knowledge sharing	5.836	
Understanding ability	4.529	

* Significant at 5% level

Decision Making Ability. All criteria relevant to the decision making ability of the students were significantly improved in Wilcoxon Signed-Rank Test at 5% level and strength of that 1.33 (Table 8).

Table 8. Decision making ability

Criteria	Value of Wilcoxon Signed-Rank Test *	Mean value (Strength) of Wilcoxon Signed-Rank Test
Personal decision making ability	4.143	1.13 (improvement of decision making ability)
Decision making ability on profession	5.836	
Decision making ability on socially	4.692	

* Significant at 5% level

Fig. 4. Strength of improvement of organizing ability

Communication ability of the students was improved with higher strength (2.2) when compared to leadership qualities and decision making ability. Leadership qualities and decision making ability were improved but with a lower strength (Figure 4). Reason for the improvements is working as a team with their groups when they are doing practical, discussions, and presentations.

3.5   Socio-economic Improvement

The following variables were analyzed under the category of the socio-economic impacts of the program to the farmers.

Income increment
Social contacts
Social status

Income Increment. Income of most student farmers (57%) generated from agriculture was poor and not sufficient before following the program. But after following the program majority of their income (65%) was increased up to level of good. Before following the program there was no one with excellent income level and after the program 35 % students' income become excellent (Figure 5).The reason is that, while increasing their knowledge on agriculture they improved their cultivations and achieved higher income level.
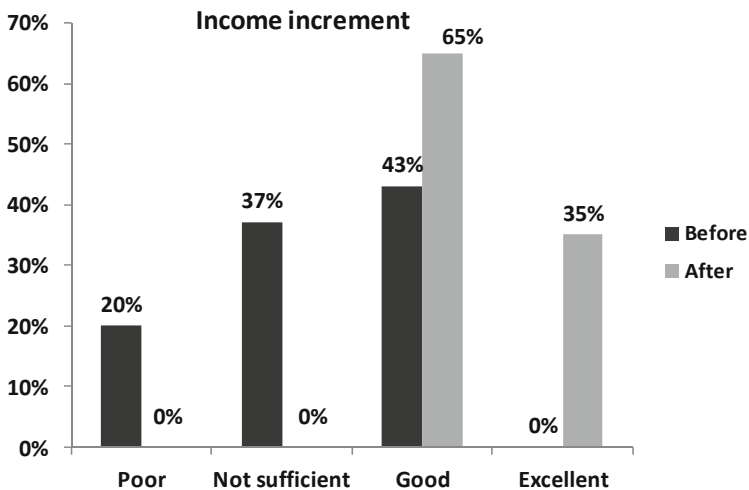

Fig. 5. Income increment

Farmers' income significantly improved in the Wilcoxon Signed-Rank Test at 5% level. Strength (mean value of Wilcoxon Signed-Rank Test) was of 1.65. The reason was their improved knowledge on agriculture and improved farming (agro-based industries) after following this program.

Social Contacts. All criteria under the social contacts were significantly improved in the Wilcoxon Singed-Rank test at 5% level (Table 9). Strength (mean value of Wilcoxon Signed-Rank Test) was 2.75.

Their social contacts with agricultural and non-agricultural institutions and persons have been strengthened while gaining the benefit of their services. Main reason for this is that they became more aware of the importance of those contacts for their personal and professional development (the organizations or institutes may be the agriculture-related, financial or other). Therefore, farmers tended to use more the services of those organizations or institutes after the program.

Table 9. Improvement of social contacts of farmers

Criteria	Value of Wilcoxon Signed-Rank Test *	Mean value (Strength) of Wilcoxon Signed-Rank Test
Contacts with government organization (agricultural)	5.504	
Contacts with NGO (relate to agriculture)	5.224	
Contacts with university staff	5.836	2.75 (Improvement of Social contacts)
Contacts with banks and other financial institutes	4.359	
Contacts with societies and organizations	4.529	
Contacts with other farmers	5.504	

* Significant at 5% level

When considering strength of the improvement, the higher improvement was seen in social contacts than social status and income increment. (Figure 6)
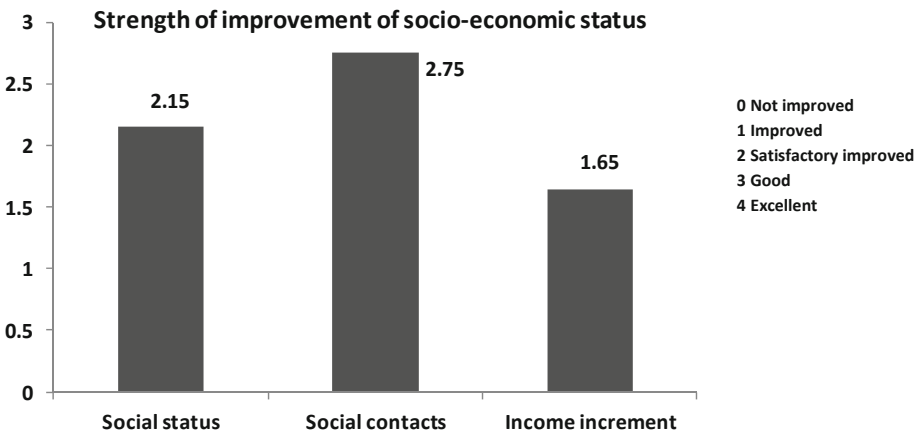

Strength of improvement of socio-economic status

Social status: 2.15
Social contacts: 2.75
Income increment: 1.65

0 Not improved
1 Improved
2 Satisfactory improved
3 Good
4 Excellent

Fig. 6. Strength of improvement of socio-economic status

4 Future Perspectives

Student farmers who followed this program had a real need to improve the knowledge on their profession and to be qualified on their profession to improve their socio-economic well-being. So there is a high demand for the program among farmers. At present the program is offered to 100 farmers per year. This number is not sufficient and should be increased gradually. Also there is a need to expand the program to North and East of the country.

The program is updating for future needs of agriculture sector and needs of the farmer students. Introduction of m-learning including live lectures video conferencing will convert part of the course to m-based learning to make available the course to more people, as at present almost all people own a mobile phone. The Institute first started Certificate level courses leading to a Diploma and now it is upgraded into a Bachelor of Agro-technology Degree by University Grant Commission of Sri Lanka. Development of home pages for all individual farmers is implementing and will be ready in future for facilitating marketing of their products. Ministry of Higher Education now may have an intention to expand this program to other institutions as an effective model of a university extension system for farmers.

5 Conclusion

As the result of following the program, knowledge on agriculture and knowledge on information technology has been significantly improved. Through this program all student farmers have empowered towards learning and farming. There is an improvement of personal and professional characters of student farmers. Because of the program, communication ability, social contacts and leadership qualities of students have been improved. Due to increment of their income via improving their cultivations they have gained a higher social status in community. Online distance learning is a suitable method for farmers to learn. This is a new and modern opportunity for younger generation who lack knowledge on agriculture and for those who have special interest on agriculture. Also, this program is considered to student farmers as a way of keeping themselves with satisfaction and pride towards agriculture as their profession.

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Can Mobile Health Deliver Participatory Medicine to All Citizens in Modern Society?

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Abstract. In Finland, Cardio Vascular Diseases (CVD) made up 41% of all causes of death in 2005. Best of art health IT technologies are not accessible to everyone. Replacing lifestyle and behavior with easy to adopt social routines can also prevent other non-communicable diseases like weight disorders, diabetes, depression, dementia and musculoskeletal illness.

In this paper we present the health-e-living concept: a mobile solution to deliver preventive, educational and promotional health to all citizens comfortable with IT technologies independently of their age or geographical location. The system includes a mobile phone application to collect personal data from sensors related to exercise activity, food intake and moods with minimal user intervention. The data collected is processed by an automatic learning classifier and presented to a nurse capable of instructing for better health behavior and to keep user progress on the targeted track. Health-e-Living uses the metaphor of social networks to improve health habits of persons connected to their support network in real life (family, friends, and colleagues).

The first RCT covered 35-45 year old men with cardiovascular risk factors consenting on being monitored for over 12 weeks. The vitals collected are heart rate, glucose, BMI, blood pressure and emotional state along with daily pictures of their meals. The barriers and facilitators for lifestyle change are assessed during the trial period. The study showed that a generic platform is useful in medical research and protocol pilots. The adoption pattern was not validated for an active aging population segment.

Keywords: mobile health, e-health, lifestyle intervention, social forum, and behavioral medicine.

1 Introduction

Health care systems are using more and more ICT solutions and services with the advance of ubiquitous computing and telecom technologies. Despite healthcare costs and aging population increase, consumers are not fully aware of technology's potential to help them improve their wellbeing, manage their diseases, and live safely at home as they age [1].

In Finland, Cardiovascular Diseases (CVD) made up 41% of all causes of death in 2005 compared with 52% in 1983 [2]. These figures are reported in a country where

health services using ICT technologies include best of arts in Patient Monitoring, Medical Image processing, Medical Signal processing, Computer Assisted Diagnostics, Telemedicine, Medical Informatics and Biomedical Informatics [3]. The future of health services in Finland is trending towards technologies for diagnostics, preventive care, healthcare process efficiency and mobile health services for improving the quality of life-style [4].

Personal health systems are already available in the area of sports, fitness, wellness, chronic diseases and independent living [2]. Still offering of health services is not matching the demand: in 2008, 37% of Finns lived in municipalities where the waiting time for a non-acute physician appointment was more than two weeks. The trend is growing compared with 25% in 2005 [5].

The forecasts of citizen's health and behavior are of interest for insurance companies. Often these forecast influence the direction of social development and thus of investments. The data used for forecasting is frequently collected from connected networks of health systems, sensors, devices, human specialists and target living systems. The US health reform in 2011 provides free preventive care for Medicare and Medicaid members [6].

In this paper we address the question on how these trends in mobile health technology would impact modern life-style. Who have access to this new development and how should citizens be educated in healthy living irrespective of their social background? The health-e-living concept aims to explore a mobile solution to deliver preventive, educational and promotional health to all citizens comfortable with IT technologies independently of their age or geographical location.

2   Related Work

There are certain assumptions that set the base of most of the research literature used as basis for this work. Here is a list of the main ones:

- Mobile health return of investments is positive in magnitudes from 10 to 30 euros per invested euro [7], [8].
- Mobile data privacy and legal issues are technically and ethically solvable [9].
- Mobile phone use does not affect personal health adversely [10].

The Finnish Ministry of Social Affairs and Health did in 2010 publish its strategy for social and health policy towards 2020. As part of the challenges is included the fast aging of the population, the increase of financial pressure, the increase of cross-border mobility and multiculturalism and the increase of chronic lifestyle illness, among others. At the same time the opportunities included the fast changes in interaction forms between people, the leveraging of technology and information resources expanding the operating potential of the health care sector and the new changes in forms of work and working life [11].

Sustainable financing for health insurance coverage can be obtained from tax, social security contribution and motivated insurance premiums [11]. These institutions are most interested in solutions for preventive health that will lead to savings in treatment, unnecessary doctor's visits and extended working life. The focus of customer oriented health service is shifted towards preventive action; service funding will be changed to augment public access with private social welfare [11].

Citizens are willing to take responsibility for nurturing their own health by accessing operational mobile health services if they perceive mobility comfort, enhanced wellbeing and quality access without compromising efficiency, reliability and affordability. For that, an obstacle-free environment will ensure ease of access, availability of services, secured citizen's income, efficient insurance system and disruption-free information management system [11].

From the statements above it is visible that strategy implementation officers could succeed by assuming several issues:

1) Health services are accessible only to legally declarable citizens.
2) Citizens do always have time and income to afford health care services.
3) The only option available for resource-limited areas is self-care.
4) Citizens would have enough education to responsibly manage their own health.
5) IT and mobile health solutions always facilitate rather than make the access to health services difficult.

With these premises, the search for a generic consumer platform should allow all citizens and especially the elderly to keep their independent way of living while having access to social security services regardless of their location. The second constraint should be the economical affordability of the service, either by public or private insurance. Finally, to support equality, caregivers and family members are expecting to access services anywhere and anytime, with minimal technological intervention. The latter implies that available limited resources (physicians, nurses and clinics) are forced to rely on well-connected and reliable technical systems.

(a)   Responsibility

A health dissemination example is the study on mobile health application for wellness management: "Understanding the purpose of the applications and perceiving them as personally relevant may have increased the usage rate in all applications" [12].

By recognizing patients as sources of indispensable information about their own health and treatment options, individual providers and care delivery systems can create value while improving patient comfort and satisfaction with their health and health care [5].

Health service buyers are demanding more quality and are even willing to participate more on their own care as they realize that preventing health conditions is a major contributor to healthcare savings and an alleviator of unnecessary care [8].

(b)   Usability

All benefits from IT and mobile health are impossible without usability. Mobile technologies allow regular management of chronic diseases [13], better adherence to medication regimen [14], facilitate regular feedback [8], prevent re-admission by monitoring patients after acute events [4] and educate communities to better manage their health conditions [12], [15].

3   Study

Before designing a randomized controlled trial to prove the concept, it was identified what problems of preventive health and participative medicine [16] could be solved with health-e-living mobile health services. Non-communicable diseases selected for the first phase were diabetes [17], cardiovascular disease, hypertension, overweight [18], muscle-skeletal disorder, dementia [19] and depression [20] as they have bigger impact on the population and are relatively easy to intervene with through remote mobile monitoring [21].

The system includes a mobile phone application to collect personal data from sensors related to exercise activity, food intake and moods with minimal user intervention. The data collected is processed by an automatic learning classifier and presented to a nurse capable of instructing for better health behavior and of keeping user progress on the targeted track. Health-e-Living uses the metaphor of social networks to improve health habits of persons connected to their support network in real life (family, friends, and colleagues).

In 2002, over a million people in Finland reported a long-term musculoskeletal disease, and about 600 000 have restricted functional capacity because of it [22]. For the same reason sick allowance was claimed in 33% of sickness periods during 2006 [2]. There are estimated to be about 150 000 people with diabetes in Finland, about 23 000 of whom have type I diabetes (an incidence of almost 40 per 100 000 population) [22].

For this reason the protocol designed by Helsinki University Hospital and a clinic from Municipality of Vantaa was focused on cardiovascular diseases and hypertension. The intervention was oriented to a comparative study between a male population under risk of cardiovascular diseases and with poor physical activity habits, and a reference population using primary services provided by public clinics.

The team of medical specialists required a mobile application that was simple and easy for middle-aged men with very low knowledge of ICT and mobile technologies to use. The nurse did the screening at the clinic, where the subjects consented to participate in the trial after taking blood samples, weight and waist perimeter measurements.

The subjects were instructed in the use of the mobile application to collect data from physical activity based on the Polar heart rate sensor that is commercially available. The food intake for diet recording is acquired by the phone camera and processed offline by a cloud engine where a multi kernel classifier [23] returns an approximate calculation of calories contained. A nutrition specialist assessed the calories estimation during training phase [24]. The picture in Figure 1 presents a general diagram of the used system.

The Nurse interviewed the subjects monthly during a three-month period to follow up the adherence to the selected health plan. During the clinic visit it was possible to update the health status progress. The diet and physical activities were monitored almost daily according to data collected voluntarily by subjects. The nurse provided feedback once or twice a week depending on the amount of diary entries submitted via the web interface.
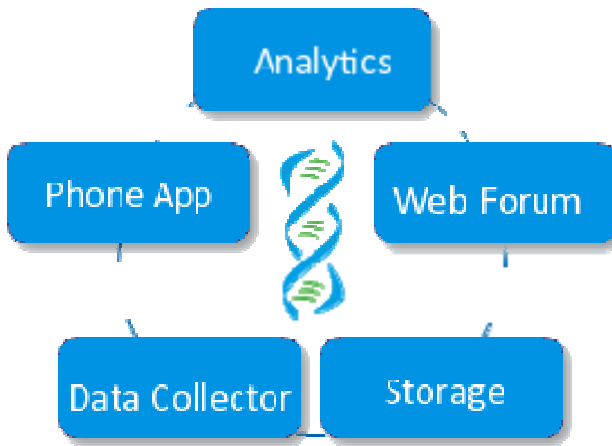
Fig. 1. Generic diagram of health-e-living system

The system stored the documents related to exercise plan and sample diet in a common location with access for all participants. At the end of the study the participants filled in a questionnaire and reported their impressions of the system usage.

4   Implementation

The software implementation is described in two parts: the mobile phone software and the web engine software.

4.1   Phone Component

Aspects like usability, convenience, security, privacy and trust are relevant to the adoption of mobile services. Patients (and clinicians) are accessing health information and actively participating in their own care (participatory healthcare), and maintaining contact with their healthcare providers through smart phones. Smart phones are useful to keep clinicians up-to-date with the latest medical techniques, and it is easy and cost-effective to communicate updates, advice and guidelines to a distributed community of practice in this way. As has also been demonstrated, mobile phones are useful for monitoring and diagnosing health conditions when clinicians are at distance from their patients [17].

The programming framework used for the mobile application was Android Development Toolkit by Google in a Java Eclipse IDE. The mobile devices were targeted to Android platform 2.1 and 4.0 to cover the price range from small form factors to smart phones. The Bluetooth protocol description for Heart Rate sensor was available in Polar web site.

The user experience design included big buttons and a lean screen to minimize erroneous interactions. The execution flow was simple for both diet and exercise: selection, start, stop and sending data to the cloud engine. All activities were buffered in the phone to avoid excessive data traffic over wireless and to recover from connectivity breaks.

The availability of mobile devices and its computing capabilities currently favor the technology adoption for social sectors where minimum income (at least to afford the mobile subscription), minimal education and social interaction with other group members already comfortable with mobile phone use are guaranteed.

4.2   Web Component

The development environment for the web platform was Ruby for user interactions and Java Jersey for REST web services. The machine learning classifier used available Java libraries. The web interface allowed users to review their data chronologically and provide comments on their own activity or in member of the group. Some persons are reluctant to rely on the web as a primary source of information while others are willing to trust health-related guidance and suggestions [25].

The web was accessible only to the nurse and members of the pilot trial. Main preferences were in the area of simple design, ease to navigate, and simplification of medical terms. The tracking of health diary activities was complemented with the ability to upload user documents like diet targets or specific training exercises.

5   Discussion

The data collected from the first trial subjects was enough to suggest improvements in both the mobile application and the web interface. Both the subjects and the nurse were concerned about aspects like convenience, security, privacy and trust during the early adoption of the data collection service. It was clarified that the web application was internal to the participants only.

After one week of usage, the subjects were providing comments to the pictures in the web interface to the nurse and to selected participants, as they felt confident on self-disclosure. The visualization of the timeline produced large amount of data for the nurse but maintaining contact with the participants was more highly valued.

The motivation to track the exercise plan or the diet plan was initially quite high but it decreased over time according to the amount of entries. The diet data collection seemed to be easy to insert in the daily routine.

The study revealed that usability was a key aspect in the exercise tracking. Besides the initial learning associated with the heart rate device, there were other issues affecting the continuity of use like for example battery drainage, the lost of connectivity or ease to forget as it was separated from the phone.

From the nurse's view it was important to have access to stored data remotely as it was easy to refer to the activities narrated by subjects and to the exercise efficiency measured by the heart rate sensor. The possibility to comment on the diet pictures was perceived more important than the accuracy of calories counting.

Finally there were no relevant results proving the equal opportunity access for participants, as the population was quite homogeneous and devices were provided by the clinic fund for free when existing ones did not match the requirements. Users were instructed to use free Wi-Fi hotspots to reduce the data charges as not all were having data services in their mobile subscription. Currently the skills needed in PC and mobile usages are known barriers to access to new mobile health services in addition to the poor usability design.

6 Future Directions

The first trial showed that the system was not optimized for the amount of data collected. Also the visualization techniques were not as user-friendly as needed. It is desirable to arrange a dedicated usability study with a large number of subjects, especially from an active aging population.

Another interesting aspect to study would be the demographics of persons using the mobile service and the possibility to prescribe to it directly by the nurse.

The web search and navigation functions should be improved. The web interface should be connected to online forums and medical information sites for jargon clarification and in-depth learning explorations.

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Complaints Made to the Council for Mass Media in Finland Concerning the Personal and Professional Lives of Doctors

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Abstract. The Council for Mass Media in Finland is a self-regulatory board of journalism that evaluates complaints concerning the execution of the Finnish Journalism Guidelines. Between 1995 and early 2002 26 verdicts given by the Council dealt with matters related to the private lives or work of medical professionals. These cases were analyzed in order to determine the limits for acceptability in treatment of physicians in the media. Four key themes were identified: the rights of an interviewee, the right for a subject of negative publicity to defend a physician's right to privacy and media impact on patients' health choices. Results: patient-doctor confidentiality may pose a challenge to a doctor's right to defend him/herself publicly; a doctor's profession should not be mentioned if it has no relevance to the event that is being reported; the media may well challenge existing medical paradigms.

Keywords: medical journalism, media ethics, medical profession.

1 Introduction

The media is an important source of health information for the general public and many patients discuss media reports with their doctors [1]. In Finland the standard of medicine is considered to be high and advances in medicine are one of the most actively followed science fields by Finns [2]. The most important source of health information for Finnish patients is medical professionals [3]. Television was considered a reliable source of such information by 79-83%, newspapers 61-65% and radio 75-77% [3]. Mass media has been utilized as a tool for modifying patients' views on treatment paradigms [4] and the media has been found to constantly mold the public's image of health care [5]. Doctors themselves are prevalent in media – for instance television viewers witness several doctors a week in prime-time broadcasting [6]. Medical professionals can attain many media roles, e.g. as experts of certain diseases, in the course of a major disaster or perhaps even as subject to criminal charges or an investigation into professional conduct that has garnered public interest.

There is evidence that negative news concerning health care gets more easily published than positive news [7] and it has been suggested that scientists such as doctors are especially concerned by media messages that question their credibility [8]. Several studies and commentary articles have looked into how doctors are portrayed in the media and results have differed from negative [9-11] to balanced [12] atmosphere towards the profession. The question has been raised whether negative mass media coverage could even contribute to doctors' being unhappy in their profession [13]. It has been claimed that doctors are under heavy scrutiny by the media, media climate towards doctors has become harsher during the past decades [14] and journalists seem to favor the patient's perspective [15].

It would be beneficial for both journalists and physicians to have an understanding of the limits of acceptable journalistic practice concerning doctors. The Finnish Medical Association has, together with the Finnish Union of Journalists, published a joint set of guidelines [16] for the interaction of media and medicine although the recommendation focuses on reporting medical information and not on the treatment of physicians by journalists. Finland is tied with Norway for the first place in the Freedom of Speech index [17] and media self-regulation in Finland has been found to be comparably healthy and effective [18], [19]. All this makes Finland an interesting subject in the study of acceptable limits for treatment of medical professionals in mass media.

The Council for Mass Media is Finland's national self-regulatory board of journalism with the purpose of defending freedom of speech and determining through statements and the evaluation of individual cases the limits of acceptable conduct in Finnish journalism. Similar boards exist in numerous countries around the world but their impact varies. Finnish journalists consider the Finnish Council an important institution in upholding media quality and see the Council as a suitable tool for defining good journalistic practice [20], [21]. The numbers of complaints made by members of the public to the Council has been on a heavy rise in recent years[1] [22], which could be interpreted as a sign of strengthened public trust. The Council is also partially financed by the government [18], further fortifying its standing in society.

The Council is overseen by a Managing Group, the members of which have signed the Council charter and are thus subject to the Council's decisions [22]. All major Finnish media outlets have signed the charter and the Council only processes complaints concerning these affiliates [22]. The ethical principles agreed on by the profession are verbalized in the so-called Finnish Journalism Guidelines [23], which have gone through many changes since the Council was founded in 1968.

The Council consists of a chairman[2], seven journalism professionals and four representatives of the general public, one of which currently is a medical doctor. Journalist representatives are elected by other journalists and representatives of the public are selected through an open application process [22].

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[1] Complaints number lately around 300 per year.

[2] The Chairman's background is not required to be in media but in recent years this has been the case.

Anyone who feels that a media outlet has breached good professional practice in light of the Guidelines can make a complaint to The Council. These must be made in writing and cannot be anonymous. Journalists are also free to submit similar complaints concerning the work of their colleagues. The Council has no legal jurisdiction in Finland and the complaint process is also meant to replace slow and expensive legal processes [22].

All complaints are first evaluated by the Chairman who can either reject them or direct them for further processing. In cases that are accepted for evaluation a statement is taken from the representative of the media in question. Minor matters resulting in acquittals are then resolved by the Chairman alone. Only complaints with broader ramifications to journalistic practice or grave accusations will be given to the full Council to evaluate. If the Council finds the criticism voiced in a complaint valid they will issue a notice[3] which the guilty party must publish, thus effectively admitting to their readers or viewers that they have violated good professional practice [22].

An acquitting decision by the Council rarely means that the media in question have acted honorably in all aspects. The Council often rebukes the media in question concerning some particular shortcomings in the case and reminds them of the pertinent Journalism Guidelines even though The Council is giving an acquittal based on the big picture. Guilty verdicts are thus reserved only for grave misconduct in order to uphold their weight as punishment. The Council only evaluates the journalistic merit and practices in a certain case, not the subject matter of the journalistic product in question [22].

2   Purpose of This Study

The purpose of this study was to determine the limits for acceptability in the treatment of medical professionals in Finnish journalism by evaluating Council rulings in cases related to the private or professional lives of medical professionals. Another goal was to find out common denominators or key themes in those encounters between journalists and Finnish medical professionals that lead to such a complaint being made to the Council.

3   Data and Methods

All Council rulings between 1995 and February 2012 have been published online [22]. This time period was selected because the Finnish Journalism Guidelines have been changed regularly since the dawn of The Council in 1968 [22]. Journalistic practice is a product of its time and older cases would not reflect current practices. The year 1995 was selected as the first to be examined because at that time the Council began publishing its verdicts online – thus offering unlimited access to the material.

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[3] Which will be referred to as a guilty verdict in this paper for the sake of clarity even though Council rulings have no legal ramifications.

A search was made in the online case database made using all possible Finnish synonyms for a doctor, including titles for different medical specialties and academic personnel. All cases returned by this search were given a pre-evaluation and cases that seemed to even mildly link to medical professionals were selected for further study. These potentially pertinent cases were then examined more closely by accessing the full case documentation stored at the Council office.

The case documentation typically included the complaint documents, the article or program in question, a statement given by the editor and/or the journalist in question, notes made by the secretary in charge of evaluating case and the final verdict text. Some cases included additional background material such as court documents. In cases where the complainant or other main subject in the matter was a physician but his profession turned out to have no relevance to the nature of the complaint was excluded.

Facts gathered from relevant cases included: a summary of the subject matter, type of the media in question, the profession of the complainant if available, journalistic themes present as related to the Journalism Guidelines, nature of the verdict (guilty or dismissed and whether there was a vote) and other relevant evaluative comments given by the Council. A qualitative, grounded theory –influenced approach was then utilized to find common denominators in the case data. Results were compared to the Finnish Journalism Guidelines, as referenced in the Discussion section.

4   Results

4.1   General

Total annual number of cases from 1995 to 2011 varied from 44 (in 1999) to 324 (in 2011) (Figure 1, 25]. Altogether 26 cases fulfilled the inclusion criteria (Table 1). A great majority of complaints were directed towards magazines or newspapers (22 cases). Half of these concerned smaller local papers. Four cases dealt with television and three cases dealt with tabloids. In 21 cases the complainants included at least one medical professional. The number of relevant cases per year did not correlate with the total amount of verdicts given by the full Council or the total number of complaints per year (Figure 2).

Out of the 26 cases analyzed eight (31%) led to a guilty verdict for the media outlet in question. Nearly all of the cases that led to this disciplinary action dealt with newspapers; one magazine and two tabloids received a guilty verdict. The amount of guilty verdicts in this material was in line with all Council cases; out of those evaluated by the Council from 2008 to 2010 25-37% led to a guilty verdict.

Four key themes could be identified in the case material: 1) the rights of an interviewee; 2) the right of a subject of negative media attention to defend himself; 3) a physician's right to privacy including the relevance of disclosing his profession when placed in the limelight concerning his death or events in his private life; 4) the impact of the media on patients' health choices. A fifth category, "other" was used to denominate thematically singular cases.
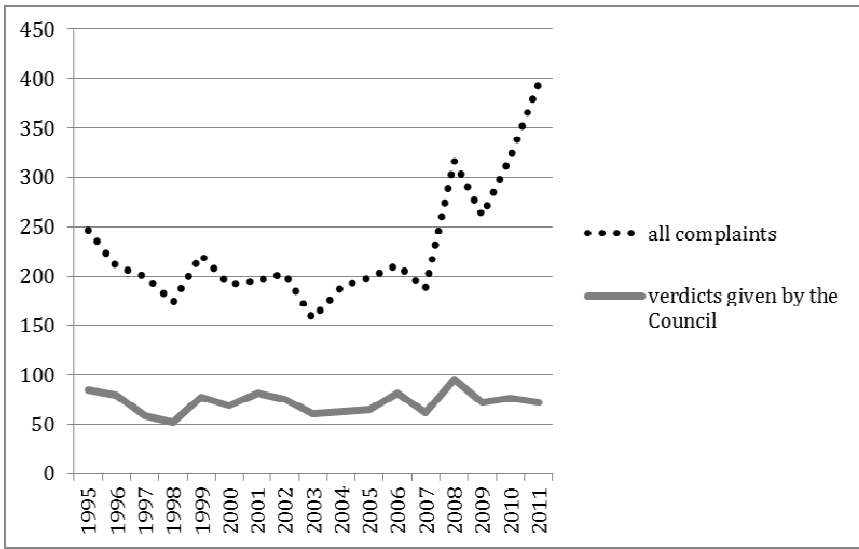
Fig. 1. Annual numbers of complaints to the Council for Mass Media in Finland and the number of verdicts given by the Council per year
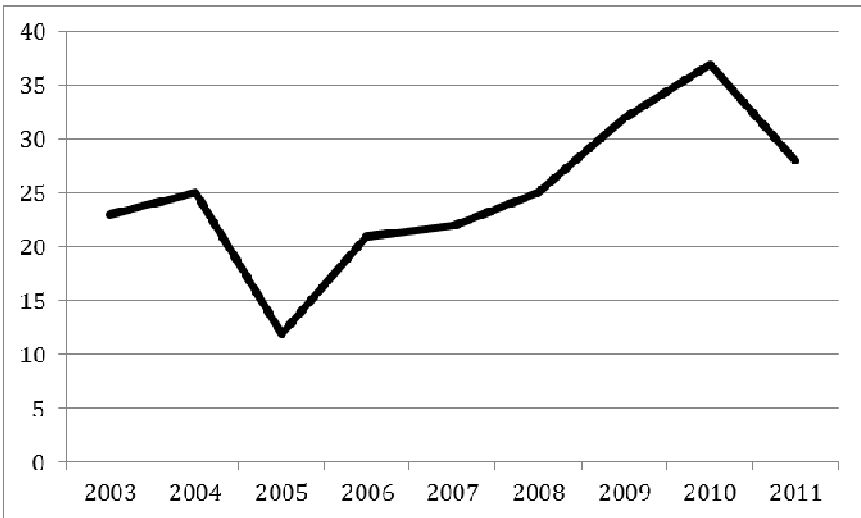

Fig. 2. Annual percentage of guilty verdicts given to cases evaluated by the Council for Mass Media in Finland

Table 1. Description and categorization of cases dealing with medical professionals evaluated by the Council for Mass Media in Finland in the years 1995-2011

Theme	n:o	Media typ	Year	Complainant	Summary	Council verdict (vote result)
1. Rights of an interviewee	1a	television	2011	the surgeon in question	a surgeon's interview was used in a tv program as an example of bad doctors	acquittal (6-5)
	1b	television	2000	the student in question	a medical student interviewed about his rare and disputed medical condition felt that certain program content questioned his credibility	acquittal
	1c	newspaper	2010	the gynecologist in question	a gynecologist was claimed to comment on patients' family planning decision in an inappropriate manner	acquittal (9-2)
2. The right to be heard when subjected to negative publicity	2a	newspaper	2004	thegeneral practicioner in question	an article about a petition against a general practicioner who was also a local politician	acquittal
	2b	magazine	1996	the doctor in question	an editorial was critical towards a doctor's expertise in sports medicine	guilty
	2c	newspaper	2010	another individual with the surgeon's permission	a surgeon was described by a patient as a butcher in an interview	guilty
	2d	newspaper	2011	a private hospital	articles about clustered cholecystektomy complications in a recently privatized hospital	acquittal
	2e	newspaper	1995	one of the doctors in question	two doctors' disagreement about working conditions became public	acquittal
	2f	newspaper	2009	a doctor representing the clinic	an anonymous patient criticized the treatment he had received at an occupational health clinic	acquittal
	2g	magazine	2007	a Finnish doctor mentioned in the article	an article claiming the drug rehabilitation practices of an Estonian hospital were questionable	acquittal
	2h	newspaper	1999	the doctor in question	article about administrative disciplinary action towards a doctor	acquittal
	2i	newspaper	1999	a colleague of the professor	article about a court case against a dental professor accused of misusing research funds	acquittal
	2j	television	2006	a private clinic mentioned in the program	several programs about the potentially questionable connections of public sector doctors to private healthcare	acquittal
	2k	tabloid	2005	the doctor in question	a columnist compared a doctor, who was also a member of the Finnish parliament, to the Nazi physician Mengele	guilty
	2l	newspaper	2005	the doctor in question	a columnist wrote negatively about her visit to a doctor who was named in the column	acquittal

Table 1. (*Continued*)

3. A physician's right to privacy	3a	newspaper	2001	an occupational physician on behald of the widow	the profession of a drowning victim was publicized against the widow's wishes	guilty
	3b	newspaper	1996	head of PR for the Finnish Medical Association	the name of a doctor suspected of assault was publicized	guilty (10-3)
	3c	magazine	2004	the doctor in question	article about the ongoing selection process for a professor	acquittal
	3d	newspaper	2002	the father of the deceased	the dental profession and the unfavourable state in which a suicide victim he was discovered were publicized	acquittal
4. Media impact on patients' health choices	4a	television	2010	a cardiovascular physician	a program presented critical views on dyslipidemia medication	acquittal
	4b	tabloid	1998	a pharmaceutical company and a general practicioner	article about the possible risks of antidepressant medication	acquittal
5. Other	5a	tabloid	2008	a holiday tour guide injured in the accident	a journalist used his physician wife to gain interviews from hospitalized bus accident survivors	quilty
	5b	newspaper	2004	the dentist in question	an interviewed patient claimed a dentist had revealed to him negative facts about public dental care	guilty
	5c	newspaper	1995	the other pathologist	an interviewed pathologist made grave accusations against another pathologist and the newspaper failed to verify these claims	guilty
	5d	newspaper	1999	the doctor in question	a doctor felt that wordplay in an opinion piece in a newspaper hinted to him in connection with alcohol use	acquittal
	5e	newspaper	1996	a consumer rights advocate	an article about alternate therapies painted a negative picture about medical treatment of rheumatoid arthritis	acquittal

4.2   Summaries of Notable Cases in Theme 1 (Three Cases): The Rights of an Interviewee

Case 1a: A surgeon was interviewed for a TV program about his controversial surgical treatment method. According to his complaint he was under the impression the subject of the program was to provide a neutral look into his work. According to his complaint he had been very surprised to discover that the subject matter of the program section was, in fact, quackery and bad doctors. His interview was used in the program as an example of such a doctor. The acquitting verdict came through with a narrow vote, with several Council members giving a written dissenting opinion in the verdict text stating that the atmosphere of the program strongly painted the surgeon in such a questionable light that no amount of mitigating could have repaired the damage to his reputation.

   Case 1c: A newspaper article claimed that a gynecologist had been making off-key remarks to patients' concerning their family planning decisions. Patients were

interviewed anonymously but the gynecologist was interviewed and named in the article. In his complaint to the Council he stated that he had been mislead about the subject matter of the interview. In following issues a fellow gynecologist's letter was published, defending a gynecologist's right – perhaps even duty – to discuss the biological facts of prime reproductive age with his patients. At least one of the clinic's patients wrote to the paper as well with a negative outlook on the gynecologist's manners. The Council gave an acquittal after a vote.

Summary: Individual doctors' interviews were used to illustrate questionable medical conduct. The physicians in question felt that the journalists had failed to disclose the context in which the interview material would be used. This made it difficult for the physicians to defend themselves against these accusations.

4.3   Summaries of Notable Cases in Theme 2 (Twelve Cases): The Right to be Heard When Subjected to Negative Publicity

Case 2a: An article was published in a local paper about a petition being gathered against a local general practitioner by patients who were discontent about his manners and professional conduct. The newspaper had recognized the article to represent very negative publicity and thus gave space in the article for the doctor's comments. The doctor did not consider this to be enough to clear his reputation and complained to the Council. He felt that by publishing the article the newspaper had effectively egged on those gathering the petition. In its acquitting verdict the Council lined that general practitioners working in the public sector hold a public position and are thus must subject to public evaluation by the media. Since the doctor in question was also active in local politics he had to be able to endure such public scrutiny.

Case 2b: A magazine editorial directed harsh personal criticism towards a doctor, questioning his expertise in sports medicine. As the physician's reply to these accusations he sent in a two-page letter and lengthy lecture notes. The magazine considered the amount of material to be too excessive for the format of the magazine, and no part of the material was published. The Council gave the case a guilty verdict, stating that the accusations made in the editorial were so heavy that the magazine should have negotiated with the doctor about reformatting his reply to fit with the magazine format in order for the doctor's right to defend himself to be fulfilled.

Case 2c: An anonymous patient was interviewed in a newspaper airing his dissatisfaction with the results of plastic surgery. The patient described the surgeon to be "a butcher". The surgeon, who was named in the article and asked to comment, declined to do so on the basis of patient-physician confidentiality. The complainant was not the surgeon in question but another individual with the surgeon's permission. The case resulted in a guilty verdict – the Council ruled that such terminology should not have been used about a doctor even if it were a direct quote from a patient.

Case 2i: A newspaper wrote about a court case concerning a professor of dentistry accused of misusing research funds. The complainant – a colleague of the professor - felt that such a tenured researcher should have been treated with more respect in the media and that the defendant could not offer a reply due to illness limiting his ability to deal with all the publicity. The Council gave the article an acquittal. Although the

headline of the article seemed to contradict the fact that the court acquitted the professor, the article itself contained no mistakes and nothing was misquoted in the Council's view.

Summary: In cases dealing with negative publicity the case outcome depended on whether the complainant had been given ample opportunity to defend himself and the nature of the allegations – factual or abstract such as describing a doctor as a "butcher". The Council ruled that doctors – especially those who also take part in local politics – must be able to handle a certain amount of public scrutiny since they are employed in a public position. Court material was an exception to the right to defend oneself since associated claims had already been legally verified as fact.

4.4   Summaries of Notable Cases in Theme 3 (Four Cases): A Physician's Right to Privacy

Case 3a: A doctor had drowned and a small local paper published his name against the widow's wishes. The complainant was the widow's occupational physician and he stated in his complaint that revealing the name of the deceased had caused unreasonable anguish to the widow and that his name had no relevance to the newsworthiness of the event. The Council agreed and gave the case a guilty verdict.

Case 3b: The police had charged a doctor with assault that happened in a family situation off-duty. In its reply to the complaints the newspaper in question claimed that the Finnish Medical Association had pressured them to refrain from publishing the name and had even contacted a Council member in this purpose. The newspaper did not offer any proof concerning this accusation although the complainant was, in fact, the head of PR for the Finnish Medical Association. The Council ruled that publishing the name had been irrelevant in this context and gave a guilty verdict.

Case 3d: A dentist was found to have committed suicide and was nude when the body was discovered. His father complained to the Council because he felt his son's privacy had been violated when media had reported intimate facts about his death and that revealing his profession could lead to his name surfacing in the community. According to information submitted to the Council there were dozens of dentists working in the area, lowering the risk of revealing the dentist's identity. The case was given an acquittal.

Summary: The Council ruled that a sensitive approach should be taken when publishing the names of the deceased. Disclosing the profession but not the name was acceptable as long as there were numerous colleagues working in the area.

4.5   Summaries of Notable Cases in Theme 4 (Two Cases): Media Impact on Patients' Health Choices

Case 4a: A TV program voiced doubts about the role of cholesterol in cardiovascular disease pathogenesis and the benefits of dyslipidemia medications. A physician complained to the Council that the claims made in the program were not evidence-based and could jeopardize the health of many Finns. The Council gave the program an acquittal, stating that it was not reasonable to expect that a single piece of

journalism could offer a complete and perfectly balanced look into such a complex subject that not even all medical experts on the subject agree on.

Case 4b: A tabloid article reported on the potential adverse effects of antidepressant medications. The article referenced data published by the Swedish Drug Administration stating that two deaths may have resulted from the use of these drugs – although it was most likely the deaths were the result of interactions with other drugs or unusual doses used. The article contained a table with the headline "beware of these drugs". A pharmaceutical company manufacturing antidepressants and a Finnish physician complained to the Council. The doctor stated that one of his own patients had abandoned his antidepressant medication because of the article and that such journalism could lead to suicides if depressed patients refused similar treatments. The editor of the tabloid stated that they had tried to obtain an interview from a Finnish expert but due to a close deadline this had not been possible. The Council agreed with the complainants that the overall setup of the article with its table of "dangerous drugs" was provocative and when dealing with such subject matters more caution should be taken not to unnecessarily scare the public. On the other hand the Council considered it important for the media to highlight such possible risks in common medications and the sources used by the tabloid were reliable. The tabloid did publish a second article on the subject and a letter from a reader as well, diversifying the topic. The Council gave the case an acquittal.

Summary: It is acceptable for the media to challenge existing medical paradigms. Such journalism can become sensationalist and even scare patients. A single piece of journalism cannot be expected to present a complete view of all aspects in a medical issue.

4.6   Summaries of Notable Cases in Theme 5 (Five Cases): Other

Case 5a: A complaint concerning the professional conduct of a journalist reporting on a bus accident abroad where several Finnish holidaymakers were injured and subsequently hospitalized. The journalist went to hospital to get some comments from these patients, taking advantage of the presence of his physician wife and neglecting to inform the patients properly of his journalist role. This resulted in a guilty verdict for the newspaper but a specific guilty verdict for the journalist as well[4].

Case 5c: An interviewed pathologist made grave accusations towards his colleague of professional misconduct bordering on criminal negligence. The colleague in question complained to the Council, stating that it was, in fact, been the interviewee who was guilty of malpractice and the interview was his revenge towards the colleague who had discovered this misconduct. The complainant pointed out that all these claims could have been easily proven or disproven by checking certain official sources readily available. The Council found this to be true. The newspaper had thus failed its obligation to check its facts prior to publication even though the accusations made by the interviewee were extremely damaging. The resulting publicity towards an individual had been so negative that no amount of written correction could have repaired the damage. The Council gave the case a guilty verdict.

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[4] Usually verdicts are only directed to the media outlet in question, ie the newspaper or a radio channel.

5   Discussion

A substantial number of cases analyzed dealt with negative media attention and a physician's response to such publicity. According to the Finnish Journalism Guidelines, interviewees have the right to know the context in which their statements will be used and the right to inspect their own quotes if the publication schedule so permits [23]. In cases where the journalist had failed to inform the interviewee of this context the case resulted in a guilty verdict or a voted acquittal. The interviewee does not have the right to read the whole article or see the whole program prior to publication although many journalists do allow this [23]. That the subject of the interview is unhappy with the angle of the end product or feels like he has been presented in a negative light is not grounds for pulling the article or program.

If a publication's intention is to present very negative information about a clearly identifiable individual, company or organization, the object of this criticism must be granted the right to reply to these accusations immediately [23]. This can be done either by simultaneously interviewing the subject and including this information in the article, or by publishing the individual's rebuttal later on [23]. Cases dealing with a supposedly questionable execution of this guideline were numerous.

The concept of confidentiality poses a unique challenge for medical professionals interacting with the media. It is understandable that media often takes the side of the patient's subjective experience [16] in presenting medical stories – it offers a human interest angle and a relatable story for the readers. A more balanced perspective could be offered by presenting the scientific side of the issue which could be best offered by the other participant in the relationship – the physician.

In cases where the media referenced the experiences of a single patient it was difficult for an individual physician to defend himself since it would have entailed disclosing facts that fall under doctor-patient confidentiality. In order to be able to defend himself the physician would require permission from the patient in question to discuss their private medical information publicly. It would be doubtful whether patients would be willing to grant such a permission.

According to Council rulings there is a limit to what kind of language can be used towards individual physicians - terms such as "butcher" or "Mengele" go beyond acceptable public scrutiny of public officials. Cases where the language remained more neutral but a physician was singled out as an example of badly behaving or malpracticing doctors seemed to divide the Council – the cases went to a vote, the result sometimes being very close. These were the same cases in which the interviewee had not been properly informed of the larger context in which their interviews would be used.

In certain cases one of the bases for an acquittal was that the complainant had delayed his response to negative publicity – he had not requested a rebuttal to be published, had not contacted the media outlet in question with demands for correcting mistakes or had been unwilling to negotiate on the content of a rebuttal. In some cases the rebuttal submitted was either too extensive or crude. A common denominator in whether the case resulted in a guilty verdict concerned the issue whether the media had negotiated with the subject on editing such a reply to a publishable form.

Several case verdicts sought to outline when the medical profession or the name of an individual is relevant to a news story. The Council ruled that when someone is

suspected of assault in a family setting, his profession has no relation to the crime and thus should not be disclosed. One newspaper editor commented in his statement to the Council that sometimes it might be necessary to reveal a name in order to avoid other individuals becoming the subject of rumors. When local media reports something happening in the life of a local doctor it might not be difficult to guess the name even if it is not published. The Council also ruled that if many doctors work in the area, disclosing a deceased doctor's profession would not jeopardize his anonymity.

Two complainant doctors raised the issue of media's responsibility when patients abandon their treatment. It is not the role of the media to uphold and defend medical consensus. The forming of such an agreement is the responsibility of medical professionals. According to the spirit of the Journalism Guidelines the media should also never accept perceived consensus at face value but to provide a voice to all sides of an argument. A good example of this was the 2010 widespread Finnish public discussion on the safety and efficacy of cholesterol medications. A notable characteristic of the media coverage was that expert researchers in the subject were pitted against laymen and alternative treatment providers who presented themselves as equals to scientific professionals. This posed unique new challenges for the expert interviewees – they had to compete with the provocative views of the alternative thinkers with their more complex, evidence-based arguments. Having the data was not enough – the ability to present it in a concise and convincing form seems to have become equally important.

These results offer valuable data on potential problem areas of physician-journalist encounters and could well prove useful to both physicians and media personnel in avoiding these pitfalls. This material could also serve to educate doctors about journalistic practices, and their rights as interviewees. For journalists it could offer an understanding of why interviewing individual patients about their negative encounters can be troublesome in terms of grating a physician the right to defend himself. One could assume that in cases of a guilty verdict in the area of theme 3, i.e. 'A physician's right to privacy', the Council's decisions were not strongly influenced by the fact that the complainant or his substitute represented the medical profession and the Council could have taken the same decisions in similar cases to virtually any complainant.

A strong point of this study is that all Council rulings from the years 1995 to 2011 that seemed to even mildly link to medical professionals could be included in the data. A weakness is that materials of complaints rejected by the Chairman due to their low journalistic value is not archived by the Council and thus is not available for analysis. Some of those complaints may have come from physicians. Since the work of the Council is based on active complaints and not on independent investigation and supervision, the question about how well the data represented all cases that theoretically could have been taken up by the Council during the study period remains open. The comparably low amount of pertinent verdicts compared with all Council cases per annum can be seen as a sign that not too many encounters between doctors and journalists turned out to be problematic enough to warrant evaluation by the Council.

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Governance of Managerial Information Needed by Nurse Managers in Hospitals – A Literature Review

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Abstract. Information technology has a great impact on efficiency and effectiveness in health care organizations. Software solutions are used not only to manage organization revenues and expenses but also for managing functions and activities when patient care is coordinated. Managerial decision making may concern strategic, tactical and operational levels. Different kinds of information related to care coordination is needed by the hospital nurse managers every day. A literature review was made to explore information systems used by nurse managers in hospitals for information needed in tactical decision making.

Keywords: Decision Making, Nurse Manager, Information Systems.

1   Introduction

Much information is processed daily in hospitals and a considerable amount of money is put into information processing. Systematic information processing and improvements in information and communication technology increase the quality of care and reduce costs [1]. Typical examples of clinical systems in hospitals are laboratory, pharmacy and radiology systems; clinical data repository (CDR) systems; computerized provider order entry (CPOE) systems; nursing/clinical documentation systems; clinical decision support systems (CDSS) and picture archiving and communication systems (PACS). Most of the clinical systems are developed to support only one specific clinical task such as diagnosing or medication administration. Furthermore, there have traditionally been challenges with the communication between different clinical systems [2].

   In health care organizations, information systems are also needed to support managerial decision making. Managerial decision making and information is needed when organizational goals are accomplished through planning, execution and control [3]. Commonly, the information needed by managers is scattered in different systems and managers are also presented with inaccurate or unreliable data. Furthermore, vast amounts of information might lead to information overload. However, the information overload might also be dependent on the manager's ability to interpret information, instead of the amount of information [4]. Information technology can be used to reduce information overload and support managerial decision making [3].

Health care organizations are characterized by hierarchy of authority and coordination is essential for health care organizations to function. In hospitals, information is needed for managerial decision making on three levels: strategic, tactical and operational. Information management concerns on the strategic level organizational long-term goals, the tactical level short term goals and processes and the operational level daily activities [1], [5]. Coordination can be described as management processes of dependencies between activities [6]. Coordination in hospitals can also be divided as follows [7]: 1) vertical coordination concerning decision making responsibilities and information on different levels in the hierarchy (e.g. workload information), 2) lateral coordination covering different areas that obtain information to be combined into a broader base of knowledge (e.g. clinical knowledge) and 3) longitudinal coordination referring to activities concerning the patient, surrounded by continuously modified information (e.g. clinical management). These three types of coordination can be seen on strategic, tactical and operational levels and they also affect each other as described in Figure 1.
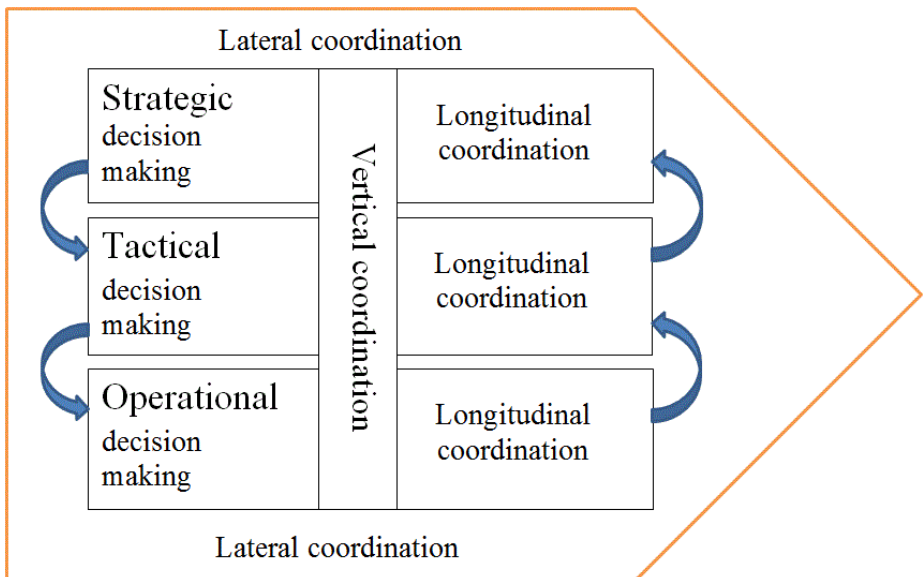

Fig. 1. Decision making and coordination of care

Typically, nurse managers coordinate nursing activities in health care organizations. A nurse manager's work encompasses responsibility activities, accountability activities, bedside nursing and other scattered duties. Responsibility activities consist of communication, cooperation and organization. Communication comprises the transfer of information both verbally and in documented form. Cooperation activities include staff meetings and working with other professionals and departments. Organization involves many activities, for example, supervision of nursing care, planning and evaluating staff workload assignments, working conditions and patient flow, and also financial duties. Accountability contains activities such as

supporting staff, ensuring staff competencies and development work. Furthermore, nurse managers may attend bedside nursing through direct and indirect patient care, nursing expertise and handyman tasks; although, bedside nursing by nurse managers is less frequent in university hospitals, where responsibility related tasks are more emphasized, in comparison to psychiatric or rural hospitals. [8] Nurse managers are responsible for the quality of nursing, nurse staffing and budgeting in their unit. The goal of managerial decision making in nursing is to provide optimal patient care with minimal costs. A nurse manager's decision making often takes place between tactical and operational levels in the hospital and in order to coordinate nursing activities this decision making is often characterized by information that is needed without delay, here called immediate decision making.

Information systems in hospitals have been developed for multiprofessional use, but systems developed for nurse manager's decision making are still few. Generally, information systems can support managerial decision making in different ways. These include access to data and tools for data manipulation, reporting, documentation, communication, statistical analysis and decision support. Information systems support managerial decision making through controlling operations (management information systems), automating highly structured decisions (automatic payroll deposit), supporting complex unstructured decisions (decision support systems), augmenting knowledge (expert systems), knowledge management (organizational learning) and strategic planning (executive support systems) [3].

Nurse managers are presented with very much information and their need for decision support tools has been seen. They use many different information systems in order to get the information they need and the absence of integration between these systems is a typical problem. [9] For nurse managers, there are for example, computer based decision support tools that integrate clinical and financial information with unit activity and staffing patterns, in order to support decision making about the adequacy of resources. But, still the nurse managers need other sources of information to explain patterns the decision support systems are not able to explain. [10] Nurse managers decision making processes are complex and they use different decision making strategies [11]. Clinicians may use very much time to make information tools to support their information needs when coordinating care [12].

The purpose of this literature review is to describe what information systems are used by nurse managers in hospitals and for what purpose. The focus is on nurse managers' tactical decision making.

2   Methods

To explore what information systems nurse managers' use and for what purpose, different databases were searched (CINAHL, PubMed (MEDLINE), ABI/INFORM Global, IEE Xplore and Cochrane Database of Systematic Reviews) with different combinations of the following key words: management information systems, hospital, coordination, technology, nurse manager, nursing. A manual search was also conducted on the basis of the findings in the database searches. The database searches are described in more detail in Table 1.

Inclusion criteria for the chosen articles were: scholarly journal publications about information systems that nurse managers or nurses in charge of care coordination use in decision making in hospitals. Articles concerning strategic (hospital management) and operative (nursing) decision making in general were excluded. The articles were reports of studies, or writings by specialists in the area. The quality of the articles was evaluated with a tool developed in the "Effectiveness with scientific nursing evidence"-project. The tool included evaluation of the following areas, when applicable: background, purpose, target group, design, intervention and its purpose, used instruments, data collection, data analysis, reliability, ethical considerations, main results, clinical relevance and applicability of the results [13].

Table 1. Results of database searches

Database	Search words	Results
PubMed MEDLINE	management information systems AND hospital AND coordination AND technology	41
	management information systems AND hospital AND nurse manager AND technology	32
	management information systems AND hospital AND nurse manager AND technology AND coordination	0
CINAHL (Ebsco)	management information systems AND hospital AND coordination AND technology	9
	management information systems AND hospital AND nursing	37
ABI/ INFORM Global	management information systems AND hospital AND coordination AND technology *	36
	management information systems AND hospital AND coordination AND technology AND nurse manager*	1
	management information systems AND hospital AND nurse manager*	21
IEEXplore	management information systems AND hospital AND coordination AND technology **	3
	management information systems AND hospital AND nursing**	5
Cochrane Database of Systematic Reviews	management information systems AND hospital AND coordination AND technology	0
	management information systems AND hospital AND nurse manager AND technology	0
	management information systems AND hospital AND nursing	2
*limited to scholarly journals, ** limited to journals	In total:	187

3   Results

From a total of 188 articles, including 1 article found by manual search, 22 articles were included in this literature review. Articles were excluded for the following reasons: not in English (5), not about tactical managerial level (56), not about hospitals (19), not about nurse managers (29), not about information systems for tactical managerial level (24), copy of article already found in search earlier (14) and not accessible article (18). The selection of the included articles is described in Figure 2.
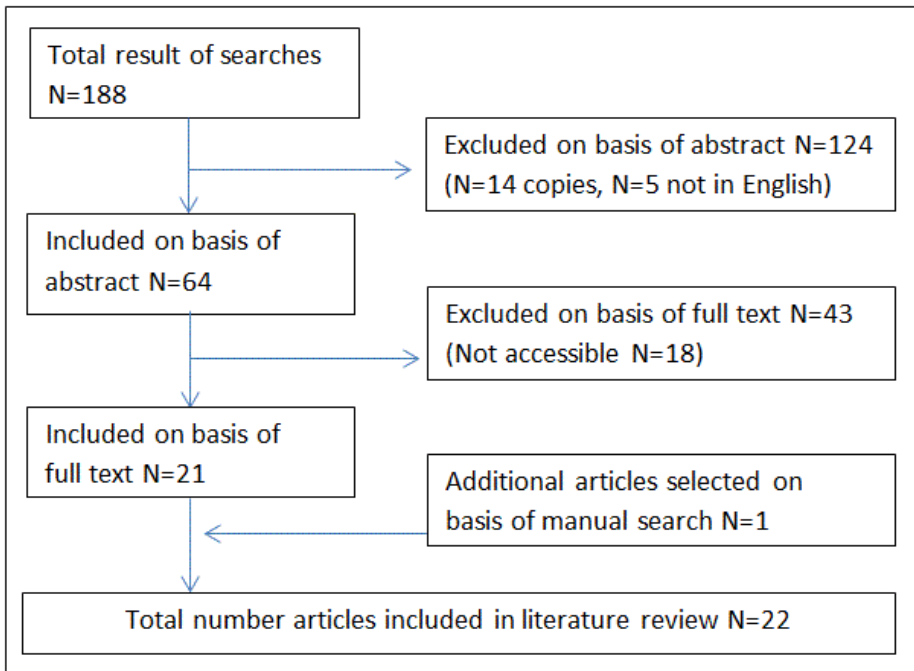
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│  │ Total result of searches │                                         │
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│         │────────▶│ Excluded on basis of abstract N=124     │          │
│         │         │ (N=14 copies, N=5 not in English)       │          │
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│  │ Included on basis of     │                                         │
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│  ┌──────────────────────────────────────────────────────────────┐    │
│  │ Total number articles included in literature review N=22     │    │
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Fig. 2. Flowchart of selection of articles included in literature review

A large number of the articles included in the literature review were from the USA (15), but there were also articles from Canada (1), Finland (2), the Netherlands (1), Denmark (1), the UK (2) and China (1). The articles were published between 1987 and 2011. Most of them (15) were published between 2000 and 2011. A large number of the articles were descriptive writings by specialists in the field (14) and only a few studies (8) were implementing information systems in practice and even fewer (6) were evaluating these information systems.

The literature review showed that nurse managers use information systems that are both in general use by different professionals [14-17] and information systems specifically developed for nursing management [18-23]. The information for these information systems was usually obtained from several sources. There were several information systems developed for managerial decision making regarding the allocation of nursing resources [17], [19-20], [24-26]. These were based on patient classification systems or workload measurements. There was also information systems developed for the integration of nursing resource information with hospital resource measurements, providing managerial information for planning and budgeting [18], [27]. Other information systems were developed for communication [15], [18] performance evaluation [21, 28-30], quality measurement [30-32], decision-making [16], [22], open shift management [33-34] and improvement of care [31], [35].

The results indicate that information systems used by nurse managers are poorly evaluated. The few studies found evaluating these systems usually focused on the usability of a system through interviews and questionnaires [15], [20-21]. Only two

studies evaluated the effectiveness of the system with other methods [14], [24]. Interestingly, two articles reported that nurse managers did not perceive that the information systems provided the necessary information for managerial decision making and that these systems sometimes were difficult to use [17], [24]. The findings of the literature review are summarized in Table 2.

Table 2. Information systems used by nurse managers

Authors, country, year	Description of used systems	Statements of purpose	Main users or end users	Evaluation of the system
Bantle USA 2007	The computerized automated workforce tracking system enables nurse managers to post vacant shifts online. Then qualified nurses at six hospitals can browse for suiting work and make requests for suiting shifts from home or at the hospital. Open shift management improves staff satisfaction and resource allocation. The system has increased nurses' work outside their units.	A descriptive article of an open shift management program.	Nurse managers and staff nurses	Evaluative research not reported in article. Written by specialist.
Botter USA 2000	Information provided by Patient Classification Systems (PCSs) can be used for many decisions e.g. assigned patients, manage staffing, manage budgets, analyze trends, track performance, check workload, calculate costs, explain and verify judgment.	A Case-study exploring ways to use the information from Patient Classification Systems (PCSs).	Nurse managers	Evaluative research is not reported in the article.
Claudio USA 2004	There are different patient acuity systems. Task based acuity systems focus on nursing tasks and assessment based acuity systems on assessed care needs. These systems provide objective data and calculate a patient's need of care. They can be used for managing nursing resources, present workload data and justify need for more resources.	A descriptive article of workload measurement systems for managing nursing resources.	Nurse managers	Evaluative research is not reported in the article. Written by specialist.
Diers, Bozzo USA 1997	Retrospective integration of nursing resource information with hospital resource measurements and management projects can provide managerial information for planning and budgeting.	A descriptive article of a method to weigh diagnosis related groups (DRGs) directly by nursing intensity.	Nurse managers	Evaluative research is not reported in the article. Written by specialists.

Table 2. (*Continued*)

Fabray, Luck UK 2000	The implementation of the computerized ward management system (CWMS) can improve the proportion of planned decisions by ward sisters at wards with low difficulty index rankings, but not wards with high difficulty index rankings, consisting of many factors (staff sickness, number of ad hoc doctor rounds, throughput of patients, level of support staff, patients to theatre, rate of emergency admissions, bed occupancy, occurrence of patient escorting, meal distribution and ratio of learning staff). In order for these ward management systems to function properly they must be adopted by the person with budgetary control and managerial responsibility.	A study exploring management decision making and the contribution of a computerized ward management system in a hospital.	Nurse managers	Evaluated the effect of the CWMS on ward sister's decision making.
Fralic USA 1989	Information needed in managerial decision making is organization dependent. Nurse executives need decision support systems for their decision making that provide the right information, at the right time, in the right format and in the right amount. Information systems can provide this information. Patient Classification Systems can be used by nurse managers for optimal allocation of resources.	A descriptive article of decision support systems to secure staff and other resources for quality patient care and the role of a Nursing Division in the development of these systems.	Nurse managers	Evaluative research not reported in article.
Gregory USA 1995	A Nursing Performance Information System (IPIS) model gathers quantitative data for nurse managers for the monitoring and evaluating of the work environment. With it managers are able to identify job stress or dissatisfaction and the effect on quality assurance and performance. It can consist of components such as staffing, work environment, unit performance measurement and evaluation. This provides information about quality assurance, staffing requirements, work conditions, attitudes and patient relationships. The tool helps identify problems that need to be attended to.	A descriptive article about a Nursing Performance Information System (NPIS).	Nurse managers	Evaluative research is not reported in the article. Written by specialist.

Table 2. (*Continued*)

Hansen, Bardram Denmark 2007	The system consists of three parts. 1) The location tracking system that provides information about actions and locations of clinicians. 2) The AwareMedia system, that consists of touch screens located in different areas; providing information about the general situation about daily activities and it can also be used as a communication method between different stations. 3) The AwarePhone system that runs mobile devices with a phonebook, calendar bookings and locations of clinicians. This can be used for calls or messages between professionals.	A study about the development and implementation of a set of computing systems, with the purpose to support coordination of work in an operating ward and to improve communication and awareness.	The system is used by medical staff, nursing staff and supporting staff	The system was evaluated with a questionnaire and interviews with the users. According to the users the system enhances care coordination a surgical ward.
Junttila, Meretoja, Seppälä, Tolppanen, Ala-Nikkola, Silvennoinen Finland 2007	The Nursing Management Information System (NMIS) based on a data warehouse approach was implemented to support managerial decision making. The system includes data about the patient, the clinical process (e.g. throughput time), personnel and financial perspectives. Data is obtained from several information systems and used for assessment of nursing performance.	A study about using data warehouse approach when designing an information system for nursing management in hospitals.	Nurse directors, nurse managers	Usability and relevance of system was evaluated with a survey and interviews.
LaBranche USA 2011	A clinical dashboard which updates information from electronic medical records on a daily base. This system enables managers to evaluate performance and monitor results almost in real time. The system helps managers and clinicians to improve the quality of care and mentor staff.	A descriptive article of an electronic health record based system providing managerial information.	Nurse managers and clinicians	Evaluative research not reported in article. Written by specialist.
Lammin-takainen, Surakka, Kivinen Finland 2010	Nurse managers use different information systems in their work. The focus in the article is on the use of electronic information systems in general. Nurse managers use electronic information systems for 1) human resource management (e.g. rostering and education), 2) financial management (e.g. budgeting), 3) operational/clinical management (e.g. electronic patient records) and 4) communication (e.g. internet and e-mail). Nurse managers were of the opinion that these information systems do not provide all needed information for managerial functions and managerial decision making and that they are sometimes difficult to use.	A study about nurse managers' perceptions of the use of electronic information systems in their daily work.	The different information systems are used by different personnel in health care organizations. All these are used by nurse managers	The different information systems are not evaluated separately in the article.

Table 2. (*Continued*)

Li, Wu, Chen, Zhou, Xu China 2011	Data warehouse modeling can be used for hospital information systems in order to integrate and put medical data into full use. These consist of three layers: a datacenter layer that stores information, a system-function layer that deals with user requests and a user-interface layer with the capability to interoperate among different systems. The data warehouse model can include e.g. management of patient information, management of information of medical workers, management of information of medicines and management of hospital business information. A hospital information system based on warehouse modeling would improve online analytical processing and alleviates deficiencies in the decision support systems.	A descriptive article that discusses the role of a data warehouse modeling method for the hospital information management system and the development of a data warehouse.	Hospital personnel	Article on theoretical level. Empirical evaluation not reported.
Malone, Loader, Poulter UK 1997	A computerized nursing information system which provides nurse managers with clinical data and reports of workload information hence improving the management of budgets and nursing staff. Very few benefits from using the system were found. A slight improvement in documentation was seen and the staff was able to develop more evidence based practice due to care libraries. But, nurse managers felt that the system did not support their information needs.	A study evaluating the benefits of a nursing management information system.	Nurse managers	The system was evaluated through questionnaires, and financial data.
Mays, Kelley, Sanford USA 2008	A "Six-Pack" tool was developed that combines data about department volumes, budgeted and total costs, patient satisfaction goals and scores, turnovers, hours per patient day and percentage of premium labor. This tool provides information for managerial decision making and development. It is stated that the tool helps nurse managers to utilize their data and understand and explain budgets.	A descriptive article about an information tool developed to help coordinate the large amount of information needed for their management responsibilities.	Nurse managers	Evaluative research not reported in article.

Table 2. (*Continued*)

Mowry, Korpman USA 1987	Different hospital systems supporting patient care should be integrating. They should be built around one database. Data entry and data retrieval devices should be easily accessible. There should be data filtering criteria for different professionals. Such a system could for example calculate patient acuity and staffing patterns, retrieve labor and material costs, automate supply inventory on basis of usage, provide management reports on query, evaluate performance, facilitate productivity measurements and improve monitoring. Automated information systems can increase the quality of care and personnel efficiency.	A descriptive article evaluating information systems for nurse managers.	Nurse managers	Evaluative research is not reported in the article. Written by specialists.
Simpson USA 1997	The Nursing Management Minimum Data Set (NMMDS) is a data management system, which is based on three elements: nursing environment (e.g. complexity of clinical decision making, patient population), nurse resources (e.g. nursing staff, satisfaction) and financial resources (e.g. budget, expense). The system provides information for quality measurement, analysis and care improvement.	A descriptive article of the Nursing Management Minimum Data Set (NMMDS).	Nurse managers	Evaluative research is not reported in the article. Written by a specialist.
Sundara-moorthi, Rosen-berger, Chen, Buckley-Behan, Kim USA 2010	A simulation based data integrated prototype developed for appropriate assignment of patients to nurses. The simulation model was made on the basis of nurse workflow (through a tracking device) and patient data. The developed prototype makes a simulation of an individual nurse's workflow. Patient to nurse ratios are evaluated on the basis of this simulation. This prototype can be used when assigning patients at the beginning of a shift. Another system is needed for assignment of new patients.	A study about the development of a simulation based data integrated prototype for evaluation of patient to nurse assignments ahead of a shift.	Nurse managers	The usability of the prototype was assessed with a survey with students.

Table 2. (*Continued*)

Valentine, Houghes, Nash, Douglas USA 2008	An automated open shift management system was implemented in a three hospital system for more effective staffing. Nursing staff were trained to fill open shifts and nurse managers had the flexibility to decide rewards for motivating nurses. The system functioned 24/7 and it facilitated open shift staffing requirements for the hospitals. Nurses could access this system wherever the Internet was available. This system identified all open shifts across the enterprise and let nurses know of available shifts matching their qualification. It is stated that the implementation of the program led to savings in costs and nurse manager's time as well as improved nurse recruitment, retention and satisfaction.	A descriptive article about the implementation of an open-shift management system in a three hospital system.	Nursing staff and nurse managers	Evaluative research is not reported in the article.
Vautier, Connor, Fragala, Hart, Brown, Sverdlik, Wood, Talentino, Yeager, Vosloh USA 2003	Many systems are used to improve communication such as: online booking systems, wireless phones, intranet, telemedicine, e-mail, clinical web pages, shared drives, computerized patient tracking boards and operating room boards. Online class requests enable the approval of staff requests of in-service education, and records of employee education documents with the staff's current knowledge and skills. Automated staffing and scheduling systems help managers to plan staffing and to manage staffing budgets. They also enable the providing of reports of staffing at any time and provide staff telephone numbers for emergencies. These systems also bring together reports for adjusting staffing patterns.	A descriptive article of innovative technology supporting organizational goals defined by administrative nursing staff.	Administrative nurse	Evaluative research is not reported in the article. Based on specialist opinions.
Waldo 1997 USA	Information systems store, retrieve, collect, analyze and compare data and they help identify areas for improvement. They can integrate clinical, financial and operational data. Information systems can be used in performance measurements.	A descriptive article of performance measurement supported by information technology.	Nurse managers	Evaluative research is not reported in the article. Written by specialist.

Table 2. (*Continued*)

Walsh USA 2003	A computerized workload measurement system evaluates work performance and recognizes needed nursing resources. It is based on staff scheduling and workload measurements. This system calculates the hours of care needed by patient groups and the number of hours nurses need to work. Automated workload measurement systems can increase staffing accuracy, justify more nurses, integrate with the payroll system and balance the budget, support staffing during peak hours, monitor agency use and overtime and track nursing staff with special skills.	A descriptive article about workload measurement in a health system with 2 hospitals and several outpatient facilities.	Nurse managers	Evaluative research is not reported in the article. Written by specialist.
Wong, Caesar, Bandali, Agnew, Abrahams Canada 2009	An electronic patient tracking system, the "GIM whiteboard" was implemented in order to improve communication for care coordination. This tool was installed on all nursing and allied health computers and to the community care access center office. The application reflects the patient's trip from admission to discharge. It displays relevant and real time patient information. Information from patient charts is also integrated into the whiteboard and these have notification triggers for different professionals. The tool improves communication and coordination of care in a multidisciplinary team.	A study about the development, implementation and evaluation of an electronic whiteboard on a general medicine inpatient unit.	Allied health (e.g. clinical nutrition, psychology, respiratory therapy, social work), nursing personnel and physicians	The usefulness and effect on work practices was evaluated.

4   Conclusions

This paper discusses what information systems are used by nurse managers and to what purpose in the tactical decision making level in hospitals. Based on the literature review, it seems that information tools have been adopted for all types of coordination; vertical, lateral and longitudinal and nurse managers in hospitals use information systems for responsibility activities (communication, cooperation and organization) and accountability activities (supporting staff, ensuring staff competencies and development). In the literature review, no information tools were found for nurse manager's bedside nursing activities. This can be explained by the fact that nurse managers working in hospitals seldom participate in bedside nursing and that articles about the operational level were excluded from the review. However, information systems and the effect of their use by nurse managers seem to be poorly evaluated. Nurse managers' also perceive that the information systems used do not support their work sufficiently.

Nurse managers' use many information systems in their tactical decision making. Most of the information systems found in the literature review were used for responsibility activities, in particular organization activities. These systems were

mostly retrospectively collecting data for planning and evaluation of nursing, financial duties and quality measurement. These information systems can be seen to support vertical coordination. But nurse managers also use information systems to support lateral coordination, when performing responsibility activities, for example, supporting staff through open shift management or ensuring their competence through in-service education and education documentation. However, information systems supporting longitudinal coordination and immediate decision making, when coordinating care, seem to be scarce.

Nurse managers' decision making occurs often in situations where decisions must be made without delay and based on the findings in the literature review it seems that nurse managers' immediate tactical decisions are weakly supported by information systems. This finding supports an earlier study [9]. In addition, information needed for these immediate tactical decisions seems to be scattered in different locations. There are some studies on a general level about different information systems that nurse managers use in their decision making, but the systems are poorly evaluated and their influence on end-users' decision making has not been properly studied.

The reliability of the result of the literature review is dependent on the search words used in the database searches and the quality of the articles included in the review. The search resulted in 188 articles, of which only 8 articles reported studies in practice. Hence, writings by specialists were also included in the literature review. The articles written by specialists were usually based on experiences of information systems and some of them, were written on a general level, not explaining in detail the implementation of a specific information system.

Research regarding information systems used in nurse managers' immediate decision making on a tactical level in hospitals seems to be scarce. There is also a discrepancy between the information systems needed by nurse managers and the existing ones. An explanation for the differing information system needs of nurse managers and the lack of the existing ones is that, nurse managers might not have been able to communicate their need for information systems. A comprehensive understanding of the subject would create a basis for further development and improvement of information systems and also support nurse managers when they are coordinating care. Also, how the different information systems support nurse managers' decision making needs to be studied further. More research is needed on how the nurse manager should use operative level info in tactical decision making and information systems for this purpose should be developed.

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Avoiding Hazards – What Can Health Care Learn from Aviation?

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Abstract. Effective methods are needed to identify and analyze risks to improve patient safety. Analysing patient records and learning from "touch and go"- situations is one possible way to prevent hazardous conditions. The eventuality for the incident or accident occurring may be markedly reduced in case the risks can be efficiently diagnosed. Through this outlook, flight safety has been successfully improved during decades. Aviation and health care share many important points and similarities, thus the methods for improving safety could be transferred between the domains. In this paper, text mining and especially clustering is applied to identify lethal trends in both patient records and aviation for comparing and evaluating these trends in the two fields.

Keywords: Health care, aviation safety, text mining, clustering.

1 Introduction

High quality health care is recognized and valued by the European Union as a key human right. Adverse events in health can lead to serious consequences, and it has been estimated that nearly 100,000 patients in the USA die annually from medical errors [1]. The need for increasing health care safety practices is emphasised by Whitehurst [2] by expressing that these errors, which could have been prevented, are discovered to having caused patient suffering, permanent disability, and even death. The patients mentioned may have died from medical errors due to frequent lack of formal data schemas for the structured data of voluntarily reported events. Given that, both standardised, codified aggregate data and its thorough examination using analysing methods for drilling into granular detail is greatly needed in order to identify event trends accurately and consistently [2].

As methods in risk identification, analysis, and management are more advanced in aviation than in health care, health care could potentially gain from adopting and integrating many important tasks from aviation to reduce errors and to standardise processes [3]. In health care, however, safety issues have got an increasing attention in recent years. Practice guidelines and safety protocols have been announced in order to reduce harm to the patient. In addition, different quality checklists and instruments have been developed, e.g. GTT [4], [5] to identify adverse events and possible hazards in health care.

The flight safety is today based on one word: the procedures, i.e. agreed operations models that create the aviation safety net. At most they are written in manuals telling the crew all the exact procedures, many hundreds of them, with their accurate timing in corresponding situations during a flight [6]. Other well-tried (and often obvious) things, like good airmanship, can also be classed to them. Standard operating procedures are a strong defence against deviations and errors causing harm in the aviation industry. They are in close connection with the culture of an organisation. In the organisations working among high risk, they are results of development processes having required active human participation [7]. However, because of the huge complexity of the procedures and their combinations, deviations do occur, which, as explained before, might cause a series of them leading to fatal consequences. In fact, the failures in following the standard operating procedures have been proved to be the major contributing factor to aviation accidents [7].

Since the beginning of the 1960s, the aviation accident rate has been greatly reduced through systematic safety work [8]. Fundamental to safety management is the principle of collecting and analysing operational data [9]. The data collected in airline industry can roughly be divided into two types: structured data and unstructured, narrative data. With structured data, the explanation of the case usually tells the truth till a certain rate, but completed with narrative data it can reach the level of 100 per cent, at least theoretically. It has been widely estimated that the main part (over 80%) of the information in reporting is written in the unstructured and textual format. This information could contain nuggets of valuable knowledge. The latest studies on aviation suggest that text mining can be utilised to detect "lethal trends" [10], i.e. chains of events that without intervention lead to accidents [11]. Finding and analysing these chains allows focusing on the development of safety practices to critical situations. The purpose of this paper is to apply text mining for identifying lethal trends in patient records and in aviation and to compare and evaluate these trends in the two fields. The goal is to explore if health and aviation records can be evaluated in similar ways. This scheme of things is clearly expressed in the statement of the Chief Medical Officer annual report as follows: "Like the aviation industry, safety must be at the core of our health services if we are to improve patient care" [7].

Health care shares many features with aviation: high safety standards, the importance of communication, multidisciplinary teams, stressful working environment, and high requirements for skills and technology [12], [13]. Like in aviation, also in healthcare errors and system failures action should always follow. The question is always finally of individuals. Each story of failure ends with a real person with a real story [7]. Both sectors belong to the so-called high-risk or safety critical industries, among which the concept safety culture is essential. It originated in practical aspects, being used for the first time in touch with the accident investigation of the Chernobyl disaster to illustrate that the origins of the accidents are not only in technical failures or human errors made by individuals [14]. This concept was presented in order to emphasise that also factors in connection with management, organisation, work community and even the society affect the emergence of accidents [15].

2   Materials

The data consisted of two data sets. The flight safety data was provided by the Finnish Civil Aviation Authority (FCAA) which, like other aviation authorities throughout the world, is in charge of issuing instructions and regulations on flight safety and security, and assumes other regulatory duties on civil aviation. The data set, flight safety reports from the years 1994-1996 was extracted from a database and of the whole material, the narrative parts of total 1240 safety reports of hazardous events were chosen to be used as test material. The size of the narratives varied from a few words to a paragraph. The cases included all types of aviation: airline traffic, other commercial aviation, sports aviation, etc. The reports were written about events in Finland or those happened for Finnish aircraft abroad. Only the cases in which a military aircraft was implicated were excluded. In the narratives, where the names of persons were mentioned, they were replaced with N.N. A three-year period containing more than 1000 reports was considered creating a 'critical mass' for producing relevant and reliable mining results. At the moment when the data set was extracted from the database, it contained about 16000 reports. Another factor that determined the choosing of the data was its age. Hereby the material was more than 10 years old. This guaranteed that the data was already statute-barred and there were no open cases. The main principle is that all the decisions and cases are public. This is in concordance with the law and practices adopted by the governmental organisations in Finland, that the documents and decisions of the authorities are public [16].

The patient record data set consisted originally from all electronic health records of about 26000 patients that had been admitted to one university hospital with any type of heart problem from the year 2005 to 2009. From these records, we extracted all those that had a mention of resuscitation in the narrative parts of the discharge statements of the physicians, resulting in 1083 text units. Their size varied from a few sentences to a paragraph. Resuscitation was chosen for representing a possible hazardous event in health care. It is one aspect analysed in the Global Trigger Tool (GTT), an instrument used in health care to identify adverse events, and comparable with the events in the flight safety data [17]. Like the events described in the flight safety reports, resuscitation is a hazardous event that may be prevented. Resuscitation can also lead to either successful or unsuccessful (lethal) outcome.

Even though aviation and health care may at first seem distant from one another, the languages used in the two domains are actually fairly similar. Typical for them both is that their language differs from the general language. Both fields have specialized lexicons with frequent domain-adapted terms and abbreviations, such as *marevanisointi* ("marevanisation", starting dose of Marevan medication), l.dex. (dextral) and l.sin. (sinistral) in health care and GOGLA (waypoint in air traffic), Do-27 (Dornier 27 -type aircraft), and R11P (Air Traffic Service route designator) in aviation. Both languages can also be considered "telegraphic" [18] as verbs and copulas can be omitted and links between sentences may be left unclear. For instance, in aviation, a simple noun phrase can act as a sentence: *Rajaloukkaus.* (Border

violation.) *Arvioitu saapumisaika* 18.00. (Estimated time of arrival 18.00.). In health records, x is also often used to indicate times when describing the patient's medication: [drug name] 15 mg x 1 (for more examples in clinical texts, see Laippala et al. [19]). The writing context of the texts is however different: clinical texts are usually written in a hurry, along with the actual work, often as the critical events take place, whereas aviation safety reports are written after the action when the plane is safely on ground. This difference is very much visible in the texts. Misspellings and spelling variations are typical in health records, where, for instance, the word *diagnoosi* (diagnosis) can be abbreviated both as Dg. and as Dgn. and the Finnish word for patient is written is a dozen different ways. In the safety reports, such variation is not present.

The languages used in both health records and aviation can be considered as examples of sublanguages used in particular contexts with their own grammatical, structural and lexical regularities. Depending on the domain, the sublanguage may include either more specific norms than the general language, or it can have its own structures that would be deviant in the general language [20], [21]. For instance, in health care and in aviation, verb and copula omission is very well accepted even though it would not be tolerated in general language. On the other hand, technical details or drug names and dosage instructions must be very precisely indicated in these sublanguages, whereas in general language the norm is not as specific and the same information can be referred to by a more general word. Sublanguage analysis has already been applied to texts written in both healthcare and aviation domains, more specifically to biomedical texts and aircraft manuals [22-26]. Even though the health care and aviation sublanguages are often difficult to understand for laymen, professionals usually understand them without problems. Therefore the language itself only seldom constitutes a safety issue.

3   Methods

Potentially hazardous events do not necessarily result in accidents; they may be prevented. In this paper, potentially hazardous events are studied through Reason's Swiss cheese model, a theoretical tool for analysing the development and outcome of lethal trends. In the model, defensive layers protect potential victims from local hazards that would otherwise continue their way through the cheese and result in an accident [11]. In the model [27] the five defensive layers are divided into latent and active failures (see Fig.1). An illustrative example [28] of applying the Reason's model in aviation domain is a case from the year 1995, in which a mechanic taxied an ATR-72 type passenger aircraft after maintenance onto the hangar door causing significant material damage. He made test run after maintenance, after which he intended to taxi the aircraft to another position. He forgot to switch the hydraulic pumps on, when the aircraft brakes did not function and it dashed against the hangar door.
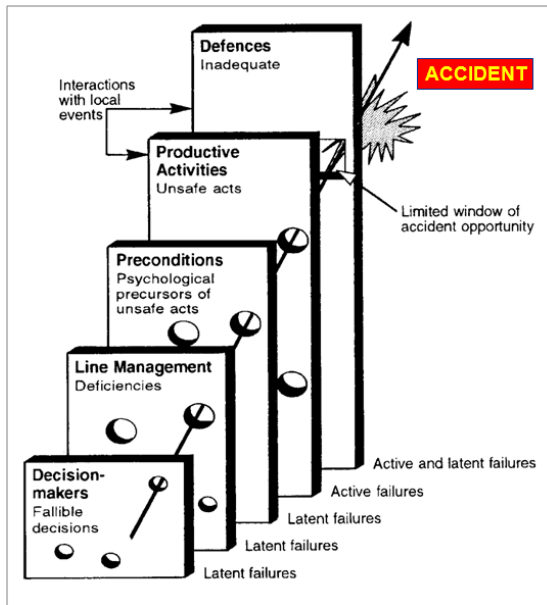
Fig. 1. The Reason's Swiss cheese model (Source: Reason 1997)

In the first, latent failures defence, the Decision-makers Fallible Decisions were inadequate authority regulation and not controlled implementation of the quality system, at least concerning the test running. In the second, Line Management Deficiencies, both test run processes and training were inadequate; neither the importance of sufficient mental agility level was noticed during night shifts. The lethal trend passed the third latent failures layer of Preconditions Psychological precursors of unsafe acts because testing run put significant mental load on the mechanic, whose mental agility level was very low. The hazard continued through the fourth, active failures layer of Productive Activities Unsafe acts, as the hydraulic pumps were not switched on. The final proceeding through the fifth layer of both active and latent failures of Defences Inadequate happened due to missing defences, in this case no checklist was used, and because the mechanic did not recognise **HYD** warning light.

As illustrated in the example, the defensive layers may depend on technology or they may rely on people. Mostly these layers manage to prevent the hazards but in the worst cases they line up and lead to serious consequences. Studying weaknesses in defensive layers helps to analyse possible lethal trends and manage risks proactively. In order to study the causes and consequences of the potentially hazardous events and the possible lethal trends, the two data sets were clustered into groups of reports. This method enables finding the similarities of the cases that might include indications of a lethal trend, without having any presumption whether these exist or not.

The documents were clustered using word-space models [29]. The basic assumption in this approach is that co-occurring words define the meaning of a word or the topic of a document. Documents with similar word distributions are considered

to be related to each other in these models. However, the documents in a cluster may share a word or a topic but still they are not meaningfully related for a human being. Thus the clusters were manually analysed by domain experts to find the topics of interest.

In the patient record analysis, epicrisis records, recognised by the title word "*loppuarvio*", were queried for resuscitation. Resuscitation was chosen because it is one of the hazardous events identified by the GTT. Each mention of resuscitation was represented as a bag-of-words vector as follows. The words were lemmatised using the morphological analyser FinTWOL and the disambiguator FinCG [30] and those containing non-alphabetic characters were removed. Ten words both before and after the mention were selected in their lower-case form. The frequency vectors were transformed into a tf-idf space and the cosine similarities were calculated with Gensim [31]. A hierarchical clustering was generated using the complete linkage method. Flat clusters were then obtained by applying the inconsistency criterion of 1 (i.e. if the inconsistency values of a node and its descendants is at most 1, the leaf nodes belong to the same cluster). The clustering was performed with SciPy [32].

As for flight safety reports, for benchmarking three systems for text mining were tested. One of these was totally language independent, the other had a specific configuration for Finnish and the third was originally created for English, but encouraging results had been achieved with Spanish and that is why a Finnish test was also undertaken. In all of the systems, clustering was used as method. The way the different systems processed the data and displayed the results produced coherent results [10].

The data mining is a rather complicated process requiring several phases, like creating the lists of stop words and synonyms, which as for the aviation safety data set were made manually based on filtered word lists. Of the tested three systems, one was equipped with a module capable of mining Finnish, that means, those lists were not needed, but for the two others they were necessary. Stop words are those without significance in the process, like articles, linking words and particles. List of synonyms is mapping multiple synonyms to one word. Misspellings and abbreviations, that aviation is full of, can be fixed here, too. Those for airport codes and navigation fixes, for example, frequently encounter in pilot narratives.

Successful mining results require an iterative process. All the tested systems confirmed the fact that especially text mining should be an iterative process, as the results of the first round revealed an obvious need for tuning the test material, essentially the definition of stop words and synonyms as well as correcting pure mistakes. Due to this, the results were analysed using quantitative data analysis application called NVivo to get deeper analysis information. Almost one hundred checking procedures were made with synonyms and stop words. After careful estimation about the impact of possible changes, no major ones were made, only the most obvious tunings in case forms which does not change the process but make the results be more accurate. Using the tuned definitions, the second round was performed with the two mining systems not equipped with the Finnish module [33].

Through using only one refinement between the two rounds, the results were clearly improved, still permitting further rounds with more and more accurate data refinement between them to be made. However, there is certainly no sense in continuing the iterations endlessly, but an optimum that depends on the data put through the mining system and its utilisation environment should be found.

4   Results and Discussion

The previously [10] clustered 1240 flight safety reports were divided into 100 clusters, the sizes of which varied between 58 and 1. In the aviation data, about 20 clusters had possibly hazardous trends, such as door opening during the flight. The patient record analysis produced 1523 mentions of resuscitation that were partitioned into 511 clusters, 470 of which with five or less nodes. The clustering technique was also applicable to health care data, and 41 clusters related to patient resuscitation were found. These were divided into irrelevant and relevant clusters. The irrelevant clusters were logical but not of interest in this approach. In most cases the clustering factor related to the reason or the time of the resuscitation. The relevant clusters included significant information about the moment of resuscitation. However, the clusters did not provide sufficient information for closer inspection related to the resuscitation process. Two particularly interesting clusters were found: medication causing adverse events during treatment and resuscitation connected with procedures. These two findings can be connected to the Finnish reporting system for safety incidents in health care organizations [5].

The success of aviation safety has several key elements of which the next ones can be mentioned. Firstly, setting the clear goal is of great importance. Secondly, the foundation for safety work is laid by collecting useful data that are also used in the manner that everybody understands what is searched and which changes need to occur. The third important phase is the comprehensive and multifaceted approach to risk management, focusing on the important issues [7]. As already mentioned before, the accident rate among aviation has remarkably decreased at the beginning of the 60's. There is no single explanation for this clearly observable trend as well among international air traffic and sports aviation as military aviation. However, according to the common opinion of experts, it is the joint effect of several factors like augmented technology, systematic investigation and analysis of deviations, increased attention to develop instructions, all of this resulting in improved safety culture that for one's part has positive multiplier impact on its basis components.

All this could obviously be copied also to health care. Systematic air traffic regulation has a lead of several decades because its origin goes as far as up to the year 1944, when Convention on International Civil Aviation (also known as Chicago Convention), was signed on 7 December by 52 States [34]. This period from that till today gives the health sector a good observation dimension to adopt the best applicable and most appropriate experiences and practices from aviation.

5   Conclusions

We can conclude that identification of hazardous events in health care documents can be done in similar way to aviation reports. Using text mining and clustering as methods gives promising results in the identification of hazardous events in health care and in aviation. Although our results are preliminary, we can recommend these methods for further evaluation. Electronic health records as well as aviation reports give a rich material for studying hazardous events. We need more comprehensive research in this field. Both data sets might have vast amount of hidden information not yet explored.

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Citizens Involvement for Safe and High Quality Urban Living: Three Success Factors for ICT-Enabled Initiatives

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Abstract. By enabling different forms of networked, participative systems, ICTs could play a pivotal role in enhancing the safety of everyday living settings, spanning from private homes to city contexts. But the literature on this issue is still in its infancy. This theory-building paper seeks to contribute to the identification of success factors for participative systems influencing living settings safety. Three different case studies were conducted, enlightening several aspects such as remote home assistance for the elderly, city day-by-day management based on citizens' reports, and city emergency management. On the basis of such case studies, three possible success factors were extracted: in all the successful cases examined, (1) citizens perceived their involvement as an "inverse commons" investment; (2) before involving citizens, the necessary back-office had been soundly organized; and (3) at least in the first place, the role of citizens essentially consisted in collaborative sensing and monitoring.

Keywords: City safety, home safety, tele-monitoring, social network, participative systems.

1 Introduction

Enhancing the safety of everyday living settings, even the private ones such as the dwelling places, entails important social impacts, and it is then of public interest. In fact, this issue is more and more catching the attention of government institutions and other stakeholders; innumerable initiatives at different levels are being studied, experimented and implemented, and such initiatives almost always imply an important role of ICTs. But such initiatives are fragmented and not always successful [1]. What is coming out is that the success factors for such initiatives go far beyond those identified by the traditional top-down approaches. In fact, the active involvement of citizens is an essential aspect of most processes aimed at improving the safety and, more generally, the quality of life in concrete living settings.

What is, then, the possible role of ICTs in boosting such cooperative processes? Literature on this issue is in its infancy, as we will seek to demonstrate in the paragraph below. As a consequence, the field investigations on possible success

factors are still almost absent. Of course, some "generic" success factors are mentioned, that had already been identified by literature as recurrent antecedent of all ICT-enabled initiatives, such as management commitment, or technology acceptance, or interface usability. Moreover, some emergent studies identify further, interesting success factors, which are on the other hand specific for certain categories of users, such as the elderly or the impaired people [2].In this paper, on the contrary, we will seek to concentrate on the common aspects of all the ICT-enabled initiatives entailing citizens' involvement, aimed at improving safety in living settings. We will call these initiatives and the solutions enabling them, synthetically, *participative systems for living settings safety.*

We found that the existing literature is poorly equipped to explain why so many participative systems for living settings safety end up being unsuccessful.

This paper, then, seeks to better understand the factors that positively / negatively influence the success of participative systems for living settings safety, independently from the specific characteristics of users. We are aware that ignoring the specific needs of the specific users involved in a specific project is a strong factor of failure; but this important factor deserves specific investigations, and is therefore beyond the boundaries of this paper.

2   Literature Survey

The issue "participative systems for living settings safety" may be an interesting issue for several areas of study.

For our literature survey, we have considered those disciplinary areas where the social *and* organizational *and* technological aspects of citizens' participation in public interest processes are investigated, and namely: e-Participation, e-Government, e-Health. We have not taken into consideration for our literature review, instead, the role of this issue in strongly design-oriented approaches, such as, for example, in engineering studies on domotics.

"eParticipation involves the extension and transformation of participation in societal democratic and consultative processes mediated by information and communication technologies (ICT), primarily the Internet. (…) It aims to support active citizenship with the latest technology developments, increasing access to and availability of participation in order to promote fair and efficient society and government" [3]. eParticipation normally focuses on participatory processes connected with political or public interest decision-making.

One could expect, then, that e-Participation literature focuses also on participation processes aimed at enhancing safety in urban and regional settings, since it certainly is an issue of public interest; but this rarely happens. As a matter of fact, e-Participation studies are traditionally oriented towards other expected effects of e-Participation, such as improved civic awareness, improved civic engagement, enhanced civil rights, [4], and increased economic development [5]. Improvements in concrete daily living settings have not really caught the attention of e-Participation scholars so far. Keyword research (safe OR safety + e-Participation OR

eParticipation) within the Econlit and Business Source Première databases, investigated through the EBSCO engine, and within the Google Scholar database (as for the first 100 results, beyond which the likelihood of relevance is really very low), yielded no relevant results in winter 2011-2012. Of course, this does not mean that writings on participative systems for living settings safety do not exist in e-Participation literature, but if they do, they are so rare and so rarely cited that neither EBSCO nor Google Scholar have indexed any. This was considered a sufficient test for literature paucity.

Studies on e-Government, on the other side, are traditionally focused on processes where the main designer, actor, sensor and actuator is the Public Administration body. In many cases, citizens are expected to "follow the instructions", instead of being actively involved. Moreover, concrete effects of government activities on daily living settings safety are generally not taken into consideration in literature as possible metrics for e-Government performances. This sounds quite odd, since perceived changes in concrete daily living settings safety are normally considered as powerful drivers for voting decisions on the part of citizens. Anyway, a keyword research (safe OR safety + e-government OR eGovernment) within the Econlit and Business Source Première databases, investigated through the EBSCO engine, and within the Google Scholar database, yielded no relevant results as well, in winter 2011-2012.

Another field of study that could be potentially very interested in daily living settings safety is e-Health. In effect, a recent in-depth survey on e-Health literature [6] identified some emerging strategies in health care, which should be strongly supported, in order to build more effective and more sustainable health care systems. Among these emerging strategies, some entail participative systems for living settings safety, and namely: (i) make independent living at home more possible, also for the elderly and the impaired people; (ii) develop preventive strategies, to decrease the need for ex-post care; and (iii) integrate health, social and government activities. The most interesting (to our goals) writings identified in this survey focused on the potential enhancement in independent living provided by telemedicine [7], and on the possibility to develop online health-oriented and safety-oriented personalized coaching [8].

3   Research Method

Since the theoretical corpus on the issue of participative systems for living settings security is still very weak, we chose to conduct an exploratory qualitative research, as it is unanimously suggested by methodological literature [9]. The purpose of our field research was to better understand what core features, within the design of a participative system for living settings security, may positively / negatively influence the performance of the system, independently from the characteristics and needs of specific users. Given the nature of the research question, which is oriented towards the build-up of generalizable propositions, rather than towards the in-depth understanding of specific processes, we chose the method of multiple case studies

instead of more in-depth, individual case analysis approaches (such as, for example, the ethnographic approach).

The four cases presented here were chosen thorough the method of purposeful sampling: the cases were chosen taking into account (i) the maximum variety criterion: the cases are very different from one another (the projects had different goals, different audiences, different geographical scenarios, different designers and different stakeholders) and (ii) the intensity criterion (the phenomenon under study was important and highly visible in the chosen cases).

The four cases are located in Northern Italy. Northern Italy was considered a satisfying study context since its economic, demographic and educational levels are highly representative of the situation of advanced Western countries [10]. On the other hand, we thought that Italy is a particularly good source of sampling as for our research question, since both the levels of digitalization and the attitude to mature democratic participation on the part of people are often considered lower than in other Western countries with longer democratic traditions [11]: as a consequence, the identification of success and failure factors for participative systems in this territorial context may be more meaningful than in other "easier" and more mature contexts.

4   Research Outcomes

4.1   Case 1: Independent Living for Elderly People in Bolzano, Italy

The first case we chose, in order to extract suggestions for theory building, is a pilot project developed by the municipality of Bolzano, Italy, in collaboration with a leading international business information systems company. Thirty people aged 66 or more, with or without chronic pathologies, living alone, and needing home assistance, were provided with a tele-monitoring and tele-coaching system for six months in 2010. The goal of the pilot was to provide remote coaching and assistance to the panel of users, while in their home or in their daily outside activities, in order to make safe independent living possible. For each elderly person, a personalized network of assistants was involved, including professionals, the PA social services and the relatives of the old person monitored; the assistants were linked by a web and mobile system of interaction. The system was based on (i) a system of sensors to monitor house parameters and activate emergency routines in case of data discrepancy; (ii) a mobile application to retrieve feedbacks from users on their mental/health/generic-well-being status with coaching functions and click-to-call emergency call; and (iii) an interactive touch-screen system to coach end users in both physical and mental rehabilitation activities while in their house, with remote potential live support of therapists.

The municipality and the partnering organization provided us with rich documentation, including detailed reports, photos, maps, and several video recorded interviews to the involved elderly and to their caregivers. We thoroughly studied this documentation before interviewing the project leader; this document analysis was particularly interesting because it included also data on problems and failures (e.g. data on people who gave up the project, interviews where people expressed criticisms

towards some aspects of the initiative). We then conducted two semi-structured interviews to the project leader. The first one was conducted by phone and lasted about 30 minutes, and the second one was face-to-face and lasted about one hour. The interviews were not recorded in that we believed that this choice would be beneficial for an open and smooth conversation. We took notes and we discussed our perceptions with the interviewee during and immediately after the second interview.

The core goal of the conversation was to extract from the interviewee his opinions and feelings about the main success / critical factors for the project we were talking about, and to understand whether, in the interviewee's opinion, some of these success / critical factors were generalizable.

"We must distinguish" said the project leader; "the pilot project is one thing, but its possible large-scale, long-term implementation is another thing, it poses other problems". The pilot was conducted by few, highly motivated people, both on the users' side, and on the professionals' side; it did not imply large-scale organizational change efforts on the part of the Public Administration (PA) body; moreover, it could count on funds that would not be available any more after the release.

"We strongly believed in the importance of an integrated approach, involving automated monitoring for alerts, on the one side, and tele-coaching, on the other side" the project leader said. Via the tele-coaching system, the elderly were asked to perform exercises aimed at keeping an agile and active attitude, and at stimulating their attention levels. This is the most interesting part of the experiment, but also the most difficult to accept, both on the part of the PA social services, that are expected to provide the costly personnel enabling the tele-coaching processes, and on the part of the elderly, that sometimes have problems with the interface, or, more simply, are not really motivated in actively engaging in coaching programs, that may be perceived as invasive or bothersome. "The monitoring system was proven very effective" the project leader said; for example, if the old person did not regularly eat or sleep, the CO_2 level sensors detected it, and alerted the network of care-givers. This is often highly appreciated by the elderly and their relatives, since it reassures them on the possibility of independent living. "But who pays for this service? In today's situation, it is impossible that the monitoring and intervention costs are completely covered by the PA. I think that costs can be covered in two ways: first, the elderly people directly pay for a certain part of the costs of monitoring; second, they actively contribute to bring down some expectable future health care public costs, by adopting life styles, such as those encouraged by the tele-coaching system, that are proven effective for pathology prevention strategies. That's why the coaching part is so important". From this conversation, the importance of equilibrated trade-offs between the systems' perceived costs and benefits emerged: according to the interviewee, in the implementation of this kind of tele-assistance systems the PA bodies will take into account short-term and long-term financial sustainability, political approval, organizational constraints, and power games entailed by the project; the elderly and their families, on the other part, will take into account their needs for reassurance, for dignity, for sustainable independent living, and the costs of the system in terms of privacy loss, change uneasiness, learning efforts, active engagement efforts, and money contributions.

4.2   Case 2: Participatory Monitoring for Snow Emergency in Bologna, Italy

In February, 2012, a series of exceptional snowfalls severely impacted central Italy. In such junctures, continuously updated information on specific local situations is very important both for emergency managers and operators, on the one side, and for citizens, on the other side. A pilot experience to manage the 2012 snow emergency was conducted in the city of Bologna, Italy. The municipality of Bologna had already activated a Twitter account, Twiperbole, which the citizens already used to refer to as for, e.g., information on city events, participation in urban planning, or Citizen Relationship Management (CzRM) initiatives. On the occasion of the snow emergency, Twiperbole was intensely used by citizens (and by reporters) to share information on risks, traffic problems, railway blocks, feasible streets, suggested solutions for basic needs, etc. The strong participation of citizens resulted also in a more proactive and participatory check of costs and performances of snow-plough service. The Municipality of Bologna used the Twiperbole channel and the tag #boneve (an abbreviation for "Bologna Snow") to keep citizens informed about school closings, public transportation services activated, intervention priorities, etc.

One of the authors of this paper was given the possibility to perform a direct observation of the use of Twiperbole in one of the emergency evenings, since she was in Bologna with an acquaintance who is a Twiperbole follower, and who had to drive across the city during one of the main snowfalls. During the trip, the author's acquaintance found the chosen way impracticable twice, and each time she stopped and uploaded the information to Twiperbole via her smart phone. She used Twiperbole also to receive information about the streets where the snow-plough service had just passed, and she received two phone calls, from a friend and from a relative, who did not own a smart phone and were confident to receive updated information from a Twiperbole user.

A friendly interview on what happened was conducted few hours after the snowfall, and revealed that the interviewee considered very natural to contribute to Twiperbole in emergency situation. "I have already been using Twiperbole for one year: it is very easy to use to me, and the energy invested to upload useful information is negligible in comparison to the advantages of belonging to a community doing the same" she said. "Moreover, it was very gratifying to see that the flows of information on the snow emergency uploaded to Twiperbole were immediately used by the local media, such as radios and web information portals, in real time. The whole population benefited from the contribution of our community. We all feel urged to be helpful in emergency situations, don't we?"

The "#boneve experience" was thoroughly discussed in a conference on emergency management organized by the Italian Civil Protection, held in Bologna in March, 2012. Our qualitative study was conducted on the basis of the rich documentation on the Twiperbole experience, available online; on the direct observation and the informal interview described above; and on the audio recordings of the Bologna conference of the Civil Protection.

These three sources are convergent in the identification of the following success factors for the Twiperbole tool in the 2012 snow emergency: (1) Twiperbole was a

well-known tool for users, who needed no learning efforts to use it in the emergency situation; (2) uploading information to Twiperbole entails very little effort and negligible, if any, costs; (3) the Twiperbole community was already established as a cooperative network, and it was already considered reliable by users; (4) Twiperbole is implemented and managed by the city municipality, and so the users knew that the information uploaded would be seen and used by people who takes decisions for city management and by the local media; (5) an emergency situation makes goal sharing much more likely, and so (6) in emergency situations, people participate in information sharing activities without being disturbed or influenced by political issues, such as the fear that rival approaches or interests or projects could prevail (as happens, for example, in e-consultation for urban planning).

4.3   Case 3: Citizen Relationship Management in Piedmont, Italy

The Italian law recently introduced a structural innovation in PA bodies. This innovation is based on dedicated Departments, named URPs; each PA body is expected to have its own URP, which should have the role of a Citizen Relationship Management Department. Each URP should act as a sort of 'internal consultant' of the PA body: it should exploit the deep knowledge of both citizens' reports and internal situations, in order to foster problem-solving and service-oriented approaches throughout the whole PA organization.

We studied how the URP department was implemented in a small town local government organization (population 24,000 in 2007) in Piedmont, Italy. The field research was conducted in the years 2009 – 2010 and was based on thorough document analysis (the URP's annual reports and working papers), on the analysis of the URP's information system, and on two interviews to the URP Director; moreover, the front-office activity of the URP was observed during four operative days (spread throughout the year 2009).

When the URP Department had started up in the late 1990s, it was perceived by the city administration employees as a possible means of control and "hostile" evaluation on the part of the Mayor and/or of the City General Manager. Moreover, the URP was perceived, at first, as a dangerous innovation that could take away from managers and employees their traditional power of "monopolizing" information. Finally, the URP was perceived as a possible source of a disturbing increase of fulfillments for the other Departments, which feared to be forced by to change their procedures and to provide the URP department with futile reports.

During the first year, then, the URP Director dedicated himself mainly to internal relations activities in order to overcome such resistances, thus postponing the opening of the Front Office and the setting of the ICT tools.

Thanks to these strategies, the URP Director started gaining the trust and cooperation of several employees, and dedicated himself in building the main back-office framework, which was ready in the first 2000s. The front office started and progressively enhanced its activities from then on.

During field research of the year 2009, the direct observation of employees' behaviors and interactions indicated overall friendly relationships within the PA body

structure; the Mayor and the City's General Manager claimed that the URP department was a pivotal structure, that could be effectively leveraged in order to address several even strategic issues (e.g. the starting up of door-to-door separate rubbish collection).

During our observation of front-office activities, the URP proved able to intercept and to manage a huge amount of requests, questions and claims, and to actively assist citizens in accessing PA documents and procedures. Citizens often appeared satisfied of the courtesy, assistance and feedbacks provided, and generally behaved respectfully towards URP operators. There was a group of habitués that used to frequently report to the URP, and among these, there were some city councilmen that, though belonging to the PA organization itself, used to address everyday problems (e.g. traffic policemen unexpectedly missing in front of a school), by asking intervention through the URP department, instead of through traditional bureaucratic or political internal channels.

Data gathered by the URP through its own front-office activities were used to edit annual reports on the needs of citizens and on the service levels provided by the PA. Along with these reports, in-depth surveys were periodically created, to monitor citizens' perceptions about specific issues.

The URP also provided the PA organization with counseling about procedure innovation and simplification, but these advices sometimes had clashed with enduring resistance. Nevertheless, several even simple, but concrete innovations (e.g. citizen-centric change of opening times of the various Offices) had already been successfully implemented after suggestions stemming from the URP department.

We asked the URP Director to express his opinions about the main success factors for this experience, and his answers may be synthesized as follows: the URP was successful because (a) internal and external communication was completely committed to the URP, which managed all media channels and ICT infrastructures, from the PA's telephone switchboard operator to the City web site; in this way, all of the citizens' reports, also those collected in face-to-face contact, were managed consistently; (b) maximum attention was given to the core business of the URP, i.e. workflow management: the URP department collected reports, claims, concerns and ideas by citizens, and then elicited answers and problem solving from the involved departments of the PA body; finally, it provided citizens with adequate feedbacks until the problem was solved or filed; (c) the URP could count on a strongly established back-office and on collaborative relationships with the other departments; (d) the URP data made comparative evaluations of the concrete performances of the PA body possible.

5   Conclusions: Three Possible Success Factors for ICT-Enabled Citizen Involvement for High Quality Urban Living

On the basis of the multiple case study research described above, we extracted several ideas about the possible success factors that should be taken into account when designing participative systems for safer living settings. We sought to express these

ideas in form of propositions, and to select those that were consistently corroborated by all the outcomes our field researches and by the opinions of all the interviewees. The following three synthetic propositions, suitable both for further qualitative research, and for operationalizing and testing in quantitative research, are the final outcome of our paper:

5.1   Success Factor No. 1: Citizens Perceive Their Involvement as an "Inverse Commons" Investment

The first important factor we identified is about the perceived cost-benefit ratio for citizens. Citizens seem to be willing to join participation initiatives if they can concretely perceive a benefit from their participation, and if this benefit is perceived as greater than the effort needed for participation. For example, the effort of reporting on the snow emergency situation may be perceived as acceptable when compared with the benefit of being more thoroughly informed by many other citizens doing the same. This condition for altruistic, proactive and participatory behavior is effectively described and explained by game theories and adaptive dynamics, with the theory of the "inverse commons" [12].

5.2   Success Factor No. 2: Before Launching the Participative System, the Necessary Back-Office Is Soundly Organized

If citizens use a collaborative system (e.g. a geo-referenced portal, or the municipality claim office) to report on a problem or to express a need, but they receive no satisfying feedback, such as the solution of the problem or at least an explanation about the difficulties of solving that problem, they are likely to lose their trust and to quit participation. In other words, a networked citizen participation / inclusion system is a double-blade weapon, in that it amplifies the perception of the possible poor capabilities of the involved authorities to solve the problems identified by citizens. For this reason, even if a citizen participation project is usually perceived as a "front-office" problem by PA bodies, the real challenge is often at the back-office level. The experiences examined suggested us that it may be better to even postpone the kick-off of the project, until the back-office is decently ready to face the citizens' requests [13].

5.3   Success Factor 3: The Core Role of Citizens Is Collaborative Sensing and Monitoring

The examined cases show that people, especially huge amounts of people, are more likely to be successfully involved in collaborative sensing and monitoring than in collaborative problem-solving. This does not mean that collaborative problem solving is impossible: but it is more likely if collaborative problem-solving is rooted in a channel where people has already successfully experimented simpler interactions, such as sensing and monitoring. In other words, before accepting high-level problem solving involvement, for example in city planning, people tend to test more basic

functions: for example, if I report on a hole in a certain street, and I see that the hole is quickly fixed, then I feel that the collaborative tool is trustworthy and I can invest in more costly, high-level cooperation efforts. These findings are consistent with literature reporting on failures in too "ambitious" eParticipation projects [1].

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Finnish 'Silver Surfers' and Online Health Information

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Abstract. The Internet is thought to be beneficial for the elderly regarding health communication. Many of those over 65 years of age do not, however, use the Internet. This paper presents results from a survey and a follow-up interview concerning health information seeking of Finns aged 65-79 years. Questionnaires were distributed to 1000 persons living in the Turku region in January 2011, and 281 questionnaires were returned. Interviews were conducted with 49 of those who had returned the questionnaire, and 19 interviews are included in this study. The results show that the Internet is fairly little used when elderly seek health-related information, and that many older, less educated and unhealthier persons do not use it at all. Those who use it the most mainly search Google, and obtain hits that can vary in quality. Health and information providers should be cautious to rely on the ability of seniors to take care of themselves and their health through information on the Internet, as there are still so many who do not use the web at all.

Keywords: elderly, health information, internet, seniors, web resources.

1 Introduction

Seniors constitute the group of people that is thought to benefit the most from the Internet as a medium for health communication [1]. Internet resources are convenient because they, for example, make it possible to see a physician from your own home [2]. The Internet also provides quick access to information for health-related purposes [3]. In addition to quick access, also access to multiple resources, and the possibility to become more knowledgeable before seeing a doctor can be beneficial to seniors [4]. Different aspects of older adults' use of the Internet have been studied. These include the seniors' ability to use the computer and the information; what types of information seniors look for on the Internet; how health information acquired from the Internet is used for decision making, and; why the Internet is used as a source for health information by seniors [1]. Which kinds of web resources so-called 'silver surfers' [5] prefer for health information and the way they find them has so far, however, only been scarcely studied. This paper examines the frequency of use of Internet resources for health-related information among Finns aged 65-79 years, and gives an insight into how they search for health information on the web and their preference for resources.

2   Background

The Internet is an important health information source for elderly in some populations. Sixty-eight percent of Americans aged 65 years or older had gone online to look for health information in 2006 [6]. In Canada, 58% of the seniors had sought health information online [7]. A more recent survey of Americans showed that the Internet use is steadily increasing not the least among those aged 70 years or older, and seeking of health information was the third most popular online activity among Americans aged 73 years or older [8]. A Finnish survey of people aged 18-65 years did, however, show that those who were older and those with lower levels of education used Internet resources the least for health information [9]. Fifty-three percent of Finns aged 65-74 had used the Internet during the past three months in 2011, a share that is considerably smaller than that of younger age groups [10]. Also British seniors used the Internet less frequently in older age [11]. Taha and colleagues found that seniors who had poorer health more often belonged to a group of non-Internet users, as well [12]. Elderly people may face several barriers to Internet use, such as perceived lack of using skills [13], [14]. A British study revealed that seniors might also lack interest to use Internet, lack a computer or Internet access, and feel too old to use the Internet [15]. Psychological barriers such as perceptions of usefulness and ease of use can, furthermore, influence Internet use among seniors [16]. For those with lower levels of education, the provided information itself might constitute a barrier; medical information on the Internet has been found to require reading abilities at a fairly high level [17], [18].

Finnish seniors who did use the Internet, mostly used e-mail programs or search engines, whereas web sites related to health or medicine were only marginally used. The users were also showing fairly little trust in the information found on the Internet [19]. The most common Internet activity of Australians aged 55 years or older was using a search engine, as well [20]. Sixty-six percent of Americans looking for health information online had started their search at a search engine, whereas 27% began their information seeking at a health web site [6]. Merja Drake interviewed Finnish patients and found that they mostly used Google to find health-related information on the Internet [21: 105].

3   Current Study

This paper presents results from both a survey and a follow-up thematic interview conducted in the winter and spring of 2011. The survey was conducted in January 2011 on a random sample of 1,000 65-79 year old Finns living in the Turku region in Southwestern Finland, drawn from the Finnish Population Register. The distributed self-administered questionnaire was accompanied by a note asking those who were interested to take part in a follow-up interview to give their contact details, that is, e-mail address or phone number. A total of 281 completed questionnaires were returned by mail (response rate 28%), and 99 of these respondents had also attached their contact details. The respondents were contacted in the order they had returned their

questionnaire, and a total of 49 personal interviews were finally conducted. The interviews were recorded and transcribed. In the questionnaire the respondents were given a list of 13 named health information sources, and were asked to rate them on a 5-point scale (1 not at all - 5 very much) regarding their importance and trustworthiness. An additional option of "do not know" was also available. The sources included media sources, interpersonal sources and electronic resources. In this paper, the focus is on Internet resources. The same list of sources was, furthermore, used in the personal interview, where interviewees were asked more thoroughly about their actual use of different types of information sources. Of the 49 persons attending the interview, 19 (39%) had ticked that they use Internet resources fairly or very much (4 or 5). These 19 persons were during the interview asked to specify which kinds of web resources they mostly use, and how they find them. Their responses constitute the material for the qualitative part of this study. Descriptive statistics were used for the analysis of the quantitative data. Using PASW Statistics 18 for Windows, use of and trust in Internet resources were cross-tabulated with the following background variables: gender, age group, education level, and self-rated current health. Chi-square analyses were conducted and P values at .05 or lower were considered statistically significant.

4   Results

4.1   Demographics of the Respondents

The questionnaires were returned by 122 (43%) men and 159 (57%) women. The mean age was 70 years. Age was categorized in three groups: 65 to 69 years (49%, n=137), 70 to 74 years (32%, n=90), and 75 to 79 years (19%, n=54). The education levels varied, as 34% (n=95) had a primary education, 44% (n=124) had a secondary education, and 22% (n=60) were highly educated (university level or equivalent). Sixteen percent of respondents (n=45) rated their current health as poor, 36% (n=98) as mediocre, and 48% (n=132) as good or excellent. The 19 interviewees who are included in this study consisted of 9 (47%) men and 10 (53%) women. Of these, 58% (n=11) were aged 65-69 years, whereas 37% (n=7) were 70-74 years old, and 5% (n=1) belonged to the age group 75-79 years. Eleven percent (n=2) had a basic level of education, 56% (n=10) had a secondary education, and 33% (n=6) had a high level of education. One interviewee had withheld his education level.

4.2   Health Information Sources and the Role of the Internet

Figure 1 shows the frequency of use of different types of information sources for health-related information. As can be seen, these sources are very medical, as information attached to medical packages, including prescriptions and patient information leaflets, is the most used source. Forty-five percent (n=124) of the 281 respondents used them very much, and an additional 29% (n=81) used these sources fairly much. Pharmacy staff followed, with 26% (n=72) using them very much and 34% (n=94) fairly much. Health professionals were used very much by 25% (n=69)

and fairly much by 35% (n=98) of the respondents. One-fourth (26%, n=70) of the respondents used Internet resources very or fairly much for health information, but of these only 12% (n=32) actually used them very much. Furthermore, as many as 40% (n=105) did not use Internet resources at all, and an additional 13% (n=35) chose to tick the option "do not know".
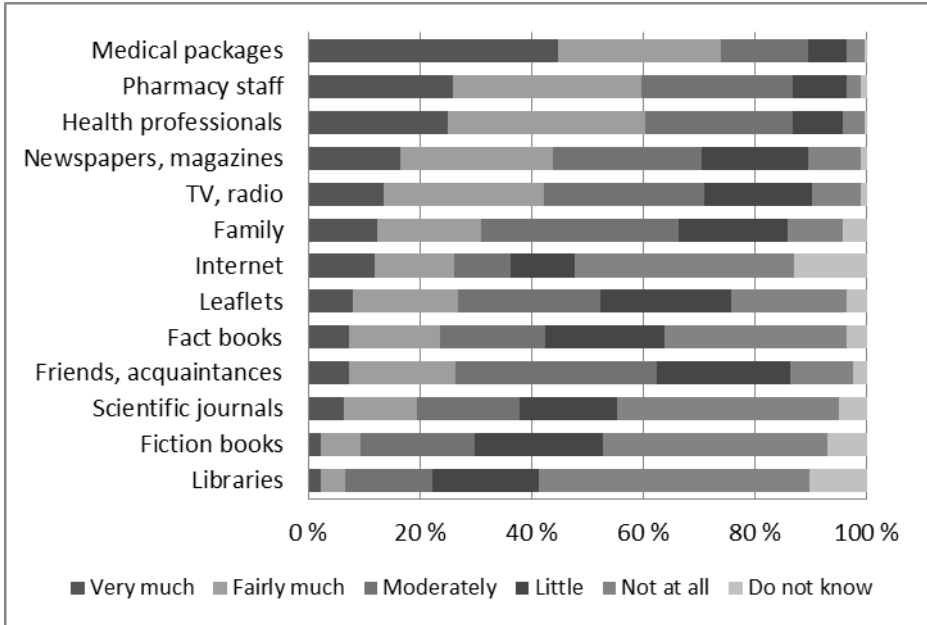

Fig. 1. Frequencies of use of different types of information sources

Regarding trust in information sources, the three most used information sources, that is, information attached to medical packages, pharmacy staff, and health professionals were the most trusted sources, as well. Pharmacy staff were considered very trustworthy by 42% (n=117) and fairly trustworthy by 44% (n=122). Medical packages are very trustworthy according to 40% (n=110) of the respondents, and ticked fairly trustworthy by 43% (n=120). Thirty-eight percent of the respondents (n=104) had ticked that health professionals are very trustworthy, and 49% (n=136) that they are fairly trustworthy. Only 4% (n=11) considered Internet resources to be very trustworthy, and 17% (n=44) thought that they are fairly trustworthy. Only 12% (n=32) did, however, not trust them at all. Instead more than one-third (35%, n=93) of the respondents had chosen to answer "do not know" on this question.

When use of and trust in Internet resources were cross-tabulated with gender, age group, education level, and self-rated current health, some, yet small, differences were found concerning gender. As shown in Table 1, male respondents were somewhat more inclined to use Internet resources. Age group and education level where, however, significantly related to use. The younger respondents and those with higher levels of education were using Internet resources more. As many as 60% of the respondents in the oldest age group, and one-half of those with only a basic level of

education, did not use this information source at all. Furthermore, those who rated their health as better used this resource more often, whereas more than one-half of those who rated their current health as poor did not use Internet resources at all.

Table 1. Use of Internet cross-tabulated with background variables

Back-ground variables	Chi-square (P value)	Use very much % (n)	Use fairly much % (n)	Use mode-rately % (n)	Use a little % (n)	Do not use at all % (n)	Do not know % (n)	Total % (n)
Gender	**5.876 (.318)**							
Female		11.0 (17)	13.0 (20)	12.3 (19)	9.7 (15)	42.9 (66)	11.0 (17)	100.0 (154)
Male		13.2 (15)	15.8 (18)	7.0 (8)	14.0 (16)	34.2 (39)	15.8 (18)	100.0 (114)
Age group	**31.567 (.000)**							
65-69 y		15.8 (21)	18.8 (25)	14.3 (19)	12.0 (16)	30.1 (40)	9.0 (12)	100.0 (133)
70-74 y		9.2 (8)	12.6 (11)	9.2 (8)	13.8 (12)	41.4 (36)	13.8 (12)	100.0 (87)
75-79 y		6.3 (3)	4.2 (2)	0.0 (0)	6.3 (3)	60.4 (29)	22.9 (11)	100.0 (48)
Education level	**40.671 (.000)**							
Primary		7.9 (7)	4.5 (4)	4.5 (4)	10.1 (9)	49.4 (44)	23.6 (21)	100.0 (89)
Secondary		9.4 (11)	17.1 (20)	12.0 (14)	14.5 (17)	39.3 (46)	7.7 (9)	100.0 (117)
High		21.7 (13)	23.3 (14)	15.0 (9)	8.3 (5)	25.0 (15)	6.7 (4)	100.0 (60)
Current health	**17.589 (.062)**							
Poor		4.8 (2)	7.1 (3)	4.8 (2)	11.9 (5)	54.8 (23)	16.7 (7)	100.0 (42)
Mediocre		7.6 (7)	13.0 (12)	9.8 (9)	13.0 (12)	40.2 (37)	16.3 (15)	100.0 (92)
Good/ excellent		17.8 (23)	17.8 (23)	11.6 (15)	10.1 (13)	32.6 (42)	10.1 (13)	100.0 (129)

Table 2 shows the trust in Internet resources cross-tabulated with gender, age group, education level and current self-rated health. Women seem to trust Internet resources slightly more than men do, although the differences are small. Age group and education level, as well as self-rated health, are all significantly related to trust; the younger, more educated and healthier respondents trusted these resources more. More than 60% of those aged 75-79 years, almost 50% of those with a primary education, and more than 40% of those with poor health hade ticked that they do not know.

Table 2. Trust in Internet cross-tabulated with background variables

Back-ground variables	Chi-square (P value)	Trust very much % (n)	Trust fairly much % (n)	Trust mode-rately % (n)	Trust a little % (n)	Do not trust at all % (n)	Do not know % (n)	Total % (n)
Gender	**4.895 (.429)**							
Female		5.4 (8)	18.2 (27)	20.9 (31)	10.8 (16)	8.8 (13)	35.8 (53)	100.0 (148)
Male		2.6 (3)	14.7 (17)	21.6 (25)	10.3 (12)	16.4 (19)	34.5 (40)	100.0 (116)
Age group	**36.614 (.000)**							
65-69 y		5.2 (7)	23.1 (31)	26.1 (35)	10.4 (14)	6.0 (8)	29.1 (39)	100.0 (134)
70-74 y		4.7 (4)	9.3 (8)	22.1 (19)	12.8 (11)	19.8 (17)	31.4 (27)	100.0 (86)
75-79 y		0.0 (0)	11.4 (5)	4.5 (2)	6.8 (3)	15.9 (7)	61.4 (27)	100.0 (44)
Education level	**32.883 (.000)**							
Primary		2.4 (2)	12.9 (11)	11.8 (10)	7.1 (6)	16.5 (14)	49.4 (42)	100.0 (85)
Secondary		5.1 (6)	16.9 (20)	18.6 (22)	15.3 (18)	11.9 (14)	32.2 (38)	100.0 (118)
High		3.4 (2)	22.0 (13)	40.7 (24)	6.8 (4)	6.8 (4)	20.3 (12)	100.0 (59)
Current health	**21.145 (.020)**							
Poor		2.4 (1)	7.1 (3)	9.5 (4)	19.0 (8)	19.0 (8)	42.9 (18)	100.0 (42)
Mediocre		2.2 (2)	13.0 (12)	27.2 (25)	7.6 (7)	10.9 (10)	39.1 (36)	100.0 (92)
Good/ excellent		6.4 (8)	23.2 (29)	20.8 (26)	9.6 (12)	11.2 (14)	28.8 (36)	100.0 (125)

4.3   Searching the Internet for Health Information

Most of the 19 interviewees who had ticked that they use the Internet very or fairly much chose this source in order to find information in case of illness, symptoms or otherwise raised information needs. The following quotes give examples of these situations:

"Sometimes if [someone] somewhere in the close environment or you yourself have a special symptom or thing, then I might take a look at some recommendation in Käypä hoito*"* (woman born 1939)

"What happens to occur sometimes, if you get an address from a newspaper or something" (man born 1939)

"And then of course from the computer, and the web, especially If I have that kind of ailments that I think I might find something [about them]" (woman born 1941)

"I look [online] every time when there is an interesting thing that I want to know about, from there you get it" (woman born 1936)

"I have now as old noticed that on the web you can, like, find everything, so every time I or my wife or the daughters have something, I like to go there because I have enough time to" (man born 1937)

Google was the dominating search engine; as many as 14 of the 19 interviewees (74%) answered that they use Google, and an additional one only mentioned seeking information by using search words. One interviewee who explained that he uses Google because it is the fastest way to find information said that:

"Google is a good start; from there you can then go on an adventure" (man born 1944)

A couple of interviewees specified that the searches were done by typing symptoms or illnesses:

"Through Google then, [I] type that illness, for example" (woman born 1941)

"You find quite easily when you feed something like for example an illness or a symptom or something, you don't really need to feed anything else, and then it searches from different places from where you can, you get links to different sites" (man born 1937)

Most of the interviewees could not specify which kinds of web sites they actually use after having done the searches. Some did, however, mention what kinds of sites they avoid:

"You try to find something where they describe the symptoms of certain illnesses, from that kind of sites you try to find information, so that, not from those discussion forums no, they are not of any use, I think that it is better to get information that is current at that specific moment" (man born 1945)

"For example Wikipedia, there, like, it is information gathered by people and not by experts" (man born 1945)

Those who did mention specific sites mostly preferred health portals. One interviewee mentioned an unnamed site where you can get a diagnosis through a dialog with the doctor, but some interviewees could also name the sites they visit. Named health

portals were mentioned six times; *Käypä hoito*, the Finnish national current care guidelines developed by the Finnish Medical Society *Duodecim* in cooperation with other medical societies was mentioned three times, whereas the web site of *Duodecim* itself containing e.g. *Terveyskirjasto* (Health library) was mentioned twice, and the commercial health portal *Tohtori.fi* was mentioned by one person:

> *"Well if you talk about health, this* Tohtori.fi *is that kind of information source for us, there we check medications and get to know all diseases and what there is, and then also the stories at* Käypä hoito*, there you can also go to do research"* (man born 1945)

Two interviewees had found the abovementioned health portals through searches on Google, and one mentioned that she has the *Duodecim* web site in her list of favourites and goes there directly when needed. Those who did use Google often expressed concerns about the amount of found web sites and the trustworthiness of these:

> *"There are millions and millions of hits"* (man born 1939)

> *"Well I do look there, like there are huge amounts of information and I look every time when there is an interesting thing that I want to know about, from there you get it, but you have to filter it then"* (woman born 1936)

> *"If you have to find out something you will find it there, and then you have to try to decide that whose text is this now, that you don't necessary get trustworthy [information] from there"* (man born 1944)

> *"And I don't, like, use Google that much because you can also get all kinds of information from there"* (woman born 1939)

> *"I think that something like the* Käypä hoito *recommendation, that is then quite specific and has gone through many filters, that kind, I hardly research anything else there"* (woman born 1939)

When the interviewees were inquired about which sources they prefer to turn to, in case they need health-related information, health professionals were most often mentioned - by 11 interviewees - whereas 9 interviewees mentioned that they turn to the Internet, either as the only first-hand source, or combined with health professionals or other sources such as medical encyclopedias:

> *"Well it is probably first a physician, but when you come from the appointment and he has perhaps not really, [or] she has not taken time to explain, then you go online and read"* (woman born 1941)

> *"Yes, at first I check the web and if that doesn't help I will make an appointment"* (man born 1939)

5   Discussion

This paper has presented an overview of Finnish seniors' use of Internet resources for health-related information. The studied population, that is Finns aged 65-79 years, did not differ much from those in previous studies, because web resources were fairly little used as a health information source, compared with some other sources. Several studies have shown that health professionals, such as physicians and pharmacists, are the sources seniors prefer to turn to in case they need health-related information [22-27]. Most studies do not include information attached to medical packages as a named source, but those who do, show that this source is very important to the elderly [25-27].

American seniors looking for online health information mostly sought information about medications, treatments or procedures, or specific illnesses, as well as information on nutrition and exercise [6], [28]. In the current study illnesses seemed to be the most common sought-for topic, searches were conducted in case of occurred symptoms, but also to find out more about medications.

Age and education level were significantly related to use of the Internet in the studied population, whereas current health was also related to some extent. Also this finding is in line with the results of previous research showing that older age, less education, and poorer health was connected with non-use of the Internet [9], [11], [12]. The oldest respondents, as well as those with a primary education and poor health had, furthermore, to a large extent answered "do not know" on the question about trust in Internet resources, probably because they could not decide on this as they did not use this source at all. The pattern was repeated in the interviews; the interviewees who were included in the study because they used Internet resources very or fairly much were mainly younger and had a medium or high level of education, as well. Like in previous studies [6], [21], use of search engines - not the least Google - was the most common way to find health information; only a few of the interviewees could name certain health sites that they turn to directly. Harris, Wathen, and Fear [29] thought that limited use of health portals could be due to ignorance of their existence. In fact, a couple of the interviewees of this study had found the named health portals through searches on Google. One respondent mentioned that he used Google because it was the fastest way to find needed information. The possibility to obtain information quickly has been a major reason for Internet use in American studies, as well [3], [4].

Searching the Internet brought large amounts of information, but could also cause trouble, due to the huge number of hits and worries about the trustworthiness of the sites found. Also previous research shows that seniors worry about the trustworthiness of Internet resources [25]. Americans expressed concerns about potential violations of privacy or confidentiality and also about the accuracy of the information as barriers to use of online health information [3].

6   Conclusions

The results show a divide between seniors, regarding their use of Internet resources. The older respondents, those with lower levels of education, and those who rated their

health as poor were less likely to use the Internet to find health information. This is possibly a matter of concern, as older age is bound to increase health problems, and both the older persons and those who already experience health problems could benefit more from the possibilities Internet offers. One challenge is to not only make seniors in the more vulnerable groups aware of these possibilities, but also to get them more interested to make use of these. Health and information providers should, furthermore, be cautious to rely on the ability of seniors to take care of themselves and their health through information on the Internet, as there are still so many who do not use the web at all. Only a few of the interviewees could name certain health portals that they turn to directly. This could also be worrisome, as although the respondents seemed to be cautious with trusting all the found information, the large number of web sites found through the search engine increases the possibility of ending up at sites containing less trustworthy information. The number of interviewees was limited, and further qualitative studies should be conducted in order to increase the knowledge about how 'silver surfers' actually search and use the online health information they come across. The amount of information available on the Internet is evermore growing, as is the number of older adults in the world. The challenge is still to get these two to meet.

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Vision Enhancement Technique
Based on Eye Tracking System

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Abstract. In this paper a gaze tracking system is presented that allows stress free reading for people who are paralyzed, with low vision or who have both disabilities. The system tracks the positions of the eye pupil corneal reflection and finds the point of the readers gaze. The user wears a head-mounted device (special eyeglasses) when he sits in front of the computer screen. The integrated possibility of magnification has allowed more effective working with the computer, including accurate selections of targets, faster reading and writing. The experiments have shown the usefulness of the proposed system and claim that it can not only enhance the human vision but can also increase the living quality by allowing non-contact interaction with the computer.

Keywords: Eye tracking, human machine interaction, assistive technology.

1 Introduction

Input devices that allow the interaction with computers or other physical devices without actually touching them opens a new communication potential for people with physical impairments. In the last decade the interest in assistive devices, so called gaze tracking systems, has been rapidly growing [1]. Eye gaze is a very natural manner of pointing, as people tend to look at the object they want to interact with. The gaze tracking systems have assisted users with motor disabilities (mostly persons who are unable to use their hands), allowing them to control a computer with their eyes [2-5].

The complexity of using a computer depends on the individual impairment level. Therefore, technical aids should be personalized for an effective assistance. The designed gaze tracking system must satisfy strong requirements, that come from the users of the target group: the system must be stable and work steadily in different lightning conditions; the user should be able to calibrate and recalibrate the system easily and independently; the system should be portable, flexible and as small as possible; it should be possible to use the system for emailing, internet browsing,

writing, gaming, etc. In general such communication devices are based on a video camera that captures fast motions of the user eye and estimates the gazing point. The system detects the position of the eye automatically and assigns appropriate commands to the external device or/and application program. There are a number of various methods for extracting the point of the gaze [6-9], but a head mounted device, which allows relatively free head movements, is a more suitable option when accurate gaze detection is needed [10-12].

In this paper the proposed gaze tracking algorithm uses a monocular black and white video camera which is mounted on the glasses and directed to the user's left eye. The user's eye is illuminated with three IR light diodes, which are mounted to form a triangle. The accurate look and control functionality, the ease calibration/recalibration of the eye tracking is established using four fundamental features: calculating L2-norm of the grayscale image, finding the mathematical relation between pupil position, corneal reflection and gazing point, and gaze point mapping. The proposed system is flexible enough to meet most of the needs of the persons with different disabilities. However, the popularity of graphical interfaces causes problems for the disabled users with poor vision. Such users encounter some difficulties of accurate selection of the small targets in the interface. Viewing area magnification is one of the solutions, which enables the increase of target objects to desirable size.

Computer magnifiers (license free or commercial) usually allow you to select the level that suits your vision and to "zoom in" a portion of the original screen image at one time [13-16]. Low vision is often a loss of sharpness, therefore magnifiers enable the change of the color contrast and improve the visibility of the mouse pointer [17]. The integration of a magnifier into the gaze tracking system has a double benefit, that is, stress free reading/writing with a computer and increasing of the accuracy and speed of the target selection [18], [19]. The purpose of this research is to integrate a Windows magnifier to the proposed low cost gaze tracking system, thus allowing users to select and read information more accurately and faster.

2   Theoretical Background of Eye Tracking

The detection of the eye pupil is executed in the eye images captured in the near infrared light (IR). A human eye cannot see the near IR and illuminating the eye with such light does not cause undesirable discomfort. The eye image captured in the near IR always shows a dark (black) pupil area that is caused by the absorption of the IR by the inner eye tissues. Knowing this eye property, the detection of the eye pupil is simplified to the searching of the dark and round region in the image. The geometrical property, such as radius, of the searched dark region is not known, because the eye pupil tends to constantly adapt to randomly changing ambient illumination by changing its size. However, the variation limits of the pupil size are well known [20] and this information is used for accurate pupil detection. In our case, we used notations R_{min} and R_{max} for the description of the lower limit and upper limit of the pupil radius.

In this work we propose the eye tracking algorithm that is based on four fundamental processes: the evaluation of the L2-norm, detection of accurate pupil position, detection of corneal reflection and finding the relation between gaze point and displacement of the pupil position. The L2-norm is used to separate the images of the closed and opened eye. The precise pupil and corneal reflection detection is achieved by computing statistical values of the grayscale image, i.e., average values μ and standard deviation σ, which are computed using formulas (1) and (2) accordantly. The control of the magnifier of any other software strongly depends on the calibration conditions, during which the relation between gaze point (X, Y coordinates on the computer screen) and pupil displacement is evaluated.

The proposed gaze tracking algorithm uses a monocular video camera that is mounted on the frame of the eyeglasses and directed to the user's left eye. The user's eye is illuminated with one IR light diode. The hardware of the proposed eye tracking system is shown in Figure 1.
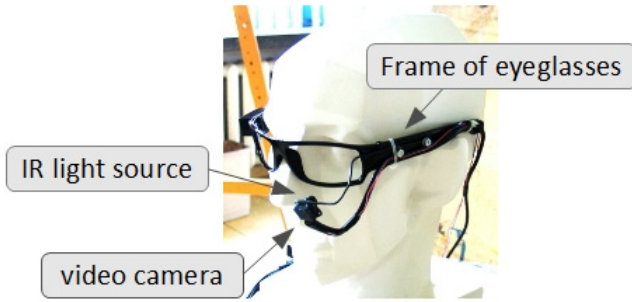
Fig. 1. The proposed gaze tracking device

In this work the notation $\Gamma_k(u, v)$ is used to describe color image of three color channels $k = 1,2,3$. The notations u and v describes the location of the pixel in the image matrix. The grayscaled image $G(u, v)$ is computed using the formula shown bellow. The pixel value of the grayscale image is acquired by computing average color of the three color channels.

$$G(u, v) = \frac{1}{3}\sum_{k=1}^{3} \Gamma_k(u, v) . \tag{1}$$

The average intensity of the grayscaled image is computed using formula (2).

$$\mu = \frac{\sum_{u=1}^{U}\sum_{v=1}^{V} G(u,v)}{U \cdot V} . \tag{2}$$

The standard deviation of the grayscale image intensity is described using formula (3).

$$\sigma = \sqrt{\frac{\sum_{u=1}^{U}\sum_{v=1}^{V}(G(u,v)-\mu)^2}{U \cdot V - 1}} . \tag{3}$$

The notations U and V are the numbers of rows and columns in the image matrix, accordantly. Calculated statistical parameters are further used for the position detection of the eye pupil and corneal reflection. More about detection is explained in the next subchapters.

(a)   Detection of Closed Eye

The eye cannot be in the "on" or "off" state. This is the well-known "Midas touch" problem where eye gaze cannot be used as a pointing and switch "device". Therefore, an additional signal (the image of the closed eye) has been proposed that allows confirmation of a voluntary generated decision, i.e., pushing the button. The L2-norm value L is used as similarity measure of the template $\tilde{G}(u, v)$ and new image $G(u, v)$ of the human eye. The norm is computed using formula (4).

$$L = \sqrt{\sum_{u=1}^{U} \sum_{v=1}^{V} |\varepsilon(u, v)|^2} \,. \tag{4}$$

$$\varepsilon(u, v) = G(u, v) - \tilde{G}(u, v) \,. \tag{5}$$

, where $\varepsilon(u, v)$ is the difference of the intensities at the u and v. The closed eye is detected when computed L2-norm is smaller or equal to the similarity threshold value Θ_L. The template image of the closed eye is captured during calibration procedure. Some examples of the L2 norm are shown in the figure 2.

Fig. 2. The example of L2norm values by comparing template and new image

(b)   Detection of Eye Pupil and Corneal Reflection

The pupil of the user's eye is detected by computing the average intensity value and the standard deviation of each new eye image. The image matrix is indexed according to estimated statistical values based on the condition shown in (6) and (7). The mapping image M_p is computed using condition (6) and it is used for accurate pupil detection in further processing. The mapping image M_r is estimated using condition (7) and it is used for detection of the corneal reflection points.

$$M_P(u, v) = \begin{cases} 1, if\ G(u, v) < \mu - 2\sigma \\ 0, otherwise \end{cases}. \tag{6}$$

$$M_R(u, v) = \begin{cases} 1, if\ G(u, v) > \mu + 3\sigma \\ 0, otherwise \end{cases}. \tag{7}$$

Some examples of the resulting mapping images are shown in Figure 3. There can clearly be seen the regions of the eye pupil and three reflection points, which are recognized by the triangular pattern. Such pattern is obtained, because the IR diodes are mounted in a triangular manner.
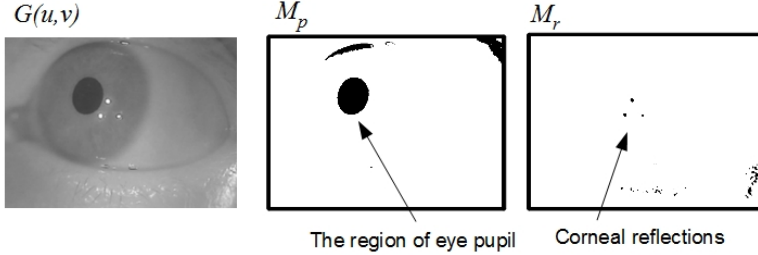

Fig. 3. The example of mapping images of the M_p and M_r

The detection task of the eye pupil is simplified to the search of a round dark region in the mapping image M_p. The geometrical center and area of each dark region are measured in the mapping image. The geometric center of the non-overlapping closed polygon by N vertices $(x(i), y(i))$ is calculated using (8), (9) and (10). The area of the non-self intersecting polygon is written as:

$$A(j) = \frac{1}{2}\sum_{i=0}^{N-1}(x_j(i)y_j(i+1) - x_j(i+1)y_j(i)) . \tag{8}$$

The coordinates of the geometrical center $C = (C_x, C_y)$ of the polygons, where

$$C_x(j) = \frac{1}{6A}\sum_{i=0}^{N-1}\left(x_j(i) + x_j(i+1)\right)(x_j(i)y_j(i+1) - x_j(i+1)y_j(i)) . \tag{9}$$

$$C_y(j) = \frac{1}{6A}\sum_{i=0}^{N-1}\left(y_j(i) + y_j(i+1)\right)(x_j(i)y_j(i+1) - x_j(i+1)y_j(i)) . \tag{10}$$

In (8), (9) and (10) the vertices are assumed to be numbered by the order of their occurrence along the polygon's perimeter, and the vertex $(x(N), y(N))$ is assumed to be the same as $(x(0), y(0))$. The j-th region is indexed as the region of the eye pupil if it satisfies the condition bellow:

$$x_c, y_c = C_x(j), C_y(j) \ if \ A_{min} \leq A \leq A_{max} . \tag{11}$$

where $A_{min} = \pi R_{min}^2$ is the minimal limit of the eye pupil size and $A_{max} = \pi R_{max}^2$ is the maximal limit of the pupil size. The notations x_c and y_c denote the center coordinates of the detected eye pupil. When the pupil center is detected the first closest reflection point is searched in the mapping image M_r. Usually it is the lower right corner of the triangle. Euclidean distance D_r is estimated to the mapping image M_r points if these points form a triangle pattern. There are k points in M_r and the distance to the each point can be expressed as:

$$D_r(k) = \sqrt{(x_c - u_r)^2 + (y_c - v_r)^2}, if \ M_R(u, v) = 1 . \tag{12}$$

The coordinates of the corneal reflection x_r and y_r are estimated by finding the minimal distance D_r using expression (13).

$$x_r, y_r = \min_k(D_r(k)) .\tag{13}$$

(c)   Gaze Point Mapping

The resulting gaze point mapping to the computer screen is obtained by interpolating the locations of the pupil center and the first corneal reflection. The gaze mapping is based on the assumption that the pupil center is approximately centered on the optical axis of the eye and the corneal reflection appears on the spherical surface of the human eye [20]. Therefore, a gaze direction vector can be computed because the camera point direction relates to the displacements of the eye pupil center and corneal reflection. All measurements which are needed to obtain gaze point mapping is shown in Figure 4. The displacements along horizontal axis and vertical axis can be expressed:

$$dx = x_c - x_r, dy = y_c - y_r .\tag{14}$$
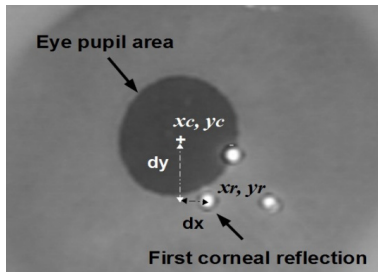
Fig. 4. The measurements needed for gaze point mapping

The linear approximation to gaze point can be expressed as:

$$X = a_{11} + a_{12}dx, Y = a_{21} + a_{22}dy .\tag{15}$$

where X and Y is the coordinates of the mouse cursor on the computer screen. Using least squares method the coeficient is calculated by minimazing error function $E(a)$.

$$E_x(a) = X - (a_{11} + a_{12}dx), E_y(a) = Y - (a_{21} + a_{22}dy) .\tag{16}$$

The system calibration procedure is executed each time, when a user starts working with the proposed daze tracking system. Custom made program plots 9 target points on the computer screen in the sequence (see Fig. 5a). The mean absolute difference between the target and estimated gaze points was used as a efficacy measure. The resulting distribution of the gaze points is shown in Figure 5b.

| (a) | (b) |
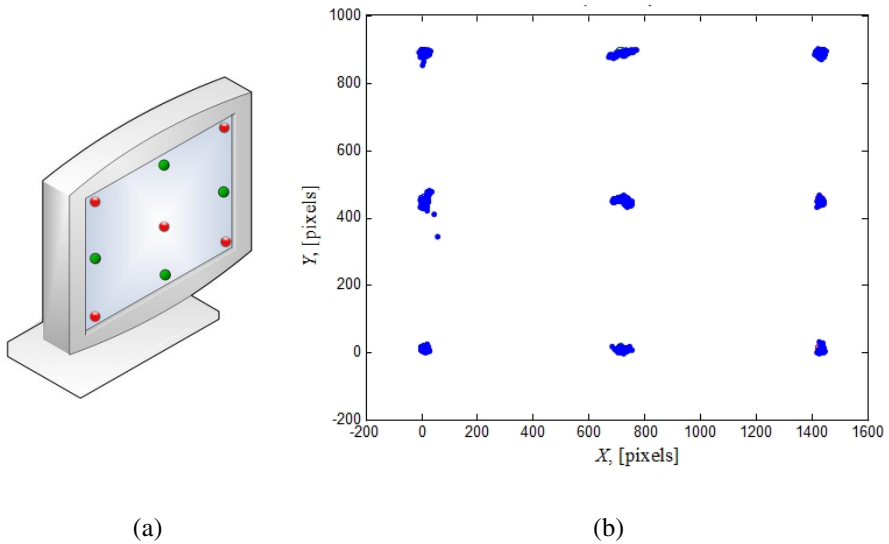
Fig. 5. The target points on the screen (a) and the distribution around target points of estimated gaze points (b)

The mean absolute gaze estimation error on the vertical axis is about 45 pixels and on the horizontal axis were 23 pixels.

3   Experimental Investigation

The well-known MS Windows magnifier from the "Ease of Access" toolbox is used for experimental investigations. Two types of experiments were performed in order to evaluate the usefulness and accuracy of the vision enhancement technique. Two types of magnification windows are used during the experiments, i.e., sliding window and splinted window (see Fig. 6). For evaluation of the system accuracy the text for
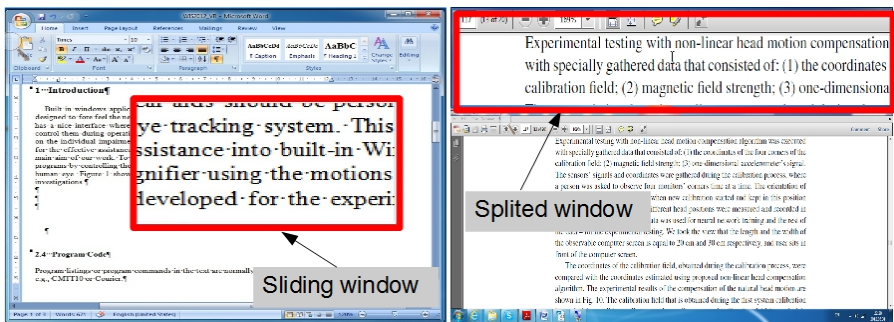
Fig. 6. Two types of magnification windows: sliding window (left) and splinted window (right)

reading was presented for the participant. During the experiment, the average time needed to read a randomly selected text was registered and analyzed. All text samples were equal by number of the letters. The accuracy is measured by the time in seconds, which is needed to read the presented text aloud. The measured time indicates the system accuracy to place the magnifier in the proper position, i.e., at the gaze point. For example, when the participant spends less time to read a text, it means that the sliding magnification window is placed with a certain precision.

Ten participants of different gender and with different vision disorders participated in the experimental investigation. All participants were put in front of computer screen at the distance of 0.8-1 meters. At the beginning of each experiment, every participant has calibrated a gaze point tracking system for him in order to properly operate the proposed application. Nine target points were observed during the calibration process. The 20 frames (about 1.5 s) were taken to evaluate the average image of the closed eye template. The whole calibration process lasted approximately 15 seconds for each participant. Also the magnification scale was selected independently for every user. Every participant was asked to evaluate the vision technique regarding usefulness, user-friendliness and robustness to noise on a scale ranging from 0 to 5.

The experimental performance results are shown in Figure 7. The best result can be achieved using a magnifier based on the sliding window approach. The average time that is needed to read a text is equal to 77.1 seconds, which is 42% faster than using a magnifier based on split window, where the average time that is needed to read a text is 117.2 seconds. The tendency is noticed that the participants learn to use the gaze paint tracking system more efficiently, so the time needed for accomplishing the task has been shortened.
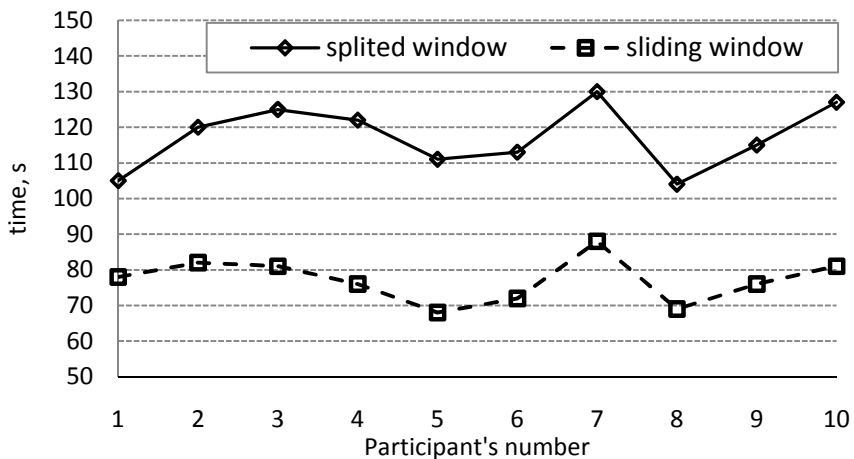

Fig. 7. The results of experiments with text reading task

The rating results of the vision enhancement technique are presented in Figure 8. The better average rating is obtained by the magnification system that is based on the sliding window approach and it is equal to 4.2. The average rating of the split window approach is 2.7.
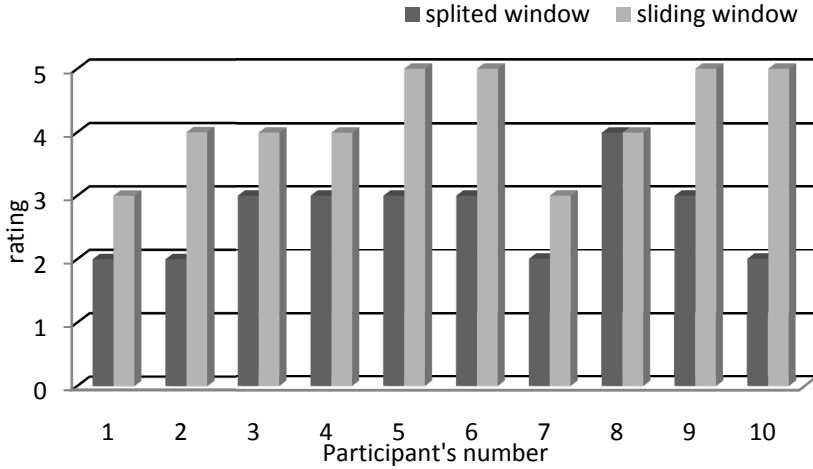
Fig. 8. The rating results of different magnification styles

The participants had complaints about the way of controlling that was used in the first magnification application. It was too complicated to fix the cursor position by closing the eye and then read the presented text in the upper window of the computer screen. During the experiments, in many cases only a small part of the text (region around the fixed position of the mouse cursor) was displayed in the magnified window. Every time a person wanted to read another part of the text, he needed to change the position of the cursor.

The situation is different with the second magnification approach. Here the sliding window was centered at the center of the estimated gaze point. It was easier and more efficient for a user with low vision to read a text. Therefore, the clear correlation between rating and the task execution time can be seen.

4   Conclusions and Remarks

The paper proposes a novel approach for vision enhancement based on a gaze point tracking system in combination with built-in windows applications. Such a combination allows adjusting the environment of the computer screen to the special need of the user. The system captures the small motions of the human eye and transfers them into commands. Therefore, the system can be applied to persons with high-level disabilities. The experimental results have shown the usefulness and effectiveness of the proposed system and claim that it cannot only enhance the human vision but also increase the living quality of a paralyzed person.

The first experiment has shown that the presented vision enhancement system can be successfully applied to text reading purposes and the shortest time can be achieved using the magnification application with the sliding window. The rating results show that every user prefers the sliding window approach. According to such results we can conclude that people with physical impairments have the possibilities not only to

enhance their vision, but also to control certain applications, without actually touching them.

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Author Index