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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Human Factors (HF).

Intended users of this ETSI Guide are the stakeholders involved in the design, development, procurement and deployment of telecare services. The individual end users (telecare clients) are the ultimate beneficiaries of the guidelines, as their application should lead to telecare services of a higher quality, offering a better user experience.

Introduction

Telecare, defined as the provision of health and social care services to individuals within or outside of their homes with the support of systems enabled by ICT, has been identified as a strategic enabler of independent living.

The demographic trends within Europe indicate a development towards a population getting older and living longer than ever before. Therefore, the market for telecare solutions is poised to expand rapidly over the coming years, in order to address the ever growing population with functional limitations [23] and [24].

The aging of our society has unveiled the problem of dependency, as the number of dependant citizens is increasing, especially at the higher levels of the population pyramid. The majority of the dependant population receives informal care, but the population of informal carers is decreasing and aging. These facts may be causing a decrease in the family support to older people and people with disabilities and therefore demand new paradigms to provide support to dependency and independent living.

The maintained delivery of traditional health care services to these user groups would lead to a considerable cost increase, at a questionable quality, as these clients expect freedom of choice, mobility and personal attention, see TR 102 415 [41]. As communication technologies mature and the average user knowledge level is on the increase, these clients may more often have experience and trust in the use of ICT products and services.

The user experience of telecare services depends on a large number of elements. Much is known about human factors (ergonomics) in general and their application within the domain of ICT, however, little has been published within the area of e-Health. This work fills some of the gap, by collecting in a single document, human factors guidelines relevant for the research, design, and deployment phases of telecare products and services. It is the intention that the application of the guidelines shall lead to the best possible user interface and accessibility implementations, leading to an improved user experience of telecare services and thereby increasing the acceptance and adoption of telecare.

1   Scope

The present document provides user experience guidelines, applicable to the research, design, development and deployment of telecare services. The focus of the guidelines is grouped along three main themes: trust, usability and accessibility, and service provisioning, addressed through a user-centric approach. Principles of design for all, adaptive design and assistive technologies are applied throughout the present document.

The present document builds on the recommendations provided in TR 102 415 [41], defining telecare as the provision of health and social care services to individuals, within or outside of their homes, with the support of systems enabled by ICT.

Intended users of the present document are the stakeholders involved in the design, development, procurement and deployment of telecare services. The individual end users (telecare clients) are the ultimate beneficiaries of the guidelines, as their application should lead to telecare services of a higher quality, offering a better user experience.

Telemedicine, diagnosis and other medically related user aspects are outside the scope of the present document.

2   References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1   Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1]   Void.

[2]   ETSI EG 202 132: "Human Factors (HF); User Interfaces; Guidelines for generic user interface elements for mobile terminals and services".

[3]   ETSI EG 202 116: "Human Factors (HF); Guidelines for ICT products and services; "Design for All"".

[4]   Void.

[5]   Void.

[6]   ETSI TS 102 511: "Human Factors (HF); AT Commands for Assistive Mobile Device Interfaces".

[7]   ETSI EG 202 423: "Human Factors (HF); Guidelines for the design and deployment of ICT products and services used by children".

[8]   ETSI ES 202 076: "Human Factors (HF); User Interfaces; Generic spoken command vocabulary for ICT devices and services".

[9]   ETSI ES 202 130: "Human Factors (HF); User Interfaces; Character repertoires, orderings and assignments to the 12-key telephone keypad (for European languages and other languages used in Europe)".

[10]   Void.

[11]   ETSI EG 202 191: "Human Factors (HF); Multimodal interaction, communication and navigation guidelines".

[12]   Void.

[13]   ETSI EG 202 048: "Human Factors (HF); Guidelines on the multimodality of icons, symbols and pictograms".

[14]   Void.

[15]   ETSI EG 202 421: "Human Factors (HF); Multicultural and language aspects of multimedia communications".

[16]   ETSI EG 202 416: "Human Factors (HF); User Interfaces; Setup procedure design guidelines for mobile terminals and services".

[17]   ETSI EG 202 417: "Human Factors (HF); User education guidelines for mobile terminals and services".

[18]   Void.

[19]   ETSI EG 201 472: "Human Factors (HF); Usability evaluation for the design of telecommunication systems, services and terminals".

[20]   ETSI EG 202 325: "Human Factors (HF); User Profile Management".

[21]   Void.

[22]   Void.

[23]   Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions: "Ageing well in the Information Society - An i2010 Initiative - Action Plan on Information and Communication Technologies and Ageing" {SEC(2007)811}.

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[24]   ITU-T Recommendation H. Sup.1: "Application profile - Sign language and lip-reading real-time conversation using low bit-rate video communication".

[25]   ISO 13407 (1999): "Human-centered design processes for interactive systems".

[26]   ISO 17799 (2005): "Information technology - Security techniques - Code of practice for information security management".

[27]   The Care Services Improvement Partnership (CSIP): "Telecare Implementation Guide" Department of Health, UK, 2005.

NOTE: Available at http://icn.csip.org.uk/telecare/.

[28]   NIST Special Publication SP 800-30 (July 2002): "Risk Management Guide for Information Technology Systems", G. Stoneburner, A. Goguen and A. Feringa.

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NOTE: Available at www.fda.gov/cdrh/humfac/doitpdf.pdf.

[30]   Cooper, A., Reimann, R. M.: "About Face 2.0. The essentials of Interaction Design" John Wiley & Sons; 2002.

NOTE: Available at http://www.amazon.com/About-Face-2-0-Essentials-Interaction/dp/0764526413/ref=pd_sim_b_img_1.

[31]   Integrating Community Equipment Services (ICES) (January 2005): "Telecare".

NOTE: Available at http://www.changeagentteam.org.uk/_library/docs/Housing/Telecare/Telecare_gettingstarted.pdf.

[32]   J. Gill: "Accessibility of Biometrics: Dimensioning the Challenges and Opportunities".

NOTE: Available at http://www.tiresias.org/phoneability/accessible_biometrics_proceedings/gill.htm.

[33]   B. Dodson, D. Nolan: "Reliability Engineering Handbook".

[34]   Reliasoft Corp (2007): "System Analysis Reference: Reliability, Availability and Optimization".

NOTE: Available at www.weibull.com/systemrelwebcontents.htm.

[35]   ISO/IEC JTC1 SWG-Accessibility: "User Needs Summary".

[36]   J.M. Winters, M.F. Story: "Medical Instrumentation: Accessibility and Usability Considerations".

[37]   ISO/FDIS 9241-20: "Ergonomics of human-system interaction - Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services".

[38]   The Unicode 5.0 Standard".

NOTE: Available at http://unicode.org/.

[39]   ISO/FDIS 9241-171: "Ergonomics of human-system interaction - Part 171: Guidance on software accessibility".

[40]   World Medical Association Declaration of Helsinki: "Ethical Principles for Medical Research Involving Human Subjects".

NOTE: Available at http://www.wma.net/e/policy/b3.htm.

2.2   Informative references

[41]   ETSI TR 102 415: "Human Factors (HF); Telecare services; Issues and recommendations for user aspects".

[42]   ETSI TR 102 068: "Human Factors (HF); Requirements for assistive technology devices in ICT".

[43]   ETSI TR 102 133: "Human Factors (HF); Access to ICT by young people: issues and guidelines".

[44]   ETSI ETR 095: "Human Factors (HF); Guide for usability evaluations of telecommunications systems and services".

[45]   ETSI ETR 329: "Human Factors (HF); Guidelines for procedures and announcements in Stored Voice Services (SVS) and Universal Personal Telecommunication (UPT)".

[46]   IEEE 802.11: "Handbook - A Designer's Companion".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

accessibility: usability of a product, service, environment or facility by people with the widest range of capabilities (according to ISO 9241-171 [39])

assistive technologies: any product, instrument, equipment or technical system used by a disabled person to prevent, compensate, relieve or neutralize an impairment, disability or handicap

assistive technology device: device used by a disabled person to prevent, compensate, relieve or neutralize any resultant handicap and which has the ability to interface to an ICT device

carer: individual who provides health or social care to the client

    NOTE: Both professional and informal carers are included in this category.

child: defined for the purpose of the present document as a person up to the age of 12 years

client: individual receiving the telecare service, to support independent living and/or using telecare services for the care of his or her own health

coordinator (coordination agent): individual who coordinates the delivery of care through the use of the telecare service

    NOTE: Coordination agents will need to be able to use the telecare services efficiently and will have human factors needs that should be addressed.

design for all: design of products to be usable by all people, to the greatest extent possible, without the need for specialized adoption

disability: person's activity limitation or participation restriction

    NOTE: Disability is conceived as a dynamic interaction between health conditions (diseases, disorders, injuries, traumas, etc.) and contextual factors (i.e. personal and environmental factors).

domiciliary (home) care: care arranged by social services and delivered to persons in their own homes and can include assistance with personal care (e.g. washing, dressing, going to and getting out of bed) and a range of practical/domestic tasks

emergency service: service, recognized as such by the EU Member State that provides immediate and rapid assistance in situations where there is a direct risk to an individual's life or limb, public health or safety, private or public property, or the environment, but not necessarily limited to these situations

end user: See **client, carer** and **coordination agent**.

health/care professionals: professionals (e.g. clinicians, doctors, occupational therapists, social workers) involved in the assessment of clients and delivery of more specialist care than that provided by carers

health/care managers: professionals (typically working in the public sector) who control budgets and direct resources within their local area and who will have direct contact with health care professionals but not with carers or their clients

ICT devices and services: devices or services for processing information and/or supporting communication

impairment: any reduction or loss of psychological, physiological or anatomical function or structure (such as a significant deviation or loss)

informal carers: relatives, neighbours, friends or volunteers providing care for the person in need

interactive voice response: technology that allows a computer to detect voice and touch tones in a call and provide output using pre-recorded or synthesized speech

mobility: See **personal (user) mobility and service mobility**.

residential care: personal and/or nursing care that is provided to a person in a managed care home, in which the person is also provided with accommodation that includes appropriate staffing, meals, cleaning services, furnishings and equipment, for the provision of that care and accommodation

roaming: availability of a service at a location other than the home location, where the service was originally registered

service mobility: possibility for services to be accessed and delivered independently of network, service provider, terminal or geographical location attributes

telecare service: delivery of health and social care to individuals within the home or wider community, with the support of systems enabled by ICT

> NOTE: Additional components of the concept also include safety and security monitoring services and Electronic Assistive Technologies (EAT).

telecare service providers: public sector body (e.g. a local health authority) which has purchased a telecare system from a manufacture and uses it to provide a telecare service to their citizens; or a private sector company or charity, which has been contracted by the authority to provide a telecare service (but who are independent of the local authority); or a private sector company which offers telecare services directly to subscribing customers

terminal: physical device which interfaces with a telecommunications network, and hence to a service provider, to enable access to a telecommunications service

> NOTE: A terminal also provides an interface to the user to enable the interchange of control actions and information between the user and the terminal, network or service provider.

usability: effectiveness, efficiency and satisfaction with which specified users can achieve specified goals (tasks) in a particular environment; it includes the concepts of learn ability and flexibility

User Interface (UI): physical interface through which a user communicates with an ICT device or service

user requirements: requirements made by users, based on their needs and capabilities, on a telecare service and any of its supporting components, terminals and interfaces, in order to make use of this service in the easiest, safest, most efficient and most secure way

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CSIP	Care Services Improvement Partnership
EAT	Electronic Assistive Technologies
ECG	Electro Cardio Gram
GSM	Global System for Mobile telecommunication
ICT	Information and teleCommunication Technologies
MTBF	Mean Time Between Failures
UCD	User Centered Development
UI	User Interface
Wi-Fi	Wireless Fidelity ISO/IEC local area network standard (IEEE 802.11 [46] family)

4 Approach and structure

4.1 Definition, approach and methodology

In accordance with the definition provided in TR 102 415 [41], the present document uses the following definition of telecare:

"Telecare is the provision of health and social care services to individuals, within or outside of their homes, with the support of systems enabled by ICT".

This definition is not un-disputed, as is regarded by many as a sub-discipline of telemedicine, which also includes business-to-business ICT services for supporting cooperative work between health professionals.

The main aim of telecare is to reduce the need for hospitalization and institutionalization and refers to cases where services are provided to a client; it can thus be classified as a business-to-consumer service. Telecare should clearly be distinguished from telemedicine (customarily defined as the use of ICT to support cooperative work between health professionals), a business-to-business service.

Our approach to telecare services builds on the framework described in TR 102 415 [41], whereby personal monitoring, security management, electronic assistive technologies and information services are used to support personal health and well-being. Health and social care clients are the primary beneficiaries of telecare services, and the main focus of the present document. However, other groups like carers and coordination agents are also users of the services, and will have human factor needs that will be addressed as well.

The overall methodology used to produce the guidelines consists of three main components: the approach and structure of the document itself; the bibliographical review of related scientific, technological or standardization references; and the procedures followed by the team to identify and document the guidelines.

Several approaches were considered and carefully analysed for structuring the guidelines, based on either the development and deployment lifecycle of a telecare system, or the main human factors issues associated with developing and deploying a telecare system. In addition, several hybrid approaches were considered, which incorporated the benefits of both the lifecycle and human factors approaches. A major consideration in choosing the approach was to keep the duplication of guidelines in different sections of the present document at a minimum.

The **Human Factors approach** would require the guideline clauses of the EG to be divided into sections addressing a major human factors topic. The advantage of this approach is that the human factors issues are given a central role and a high visibility within the document, which is important given the fact that the guide is aimed at addressing human factors issues related to the user experience of telecare services. However, it will not easily translate to the stakeholders' needs.

The **Lifecycle approach** would require the guide to be divided into sections addressing a specific part of the telecare service lifecycle. The advantage with this approach is that specific stakeholder groups would be able to easily locate those guidelines most relevant to them. However, frequent repetitions would be a considerable issue.

The **Hybrid approach** would require the present document to be divided into the four sections listed within the Lifecycle approach above. Each section would contain subsections focusing on the human factors issues described above. Stakeholders would be able to easily locate the guidelines most relevant to them, whilst the human factors issues would still be given a high profile. Alternatively the human factor issues could be promoted to become the higher level sections, with the lifecycle stages as subsections.

The approach chosen is based on the Hybrid approach with some further modifications: each human factor section firstly contains a set of generic guidelines which are applicable through the whole lifecycle of telecare. Then, guidelines specific to lifecycle stages are provided.

An important part of each following section is the introduction which determines the focus of the section. Our approach is to use the introduction as a short discussion of the issue addressed and from that identify the main, high-level, generic guidelines which should be considered by all stakeholders. This is followed by guidelines relevant for the R&D and development phases, followed by guidelines relevant for service provisioning.

The guidelines provided in the present document are applicable throughout the whole product and telecare service lifecycle. Applying a user-centric approach, the product lifecycle can be described as containing the recurring stages of service information provisioning, pre-use and subscription, initial setup and use, routine use and finally, service and equipment update and/or replacement.

4.2 Document and guidelines structure

The specific design guidelines provided in the following clauses of the present document should be applied, in order to optimize the user experience of telecare services and its elements.

By applying these common user experience principles across the elements and lifecycles of telecare services, combined with a user-centered development and testing process and professional expertise (see clause 5 for details), the human factors of telecare services will be optimized.

The first six sections are grouped under the theme of "Users' trust", while the next three sections are grouped under the theme of "User interaction". The final four sections are grouped under the theme of "Service aspects":

1) **User's trust:** a user's trust in a system depends upon his/her belief that issues relating to the security of the information used within that system have been dealt with appropriately, and that the system can deliver what is expected of it. Trust encompasses the classic elements of computer security: confidentiality, integrity, authentication, as well as issues relating to ethics, reliability of operation and safety. The present document addresses the issues of trust within the following sections:

   - Privacy and confidentiality;

   - Ethics;

   - Legal aspects;

   - Availability and reliability;

   - Integrity;

   - Safety.

2) **User interaction:** the user interface elements of a telecare system will have a direct influence on the user experience of that system. Interfaces should be designed with the needs of all end users in mind, requiring high degrees of flexibility and a sound knowledge of the end users' abilities and preferences. The present document addresses the issues relating to user interaction within the following sections:

   - Usability and accessibility;

   - User education;

   - Localization, customization and personalization.

3) **Service aspects:** the user experience of any service is influenced by the developer's ability to deliver an appropriate system to the service provider, and the service provider's ability to deliver an appropriate service to end users. Therefore the service aspects theme is mainly concerned with the system development and service provision, and ensuring that any issues which might arise here are dealt with appropriately:

   - Organizational aspects;

   - Servicing and maintenance.

Each of the following clauses address the above mentioned areas by applying the following, common clause structure:

- Clause number.1:   Generic guidelines;

- Clause number.2:   Research, design and development related guidelines;

- Clause number.3:   Service provision related guidelines.

Stakeholders should be easily able to identify the lifecycle phase applicable to their activities and select the relevant set of guidelines applicable to their needs.

Annex A provides four listings of the guidelines found in the present document, which can be used as checklists.

5   User centred design and testing

Human factors should be addressed in every stage of the telecare service lifecycle. Targeted users and contexts of use should be considered at the research stage together with ethnographic, social and cultural issues. This will lead to the definition of a set of user requirements, which should result in telecare systems with built-in capabilities to provide a good user experience. Technology and resources used within service provision need to be optimized for the specific user and context of use. Evaluation should be conducted within each individual service component at the design, development and delivery stages, with the evaluation results fed back into these stages. In addition to evaluating each component the overall service should also be evaluated in order to ensure it meets the applicable user requirements.

The adoption, within the engineering process, of specific design processes and phases of methodological evaluation of human factors aspects will enable to detect and solve deficiencies in time, increasing the quality of these services.

ISO standard ISO 13407 [25] provides guidance on human centered design activities throughout the life cycle of computer-based interactive systems. The standard is targeted to people who manage design processes. According to the standard, human centered design consists of four different types of design activities:

- To understand and specify the context of use.

- To specify the user and organizational requirements.

- To produce draft (pilot) design solutions.

- To evaluate design against requirements.

According to the guide published by the "Care Services Improvement Partnership" (CSIP) of the UK Department of Health [27], evaluation of services is critical for demonstrating the benefits (and problems) of telecare to users and other stakeholders, and it also helps to support informed procurement and strategic decisions.

According to CSIP, the evaluation of a telecare system by a service provider should cover: Management and partnership arrangements; commissioning and funding aspects; performance issues; technical and other barriers; availability of new products; environment in which equipment is used; service development; user and practitioner views, ethical considerations; service functionality; and future arrangements.

Generic recommendations for usability evaluation of telecommunication equipment are also available (after possible adaptations), see e.g. ETR 095 [44] and EG 201 472 [19]. The latter reference provides the basis for the use of a common methodology when performing usability evaluations and provides guidance on the User Centered Development (UCD) design process.

There are many publications on telecare, but few of these provide a comprehensive evaluation of human factors. This lack of evaluation may be due to the complexity of the environment in which telecare systems operate, particularly when considering end users such as chronic care patients, typically older and with low technological skills, together with the diversity of functionality for telecare systems.

5.1   Generic

5.1.1   User Centered Development (UCD) methods should be an integral part of any
                          development process of telecare services.

5.1.2   UCD methods should be applied throughout all phases telecare service development.

5.1.3   The telecare service design and development process should be a systematic
                          procedure, based on prototyping and where relevant, iterative.

5.1.4   Evaluations and testing of telecare services should be conducted with domain experts
                          and representative user samples during all stages (including customization), with the
                          evaluation results fed back into the product and service development process.