Building Continents of Knowledge in Oceans of Data: The Future of Co-Created eHealth
A. Ugon et al. (Eds.)

doi:10.3233/978-1-61499-852-5-121

Identifying Obstacles and Research Gaps of Telemedicine Projects: Approach for a State-of-the-Art Analysis

Lorenz HARST[a,1], Patrick TIMPEL[b], Lena OTTO[c], Bastian WOLLSCHLAEGER[d], Peggy RICHTER[c] and Hannes SCHLIETER[c]
[a]*Research Association Public Health Saxony, Center for Evidence-Based Healthcare, Medical Faculty Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany*
[b]*Prevention and Care of Diabetes, Department of Medicine III, Medical Faculty Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany*
[c]*Chair of Wirtschaftsinformatik, esp. Systems Development, Technische Universität Dresden, Dresden, Germany*
[d]*Chair of Technical Information Management Systems, Technische Universität Dresden, Dresden, Germany*

Abstract. This paper presents an approach for an evaluation of finished telemedicine projects using qualitative methods. Telemedicine applications are said to improve the performance of health care systems. While there are countless telemedicine projects, the vast majority never makes the threshold from testing to implementation and diffusion. Projects were collected from German project databases in the area of telemedicine following systematically developed criteria. In a testing phase, ten projects were subject to a qualitative content analysis to identify limitations, need for further research, and lessons learned. Using Mayring's method of inductive category development, six categories of possible future research were derived. Thus, the proposed method is an important contribution to diffusion and translation research regarding telemedicine, as it is applicable to a systematic research of databases.

Keywords. Telemedicine, eHealth, care, qualitative research, future research

1. Background

Since the beginning of the application of ICT in health care, high expectations were linked to eHealth solutions [1]. During the last 15 years, the number of innovative eHealth solutions increased dramatically [2]. Based on Rogers' Diffusion of Innovations Theory [3] and relying on Bashshur's taxonomy of telemedicine solutions [4], van Dyk names four types of barriers to be studied further: (1) technical, (2) behavioural, i.e. user-centred, (3) economical and (4) organizational [5]. Yet, scientifically valid evidence regarding the long-term benefits and potential risks of approaches using eHealth and telemedicine are still missing, vague or focussing only on isolated solutions [6]. Financial support is mostly focussing on setting-up telemedicine programs rather than on their

[1] Corresponding author, E-Mail: lorenz.harst@tu-dresden.de.

evaluation [7]. This leads to a paucity of studies systematically evaluating barriers of telemedicine projects [8]. Frameworks for implementing telemedicine projects mostly rely on analyses of secondary data from at least partly finished projects [5], [7]. The NICE (National Institute for Health and Care Excellence) database summarises relevant disease-specific evidence focussing on effectiveness. However, the database does not provide guidance on how to overcome challenges referring to failure of projects during implementation and scaling-up, which is frequently associated with a phenomenon called "pilotitis" [9], [10]. This is because the uptake of NICE guidelines is slow due to a lack of incentives [11].

Therefore, the aim of this study is to develop a methodology to systematically identify and categorise obstacles and research gaps by analysing lessons learned of past telemedicine projects. Qualitative content analysis [12] of lessons learned from finished projects identified in a database analysis is conducted. The systematically derived definition of telemedicine by Sood et al. was employed to identify eligible projects [13]. A terminological ontology provided by Otto et al. allowed for further distinguishing the terms eHealth and telemedicine [14]. The paper presents the methodological approach and first findings of an ongoing research project as well as practical implications.

2. Methods and Preliminary Analysis

2.1. Proposed Selection Process and Description of Qualitative Content Analysis

A database-centred approach was chosen to identify studies of interest (Figure 1). In a first step, a desktop research resulted in three health-related project databases, containing 260 projects in total. Within these databases, the authors identified projects relating to telemedicine based on the definition provided by Sood et. Consequently, to be included, a project has to aim primarily at (a) using ICTs, (b) improving patient care and/or target the education of patients, while (c) applying technology to cover distance to either send patient data or deliver care [13]. During data collection from July to October 2017, projects still running at that time were excluded from the analysis. As a next step, a desktop research has to be carried out to collect project reports and publications. If publications cannot be found, the respective projects will be excluded.

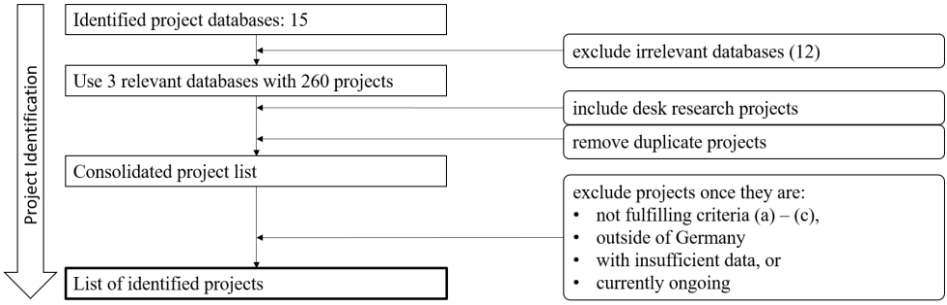


Figure 1: Project Identification and selection of projects

After extracting basic characteristics of the projects, quotes were taken from both project reports and scientific publications reporting conclusions, recommendations and limitations (Figure 2). The relevant fragments of text were categorised following

Mayring's method of inductive category development. According to this method, no ex-ante knowledge of the material to be analysed is assumed. Instead, the text material described above is examined for underlying broad patterns, called categories. Paraphrases of each text fragment concerning lessons learned or the like were then added to these categories [15].

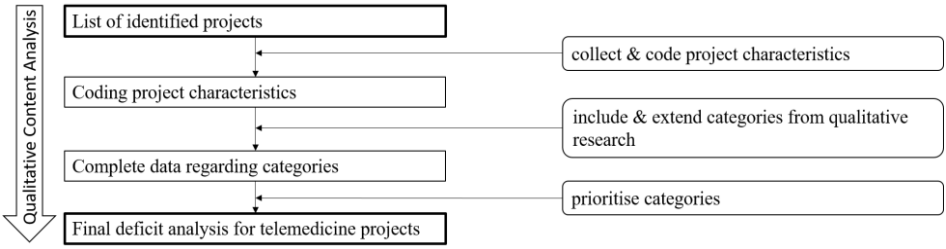


Figure 2: Process of Qualitative Content Analysis

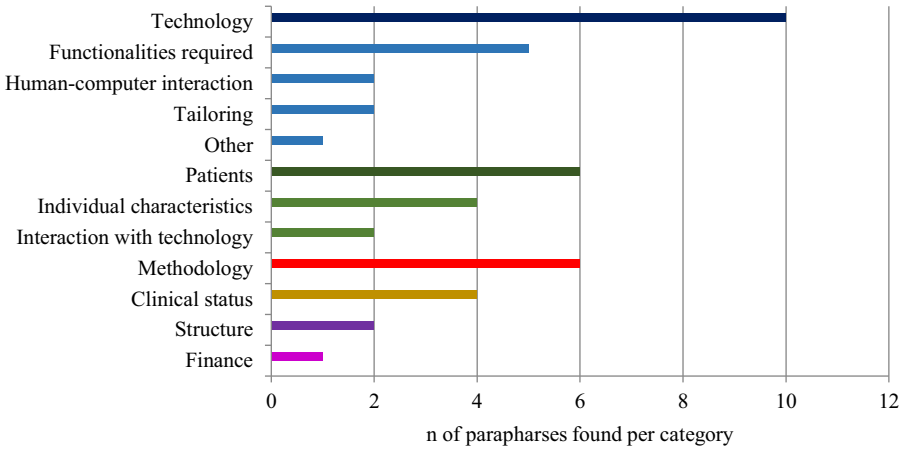
2.2. Pre-Test of Project Selection and Categorisation

A pre-test was conducted by five researchers to determine whether the three criteria stated above ((a) – (c)) make it possible to unambiguously include a project for further research. For ten projects, all researchers made seven undisputed decisions, while three projects were to be discussed. The discussion could be reduced to the question whether the given telemedicine technology was used to administer care to a patient directly. Based on the 104 peer-reviewed definitions of telemedicine collected and analysed by Sood et al. a systematic analysis of the included definitions of "care" was carried out.

The analysis revealed that, apart from the differentiation of the terms eHealth and telemedicine, telemedicine itself can be defined using two approaches. The majority of definitions interpreted *care* in a narrow sense referring to a direct benefit for the patient due to diagnosis, medical education, treatment, care and/or rehabilitation. The minority of definitions interpreted *care* in a broader sense, e.g. education/training of professionals or consultation of experts. Based on these findings, the inclusion criteria of the database analysis were adapted: (a) use of ICTs, (b) directly/immediately improving patient care and/or target on education of patients, (c) applying technology to cover distance to either send patient data or deliver care. A second pre-test, based on these criteria, led to a unified understanding of which projects to include.

For testing the qualitative evaluation methodology, the seven previously identified plus three additional projects from the GEMATIK[2]-database were selected according to the consolidated inclusion criteria. After analysing the reports, one project proved not to fulfil the "care"-criterion. Reports could be found on all but one of the remaining nine. Six projects presented their results as a research paper in a journal. Two offered only a white paper. In six out of eight reports, limitations, need for further research, open questions and/or lessons learned were mentioned. The resulting structural categories and their frequencies are shown in Figure 3.

[2] Gesellschaft für Telematikanwendungen der Gesundheitskarte



Functionalities required by the end user, but missing from original design
Human-computer interaction requires behaviour change
Individual characteristics of the end user: e.g. subjective health status and need for social support
Interaction with technology, e.g. mental capabilities required for using an application
Methodology using inadequate survey designs and tools
Clinical status not taken into account, i.e. vital parameters missing
Structural shortcomings in personnel and regional focus
Finance, indicated as lack of funding

Figure 3: Finding of Pre-Test including categories and sub-Categories

Six categories of lessons learned, need for further research, and/or open questions were identified on the basis on n=10 projects. Aspects concerning the *technology* in use formed the largest. With ten paraphrases being subsumed, the category allowed for the formation of sub-categories. Five paraphrases were subsumed under *range of functionalities required by the end user*, yet missing from the original design, e.g. personalised messages or interactive functions. The second sub-category, *tailoring*, accounts for two barriers rooted within the patient group using the application, e.g. missing ease of use. Finally, *characteristics of human-computer interaction* (n=2) referred to the behavioural change that is required when using a technical device for health care, e.g. relinquishing human contact.

The second broad category, accounting for six relevant paraphrases, was labelled *patients*, as it informs about *individual characteristics of the patient* as the end user (n=4) and his or her *interaction with technology* (n=2). The former sub-category comprises aspects like self-appraisal of health status and the need for social support. The latter serves for prerequisites patients have to meet when using an application, e.g. mental capabilities.

The category named *clinical status* (n=4) mainly deals with specific medical conditions not being taken into account. This showed in missing vital parameters and, consequently, a sufficient evidence base for the benefits of the application. *Financial* barriers (n=1) could be subsumed in a lack of funding, which in turn affects the *structural* category (n=2) as it stands for missing personnel to successfully implement the application. A lack of focus on regional requirements also belongs into this category. Finally, *methodological* concerns (n=6) cover the limitations of a given method used for evaluation, four of six being inadequate survey designs.

3. Expected Impact

The aim of this work was to develop a methodological approach to systematically evaluate and categorise the current need for research relating to obstacles of and lessons learned from telemedicine approaches by analysing finished telemedicine projects. The preliminary results of the on-going research support a more elaborated and precise understanding of telemedicine and eHealth. Thereby, problems arising from diffuse terminology were avoided [7]. In a next step, all remaining included projects need to be analysed in the proposed qualitative manner. Multidisciplinary workshops with researchers, entrepreneurs and patient representatives may be used to prioritise the findings and develop strategies targeting the identified gaps and obstacles afterwards. Thus, the work provides a proposal for a unified concept to assess the quality of future telemedicine innovations by taking into account limitations of past projects. This will deepen the understanding of obstacles for scaling up telemedicine projects.

Acknowledgement

This research was supported by the European Social Funds (ESF) and the Free State of Saxony (Junior Research Group, project number: 100310385).

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